



ACTIVITY-BASED COSTING

This article reports the results of a survey of 133 Chinese manufacturers on the implementation of activity-based costing.

POPULARITY IN CHINA

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Since the re-opening of the Shanghai Stock Exchange in 1990, and the implementation of Chinese Accounting Standards for Business Enterprises in 1993, Chinese firms started to adopt Western business management methods including management accounting techniques. More specifically, since China joined the WTO in 2001, many Chinese firms started to implement modern management accounting techniques such as standard costing, participative budgeting, activity-based costing (ABC), balanced scorecard, cost of quality report, and target costing.

This survey of ABC applications among Chinese enterprises intends to improve the understanding of the pros and cons of ABC when applied in Chinese firms. We find that there are not many Chinese firms that are adopting a complete ABC

system. One possible reason for this is that a complete ABC system is too time consuming and costly to develop. Instead, many Chinese firms only use some ABC concepts such as adopting multiple cost drivers and/or incorporating period expenses into product costs.

Survey information

We sent questionnaires to the CFOs or controllers of 500 Chinese manufacturing firms and received back a sample of 133 respondent firms. Our analysis consists of the following six questions describing different aspects of ABC:

1. Whether the respondent uses multiple cost drivers or allocation bases in allocating manufacturing overhead expenses to different products.
2. Whether the respondent's manufacturing cost driver or allocation

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Exhibit 1 Sample Distribution by Geographic Region

	Southeast coastal area	Northeast area	Middle-west hinterland area	Unknown	Total
Number of sample	98	18	16	1	133
Percentage	73.7%	13.5%	12.0%	0.8%	100.0%

Exhibit 2 Sample Distribution by Firm Size

	Small Firms	Medium Firms	Large Firms	Very Large Firms	Unknown	Total
Average number of employees	162	523	2,065	9,077		
Number of sample	21	44	46	17	5	133
Percentage	15.8%	33.1%	34.6%	12.8%	3.8%	100.0%

Exhibit 3 Sample Distribution by Industry

	Traditional Industries	Innovative Industries	Unknown	Total
Number of Sample	52	29	52	133
Percentage	39.1%	21.8%	39.1%	100.0%

base(s) increased substantially in number in the most recent three years.

- Whether the respondent allocates period expenses such as R&D expenses, interest expenses, selling expenses, and general administrative expenses into product costs for its internal management decision-making purposes.
- Whether the respondent increases the proportion of period expenses allocated to product costs to better serve internal management decisions in the most recent three years.
- Whether the respondent implements an ABC system to calculate product costs.
- Whether the respondent increased ABC applications to different product lines in the most recent three years.

We divide these 133 sample respondents into sub-samples according to region, size, and industry.

Respondent profiles

Exhibit 1 shows the details of the regions for which data were collected from responding firms. The regions comprise the southeast coastal area (Jiangsu, Zhejiang, Guangdong, Fujian provinces, and Shanghai city), the northeast area (Liaoning and Shandong provinces, Beijing and Tianjin cities) and the middle-west hinterland area (Shaanxi, Shanxi, Hunan, Jiangxi, Hubei, Henan, and the Anhui provinces). Respondents who did not indicate their region are marked as "unknown."

Exhibit 2 shows the details of the firm size for which data were collected from responding firms according to number of employees and annual sales. Firm size comprises small, medium, large, and very large. Respondents who did not indicate number of employees or sales are marked as "unknown."

This survey groups electronics, equipment, and medical industries into innovative industries while other industries

Exhibit 4 Response to Specific Questionnaire Questions

	Question 1	Question 2	Question 3	Question 4	Question 5	Question 6
Number of respondents	132	133	133	132	127	127
Mean	2.4924	2.4286	2.6090	2.5606	2.0394	2.1811
Standard deviation	4.328	3.368	5.058	4.309	4.117	4.118

Exhibit 5 Percentage of Each Question's Identification with ABC

Identification with ABC Question	0	1	2	3	4	5	6	Total
1. Uses multiple cost drivers	24.2%	18.9%	7.6%	14.4%	12.9%	11.4%	10.6%	100%
2. Number of cost drivers increases greatly in the most recent three years	20.3%	17.3%	13.5%	17.3%	15.8%	11.3%	4.5%	100%
3. Allocates period expenses into products costs	29.3%	11.3%	10.5%	10.5%	9.0%	15.0%	14.3%	100%
4. Increases the proportion of period expenses assigned to product costs in the most recent three years	25.8%	12.1%	9.8%	19.7%	7.6%	15.2%	9.8%	100%
5. Adopts the ABC system to calculate product costs	37.8%	13.4%	3.9%	17.3%	14.2%	6.3%	7.1%	100%
6. Visibly increases ABC applications in the most recent three years	34.6%	11.0%	7.9%	17.3%	13.4%	8.7%	7.1%	100%

(0 = strongly disagree; 6 = strongly agree)

such as food, textile, timber, paper making, petrochemistry, and steel are categorized as traditional industry. Respondents who did not indicate an industry are marked as "unknown."

Since there are six incomplete questionnaires, some data analyses are based on a sample of 127. Exhibit 4 shows the details of the responses to questionnaires (0 means strongly disagree or no change, 6 means strongly agree or changed greatly).

From Exhibit 4 we find that ABC is not widely applied among Chinese firms. With respect to individual questions, question three (allocating period expenses such as R&D expenses, interest expenses, selling expenses, and general administrative expenses into products costs for its internal management decision-making purposes) received the highest score, followed by question one (using multiple cost drivers in allocating manufacturing overhead

expenses to different products), while question five (adopting ABC to calculate product costs) received the lowest score. This shows that some Chinese firms adopt multiple cost driver allocation when assigning their manufacturing overhead expenses and allocate period expenses to product costs. These results also show that some Chinese firms have used some ABC concepts, but do not think the formal application of ABC is cost effective. Exhibit 5 shows the detailed answers for these six questions.

About thirty-five percent of the sample firms respond to question one with a score higher than 3, which shows that these firms have a higher adoption rate in using multiple cost drivers. Thirty-two percent of the sample firms respond to question two with a score higher than 3, which shows that these firms have a high probability of increasing the number of

cost drivers when allocating manufacturing overhead expenses to products in the most recent three years.

Responses to question three show that almost forty percent of the sample firms use another ABC concept by allocating period expenses into product costs for internal decision-making purposes, and thirty-three percent of the sample firms greatly increased the proportion of period expenses allocated into product costs in the most recent three years.

Responses to questions five and six show that there are fewer firms that use formal ABC to calculate product costs than firms that adopt multiple cost drivers to allocate manufacturing overhead expenses and period expenses into product costs—only twenty-eight percent (sum of columns four, five and six) of the sample firms use ABC to calculate product costs. This shows that there are comparatively few Chinese firms that use the ABC system to calculate product costs.

In summary, the percentage of Chinese firms that use multiple cost drivers to assign manufacturing overhead expenses and period expenses into product costs is higher than the percentage of firms that adopt a formal ABC system. From the responses of the sample firms, one possible reason for this is that a complete ABC system may be too time consuming and costly to develop. Instead, many Chinese firms use only some ABC concepts by adopting multiple cost drivers and/or incorporating period expenses into product costs.

The influence of cost structure on ABC applications among manufacturers

The ABC method allocates resource costs to activities consumed and to products according to the volume usage of cost drivers to achieve more accurate product costs. The ABC method also enables management to plan and control all the value chain activities more effectively from R&D to after-sale services.

From the Western ABC practice information, we learn that the higher the percentage of manufacturing overhead expenses to the total manufacturing costs, the more suitable for ABC applications.

Additionally, the higher the proportion of indirect expenses (all manufacturing, selling, and general administrative expenses other than direct materials and direct labor) to all value chain costs (the sum of direct materials, direct labor, and indirect expenses), the more suitable ABC is. However, the results from this survey show that current applications of ABC among Chinese enterprises do not completely follow these rules.

There are 120 usable responses for this analysis since some firms do not show the proportion of all kinds of expenses in their value chain. We analyzed the degree of application of ABC among responding companies and the relationship between this degree and the company's cost structure from three aspects: 1) percentage of the company's manufacturing overhead expenses; 2) percentage of the company's period expenses; and 3) percentage of indirect expenses.

We adopted the following data analysis methods:

- Classify sample firms by the median of manufacturing overhead expense percentage, period expense percentage, and indirect expense percentage. Firms with a manufacturing overhead expense percentage higher than 9.14 percent were defined as high manufacturing overhead expense firms; otherwise, they were defined as low manufacturing expense enterprises. Similar definitions were used for period expenses and indirect expenses.
- For the purpose of testing differences between ABC and non-ABC application firms, we rescaled answers to questions one, three, and five so that answers of 0 to 3 are set to 0 while answers of 4 to 6 are set to 1, indicating identification with ABC and its concepts. We did not change the scale of questions two, four, and six.
- Conduct a variance analysis of the answers of the six questions using manufacturing expense percentage, period expense percentage, and indirect expense percentage.

Percentages of manufacturing overhead expenses, period expenses, and indirect expenses to responding firms'

Exhibit 6 Percentage of Manufacturing Overhead Expenses/Period Expenses/Indirect Expenses to Responding Firms' Total Value Chain Costs

	Mean	Median	Variance	Minimum	Maximum
Manufacturing Expenses	12%	9%	1%	0%	70%
Period Expenses	34%	30%	5%	1%	89%
Indirect Expenses	46%	46%	5%	4%	93%

Exhibit 7 Influence of Manufacturing Overhead Expense Percentage on ABC Applications

Questions	Percentage of manufacturing overhead expense	Mean	Standard Deviation	F Value P Value
1: Uses multiple cost drivers	Low	0.37	0.49	0.098
	High	0.34	0.48	0.755
2: Number of cost drivers increases greatly in the most recent three years	Low	2.57	1.86	0.419
	High	2.35	1.80	0.519
5: Adopts ABC system to calculate product costs	Low	0.24	0.43	1.050
	High	0.33	0.47	0.308
6: Visibly increases ABC applications in the most recent three years	Low	2.24	2.00	0.000
	High	2.24	2.11	1.000

Note: Questions 2 and 6 have a scale of 0 to 6 while questions 1 and 5 have a new scale of either 0 (original scale of 0, 1, 2 or 3) or 1 (original scale of 4, 5 or 6) for the purpose of testing differences between ABC and non-ABC application firms.

total value chain costs are enumerated in Exhibit 6.

We defined the total value chain cost as the sum of direct materials, direct labor, and indirect expenses. Indirect expenses are the sum of manufacturing overhead expenses and period expenses. Period expenses include R&D, selling, general, and administrative expenses. Related data analysis indicates a visible gap between period expense percentage and indirect expense percentage among different industries; traditional industries have a higher percentage than innovative industries in these two expense percentages—period expense percentage of traditional industries is seven percent higher and indirect expense percentage of traditional industries is fifteen percent higher.

Manufacturing overhead expense percentage influences. Exhibit 7 shows that though the percentage of manufacturing overhead expense to the whole value chain cost is not the main factor that influences the applications of ABC, the firms with a high manufacturing overhead expense percentage adopt ABC more

than firms with a low percentage, which is indicated by the response to question five. The response to question six shows that there is no difference between firms with a high manufacturing overhead expense percentage and firms with a low manufacturing overhead expense percentage concerning the degree that firms increase their applications of ABC in the most recent three years; the two mean percentages are both at 2.24.

Period expenses influences. Exhibit 8 shows that Chinese firms with a higher period expense percentage are boosting their period expense allocation percentage and increasing applications of ABC in the most recent three years. From the response to question two regarding increasing the number of cost drivers in the most recent three years, we find that the mean score for firms with a higher period expense percentage is 3.12, which is 1.32 higher than the one for firms with a lower period expense percentage. This difference is statistically significant. Question six has a similar response with a mean score difference of 1.31, which is also statistically significant.

Exhibit 8 Influence of Period Expense Percentage on ABC Applications

Question	Percentage of period expenses	Mean	Standard Deviation	F Value PValue
1: Uses multiple cost drivers	Low	0.37	0.49	0.098
	High	0.34	0.48	0.755
2: Number of cost drivers increased greatly in the most recent three years	Low	1.80	1.82	17.748
	High	3.12	1.60	0.000
3: Allocates period expenses into product costs	Low	0.35	0.48	1.242
	High	0.45	0.50	0.267
4: Increased the proportion of period expenses assigned to product costs in the most recent three years	Low	2.37	2.26	1.403
	High	2.82	1.88	(0.239)
5: Adopts the ABC system to calculate product costs	Low	0.26	0.44	0.376
	High	0.31	0.47	(0.541)
6: Visibly increased ABC applications in the most recent three years	Low	1.59	1.89	13.157
	High	2.90	2.00	(0.000)

Note: Questions 2, 4 and 6 have a scale of 0 to 6 while questions 1, 3 and 5 have a new scale of either 0 (original scale of 0, 1, 2 or 3) or 1 (original scale of 4, 5 or 6) for the purpose of testing difference between ABC and non-ABC application firms.

Exhibit 9 Analysis of Low vs. High Period Expense Firms

Period expense variable	Number of cost drivers increased greatly in the most recent three years (Question 2)							Total
	0	1	2	3	4	5	6	
Low period expense percentage firms	35%	23%	5%	10%	17%	10%	0%	100%
High period expense percentage firms	5%	10%	22%	25%	17%	13%	8%	100%
Period expense variable	Visibly increased ABC applications in the most recent three years (Question 6)							Total
	0	1	2	3	4	5	6	
Low period expense percentage firms	48%	14%	2%	14%	16%	3%	3%	100%
High period expense percentage firms	17%	10%	16%	19%	10%	16%	12%	100%

(0 = strongly disagree; 6 = strongly agree)

Exhibit 9 indicates that of the firms with a higher period expense percentage, eight percent greatly increased their allocation base of manufacturing expenses and fifteen percent virtually stayed the same during the most recent three years. At the same time, the firms with a lower period expense percentage did not visibly increase their manufacturing expense allocation base and fifty-eight percent kept nearly the same allocation base. Question six obtains a similar response as question two: the companies with a response of 5 or 6 comprise twenty-eight percent of all companies with a higher period expense proportion, while the companies with a response of 0 or 1 com-

prise twenty-seven percent. However, the companies with a response of 5 or 6 comprise six percent of all companies with a higher period expense proportion, while the companies with a response of 0 or 1 comprise as high as fifty-two percent. Thus, we can deduce that most of the companies with a lower period expense proportion have not applied ABC during the most recent three years. This analysis is consistent with management accounting theory that states that the companies with a higher period expense proportion are more suitable for ABC to calculate product cost.

Expense percentage influences. Exhibit 10 shows that firms with a higher indi-

Exhibit 10 Influence of Indirect Expense Percentage on ABC Applications

Question	Percentage of indirect expense	Mean	Standard Deviation	F Value P Value
5: Adopts the ABC system to calculate product costs	Low	0.25	0.44	0.533 (0.467)
	High	0.32	0.47	
6: Visibly increased ABC applications in the most recent three years	Low	1.81	1.96	5.455 (0.021)
	High	2.68	2.05	

Note: Question 6 has a scale of 0 to 6 while question 5 has a new scale of either 0 (original scale of 0, 1, 2 or 3) or 1 (original scale of 4, 5 or 6) for the purpose of testing difference between ABC and non-ABC application firms.

Exhibit 11 Analysis of Low vs. High Indirect Expense Firms

Indirect expense variable	Visibly increased ABC applications in the most recent three years (Question 6)							Total
	0	1	2	3	4	5	6	
Low indirect expense percentage firms	42%	14%	5%	14%	14%	8%	3%	100%
High indirect expense percentage firms	23%	11%	12%	19%	12%	11%	12%	100%
Total sample firms	33%	12%	9%	16%	13%	9%	8%	100%

(0 = strongly disagree; 6 = strongly agree)

rect expense percentage adopt ABC more in the most recent three years; the difference is statistically significant. Exhibit 11 shows that firms with a higher indirect expense percentage would be more likely to apply ABC. The firms with a score higher than 4, which means these firms have expanded their ABC applications in the most recent three years, comprise twenty-three percent (= eleven percent + twelve percent) of all the firms with a higher indirect expense percentage. On the other hand, the firms with a low indirect expense percentage would be more likely not to apply ABC; this is showing that they have fifty-six percent (= forty-two percent + fourteen percent) with score lower than 2. In conclusion, based on the survey results, cost structure is the main factor that influences the application of ABC among Chinese firms, and the firms with a higher indirect expense percentage have a higher probability of adopting ABC systems.

Other influential factors

There are visible differences among the management, operations, and cost management for firms of different regions,

different sizes, and different industries. To learn more about the current situation and influencing factors on the applications of ABC for Chinese firms, we analyze the firms based on three aspects: industries, regions, and sizes in the most recent three years.

ABC applications between innovative and traditional industries. Innovative industries are good at adopting advanced management concepts and techniques. This survey tries to find out whether applications of ABC among firms in innovative industries are visibly more popular than among firms in traditional industries. Through the analysis of the sample firms, we find that firms in innovative industries absorb ABC concepts more. However, there is no clear difference regarding the manufacturing expense allocation and period expense situation between innovative industries enterprises and traditional industries. Exhibit 12 shows that the mean of innovative industries firms is higher than the one of traditional industries firms: with a 1.24 difference in question two, 1.1 difference in question four, 1.5 difference in question five, and 0.92 difference in question six (corresponding P values are

Exhibit 12 Influence of Industry on ABC Applications

Innovative Industries and Traditional Industries		Mean	Standard Deviation	F Value P Value
1: Uses multiple cost drivers	Traditional Industries	0.35	0.48	0.004 0.996
	Innovative Industries	0.34	0.48	
2: Number of cost drivers increased greatly in the most recent three years	Traditional Industries	2.04	1.71	4.550 0.012
	Innovative Industries	3.28	2.00	
3: Allocates period expenses into product costs	Traditional Industries	0.38	0.49	0.040 0.668
	Innovative Industries	0.45	0.51	
4: Increased the proportion of period expenses assigned to product costs in the most recent three years	Traditional Industries	2.41	2.02	2.527 0.084
	Innovative Industries	3.31	2.09	
5: Adopts the ABC system to calculate product costs	Traditional Industries	0.28	0.45	2.732 0.069
	Innovative Industries	0.43	0.50	
6: Visibly increased ABC applications in the most recent three years	Traditional Industries	2.04	2.01	2.835 (0.063)
	Innovative Industries	2.96	2.17	

Note: Questions 2, 4, and 6 have a scale of 0 to 6 while questions 1, 3, and 5 have a new scale of either 0 (original scale of 0, 1, 2 or 3) or 1 (original scale of 4, 5 or 6) for the purpose of testing difference between ABC and non-ABC application firms.

Exhibit 13 Analysis of Traditional vs. Innovative Industries (1)

	Number of cost drivers increased greatly in the most recent three years (Question 2)							Total
	0	1	2	3	4	5	6	
Traditional Industries	25%	19%	15%	21%	8%	10%	2%	100%
Innovative Industries	14%	14%	3%	10%	31%	14%	14%	100%
	Increased the proportion of period expenses assigned to product costs in the most recent three years (Question 4)							Total
	0	1	2	3	4	5	6	
Traditional Industries	25%	12%	18%	18%	6%	12%	10%	100%
Innovative Industries	17%	10%	0%	21%	14%	24%	14%	100%

(0 – strongly disagree; 6 – strongly agree)

0.012, 0.084, 0.069, 0.063, respectively); these values are all statistically significantly different.

Analysis of question two shows that during the most recent three years, fifty-nine percent of firms in innovative industries increased the number of manufacturing overhead expense cost drivers (which is indicated by a score higher than 3), while only twenty percent of firms in traditional industries did so; fifty-nine percent of firms from traditional industries

almost did not increase the number of cost drivers (which is indicated by a score lower than 2) while only thirty-one percent of firms in innovative industries did so. Question four shows that in the most recent three years, fifty-two percent of firms in innovative industries increased their period expense allocation percentage greatly while most of the firms in traditional industries did not do so.

As shown in Exhibit 14, question five shows that forty-three percent of firms

Exhibit 14 Analysis of Traditional vs. Innovative Industries (2)

Innovative Industries and Traditional Industries	Adopts the ABC system to calculate product costs (Question 5)		Total					
	0	1						
Traditional Industries	72%	28%	100%					
Innovative Industries	57%	43%	100%					
Innovative Industries and Traditional Industries	Visibly increased ABC applications in the most recent three years (Question 6)						Total	
	0	1	2	3	4	5		6
Traditional Industries	34%	16%	12%	10%	12%	10%	6%	100%
Innovative Industries	21%	11%	4%	25%	11%	11%	18%	100%

in innovative industries have already adopted ABC, while only twenty-eight percent of firms in traditional industries have adopted ABC. The analysis also shows that firms in innovative industries are more inclined to adopt ABC, and in the most recent three years (question six), there is an ascending trend in applications of ABC in innovative industries. We also conduct analyses on ABC applications for different geographic regions and firm sizes. We found no apparent difference among firms in different regions and different firm sizes concerning the applications of ABC.

Conclusion

We reach the following conclusions through this survey's results on the application of ABC in Chinese manufacturers:

- Few Chinese manufacturers formally adopt ABC to calculate product costs. However, some ABC concepts, such as using multiple cost drivers in allocating manufacturing overhead expenses to products and the allocation of period expenses (R&D expenses, interest expenses, selling expenses, and general administrative expenses) into product cost have been adopted by many Chinese firms. Additionally, these concepts are gaining popularity among Chinese manufacturers in the most recent three years.
- Cost structure is an important factor influencing the adoption of

ABC among Chinese manufacturers. The firms with a higher period expense percentage and indirect expense percentage are more inclined to adopt ABC concepts and/or systems, and they are pushing forward applications of ABC in the most recent three years. However, the percentage of manufacturing overhead expense does not seem to influence the application of ABC.

- There is a large difference between innovative and traditional industries concerning applications of ABC. In the most recent three years, innovative industries firms have increased their manufacturing overhead expense percentage, period expense percentage, and visibly pushed forward the application of ABC. Meanwhile, most of the traditional industries firms still keep the same degree of applications as three years ago.
- Region and firm size do not significantly affect applications of ABC.
- We recommend that Chinese firms pursue the adoption of some ABC concepts according to the specific firm's production process variety, operations situation, and product number and volume variety instead of implementing mechanical applications of ABC or copying ABC from Western firms without considering each firm's real unique circumstances. ■