A Multi-relation Based Approach to Resource Deployment Strategies, Core Resources and Performance for China Steel Industry

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Abstract: It is an important problem how to achieve and maintain the competitive advantage of China's steel industry. This problem is addressed from the viewpoint of resource-based theory. Techniques applied include DEA, Principal Components Analysis, Strategy Group Analysis, ANOVA and Multivariate Regression to the analysis of data, probing into the multi-relation of resource deployment strategy and performance and discovering out the core resources. [Nature and Science. 2004;2(3):30-40].

Key Word: resource deployment strategy; core resources; performance

1 Introduction

Barney (1991) broke the theory of competitive advantage into two models: the environmental model which emphasized on environment and the resource–based model which emphasized on making the best of internal resource advantage. These environmental models help isolate those firm attributes that exploit opportunities and/or neutralize threats, and thus specify which firm attributes can be considered as resources. The resource-based model then suggests what additional characteristics that those resources must possess if they are to generate sustained competitive advantage.

Unlike traditional SWOT analysis frame, the SWOT analysis proposed that the firms need to look for a strategic balance between its internal characteristics and environment. The resource-based view, however, focused studying on various kinds of resources, which the enterprises occupied. The resource-based view was first proposed by Wernerfelt (1984), who defined resources as "those (tangible and intangible) assets which are tied semipermanently to the firm". Examples of resources are: brand names, in-house knowledge of technology, employment of skilled personnel, trade contacts, machinery, efficient procedures, capital, etc., and figured that a holder of a resource is able to maintain a relative position that a holder of a resource is able to maintain a relative position vis-à-vis other holders and third persons, as long as these act rationally. That is, the fact that someone already has the resource affects the cost and/or revenues of later acquirers adversely. In these situations the holder can be said to enjoy the protection of a resource position barrier. Defined in this way, resource position barriers are thus only partially analogous to entry barriers, since they also contain the mechanisms, which make an advantage over another resource holder defensible. Just like, resource position barriers do, however, indicate a potential for high returns, since one competitor will have an advantage. Peteraf (1993) also figured that the lasting differences of firm profitability cannot be attributed to the differences of industries, but better explained by the resource-based view. In fact, the difference of firm performance within industry comes mainly from inter-organizational unique resource and ability; that is, the resources deployment capability to transform input into output. Hence, strengthening enterprise resource deployment capability is an important factor for obtaining and maintaining competitive advantage.

The core resource is generally regarded as a single or unique important assets or ability, which form competitive, advantage and make rival costly to imitate (Barney, 1991). Specifically, Barney (1991) suggested whether the resource having lasting competitive advantage rest on such characteristics as valuable, rare, costly to imitate and nonsubstitutable etc. Thus, the resources that have valuable, rare, costly to imitate and nonsubstitutable characteristics would be seen the core resource (Leonard-Barton, 1992). Amit (1993) also considered that the value of core resource could be improved by such characteristics as mutual complementary, rare, unbargaining, durable, suitable, limited substitutable, unsimulating and overlapped with tactic industry factor, etc.

Since 2002, Chinese steel industry has entered into the best development period. In 2003, steel output and investment increased 21% and 130% respectively compared to 2002. While growing at top speed, the competitive environment and competition pattern of the industry have changed remarkably. On the one hand, industrial structural contradiction does not alleviate but outstanding, and local repetitive construction is in a serious condition. On the other hand, large amount of private capital and large-scale steel firm of foreign countries mend their paces to enter the Chinese market. Faced with such a market where opportunity and challenge coexisted, the core issue which China steel firms should pay close attention to is how to build up and keep one's own competitive advantage.

Wernerfelt (1984) proposed a theory frame about the relationship between profitability and resources, as well as ways to manage the firm's resource position over time. Shu-Chen Kao (Kao, 1991) researched empirically the relationship between performance and resource strategies in Taiwan high-tech industry. But at present, there are few studies about Chinese steel industry competitive advantage caused by differences of resource deployment strategies. Zhao Guojie and Hao Qingmin (Zhao, 2003) have researched scale economy based on resource deployment of Chinese steel industry, but scale economy is only one factor in making enterprises obtain the competition advantage. Finally, performance would simply reflect the competition advantages of firms.

In view of this, the paper adopted DEA, factor analysis, and one-way ANOVA under the same industry condition, to discuss the relationship between resources deployment strategies in China steel industry and performance. There are three main goals in the paper. Firstly, we probe into the core resource and core competitive power in China steel industry. Secondly, we analyze resources efficiency. Lastly, we study how the characteristics and strategies of resource deployment to impact performance.

2 Analytical method

2.1 The definition and calculation of the variables

2.1.1 Resources

Resources are the key element of resource deployment and core resources. There are several methods for classifying resources. According to the resource status, for instance, one can divide it into tangible resources and intangible resource; by resource function in organization. Barney (1991) separates resource into material capital resource, manpower capital resource and organization capital resources. The classification method proposed by Hofer and Schendel (Hofer, 1978) is more comprehensive, they suggest that a firm's resources include financial resources, material resources, managerial resources, human resources, organizational resources and technological resources. Due to the lack of literature about Chinese steel industry resource deployment empirical studies, the paper combine Hofer and Schendel's classification method, steel industry characteristics, the analysis of Chinese manufacturing competitive factor (Zhang, 2003) with the choice of Chinese steel industry strategic factor (Yang, 2000) to confirm 15 variables which can reflect steel industry resources. On the whole, the resource variables should reflect steel industry characteristics and prospect, for instance, capital, research and development (R&D), capital construction, scale economy, high added value, etc. From the Table 1, we can see these resource variables.

2.1.2 Performance

Performance mainly includes two facets indices, efficiency and profitability (Koontz, 1993). Woo (1983) utilized 14 common quantitative variables for factor analysis, and get four groups of factors: profitability, market position, the changes of profitability and cash flow, and growth of the sale and market share. Lu Yujian (Lu, 2002) assessed firm performance with ROA and ROE; Thore (1996) adopted data envelopment analysis (DEA) to evaluate efficiency of IT industry, in which net assets and R&D expenditure are input variables, while income, profit, and total assets are output variables.

Table 1. The resource variables and calculation

Resource variables	Methods of calculation	Explanation of indices
Market scale	Ln (total sales)	Scale of market sale
Production scale	Ln (fixed assets)	Scale of the production equipment
Personnel scale	Ln (total employees)	Running personnel scale
Capital scale	Ln (total assets)	Running capital scale
Energy input	Ln (gross energy consumption)	Energy input scale
R&D input	The refreshing and reconstructive expenditure/total sales	R&D input power
Newly-increased fixed assets	The refreshing and reconstructive expenditure/ fixed assets	Rate of the newly-increased investment in fixed assets
Rate of fixed assets	Fixed assets / total assets	The proportion of production equipment in total assets
Rate of current assets	Current assets / total assets	Assets elasticity
Rate of liabilities	Liabilities / total assets	Rationality of the capital structure
Rate of rights and interests	Owner's rights and interests / total assets	Rationality of the capital structure
Rate of fixed assets turnover	Total sales / fixed assets	Running turnover rate
Rate of assets turnover	Total sales / total assets	Rate of assets turnover
Margin of sales profit	Sales profit / total sales	The degree of product added value
Age of firms	The time of firm established	Organization memory

Ln, dealing with and linearizing the data of larger numerical value

In this paper we integrate the above-mentioned performances assessing methods, adopted two facets performances indices, including:

(1) Business efficiency - we can utilize CCR model in data envelopment analysis (DEA) to calculate production efficiency. The input indices are total employees, total assets, fixed assets, gross energy consumption; and the output indices are total sales, sales profit, and output of steel.

(2) Earning capacity - assessing with the rate of assets returns (ROA) and rate of net assets returns (ROE).

$$ROA = \frac{\text{Annual net profit}}{\text{Total assets at the end of the year}} \times 100\%$$

$$ROE = \frac{\text{Annual net profit}}{\text{Owner's rights and interests at the end of the year}} \times 100\%$$

2.2 Samples

This paper chooses 60 large and middle scale steel firms from 78 ones in "Chinese steel industry almanac 2001", which have integrated data, and the data time was 2000.

2.3 Research methods

The following methods are chosen according to the purpose of research:

(1) We adopted data envelopment analysis (DEA) to assess business efficiency and calculated the weight of input and output under this efficiency, utilized cluster analysis to mark off strategic group according by similarity of these weighed values of input and output.

Data Envelopment Analysis (DEA) is a linear programming based technique that is useful for assessing the relative performance of comparable business units. DEA is a non-subjective, non-parametric efficiency assessment technique that determines the efficiency of an organization, business unit, agency, or any such decision making unit (DMU).

In brief, DEA measures the relative performance of each decision-making unit compared with all other comparable unit in the sample. A unit is identified as efficient if the ratio of its weighted output to its weighted inputs is greater than or equal to a similar ratio of each other unit in the sample (Manubea, 2001).

DEA method includes four models, this paper chooses CCR model, which is used for assessing total efficiency. The model, constants and variables are as follows:

Model constants

Let: n be the number of DMUs in the sample to be analyzed;

p be the number of input used by DMUs;

t be the number of outputs produced by DMUs;

be the amount of input i used by DMU j;

Y_{rj} be the amount of output r produced by DMU j;

Model Decision Variables

Let: $v_{ik} > 0$ be the unit weight placed on input i by DMU k;

$u_{rk} > 0$ be the unit weight placed on output r by DMU k.

CCR MODEL

Objective Function:

Maximize: $$f_k = \sum_{r=1}^{t} u_{rk} Y_{rk} \qquad (1)$$

Subject to:

$$\{s_{kj}\} \qquad \sum_{r=1}^{t} u_{rk} Y_{rj} - \sum_{i=1}^{p} v_{ik} X_{ij} \le 0 \quad ; \quad \text{for } j = 1, \ldots\ldots, n \qquad (2)$$

$$\{q_k\} \qquad \sum_{i=1}^{p} v_{ik} X_{ik} = 1 \qquad (3)$$

$$u_{rk} \ge 0; \quad \text{for } r = 1, \ldots\ldots, t$$

$$v_{ik} \ge 0; \quad \text{for } i = 1, \ldots\ldots, p$$

Where: $\{s_{kj}\}$ is the dual variable associated with (2)

$\{q_k\}$ is the dual variable associated with (3)

For each unit, the set of weights that maximizes its efficiency, is subjected to the constraint that neither its efficiency nor that of any other unit in the sample when subjected to the same set of weights would be greater than 1 (Wei, 1988).

DEA's measure of efficiency makes it well suited to strategic grouping analysis. This is because, in addition to determining the efficiencies of the DMUs in the sample, it also determines peer groups, which are analogous to strategic group in that its members have similar intended strategies. That is, each DMU chooses a set of weights, which puts it in the best possible light given its pattern of inputs and outputs. It follows therefore that if any two DMUs have a similar set of weights then these DMUs also have a similar pattern of inputs and outputs. That is to say that these two DUMs have similar resource deployment and therefore follow a similar business strategy (Manubea, 2001). Then we can cluster similar business strategic firm into a strategic group.

(2) We adopted factor analysis to analyze enterprise resource variables, and found out key factors by resource characteristics, then, utilized mean test to examine differences on each strategic group's key factor and resources covered by key factors, in order to summarize the resource deployment strategies in various strategic groups.

(3) We adopted one-way analysis of variance (ANOVA), multiple comparisons, and multivariate linear regression, to compare the impact of each strategic group's resource deployment strategies on performance and to find the key resources influenced performance.

3 Result

3.1 The steel industry business efficiency

We adopted DEA to access enterprise business efficiency. It is necessary that the data of inputs and outputs have positive correlations, That is, homo-tropism, thus firstly; we must carry on correlations test to these data.

Table 2. Inputs and outputs indices correlation test

	Total employees	Total assets	Fixed assets	Gross energy consumption	Total sales	Sales profit	Outputs of steel
Total employees	1.000	.547	.563	.843	.653	.211	.721
Total assets	-	1.000	.984	.877	.951	.847	.935
Fixed assets	-	-	1.000	.869	.938	.810	.911
Gross energy consumption	-	-	-	1.000	.907	.638	.972
Total sales	-	-	-	-	1.000	.779	.941
Sales profit	-	-	-	-	-	1.000	.762
Outputs of steel	-	-	-	-	-	-	1.000

$\alpha = 0.010$

From Table 2, we found that all inputs and outputs data of research samples have positive correlations, so these data accorded with DEA's homo-tropism demand. In addition, there are high correlation between fixed assets and total assets, which both belong to input variables, the correlation degree is up to 0.984, and variable nature is same, so we choose total assets, then, the input indices are the total employees, total assets, gross energy consumption, and the output indices do not change.

According to DEA result of calculation, there are ten firms having economy scale (f_k=1), the average relative efficiency is 0.728.

3.2 The resource deployment characteristics of steel industry and strategic group

3.2.1 Factor analysis of the resource deployment characteristics of steel industry

We adopted principal component analysis method to make factor analysis for 15 resource variables in Table 1. The principle is to concentrate most variance through a few main variables, and make information loss to minimum. Taken eigenvalue above 1, and factor loading above 0.5 as standard, there are 5 factors, which can explain 74.13% of resource deployment characteristics. Then we would name these factors by variables characteristic in factors as follow:

Factor 1: Had loading coefficient with largest absolute value on total assets, outputs of steel, total sales, gross energy consumption and total employees, As a whole, the factor covers some variables which can indicate firm scale, therefore, named firm scale factor.

Factor 2: Had loading coefficient with largest absolute value on rate of liabilities, rate of right and interests, therefore, named liabilities, right and interests factor.

Factor 3: Had loading coefficient with largest absolute value on R&D inputs, rate of newly-increased fixed assets, therefore, named R&D inputs factor.

Factor 4: Had load coefficient with largest absolute value on rate of fixed assets and rate of fixed assets turnover, named fixed assets factor.

Factor 5: Had load coefficient with largest absolute value on the margin of sales profit, age of firm, rate of current assets, named added value, assets elasticity and organization memory factor.

3.2.2 Strategic group analysis of steel industry

Calculated by DEA, we not only get the relative efficiency of each DMU (decision-making unit), but also get the weights of input and output of each DMU. If any two DMUs have a similar set of weights then these DMUs also have a similar pattern of inputs and outputs, and have similar resource deployment too. Adopting the hierarchical cluster analytical method to cluster these DMUs with similar weights of inputs and outputs, thereinto, cluster method is ward's method, and interval is Euclidean distance. The sixty firms in steel industry fall into five groups. The result of strategic groups cluster is in Table 3.

Table 3. Strategic groups in China steel industry

Strategic group 1	Strategic group 2	Strategic group 3	Strategic group 4	Strategic group 5
Shougang, Tjttmg, Tsisco, Hgjt, Cdsteel, Hbxg,XingXing-Piples, Tisco, Btsteel, Ansteel, Bxteel, Jltg,Bsmeishan, Shno1steel, Baosteel, No5steel, Njsteelgroup, Hzsteel, Masteel, Jigang, Laigang, Qdsteel, angang, Wisco, Xisc, Lysteel, Gise, Sgsteel, Liugang, Cqgtjt, Pzhsteel, Gzscgt, Ynkg, Jiugang, 81steel	Tjpipe, Fsspecialsteel Dalian-steel langang	Tiangangsteel, Wygt, Sigangsteel, Xtsteel, Changgang, Lygang, No3steel, Sha-steel, Huigang, Hfsteel, Haiou-steels, Pxsteel, Fjsg, Eisco, Chenggang, Xntg	Xinlinsteel, Xisteel, Chuanwei, Dagang	Cheng-pipe

These five groups denoted five kinds of strategic position in strategic group structure. There are 35 firms in strategic group 1 which are the largest scale steel firm in our country, representative firms are Capital steel, Baosteel, Tisco, Ansteel, Wisco, Gise, Cqgtjt, etc. There are 4 firms in strategic group 2 which are middle scale firms and have preponderant on single product, representative firms are Tjpipe, Fsspecialsteel, etc. There are 16 firms in strategic group 3 which are large and middle-scale firms, representative firms are Tiangangsteel, Changgang, Sha-steel, etc. There are 4 firms in strategic group 4 which are middle scale firms, representative firms are Xinlinsteel, Xisteel, etc. Only one firm in strategic group 5, it is Cheng-pipe, the analysis result basically accord with fact of China steel industry.

Because strategic group 5 only included one firm, it is an extreme value, and its characteristic does not have universality, following analysis, we only considered four strategic groups, which included more than four firms. Then, we applied mean test to order each factor and variables covered by this factor in each strategic group (Tables 4 and 5).

From Table 4, we can see the sample factor mean of every standardized strategic group, strategic group 1 occupies the absolute predominance on firm scale; strategic group 2 is very low on every principal factors; strategic group 3 has best capital structure for supreme rights and interests proportion, and firm scale is relatively larger also. Strategic group 4 has better value on inputs of R&D, fixed assets investment, products added value, and organization memory and fund turnover efficiency.

We ordered the mean of resource variables covered by each factor in each group, and estimated each strategic group resource deployment relative position based on average standard of the industry (Table 5).

Based on analysis in Tables 4 and 5, we concluded the following resource allocation strategies mainly at present.

1. Strategic group 1: was the largest scale of enterprises. Assets, output of steel, total sales, gross energy consumption, total employees, R&D inputs and age of firm was highest, and other resource indexes value lay around industry mean ones, therefore, we concluded that this group took on large scale lead strategy.

2. Strategic group 2: The production scale was relative small, the rate of liabilities was very high, exceeding 60%, but rate of rights and interests is minimal. That is, the structure of the assets was irrational. At the same time, R&D inputs are insufficient, rate of fixed assets turnover was low, but margin of sales profits were high, therefore, we concluded that this group took on high risky and profit strategy.

Table 4. The order of each factor in each strategic group

Factor		Strategic group 1	Strategic group 2	Strategic group 3	Strategic group 4
Firm scale factor		0.610393	-0.78049	-0.70964	-1.49428
	Order	1	3	2	4
Liabilities, right and interests factor		0.011822	-0.46848	0.24636	-0.1626
	Order	2	4	1	3
R&D inputs factor		0.0766	-0.74519	0.011966	0.29654
	Order	2	4	3	1
Fixed assets factor		0.042335	-0.43559	-0.2487	0.150487
	Order	2	4	3	1
Added value, assets elasticity and organization memory factor		0.026268	-1.0822	0.150487	0.2155
	Order	3	4	2	1

Note: All factor numerical values have already been standardized in Table 4.

Table 5. The order of each strategic variable in each strategic group

Strategic variable		Strategic group 1	Strategic group 2	Strategic group 3	Strategic group 4	Industry
Total assets		13.91616	12.94365	12.6669	11.77109	12.82445
	Order	1	2	3	4	
Outputs of steel		14.58685	13.00636	13.62329	12.56132	13.44446
	Order	1	3	2	4	
Total sales		13.21225	12.33888	12.20037	11.44415	12.29891
	Order	1	2	3	4	
Gross energy consumption		14.44876	12.57872	13.32908	12.62192	13.24462
	Order	1	4	2	3	
Total employees		10.2984	9.04939	9.24796	8.80625	9.3505
	Order	1	3	2	4	
Rate of liabilities		0.59851	0.6323	0.5622	0.57329	0.5916
	Order	2	1	4	3	
Rate of rights and interests		0.42089	0.35086	0.43631	0.3515	0.3899
	Order	2	4	1	3	
R&D input		0.11102	0.04411	0.09169	0.06216	0.07725
	Order	1	4	2	3	
Newly-increased fixed assets		0.1225	0.02512	0.10216	0.33093	0.14543
	Order	2	4	3	1	
Rate of fixed assets		0.54708	0.57772	0.8119	0.36055	0.57431
	Order	3	2	1	4	
Rate of fixed assets turnover		1.08038	0.61261	1.32816	1.007*	1.007
	Order	2	4	1	3	
Margin of sales profit		0.16053	0.36006	0.13659	0.09197	0.18729
	Order	2	1	3	4	
Age of firms		47.37143	45.25	42.4375	45	45.01473
	Order	1	2	4	3	
Rate of current assets		0.35283	0.36396	0.41944	0.41582	0.38801
	Order	4	3	1	2	

*Note: Rate of fixed assets turnover of Dazhou Steel Group was up to 47.85 in strategic group 4, far exceeded other firms, hence we eliminated it. Then, the mean of rate of fixed assets turnover only includes other three firms in strategic group 4.

3. Strategic group 3: had the shortest firm average age, the rate of liabilities was minimum and rate of rights and interests was the highest, that is to say, it had rational assets structure. Firm scale was only inferior to strategic group 1, R&D inputs were relative high, rates of fixed assets and current assets were both very rational, it was explained that this group had relative sound on business turnover rate and capital elasticity. Therefore, we concluded that this group took on moderate strategy of excellent assets structure and business efficiency.

4. Strategic group 4: had minimum production scale, although the total amount of R&D inputs was not too many. The percentage of newly-increased fixed assets was high, rate of current assets was relative high, assets elasticity was high, and therefore, we considered that this group took on scale enlargement strategy.

3.3 Resource deployment strategies and performance in China steel industry

We adopted one-way analysis of variance (ANOVA), multiple comparisons to test whether inter-group performance exists different from dissimilar resource deployment strategies. Strategic group performance included three indexes: business efficiency (relative efficiency by DEA), earning capacity (ROA and ROE). When there is homogeneity of variance, we used LSD method to multiple compare for each group mean, but used Tamhane's T2 method for implementation, the significant was at 0.10 level (Table 6).

Table 6. Differences of resource deployment strategies and performance

Resource deployment strategies	Number of firms	business efficiency （Means）	F	Sig.	Multiple comparisons
Large scale lead strategy	35	0.70514	2.713	0.054 Significant difference	（1，3）（2，3）（4，3） Having significance difference among the mean value per group
High risky and profit strategy	4	0.641			
Moderate strategy	16	0.8385			
Scale enlargement strategy	4	0.645			
Total	59	0.73288			
Resource deployment strategies	Number of firms	ROA （Means）	F	Sig.	Multiple comparisons
Large scale lead strategy	35	0.02716	0.63	0.599 There is no significance difference	（1，4） Having significance difference among the mean value the group
High risky and profit strategy	4	0.03539			
Moderate strategy	16	0.02645			
Scale enlargement strategy	4	0.00747			
Total	59	0.02619			
Resource deployment strategies	Number of firms	ROE（Means）	F	Sig.	Multiple comparisons
Large scale lead strategy	35	0.07405	0.488	0.692 There is no significance difference	（1，4） Have significance difference among the mean value the group
High risky and profit strategy	4	0.09899			
Moderate strategy	16	0.06862			
Scale enlargement strategy	4	0.02368			
Total	59	0.07085			

The mean difference is significant at the 0.10 level.

From Table 6, we found that the resource deployment strategies surely lead to differences of inter-group performance, but the difference mainly reflected on business efficiency, not on earning capacity.There are following three main reasons:

1. It is decided by steel industry characteristics. The development of steel industry was relative stable, and profitability of whole industry was also stable. On the one hand, the market of steel was mostly in balance of supply and demand or demand exceeds supply states recent years. On the other hand, national macro-economy would to some extent adjust and control whole steel industry average profit rate, and accordingly there are not very significant differences on whole steel industry profitability.

2. It related to samples. In this paper, all samples come from almanac, and they all are important large and middle-scale enterprises in China. Because these

enterprises had been layout and constructed uniformly by government at the times of planned economy, their age of enterprises all about 45, and they are mature, that is to say, the similarity on enterprise development life cycle and type might lead to similarity on profitability.

3. The last reason is sample amount. In group 2 and group 4, there are only four firms. We know that it is less sample amount, higher error, when std. Deviation between means is big, but sample is few, we may not to assess differences between means.

Each strategic group had significant differences on business efficiency index, p=0.054 (＜0.10). Moderate strategy had the highest value on business efficiency, next is large scale lead strategy, There are not significant different on high risky and profit strategy and scale enlargement strategy.

To ROA and ROE, each strategic group had not significant difference, p＞0.10. There was significant difference on large scale lead strategy and scale enlargement strategy, obviously, the former was superior to the latter.

Generally speaking, Moderate strategy had the highest value on business efficiency; high risk and profit strategy had the best earning capability, but maybe having some risk; on the two facets, large scale lead strategy was both in No.2, but performance in the whole was good; scale enlargement strategy needs to be improved on the two facets. Thus, it is significant that the government holds out large scale lead strategic firms on macro-economy policy and restricts small scale steel enterprises development to make whole steel industry keeping up reasonable market structure.

3.4 Core resources which impact on performance

We used multivariate regression analysis with business efficiency, ROA, ROE as dependent variables and firm scale factor, liabilities, right and interests factor, R&D inputs factor, fixed assets factor, added value, assets elasticity and organization memory factor as independent variables to analyze the core resources influencing firm performance. There is not multi-collinearity problem among these five factors, so we adopted Enter method (Table 7).

Table 7. The resources influencing firm performance

Business efficiency regression analysis					
Factor	B	Std. Error	VIF	T	Sig.
Firm scale factor	-0.0464	0.023	1	-1.994	0.051
Liabilities, right and interests factor	0.04191	0.023	1	1.802	0.077
R&D inputs factor	0.02674	0.23	1	1.149	0.255
Fixed assets factor,	0.0253	0.023	1	1.088	0.282
Added value, assets elasticity and organization memory factor	-0.0478	0.023	1	-2.054	0.045
ROA regression analyses					
Factor	B	Std. Error	VIF	T	Sig.
Firm scale factor	-0.00215	0.004	1	-0.598	0.552
Liabilities, right and interests factor	0.005727	0.004	1	1.594	0.117**
R&D inputs factor	-0.00131	0.004	1	-0.363	0.718
Fixed assets factor	0.00150	0.004	1	0.418	0.678
Added value, assets elasticity and organization memory factor	-0.0133	0.004	1	-3.714	0.000*
ROE regression analyses					
Factor	B	Std. Error	VIF	t	Sig.
Firm scale factor	-0.00572	0.011	1	-0.529	0.599
Liabilities, right and interests factor	-0.0146	0.011	1	-1.348	0.183***
R&D inputs factor	0.000017	0.11	1	0.002	0.999
Fixed assets factor	-0.00141	0.11	1	-0.13	0.897
Added value, assets elasticity and organization memory factor	-0.041	0.11	1	-3.795	0.000*

Business efficiency：R^2=0.205， α＝0.10；ROA：R^2=0.239 ** α＝0.15，* α＝0.05；ROE：R^2=0.234 *** α＝0.2，* α＝0.05

To business efficiency, the result in Table 7 indicated: Liabilities, right and interests factor had significant positive impact on it; firm scale factor and added value, assets elasticity and organization memory factor had significant negative impact on it; R&D inputs factor and fixed assets factor had no significant impact on it.

To ROA, the result in Table 7 indicated: Liabilities, right and interests factor had significant positive impact on it; added value, assets elasticity and organization memory factor had significant negative impact on it; but other factors had no significant impact on it.

To ROE, the result in Table 7 indicated: Liabilities, right and interests factor and added value, assets elasticity and organization memory factor both had significant negative impact on it; other factors had no significant impact on it.

In brief, firm scale factor, liabilities, right and interests factor and added value, assets elasticity and organization memory factor would have significant impact on performance. That is to say, these factors are core resources influenced performance. So then, In China steel industry, we should pay attention to these factor and strategic variables covered by these factors.

4 Conclusion

The paper discussed the relationship of resource deployment strategies, core resources and performance based on view of resource-based, and empirically analyzed China steel industry. The research methods mainly included DEA, Principal Components Analysis, Strategy Group Analysis, ANOVA and Multivariable Regression, etc. The result is following:

About the relationship of resource deployment strategies and performance,

(1) The resource deployment strategies would significantly impact on performance, and the impact mainly concentrates on business efficiency, but earning capability. The reason may come from three facets, steel industry characteristics, enterprise development life cycle and type, and sample size.

(2) Moderate strategy had the highest business efficiency; high risk and profit strategy had the best earning capability, but having matching risk; on the two facets, large scale lead strategy was both in No.2, but in the whole, the group performance was the best; scale enlargement strategy need to be improved on both facets.

(3) The firms which took on moderate strategy are large and middle-scale enterprises, have sound assets structure, and excellent business efficiency. Earning capability is slightly inferior to large scale lead strategic firms. Therefore, we suggest that these firms should keep up moderate development strategy.

(4) The firms, which took on high risk and profit strategy, are middle-scale enterprises, have preponderant on single product, but irrational assets structure, insufficient R&D input. To performance, these firms' business efficiency is the lowest, but earning capability is the best. Therefore, we suggest that these firms should farther keep advantage on single product and increase R&D inputs to improve the ability against risk.

(5) The firms which took on large scale lead strategy are the largest enterprises in China, have the largest enterprise scale. The resource advantage is almighty, for example, in total assets, outputs of steel, total sales, gross energy consumption, total employees, R&D inputs, etc. On the whole, performance is also the best. Therefore, we suggest that the government hold out these firms development on macro-economy policy because they represent China steel enterprises' strength.

(6) The firms, which took on scale enlargement strategy, have minimum production scale, and enlarging its scale by new project construction. Because total construction expenditures are not too large, these firms still have high rate of current assets and assets elasticity. But these firms performance level is the lowest, and therefore would improve business efficiency by enlargement. At the same time, we suggest that they should increase R&D inputs to improve earning capability.

About core resources influencing performance, firm scale factor; liabilities, right and interests factor and added value, assets elasticity and organization memory factor would have significant impact on performance. These factors is core resource in China steel industry, and accordingly, we should pay attention to these factors and those strategic variables covered by these factors, for instance, total assets, outputs of steel, total sales, gross energy consumption and total employees, rate of liabilities, rate of right and interests, margin of sales profit, age of firm, rate of current assets and so on.

The paper is subject to some limitations. First, it is short of time series data, all sample time are 2000, in fact, one-year data of firms can't completely explain actual state, and steel industry environment and inter-resources would be changed by time. That is to say, the research to relationship of resources and performance should be dynamic.

Secondly, sample type is relative unitary, these firms all are stated-owner large and middle enterprises and are about 40% market share. Due to lack of data, other type firms such as private and local enterprises have not been considered. Similar enterprises type may lead one to conclude that the performance among these firms has no significant differences.

In conclusion, this paper has done an empirical analysis of the relationship of resource strategy, core resources and the performance in China's steel industry. It is meaningful to future China steel industrial development.

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