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Analysis of Cost Management System of Food Manufacturing Enterprises Based on CVP Analysis: Taking Bright Dairy as an Example

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Abstract: *Scholars have been interested in applying material circulation cost accounting theory in environmental performance in CSR reports, but whether it applies to every distinctive enterprise is still a question. In this paper, through the traditional CVP analysis of the cost of Bright Dairy, after evaluating the existing cost management system, the MFCA theory is used to investigate Bright Dairy's environmental protection development strategy. It is found that the quality of other products is closely related. However, there are other problems to improve the current revenue situation and put forward two strategies to help Bright Dairy get through the critical turning point of net income.*

Keywords: *Cost Accounting, Bright Dairy, CVP analysis, Regression analysis*

1. Introduction

Since 2018, the China Securities Regulatory Commission has revised the Corporate Governance Standards for Listed Companies so that the disclosure of corporate social norms reports in A-shares has been more clearly defined. With the popularization of the concept of ESG, how to apply environmental performance to corporate governance evaluation and financial performance has also been widely discussed. Currently, the focus of CSR disclosure in China is still on employee relations, social expenditure and policy appeal, such as rural poverty alleviation and digital transformation, while environmental performance is still disclosed on the water pollution, air pollution and solid waste pollution.

Generally speaking, the consumption of energy in enterprises mainly comes from the production of products, so it is generally believed that industrial enterprises have more environmental pressure and cost pressure than other enterprises. In recent years, apart from applying the ABC distribution method and CVP analysis method, the theoretical research focus of cost accounting has also shifted to Material Flow Cost Accounting. This branch combines environmental performance and accounting. In short, the theory is based on the equation that the sum of the input of raw materials and the input of resources and energy is equal to the sum of the expenditure of favourable products and harmful products and more optimally allocates each cost item in combination with the production model of the product and the required energy. On one hand, MFCA is used to research industry through the depreciation loss rate of materials and the ratio of depreciation manufacturing to environmental costs (Fu, 2021), illustrating that the equation could restore the theoretical product output through detailed enterprise internal data, but it still failed to estimate the relationship between the consumption rate. It was necessary to upgrade the industrial chain to reduce pollution emissions and raw material losses in the paper-making process (Zhang, 2017). On the other hand. A survey was conducted on chemical enterprises and found that this type of enterprise had a direct correlation between cost and waste gas, suggesting that the emission of pollutants can be used as a cost driver in the future cost allocation of chemical enterprises (Xing, 2020). Similar views also appear in the survey of exhaust emissions from thermal power plants (Liu, 2021), while the survey of lactic acid was more biased towards distribution by product category (Liu, 2022), using environmental performance as an auxiliary variable for production regression. In other food companies, the distribution rate of beer was more dependent on the MFCA theory than other liquors, possibly due to its highly automated production lines (Yu, 2018). Of course, this theory also applies to the cost accounting of consumables production. An extended model through the distribution of latex gloves points out that corresponding strategies should be implemented in different nodes of the production model to save energy and reduce emissions (Li, 2020). To sum up, for the theory of MFCA, the difficulties mainly focus on determining the whole

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production process and acquiring internal production data. For enterprises that have completed digital transformation, it is not easy to put forward suggestions for improvement on the cost side in this theory, and it is not conducive to directly promoting the development of replacement technology. However, from another point of view, this also shows the general applicability of MFCA theory in the above industries. In the case of production default, approximate values can be obtained through the fitting relationship of environmental performance for prediction and estimation.

Moreover, some scholars also think about the future development direction of cost accounting from the perspective of institutional docking. Few believed that the alignment of cost accounting with EU standards should be strengthened to reduce the risk of insufficient anti-dumping evidence (Gui, 2021). However, we can not passively rely on the system's consistency in international trade disputes to reduce ambiguity and conflict. From another point of view, this research also helps to think about the matters needing attention in China's cost accounting disclosure.

On this basis, this paper will explore whether environmental performance is helpful for CVP analysis of enterprises and how to provide suggestions for future production decisions and information disclosure of enterprises according to changes in cost analysis. To investigate this problem, we will pay attention to an enterprise case to describe the application of environmental performance in MFCA theory, involving some simple regression methods.

2. Methodology

Firstly, selecting a company with sufficient cost accounting information disclosure is required. In order to be able to combine environmental data to make predictions, the selection range is further narrowed to 579 listed companies with more than 21 pages of CSR reports, mainly from manufacturing companies and financial companies. After considering the regional cultural characteristics of Shanghai and the continuous disclosure of the cost table in the annual report, it was decided to analyze Bright Dairy as a case. Since its launch in 2002, Bright Dairy has focused on dairy products. It has gradually created a complete supply chain covering foreign pastures, dairy processing, online sales and fresh milk reservation services. However, its competitiveness is far less than that of Mengniu and Yili. At present, the main market share is still concentrated in Shanghai, and it still needs to catch up with the international and domestic market competition.

Secondly, data from annual and CSR reports determines how much it helps understand production. Since its CSR report was officially released in 2018, the annual data from 2017 to 2021 were selected for collection, including the profit statement and cost change analysis table, as well as the number of employees in different departments and pollutant emissions in the CSR report. In cases where the data of the previous year in the report do not match the most recently disclosed data, adjusted statistics are selected as available data. At the same time, the data selected in the past five years can also better focus on the short-term strategy and the latest development direction of the enterprise, and the obstacles of more corporate culture and original production mode can be ignored in the discussion of reform and innovation stage.

Thirdly, the Contribution margin can be estimated. According to the annual report, Bright Dairy's approach to inventory measurement is perpetual inventory, meaning that there is no value difference between the allocation of direct material and conversion cost and the retention of inventory, the ratio of which will remain stable. However, the distribution of manufacturing costs is slightly vague; according to the system approach, manufacturing costs can be interpreted as distribution according to working hours and can also be understood as distribution according to wages. From the production process perspective, after collecting raw milk in the pasture, part of it is processed into low-temperature fresh milk, and the other part is processed into yoghurt drinks and milk powder. Therefore, the artificial strength and mechanization degree of each production equipment in different products, which is unsuitable for working hours allocation. The short shelf life of dairy products makes it difficult for the enterprise to regard it as a seasonal production change. Overall, it is more reasonable to allocate manufacturing costs according to the wages of production personnel. Although this will ignore the loss and depreciation of some machines, it can also effectively reduce the multicollinearity problem in the regression process. After considering the related costs as a function of the position, the approximate fixed and variable costs can be obtained for CVP analysis.

Finally, we need to find out Bright Dairy's development trend and potential problems in cost management. However, it is worth noting that the conclusions based on the financial statement data can only reflect the year's average level. Moreover, production costs still need to consider the impact of sales

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strategy and R&D results on product appreciation. Given the problems raised, suggestions will be made from the aspects of product preference, subject control, pollutant emission and ensuring the healthy development of enterprises in the future.

3. Results

As shown in *Table 1*, the overall Gross Margin of Bright Dairy shows an unfavourable condition over a five-year period, mainly because the increase in costs exceeds the increase in profits. It is worth noting that in 2018 the sales of Bright Dairy also showed a significant decline, in the absence of other food safety issues that may be related to inventory backlog and other issues because dairy consumption preferences will not achieve a massive change in the short term. The real turning point in 2020 should be due to the outbreak of the new coronavirus, which led to an increase in labour costs, and from operating costs began a substantial increase. The bigger problem with net income is that selling and R&D expenses need to provide more help to operating income. Generally speaking, the development of technology, whether it is through new products to increase revenue or through new technology to reduce costs, is the ideal result of R&D expense gradually increasing, which may suggest that in the new food processing, Bright Dairy encountered a bottleneck, in the short term and cannot strengthen the gross margin of the product through technological innovation. Compared with competitors, selling expenses can be ignored, but it also led to the market generally believing that the light failed to create the brand effect in promoting new products and attracting young users in both directions. However, even if the sales cost is increased, it has no significant impact on the used operating income, indicating that the strategy of strengthening the enterprise's market share through marketing activities does not apply to Bright Dairy. In the face of decreasing net income year by year, it may need more strict planning and management of product production.

Table 1: 2017-2021 profit statement data related to production

Year	2021		2020		2019		2018		2017
Revenue	29,205, 992,515	F	25,266, 056,840	F	22,563, 236,819	F	20,985, 560,398	F	21,672, 185,188
Cost of Goods Sold	23,846, 305,511	U	19,694, 818,409	U	15,504, 696,954	U	13,993, 223,213	F	14,452, 324,030
Gross Margin	5,359,687,004	U	5,571,238,431	U	7,058,539,865	F	6,992,337,185	U	7,219,861,158
Administration Expense	814,015, 577	F	826,343, 452	U	695,581, 365	U	668,331, 651	U	664,422, 619
Selling Expenses	3,649,524,399	U	3,273,827,626	F	4,860,231,451	F	4,994,995,363	F	5,163,646,454
R&D	89,259, 433	U	72,844, 897	U	68,140, 427	U	58,513, 339	U	49,510, 638
Net income of Profit	806,887, 595	U	1,398,222,456	U	1,434,586,622	F	1,270,496,832	U	1,342,281,447

From *Table 2*, it can be found that in the acquisition of dairy products, the main expenditure comes from direct material. However, the total output value of raising only accounts for 10 per cent of the output value of dairy products, indicating that the pasture can only meet part of the raw milk demand. Other food additives must still build a stable supply relationship and cost management mechanism. Considering the cold storage cost of commercially available low-temperature milk, the choice of temperature control equipment and means of transportation is another significant component of direct material. As the capacity increases, the direct material also increases linearly, which may account for a higher loss rate. From the direct labour point of view is to maintain more stable cost changes, it is also suggested that the overall industry line should not change in the direction of more intelligent so that labour costs are not significantly reduced, resulting in the production process direct material accounted for 80 per cent of the situation. From the perspective of Raising business, the distribution of each sub-category is relatively average, primarily determined by the industrial characteristics of animal husbandry focusing on labour. However, it can also be found that direct material has been stable in the current market even without a strict environmental protection disclosure stage, indicating that the high cost of raw materials encountered by Bright Dairy is an overall situation.

Without complete supply chain protection or lower-cost means of production cycle technology, it still needs to cope with the increasing production costs year by year. In other words, in the post-epidemic era, when the flow of people and materials has been impacted, if the prices of upstream and downstream raw materials rise, it is not easy to maintain the original level of labour costs under the premise that Bright Dairy follows the current production equipment and production line. As the significant product of Bright Dairy, reducing costs means not only retaining the core customer. Customers value the quality of fresh milk, but it also helps to reduce the cost of materials for the same raw yoghurt and other milk-flavoured

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beverages, thus driving the balance of direct material throughout the production process. On this basis, the capacity for raising is gradually increased, thus further reducing the expenditure on raw materials required for dairy products, and allowing for a virtuous cycle of self-owned pastures, the original eco-feed cycle, and consumption based on the health needs of the target customer. However, it will continue to have disadvantages in other derivative dairy products, and it is not easy to directly have an advantage in taste with emerging companies such as Milkground.

Table 2: 2017-2021 Production cost analysis

Year	Product	Cost of Goods	Direct Material	Direct Labor	Maufacture Overhead	DM(%)	Conversion Cost(%)
2021	Liquid Milk	12,458,225,574	10,619,327,076	436,223,033	1,402,675,465	85	15
	OtherDairy	8,100,873,483	6,870,849,274	158,037,131	1,071,987,078	85	15
	Raising	2,222,630,389	1,132,020,240	100,896,592	989,713,557	51	49
	Other	727,380,956	603,129,478	39,063,642	85,187,836	83	17
	Total	23,509,110,402	19,225,326,068	734,220,398	3,549,563,936	82	18
2020	Liquid Milk	9,885,476,580	8,408,285,420	347,273,933	1,129,917,227	85	15
	OtherDairy	7,026,615,176	5,957,451,078	138,233,417	930,930,681	85	15
	Raising	1,924,523,981	981,314,778	88,335,651	854,873,552	51	49
	Other	680,135,506	564,580,484	36,591,290	78,963,732	83	17
	Total	19,516,751,243	15,911,631,760	610,434,291	2,994,685,192	82	18
2019	Liquid Milk	8,108,866,369	6,896,952,985	284,542,628	927,370,756	85	15
	OtherDairy	5,374,655,152	4,553,745,676	105,416,896	715,492,580	85	15
	Raising	1,464,010,025	743,763,154	67,500,786	652,746,085	51	49
	Other	440,538,783	365,676,325	23,688,093	51,174,365	83	17
	Total	15,388,070,329	12,560,138,140	481,148,403	2,346,783,786	82	18
2018	Liquid Milk	6,828,891,535	5,804,780,627	240,515,967	783,594,941	85	15
	OtherDairy	4,489,495,463	3,804,732,864	88,067,493	596,695,106	85	15
	Raising	2,140,837,169	1,404,561,085	69,003,027	667,273,057	66	34
	Other	443,897,160	368,537,119	23,850,760	51,509,281	83	17
	Total	13,903,121,327	11,382,611,695	421,437,247	2,099,072,385	82	18
2017	Liquid Milk	7,565,116,907	6,434,018,060	266,507,505	864,591,342	85	15
	OtherDairy	4,393,626,516	3,728,081,480	85,521,804	580,023,232	85	15
	Raising	2,266,682,171	1,487,562,092	72,943,517	706,176,562	66	34
	Other	166,207,569	137,952,283	6,648,305	21,606,981	83	17
	Total	14,391,633,163	11,787,613,915	431,621,131	2,172,398,117	82	18

Since the production cost cannot be reduced in the short term, does the production plan conform to the actual sales situation? As can be seen from *Table 3*, yoghurt has the highest production of all dairy products, reflecting that fresh storage costs will still play an essential role in the production decisions of enterprises. Due to the short shelf life of yoghurt and fresh milk, Bright Dairy has been consciously increasing and reducing production capacity according to the number of inventories. However, milk powder has a significant inventory backlog. On one hand, it shows that the product's market competitiveness is weak.

On the other hand, it also shows that the company has misjudged the market demand in recent years. The sales situation 2018 has strengthened the confidence in production brought about by changes in fertility policies. Therefore, it is necessary to stabilize the production scale to alleviate inventory pressure and prevent losses caused by exceeding the shelf life. It is worth noting that the other major problem of Bright Dairy is exposed in the sale pricing per ton of products sold from the production point of view. Gross profit has dropped from 4437 to 1080, while the unit operating income is significantly less than the unit production cost growth, inventory costs decline is also a drop in the bucket, not to mention wasted opportunity costs. Therefore, regarding pricing strategy, Bright Dairy must increase the price of fresh milk and yoghurt with better sales. Unthinkingly affordable dairy products cannot attract more customers for enterprises, and it is easy for enterprises to fall into the mire of revenue and miss development opportunities. In the short term, it is difficult for new products to form a competitive pattern with domestic and foreign manufacturers. Unquestioningly, improving the pricing of new products can only bring a little operating income.

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Table 3: 2017-2021 Production analysis

Year	Product	Production	Cost of Production	Unit Cost(Ton)	Sales	Cost of Sales	Unit Cost(Ton)	Inventory	Cost of Inventory	Unit Cost(Ton)
2021	Fresh Milk	456,028			451,336			18,835		
	Yogurt	732,776			727,013			27,309		
	Milk Powder	291,188			227,248			123,052		
	Total	1,479,992	23,509,110,402	15,885	1,405,597	23,846,305,511	16,965	169,196	1,606,818,520	9,497
2020	Fresh Milk	372,279			370,761			14,143		
	Yogurt	661,461			662,389			21,546		
	Milk Powder	206,619			196,970			59,112		
	Raw Milk	387,240			387,039 1			1,554		
	Total	1,627,599	19,516,751,243	11,991	1,230,120	19,694,818,409	16,010	96,355	1,785,965,182	18,535
2019	Fresh Milk	319,336			318,590			12,625		
	Yogurt	660,240			669,577			22,474		
	Milk Powder	188,166			177,647			49,463		
	Raw Milk	418,947			418,657			1,353		
	Total	1,586,689	15,388,070,329	9,698	1,584,471	22,563,236,819	14,240	85,915	1,484,882,009	17,283
2018	Fresh Milk	246,986			251,156			11,879		
	Yogurt	699,243			692,660			31,811		
	Milk Powder	159,341			171,072			38,944		
	Raw Milk	441,619			441,418			1,063		
	Total	1,547,189	13,903,121,327	8,986	1,556,306	20,985,560,398	13,484	83,697	1,310,467,740	15,657
2017	Fresh Milk	625,736			629,670			16,911		
	Yogurt	796,580			809,275			25,228		
	Milk Powder	141,353			149,725			33,675		
	Total	1,563,669	14,391,633,163	9,204	1,588,670	21,672,185,188	13,642	75,814	1,095,320,356	14,447

Therefore, how to change the primary consumers from price-led to brand-led or taste-led will be the focus of the next stage of Bright Dairy, that is, how to make consumers more readily accept the reality of price increases. Technology research and development needs capital investment, and the introduction of talent needs more pay with adequate revenue support, even if no milk powder products inventory can cover the rapid rise in unit costs. For Bright Dairy, it is ideal to have a suitable capacity for each product because there will still be a regular part of the loss of consumers in the process of a shift in consumer values, which will inevitably result in sales not growing as compared to the previous year. In order to achieve the purpose of clearing inventory, the propaganda strategy also needs to focus on the backlog of products, which will also combat the market occupation of new products. Investment in new products is not to enhance the production model and reduce production costs, which can bring more profits to the enterprise.

The next step is to fit the fixed and variable cost coefficients for each existing expense based on the total number of employees. The original data is available in the Appendix, and *Table 4* is compiled from the regression results, where fixed cost is the intercept of each regression result. Although the assumption of fixed cost is ideal, it is surprising that the fluctuation of the CM ratio is shocking, among which the variable cost of sales and management costs is significant. Given Bright Dairy's history of frequent senior personnel changes, administration expenses should be effectively controlled in the future to prevent governance problems or corruption risks. In the variable cost of sales expenses, carefully considering how to build a century-old brand is necessary. It is not like Mengniu and Yili frequently sponsor entertainment programs or events because the variable cost has gradually exceeded the fixed cost. Mistakes in strategic decision-making will have a decisive impact on the profit and loss of enterprises. From the point of view of capital preservation, if the CM ratio can be stabilized at about 40 %, the future revenue requirements for Bright Dairy will be at the level of 2021. However, under the pressure of raw materials and inventory of production costs, it is a challenging goal to achieve. There is a lag effect, whether it is the redesign of management regulations or the investment of subsequent sales plans. The profitability of 2022 will become a significant turning point for Bright Dairy.

Another challenge for Bright Dairy is the direct coordination between environmental performance

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and production loss. In the fitting results of *Table 5*, only the unit emissions of carbon-containing gases are proportional to the production capacity, and the exhaust gas shows a negative correlation effect. Suppose it is not due to the difference in the production process. In that case, it can only explain the possibility of increasing the loss rate of finished products and natural resources. It is also an excellent challenge for Bright Dairy's efficiency and quality control production. It is true, but from comparing capacity scale and emissions, enterprises have made great efforts in environmental performance. However, whether this green production model is conducive to cost savings is still questionable. In the future, it is necessary for Bright Dairy to gradually optimize its gas emission technology based on enhanced product quality.

Table 4: CVP analysis

Year		2021		2020		2019		2018		2017
Revenue		29,205,992,515	F	25,266,056,840	F	22,563,236, 819	F	20,985,560, 398	F	21,672,185,188
Variable Cost		16,826,620,742	U	12,295,350,206	U	9,556,166,019	U	8,142,579,388	F	8,757,419,563
	COGS	15,410,335,115.97	U	11,258,848,013.97	U	7,068,726,558.97	F	5,557,252,817. 97	F	6,016,353,634.97
	Administration Expense	195,275,357.53	F	207,603,232.53	U	76,841,145.53	U	49,591,431.53	U	45,682,399.53
	Selling Expenses	1,165,409,966. 81	U	789,713,193.81	F	2,376,117,018.81	F	2,510,880,930. 81	F	2,679,532,021.81
	R&D	55,600,301.33	U	39,185,765.33	U	34,481,295.33	U	24,854,207.33	U	15,851,506.33
Gontribution Margin		12,379,371,773	U	12,970,706,634	U	13,007,070, 800	F	12,842,981, 010	U	12,914,765,625
Fixed Cost		11,572,484,178.37								
	COGS	8,435,970,395.03								
	Administration Expense	618,740,219.47								
	Selling Expenses	2,484,114,432.19								
	R&D	33,659,131.67								
Net income of Profit		806,887,595	U	1,398,222,456	U	1,434,586,622	F	1,270,496,832	U	1,342,281,447
CM Ratio		0.423864101		0.513364896		0.576471847		0.61199133		0.595914326
Break even point		27302345586		22542414324		20074673622		18909555771		19419711319
leverage		15.34212677		9.276568674		9.066772686		10.10862891		9.621503489

Table 5: OLS output of production

	Coefficients	Std	t Stat	P-value	Lower 95%	Upper 95%
Intercept	-33454542.57	1608401.893	-20.79986521	0.030583369	-53891226.32	-13017858.82
Carbon Per Ton	170450.1906	7874.111535	21.64691087	0.029388373	70400.11731	270500.2639
Water	-250.0960725	25.33480383	-9.871640381	0.064270521	-572.0052769	71.81313187
Gas	-1.338633632	0.118871474	-11.26118473	0.056384323	-2.849038922	0.171771659

4. Conclusions

This study used the linear regression model and CVP method to investigate Bright Dairy based on profit statement-related subjects. As shown by the data, we can find that Bright Dairy has encountered considerable challenges in cost control and operating income while maintaining the current green performance, which means that more cost expenditure is inevitable.

It is relatively straightforward that after the introduction of MFCA theory, the application in specific enterprises may be different from the overall performance of A shares, which can explain why there is a gap with the results of Yu (2018). For Bright Dairy, the biggest problem is not that cost management is not in line with the actual production model but how to reduce its inventory based on strategic misjudgment and increase the gross profit margin of the product. It has to be admitted that expanding market share and the size of potential consumers is a burden for the current Bright Dairy and, as is widely speculated, publicity costs will instead hit their precarious revenue position hard. However, no matter which choice will be opposed by many insiders, it is difficult for a bold decision-maker to make substantial changes. This can also explain why a century-old brand's performance declines in the new era. Competitors have gone global in their over-reliance on production thinking, which has become one of the factors hindering development.

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Otherwise, Bright Dairy needs to consider whether future acquisition targets will help control costs. Although Bright Dairy has also conducted many business practices in the past, the real focus is on the food technology of dairy products, which cannot be directly transformed into the consumer market to obtain feedback, so establishing a better sales system is also a breakthrough. In particular, it is necessary to strengthen the brand effect for sales channels other than direct online stores. According to the analysis of previous years' data, it is concluded that sales volume with more reference value can be used to adjust production capacity and reasonable use of discount promotion after unit price increase can be appropriately carried out to grasp consumer psychology and maintain the original revenue scale. A more detailed production plan and material budget are also necessary for specific cost management. Further disclosure of cost drivers, including manufacturing costs, will also help scholars better understand the actual situation of enterprises and put forward countermeasures and suggestions. This is why, in future acquisitions based on brand profitability, it is more necessary to consider whether the unified implementation of sales strategy and cost management system is necessary.

However, this analysis only focuses on the overall data for the whole year, which is only valid in some assumptions, especially in the case of small samples, resulting in very poor regression results except for production fitting. Furthermore, the application of MFCA theory only stays in verifying the accuracy of production. It has no more help for future production prediction, which requires further research and mining application scenarios in the future.

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