A Study on Performance Evaluation of BYD Enterprises Based on SD-BSC

Yuan He*, Xinwei Shu[a], Xin Yang[b]

Chengdu University of Information Technology, Chengdu, China

*heyuan@cuit.edu.cn, [a]1493163482@qq.com, [b]2790437637@qq.com

Abstract. Under the dual-carbon background, new energy vehicles have become the main development direction of the automobile industry. Based on the theoretical basis of balanced scorecard and the system dynamics approach, the article constructs a model for evaluating the performance of enterprises in financial and non-financial dimensions. By simulating various policy scenarios and their positive impacts on corporate performance, it clarifies that during the transition from an expansionary stage to a mature phase, enterprises should prioritize enhancing market share and containing costs and expenses.

Keywords: Performance evaluation, Balanced scorecard, System dynamics, Strategy formulation.

1 Introduction

Along with the integration of global economy, the energy problem has become an important factor restricting economic development.As the country with the highest carbon emissions in the world, China's environmental pollution caused by carbon emissions from fuel automobiles is a serious violation of the principle of harmonious development of the economy and the environment(Luo et al, 2019)[1].Therefore, economic development should be transformed, the energy structure should be changed, and enterprises should anchor their strategic implementation priorities according to different development stages.Ultimately, it provides the greatest low-carbon potential for solving climate and environmental problems.

2 Methodology

2.1 Causal Loop Diagram

This paper constructs an indicator system for enterprise performance evaluation based on the balanced scorecard, while the introduction of system dynamics depicts the complex causal relationship between specific indicators, as shown in Figure 1(Banda Webby,2023)[2].

K. Zhang et al. (eds.), *Proceedings of the 5th International Conference on Economic Management and Big Data Application (ICEMBDA 2024)*, Advances in Economics, Business and Management Research 313,
https://doi.org/10.2991/978-94-6463-638-3_35

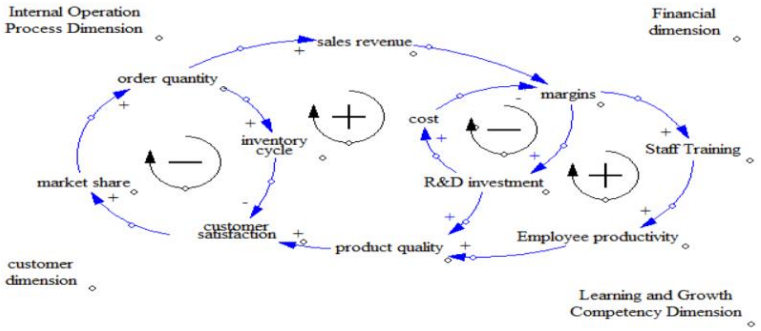

Fig. 1. Causal Loop Diagram

2.2 Stock Flow Diagrams

Based on the indicator system and causal loop diagram constructed above, this paper uses Vensim software to draw the stock flow diagram of the performance dynamic evaluation system. As shown in Figure 2(Berrak Erol Nalbur,2024)[3].

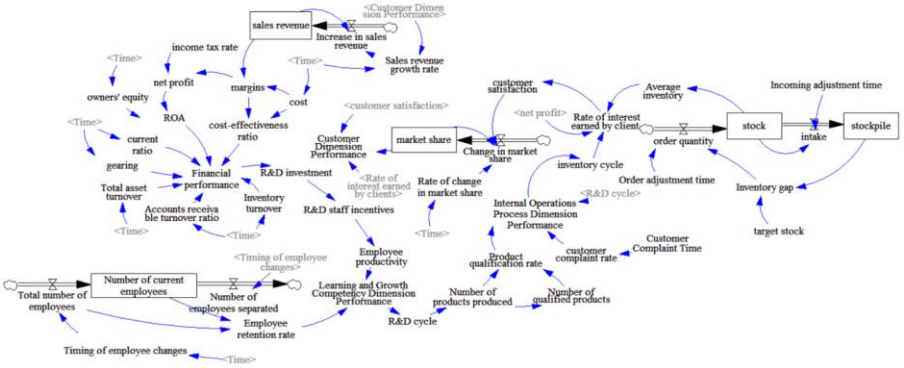

Fig. 2. Stock Flow Diagram

Determination of indicator weights

Based on the sum-product method in AHP, the quotient of each layer in the index system framework is calculated to get Wi, the quotient of Wi and each layer Aj is calculated to get AWi, and the maximum feature root is calculated, and the steps are as follows:

$$\lambda_{max} = \sum_{i=1}^{n} \frac{(AW)_i}{nW_i} (i = 1,2,3,\ldots,n) \tag{1}$$

Next, the judgement matrix is tested for consistency and the consistency index CI is calculated: the consistency ratio CR is calculated the steps are as follows:

$$CI = \frac{\lambda_{max} - n}{n-1} \tag{2}$$

$$CR = \frac{CI}{RI} \tag{3}$$

2.3 Model Testing

The validation of model authenticity involves comparing historical data with simulation results and calculating the magnitude of errors. If the average error falls within 10%, the authenticity of the model is considered valid, allowing for further simulation modeling. In this study, sales revenue is used as validation indicator. The result indicates that the error rates are significantly lower than 10%, confirming that the model has passed the authenticity validation and is suitable for simulation forecasting and policy adjustments.

Table 1. Sales Revenue Simulation and Error Rate Results

sales revenue	real value	analogue value	inaccuracies
2020	1566	1566	0 percent
2021	2161	2233	3.35 percent
2022	4241	4377	3.21 percent
2023	6023	6288	4.40 percent

3 Case Study

The publication categorizes the indicator system into three tiers: the dimension level, critical success factors level, and specific indicators level, encompassing a total of 17 specific indicators(Kaplan et al,1992). The comprehensive indicator system is detailed in Table 2(Zhao Chunhui,2018)[4].

Table 2. Performance Evaluation Indicator System

Performance evaluation dimensions	Critical success factors	Specific evaluation indicators
Financial dimension	solvency	current ratio
		gearing
	profitability	return on net assets
		cost-effectiveness ratio
	operating ability	Accounts receivable turnover ratio
		Inventory turnover
		Total asset turnover
	development capacity	Operating profit growth rate
		Revenue growth rate
Customer dimension	client relationship	Rate of interest earned by clients
		customer satisfaction
	market share	market share
Internal business processes	innovation link	R&D cycle
	business segment	Product qualification rate
	aftermarket segment	customer complaint rate
Ability to learn and grow	Employee Competence	Employee productivity
	Employee satisfaction	Employee retention rate

4 Data Analysis

4.1 Financial Dimensions

The study used Vensim software to increase these metrics by 10 percent to observe the changes in the effectiveness of BYD's strategy implementation under different financial conditions. The simulation results are shown in Figure 3 (Wang et al,2019)[5]. Among the aforementioned indicators, the cost-expense profit ratio exerts the most significant influence on enhancing financial performance. In recent years, BYD has capitalized on the energy development trend by vigorously developing the new energy automobile industry, securing substantial financial subsidies, which in turn reduced the company's production costs, R&D expenses, and ultimately bolstered its profitability. Following closely is the inventory turnover ratio. Amidst the pandemic and the influx of foreign capital into the domestic market, triggering a "catfish effect," enterprises have intensified inventory management and expanded sales to mitigate the loss of price depreciation caused by product overstocking, thereby enhancing their operational capabilities.

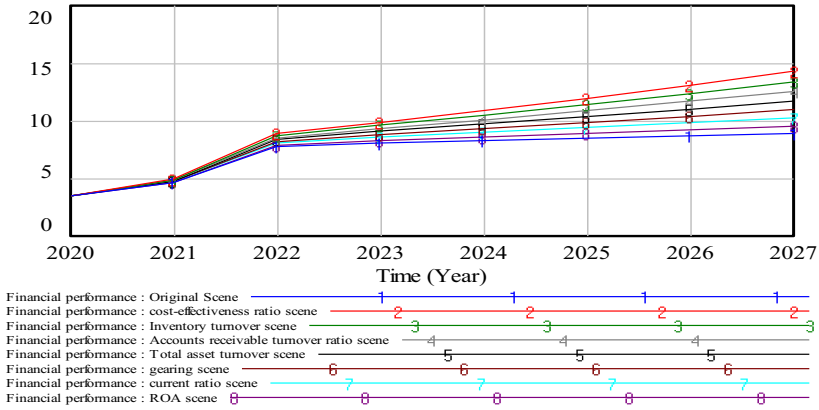

Fig. 3. Financial Performance Scenarios Under Different Policies

4.2 Internal Operational Dimensions

In the analysis of internal business performance scenarios, a 10% increase in R&D cycle and product qualification rate, along with a 10% decrease in customer complaint rate, are examined to evaluate operational efficiency and facilitate strategic enhancements in business processes(Reza et al,2017)[6].The simulation results are shown in Figure 4.Among the aforementioned indicators, the product qualification rate has the most significant impact on improving internal operational performance, followed by the customer complaint rate, while the R&D cycle has the least influence. To ensure product recognition and acceptance, the enterprise has placed greater emphasis on product quality and the development of new products since the implementation of the "542" strategy (i.e., "accelerating from 0 to 100 km/h in less than 5 seconds, all-time electric four-wheel drive, and consuming less than 2 liters of fuel per 100 kilometers").

By integrating internal resources, enterprises strive to improve product quality and thereby satisfy customers to a greater extent. However, the improvement and development of new technologies such as chips and charging piles equipped in new energy vehicles have a slightly weakening effect on corporate performance due to their longer cycles.

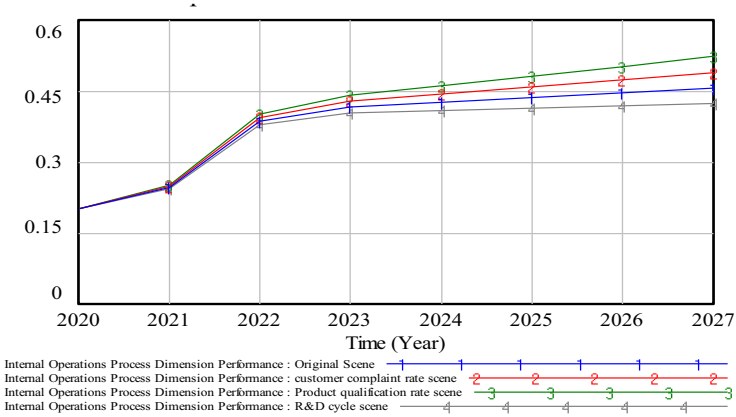

Fig. 4. Scenarios of Internal Operational Performance Under Different Policies

4.3 Customer Dimension

As shown in Figure 5, the simulation results indicate that market share has the greatest impact on customer performance, followed by customer satisfaction, while customer profitability has the least impact which is in line with the characteristics of the strategic development stage of the enterprise(Dian et al, 2019)[7]. Given the company's rapid expansion phase, continuously enhancing market share is of paramount importance. BYD has achieved this by enhancing product production efficiency, reducing lead times, and refining after-sales services, thereby fostering customer loyalty and further expanding its market share.

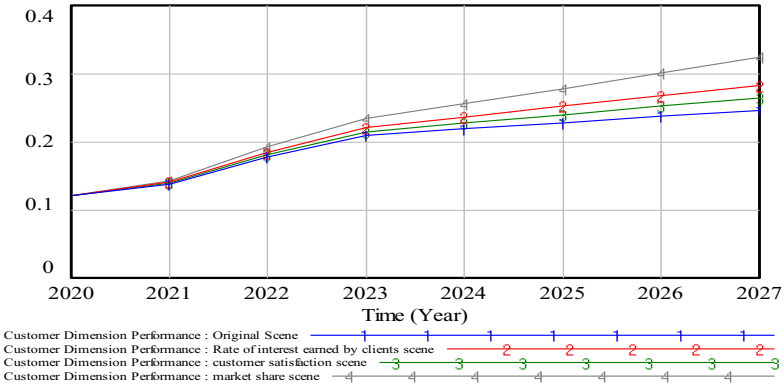

Fig. 5. Customer Dimension Performance Scenarios Under Different Policies

4.4 Learning and Growth Capacity Dimension

In this paper, we select two core indicators, employee productivity and employee retention, and conduct policy simulations based on Vensim software for scenario enhancement of 10% under different policies to observe their impact on corporate performance(Zhong,2021)[8].The simulation results are shown in Figure 6. The above different policies present a facilitating effect on the learning and growth dimension performance, with a greater impact on employee productivity, followed by employee retention, indicating that the company attaches importance to employee training, actively improves business competence, and shortens the delivery cycle(Alisa et al,2024)[9].

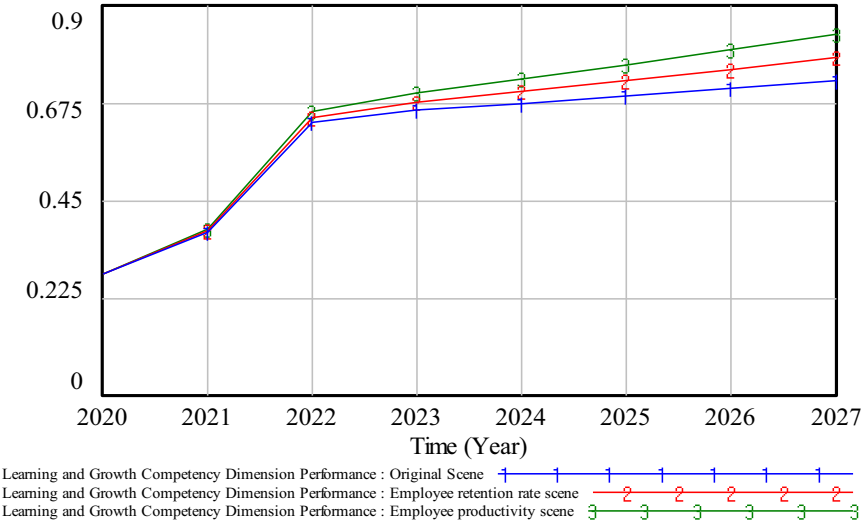

Fig. 6. Scenarios of Learning and Growth Capacity Performance Under Different Policies

5 Conclusions

Constructing a performance evaluation system encompassing both financial and non-financial indicators through the Balanced Scorecard (BSC) theory can aid enterprises in enhancing their financial management systems, thereby achieving operational stability. However, due to the lack of explicit causal relationships among various indicators, this study introduces System Dynamics (SD) as a complementary approach to address this limitation. From a quantitative perspective, the analysis of policy impacts across various dimensions in Figure 3-6 reveals that for enterprises transitioning from the expansion phase to maturity, it is crucial to elevate market share, maintain tight control over costs and expenses, and achieve a balanced relationship between profitability and risk, ultimately leading to the establishment of a robust financial structure. This research methodology not only contributes to the sustainable develop-

ment of the enterprise itself but also serves as a valuable reference for performance evaluation methods within the same industry(María et al,2024)[10].

References

1. Luo Yanmei, Sun Yongjun. Integration of balanced scorecard and internal control in advanced manufacturing enterprises[J]. Finance and Accounting Monthly, 2019(05): 44-51.10.19641/j.Cnki.42-1290/f.2019.05.006.
2. Banda Webby. A system dynamics model for assessing the impact of fiscal regimes on mining projects[J].Resources Policy,2023,81.10.1016/J.RESOURPOL.2023.103408.
3. Berrak Erol Nalbur, Ozcan Yavas. System dynamics model and discrete-event simulation of green logistics cases for the electric bus industries[J]. International Journal of Global Warming,2024,32(2):148-159.10.1504/IJGW.2024.135989.
4. Zhao Chunhui. Construction of internal control system based on balanced scorecard[J].Knowledge economy,2018(01):95-97.10.15880/j.cnki.zsjj.2017.01.054.
5. Li Kaifeng, Song Pengpeng, Wang Minmin. Research on the operating performance of listed companies in China's new energy industry[J].Friends of Planning,2014,(15):52-56.1004-5937(2014)15-0052-05.
6. Reza Sayyadi, Anjali Awasthi. A system dynamics based simulation model to evaluate regulatory policies for sustainable transportation planning[J]. International Journal of Modelling and Simulation,2017,37(1): 25-35.10.1080/02286203.2016.1219806.
7. Dian Prama Irfani, Dermawan Wibisono, Mursyid Hasan Basri. Design of a logistics performance management system based on the system dynamics model[J]. Measuring Business Excellence,2019,23(3):269-291.10.1108/MBE-01-2019-0008.
8. Wen Huizhong. Research on performance evaluation indexes of new energy automobile industry based on balanced scorecard-taking Azalea Automobile as an example[J]. Small and Medium-sized Enterprises Management and Technology (Zhongdian),2021,(12):149-151.1673-1069(2021)12-0149-03.
9. Alisa Ableeva, Guzel Salimova, Almira Farrahetdinova,. A balanced scorecard system as a character of the enterprise's financial stability[J]. International Journal of Intelligent Enterprise,2024,11(1):21-32.10.1504/IJIE.2024.135441.
10. Alejandro M. Martin Gomez, María Pineda Ganfornina, Maria Jesus Ávila Gutierrez. Balanced Scorecard for Circular Economy: A Methodology for Sustainable Organizational Transformation[J].Sustainability,2024,16(4).10.3390/SU16041464.