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Analysis of the Operating Capacity of Chinese New Energy Electric Vehicles Industry: Taking NIO as an Example

Xuanjian Huang [1], Xin Zhang [2*]

[1] The School of Management, Guangxi Minzu University, Nanning 530006, Guangxi, China | 20220167@gxmzu.edu.cn

[2] Business School, University of Bristol, Bristol, BS8 1QU, United Kingdom

[*] Corresponding Author: Xin Zhang | ZX20021110@outlook.com

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Abstract: Spurred by the global climate crisis, nations worldwide are accelerating energy-structure adjustments and promoting the low-carbon transformation of the transport sector through policy incentives. Concurrently, the deep integration of digital technologies and artificial intelligence is reshaping the automotive landscape, driving the joint evolution of electric powertrains and intelligent-driving capabilities and laying the technological foundation for smart mobility solutions. Amid this shift, an emerging cohort of next-generation automakers has entered the market. This study focuses on NIO Inc. as a representative firm within the global new-energy-vehicle (NEV) segment. Based on the operational capacity theory, study selects three key operational ratios: accounts receivable turnover, inventory turnover, and total asset turnover. Its primary objectives are to evaluate NIO's operational efficiency against industry benchmarks by checking NIO's annual financial report data from 2019 to 2023, and to propose actionable recommendations for the operational challenges identified. The study found that the accounts receivable turnover and inventory turnover of NIO fluctuated significantly, while the total asset turnover was relatively low. To address that, three improvement suggestions were proposed: refining credit management, optimizing inventory management, and enhancing asset utilization. It is hoped that these suggestions would provide a reference for other NEV enterprises and contribute to better promoting development of the industry.

Keywords: Operating capacity; New energy vehicle; Accounts receivable turnover; Inventory turnover

1. Introduction

Amid a deepening global technological revolution and industrial transformation, governments worldwide are accelerating the construction of green energy systems and utilizing multidimensional policy tools to steer the transportation equipment manufacturing sector toward low-carbon transition. Regulatory frameworks, such as the European Green Deal and the 'Fit for 55' package, mandate the promotion of low-carbon transportation and set ambitious targets for phasing out internal combustion engines. Aligned with these global industrial planning targets, NEVs are projected to achieve dominant market share in vehicle sales within leading markets by 2035.

Concurrently, the automotive sector in major economies is undergoing a structural shift from volume-driven expansion to stock optimization. Market data reveals sustained negative growth in traditional internal combustion engine passenger vehicle sales in recent years. Conversely, propelled by shifting consumer preferences, layered policy incentives, and improved supporting infrastructure, NEV passenger sales have achieved significant compound annual growth rates, with market penetration crossing critical thresholds globally. The expansion of the NEV market correlates directly with the growing number of industry participants and intensifying consumer demand. In this competitive landscape, operational capability has emerged as a strategic imperative, where enhancing operational efficiency is demonstrably pivotal to strengthening core competitiveness. Consequently, optimizing these operational dimensions represents a critical strategic priority for NEV enterprises.

The enterprise operational capacity assessment system, as a core component of financial analysis, evaluates the efficiency of capital operations and resource allocation through quantitative indicators, thereby providing valuable decision-making support for management. This analytical framework enables the identification of key characteristics within the enterprise's capital flow cycle, assists in diagnosing supply chain management inefficiencies, and supports the accurate detection of bottlenecks in the capital management process. By addressing these issues, enterprises can optimize their asset allocation structure, thereby maximizing capital appreciation and establishing a sustainable competitive advantage.

The objective of this paper is to assess the extent to which the operational capacities of a representative NEV enterprise, NIO Inc — a leading representative in the world's largest NEV market. Based on a comprehensive review of the operational characteristics of new energy vehicle enterprises, this paper builds upon the current development status of the industry, by analyzing NIO's financial ratios to identify existing operational and managerial challenges. assessing the efficiency of its vehicle asset utilization. Then this paper further explores common obstacles facing the broader new energy vehicle industry along with relevant policy implications.

2. Literature Review

Scholarly research on corporate asset operational efficiency continues to evolve with diversified methodological approaches. Analyzing Indonesian manufacturing firms' 2011-2013 financial data, Haeruddin (2023) identified that suboptimal asset turnover efficiency reduced working capital returns by 12% below industry averages, highlighting

management innovation as a critical driver for asset optimization [1]. In a complementary study, Oktavia's (2020) quantitative analysis of automotive companies listed on the Indonesia Stock Exchange (2010-2019) established significant positive relationships between operational efficiency metrics and profitability (ROA) through panel data modeling[2]. Extending the evidence beyond emerging markets, Wang (2020) further validated that optimized working capital structures enhance firm value, particularly demonstrating stronger marginal effects in capital-intensive industries using multilevel mixed-effects models[3].Li's (2021) research conceptualizes operational capability as reflecting asset liquidity dynamics and organizational vitality[4]. Synthesising these insights,Lin (2024) positions operational efficiency as a core determinant of corporate financial health, directly influencing solvency, profitability, and sustainable development [5] .

Current literature on operational capacity assessment reveals three critical limitations. First, methodological fragmentation persists, as studies predominantly adopt singular analytical perspectives (e.g., isolated metric assessment) without integrating them within foundational financial theories. Second, there is a pronounced contextual narrowness, with a disproportionate focus on traditional manufacturing sectors that neglects technology-intensive domains like NEV manufacturers. Most critically, dynamic external contingencies—including disruptive policy shifts and supply chain volatilities—remain systematically under-incorporated into existing operational efficiency frameworks, significantly limiting their explanatory power and real-world applicability. As Sheng (2023) contends, a comprehensive multi-dimensional assessment is essential to accurately diagnose operational strengths and weaknesses and inform strategic decisions [6].This gap is particularly evident within capital management research in the NEV industry, which predominantly focuses on the financial performance of traditional automakers. Consequently, a significant research void exists in assessing the working capital management efficiency of asset-light, technology-driven enterprises, such as the new car-making forces. Therefore, to bridge this gap, future research should prioritize developing integrated frameworks that synergistically incorporate financial indicators, external contingencies, and firm-specific technological innovations to generate holistic optimization solutions tailored to the unique dynamics of the NEV sector.

3. Concept and Theories of Operating Capacity

3.1. Concept of Operating Capacity

Operating capacity serves as a core measure of management quality, directly determining an enterprise's value creation capability and market competitiveness. Assets, being central to economic operations, derive their effectiveness from a dual-driven mechanism comprising allocation efficiency and turnover speed. This mechanism reflects the value transformation process throughout production and operations. Operating capacity encompasses a multidimensional evaluation system that includes liquidity, realization efficiency, and overall asset utilization, measured through key indicators such as Days Sales Outstanding (DSO), Inventory Turnover Ratio, and Total Asset Turnover Ratio. This framework systematically reveals the characteristics of an enterprise's industrial chain

operations.

Furthermore, the analysis of operating capacity not only assesses the level of asset preservation and appreciation but also, through the DuPont Analysis system, elucidates the linkage between Return on Assets (ROA) and operational efficiency at a secondary level. This provides critical decision-making support for enterprises to optimize their resource allocation models.

3.2. Operating Capacity Theory

Operating capacity is a key indicator for measuring the efficiency of capital element allocation. Its level of optimization directly determines the effectiveness of an enterprise's resource configuration and the potential space for enhancing value creation efficiency. In addition to foundational theories, this paper also draws upon relevant theories in working capital management and supply chain management, integrating theory with practice to provide a deeper analytical framework for assessing the operating capacity of industries and enterprises.

3.2.1. Working capital management

Working capital management focuses on the comprehensive integration and regulation of an enterprise's current assets and current liabilities, aiming to enhance their efficiency and create greater value. In theoretical domains, working capital management theory is primarily divided into two schools: the Element-based approach and the Channel-based approach.

Element-based working capital management theory emphasizes categorizing working capital management according to specific items of current assets and current liabilities, highlighting precise control over individual elements. It typically involves in-depth analysis of separate items such as inventory, accounts receivable, and accounts payable, thereby refining the overall management of working capital. By analyzing key indicators like turnover ratios, it accurately measures the utilization efficiency of various components of working capital. For instance, the Inventory Turnover Ratio reflects the speed of inventory turnover and the status of capital occupation.

In contrast, Channel-based working capital management theory divides the product life cycle into key short-term stages such as procurement, production, and sales. This theory aims to reduce transaction complexity and redundant links through process optimization, thereby improving overall operational efficiency. Channel-based management is primarily composed of three interrelated parts: supply chain management, channel relationship management, and customer relationship management, which together form its core framework. During implementation, enterprises need to focus on collaboration between different channels and remainly aware of the potential impact of external environmental changes on working capital management. By rationally planning and adjusting working capital management strategies across channels, enterprises can effectively enhance the turnover efficiency and usage benefits of working capital, thereby strengthening market competitiveness, improving profitability, and fostering long-term development potential. This helps enterprises maintain a competitive edge and achieve sustainable development in a fierce market environment.

3.2.2. Supply chain management

The theoretical framework of supply chain management (SCM) originates from classical strategic management theory. Its evolution represents an organic integration of methodologies from Lean Production and Agile Manufacturing paradigms, while also fully incorporating theoretical achievements from contemporary organizational behavior research. Currently, domestic academia defines SCM as a systematic management model facilitated by digital technology, achieving high-efficiency integration of logistics, capital flow, and information flow through full-chain collaborative planning.

This management paradigm relies on intelligent algorithms to optimize inventory turnover ratios, establishes visual procurement platforms, and utilizes big data analytics to improve the accuracy of demand forecasting, thereby forming a tri-flow synergistic value creation mechanism. It provides support for enterprises to build sustainable competitive advantages. Moreover, SCM strategy not only focuses on optimizing internal processes but also emphasizes close cooperation and collaboration with suppliers, manufacturers, logistics service providers, and end consumers. Through this cross-domain synergy, SCM can accurately align with market demand, flexibly adjust production and sales strategies, achieve cost-effectiveness while meeting market needs, and ultimately enhance the management efficiency of overall operating funds and strengthen enterprise market competitiveness.

3.3. Definitions of Financial Ratios for Operating Capacity Analysis

3.3.1. Accounts receivable turnover ratio

The Accounts Receivable Turnover Ratio is a key financial metric composed of net credit sales and the average accounts receivable balance. This ratio reflects the liquidity and management efficiency of accounts receivable within an accounting year. A higher ratio indicates improved capital turnover efficiency and enhanced ability to convert assets into cash. The formula is as follows:

$$\text{Accounts Receivable Turnover (times)} = \text{Net Credit Sales} / \text{Average Accounts Receivable Balance} \quad (1)$$

3.3.2. Inventory turnover ratio

The Inventory Turnover Ratio, also referred to as Inventory Utilization, is expressed as the mathematical relationship between the cost of goods sold and the average inventory balance during a specific accounting period. The calculation formula is as follows:

$$\text{Inventory Turnover (times)} = \text{Cost of Goods Sold} / \text{Average Inventory Balance} \quad (2)$$

As a crucial indicator for measuring sales efficiency and inventory management effectiveness, the Inventory Turnover Ratio reflects the speed at which inventory is converted

into cash during a specific cycle, revealing the liquidity of working capital and the level of fund utilization. A high ratio signifies accelerated inventory turnover, enhanced sales capability, reduced capital tied up in inventory, improved asset liquidity, and optimized fund efficiency. Conversely, a persistently low ratio often points to ineffective inventory control or overstocking due to poor market sales, necessitating adjustments in sales strategies to accelerate inventory flow. In terms of its functional mechanism, this ratio comprehensively assesses management quality in the product circulation phase by quantifying the speed at which inventory is converted into sales revenue or cash. A higher value directly corresponds to better sales performance and capital turnover conditions, while consistently low values expose risks of inventory accumulation and deficiencies in sales channels.

3.3.3. Total asset turnover ratio.

The Total Asset Turnover Ratio, also known as Total Asset Utilization, is calculated as follows:

$$\text{Total Asset Turnover} = \text{Sales Revenue} / \text{Average Total Assets} \quad (3)$$

As a comprehensive indicator of enterprise asset allocation efficiency, this ratio systematically reflects the synergistic operation level of fixed asset turnover and current asset turnover by measuring the ability of unit assets to generate revenue.

4. Operational Efficiency in the Chinese New Energy Vehicle Industry

4.1. NEV Industry Developing Current Status

Traditional automotive market has transitioned to a stock optimization phase, while NEV sector demonstrates robust expansion driven by autonomous industrial upgrading, market dynamism, and proactive government policies. NEV sales have achieved record-breaking growth, with the Association of Automobile Manufacturers (CAAM) reporting 2023 production and sales volumes of 9.587 million and 9.495 million units respectively. These figures represent year-on-year increases of 35.8% and 37.9%, elevating NEV market penetration to 31.6%. This sustained momentum marks China's ninth consecutive year as the global NEV market leader. China is the biggest. Historical sales volume and growth trends for 2015-2023 are illustrated in Figure.1.

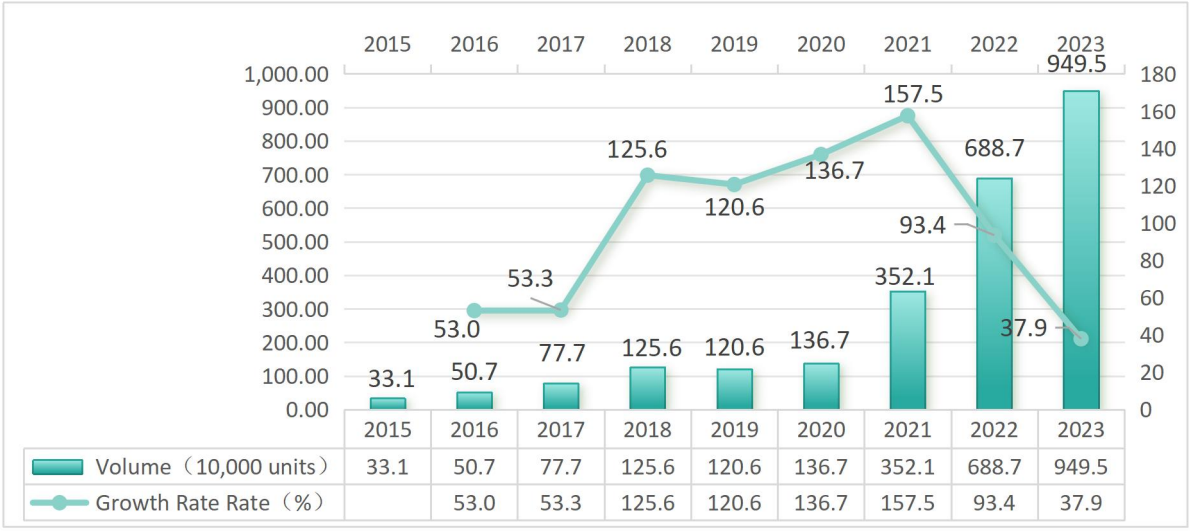


Figure 1. Sales Volume (10,000 units) and Growth Rate (%) of New Energy Vehicles in China, from 2015 to 2023

Source: China Association of Automobile Manufacturers

The NEV sector in China exhibits a competitive dynamic characterized by the dual participation of established automakers and new entrants (NEV startups). Based on product positioning and technological innovation, the market structure can be categorized into five segments: luxury brand transitions, subsidiary brands of multinational automakers, dedicated NEV divisions of domestic automakers (e.g., BYD), international NEV startups, and domestic smart vehicle specialists[7] (Bai, 2020). Data from the China Association of Automobile Manufacturers (CAAM) indicates that domestic brands secured an 81.6% share of the NEV market in 2023. Notably, NEV startups within this segment demonstrated a significantly higher R&D intensity ratio of 5.8%, compared to the industry average of 3.2%. While traditional automotive brands continue to hold a dominant position in the overall market, the rising influence of NEV startups is increasingly significant, with domestic NEV startups particularly clinching a substantial market presence.

4.2. Competitive Landscape of the NEV Industry

The competitive landscape of the NEV industry has intensified markedly, evolving into a structure broadly composed of two main cohorts: established automakers and new-energy-native startups. To provide a more granular view, this landscape can be further segmented into five distinct groups: legacy luxury brands, volume-focused global automakers, volume-focused local automakers, global NEV startups, and local NEV startups. Within the established automakers cohort, global players such as Volkswagen and Toyota leverage their mature technological platforms to maintain a significant market presence as they progressively electrify their vehicle portfolios. Similarly, local incumbent automakers, most notably BYD, have demonstrated formidable technological capabilities and manufacturing scale specifically within the NEV sector, which underpins their potential for continued market expansion. Conversely, the startup cohort is characterized by its disruptive approach.

This group is led by global pioneers like Tesla, alongside a prominent group of local innovators often referred to collectively as "Wei Xiao Li" (NIO, XPeng, and Li Auto). By employing innovative product-and-service business models, these companies have rapidly captured market share.

From the perspective of market share, established volume-focused local automakers remained dominant; however, the rise of NEV startups is noteworthy, with local NEV startups demonstrating powerful performance. According to *Figure 2* below, established local automakers accounted for 76% of the market, while NEV startups collectively held 24%. Within the startup segment, local NEV startups claimed a 13% share, and global NEV startups accounted for the remaining 11%.

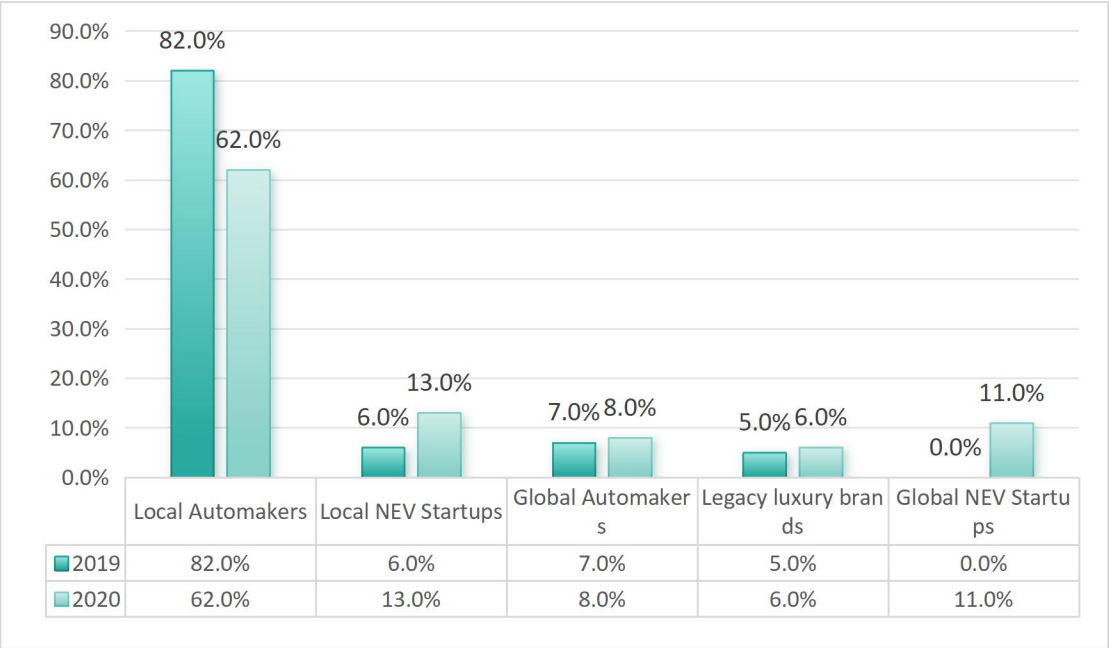


Figure 2. Competitive Landscape of the New Energy Vehicle Market, 2019-2020

Source: China Association of Automobile Manufacturers

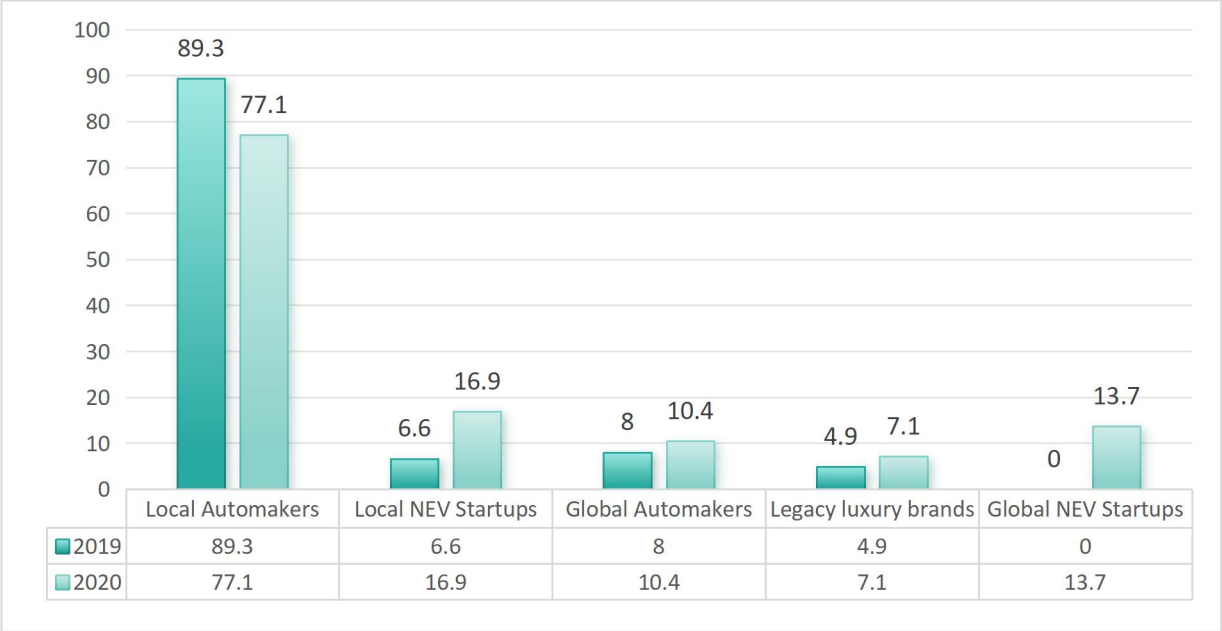


Figure 3. Sales Volume Comparison of New Energy Vehicle Manufacturers in 2019-2020 (Unit: 10,000 units)

Source: China Association of Automobile Manufacturers

As shown in *Figure 3*, sales trends in 2020 compared to 2019 reveal a decline in sales for volume-focused local automakers, while both global brands and local NEV startups experienced significant growth. This trend reflects the rapid transformation and realignment within the NEV market, where startup brands are increasingly challenging established players through innovative products and service models.

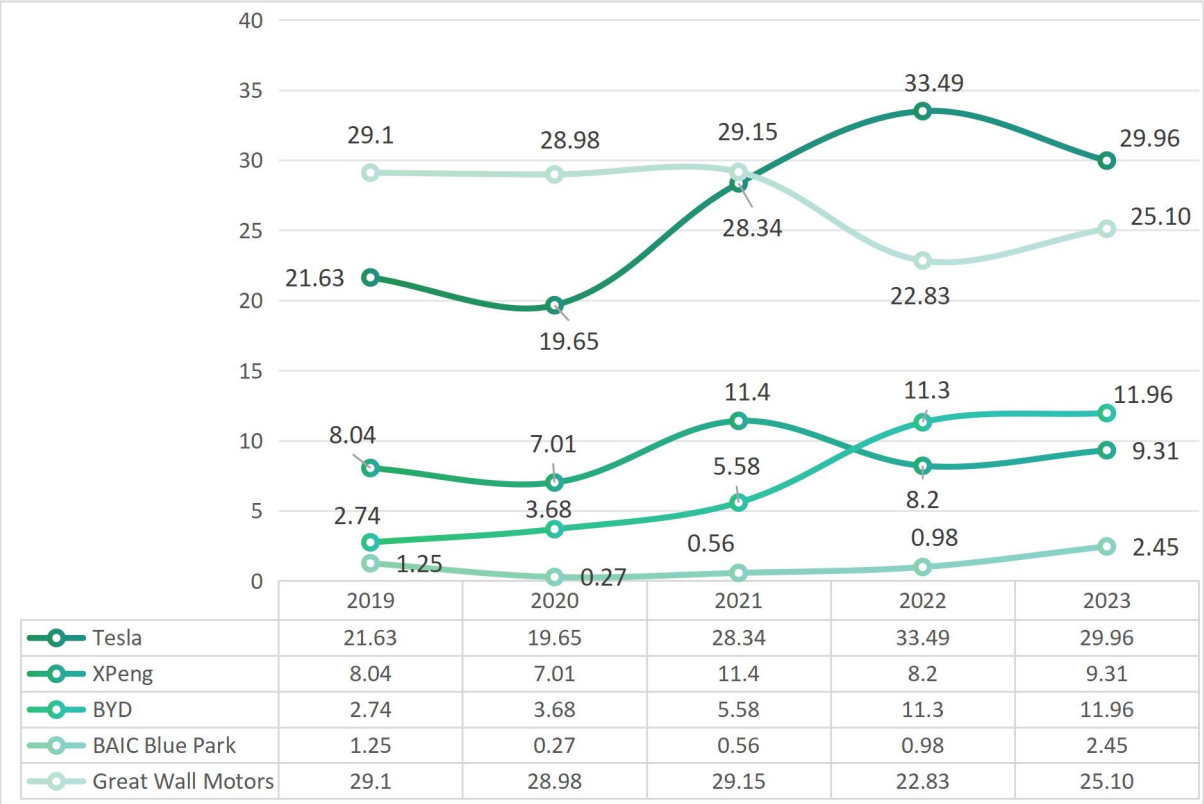
In terms of market share competition, the high-end segment (priced above RMB 250,000) has become a key battleground for leading smart EV brands such as Tesla, NIO, Li Auto, and XPeng.[8] This segment highlights the most advanced trends in vehicle intelligence and electrification. The mid-range market (RMB 100,000-200,000) is mainly dominated by longstanding automakers such as BYD and BAIC New Energy, which have deep roots in the automotive industry. [9] This segment not only represents a significant portion of the market but is also expected to be a major focus for future competition. In the entry-level segment (below RMB 100,000), models like the Wuling Hongguang Mini, Ora, and Benben have gained popularity due to their high cost-effectiveness. These vehicles meet the demand for affordable NEVs and account for a substantial share of total sales, demonstrating strong market potential and vitality.

4.3. Characteristics of Operational Efficiency in the NEV Industry

To systematically evaluate the overall operating capacity of China's NEV industry, this study employs a stratified sampling method for selecting case enterprises, based on the market structure analysis presented earlier. Specifically, according to brand market positioning and product price range, the market is divided into three tiers: high-end,

mid-range, and mass-market.[10] Representative listed companies are selected from each tier: Tesla for the high-end segment, XPeng for the mid-to-high-end segment, and BYD, BAIC BluePark, and Great Wall Motors as typical examples from the mass-market segment.

The *Figure.4* below summarize the core operating capacity indicators (including total asset turnover ratio, inventory turnover ratio, etc.) for these five representative enterprises from 2019 to 2023. All data are sourced from the companies' publicly disclosed annual financial reports and calculated using uniform formulas. Through horizontal and vertical comparative analysis of the sampled data, this study identifies the following salient characteristics of the current operational capabilities of Chinese NEV manufacturers.[11]



	2019	2020	2021	2022	2023
Tesla	21.63	19.65	28.34	33.49	29.96
XPeng	8.04	7.01	11.4	8.2	9.31
BYD	2.74	3.68	5.58	11.3	11.96
BAIC Blue Park	1.25	0.27	0.56	0.98	2.45
Great Wall Motors	29.1	28.98	29.15	22.83	25.10

Figure 4. Consolidated Accounts Receivable Turnover Ratios of Major NEV Brands, from 2019 to 2023

Sources: Tesla Reports, XPeng Reports, BYD Reports, BAIC BluePark Reports, Great Wall Motors Reports

NEV manufacturers exhibit high sensitivity to market strategies, influenced by external factors such as the pandemic and inherent product sales characteristics[12]. A defining operational feature is the relatively low and highly volatile accounts receivable turnover ratio. The phenomenon of capital remaining tied up in accounts receivable is not merely an isolated issue but an industry-wide challenge.[13] This capital retention problem reduces the efficiency of the cash conversion cycle within production operations, elevates the risk of bad debts,

lowers overall capital turnover rates, and consequently impairs corporate operational efficiency.

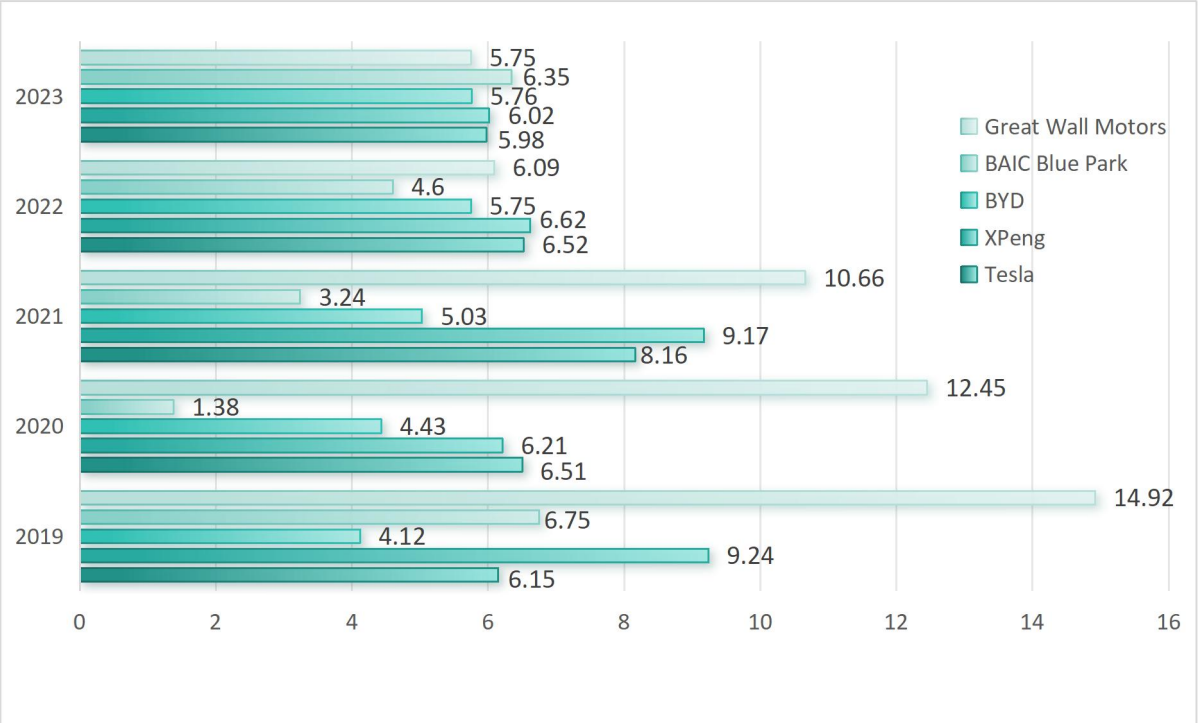


Figure 5. Consolidated Inventory Turnover Ratios of Major NEV Brands, from 2019 to 2023

Sources: Tesla Reports, XPeng Reports, BYD Reports, BAIC BluePark Reports, Great Wall Motors Reports

Persistent suboptimal inventory turnover characterizes the NEV sector, reflecting its transition into an era of stock-based competition. This operational inefficiency stems from a pronounced demand-capacity mismatch, where sales growth fails to synchronize with rapid industry scaling.[14] Consequently, manufacturers face elevated risks of inventory accumulation and fixed asset underutilization, collectively constraining working capital efficiency.

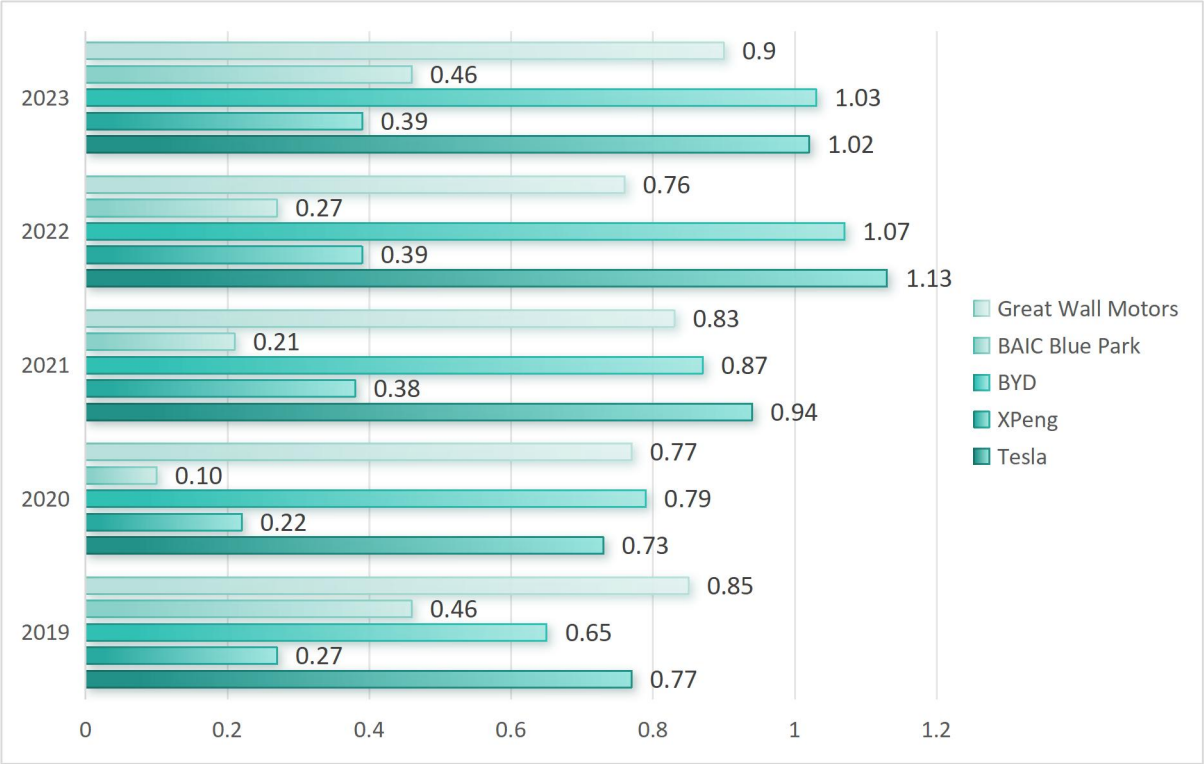


Figure 6. Consolidated Total Asset Turnover Ratios of Major NEV Brands, from 2019 to 2023

Sources: Tesla Reports, XPeng Reports, BYD Reports, BAIC Blue Park Reports, Great Wall Motors Reports

Suboptimal total asset turnover persists in the NEV industry due to its capital-intensive R&D requirements for advanced technologies. This structural characteristic necessitates substantial upfront investment with extended capital recovery cycles, creating systemic working capital constraints and heightened financing pressures across the sector.

5. Data and Analysis for NIO Operational Efficiency

5.1. Selection of Case Enterprises

Based on the previous analysis of the development of China's NEV industry, NIO, XPeng, and Li Auto, as early entrants into the market, have established significant brand influence in the smart electric vehicle sector. Leveraging their internet backgrounds, these companies focus on user needs and product iteration, effectively avoiding direct competition with traditional automakers through differentiated positioning in the mid-to-high-end market, thereby gradually building their respective market advantages.

From the perspective of market structure and economic rationale, the selection of case enterprises in this study is primarily based on their representativeness in specific market segments and the availability of data. Specifically, NIO primarily targets the high-end market with vehicles priced above RMB 300,000, XPeng focuses on the mid-to-high-end segment

within the RMB 150,000–300,000 range, and Li Auto specializes in the family vehicle niche. Together, these three companies form representative stratified price segments within the NEV market. Furthermore, as publicly listed companies, their disclosed financial data provides a reliable foundation for quantitative comparison of operational capabilities.

Among these enterprises, NIO, being the earliest to list and once leading in market capitalization, has a relatively mature business model, frequent capital operations, and continuous and complete financial data, making it a focal point for investors. Therefore, this paper ultimately selects NIO as the core case enterprise, aiming to provide a typical basis for understanding the financial characteristics and management logic of emerging smart EV manufacturers through a systematic analysis of its operational capacity.[15]

5.2. NIO Inc. Overview

NIO, founded by Li Bin in November 2014 in Shanghai, China, is headquartered in Hefei, Anhui Province. It is a leader in China's smart electric vehicle industry and a key player in the global market. In September 2018, NIO followed Tesla in successfully listing on the New York Stock Exchange. In 2023, NIO's revenue reached 55.618 billion yuan, with operating costs of 52.566 billion yuan, a gross profit of 3.052 billion yuan, and total assets of 117.385 billion yuan. In China's electric vehicle market, among brands with transaction prices exceeding 300,000 yuan, NIO ranked first in the second half of 2023, with a market share exceeding 40%.[16] From July to December 2023, NIO consistently outperformed the three traditional luxury brands—BMW, Mercedes-Benz, and Audi—in the segment above 300,000 yuan for six consecutive months. This statistic includes all vehicle types, both internal combustion engine and electric. NIO's sales performance demonstrates its competitive advantage across different power forms. NIO's key financial data from 2019 to 2023 is shown in Table.1. below:

Table 1. NIO's key financial data, 2019 - 2023 (Unit: 100 million CNY)

Item/Year	2019	2020	2021	2022	2023
Revenue	78.25	162.58	361.36	492.69	556.18
Cost	-90.24	-143.85	-293.15	-441.25	-525.66
Gross Profit	-11.99	18.73	68.21	51.44	30.52
Net Profit	-114.13	-56.11	-105.72	-145.59	-211.47
Total Asset	145.82	546.42	828.84	963.50	1173.85

Sources: NIO Financial Reports

5.3. Metric Analysis for NIO

To systematically capture NIO operational capacities, we calculated NIO three key operational metrics from 2019 to 2023, which are Accounts Receivable Turnover, Inventory Turnover, and Total Asset Turnover. Specifically, we made operational capacity comparisons

between NIO and NEW industry data which we selected five major NEV brands financial data to in the same period. All of data was collected from their annual financial reports. Such an arrangement of data and comparisons illustrate the detailed changes within NIO itself, and also reflect the situation of NIO in the entire NEV industry. Hence, with comparative analysis of these two aspects, we scientifically explained the operational capabilities of the NEV industry represented by NIO.

5.3.1. Accounts receivable turnover analysis.

Based on NIO's financial statements (2019–2023), the accounts receivable turnover dynamics are summarized in Table.2:

Table 2. NIO Accounts Receivable Turnover Ratio, 2019-2023

Item / Year	2019	2020	2021	2022	2023
Accounts Receivable	13.52	11.24	27.98	51.18	46.58
Revenue(Unit: 100 million CNY)	78.25	162.58	361.36	492.69	556.18
Turnover Ratio	13.13	7.42	18.31	11.50	16.81

Source: NIO Financial Reports, Forward Industry Database

As evidenced in Table.2, NIO's accounts receivable exhibited a marked contraction from 2019 to 2020, signaling deteriorating collection effectiveness and heightened credit impairment risk. Concurrently, the accounts receivable turnover ratio plummeted from 13.13 to 7.42 times/year during this period, reflecting suboptimal working capital management.The 2020-2022 phase witnessed sustained receivable expansion (11.24→51.18 billion CNY), indicating extended payment terms and lengthened cash conversion cycles. The number of cases rose from 7.42 in 2020 to 18.31 in 2021, then fell from 18.31 in 2021 to 11.50 in 2022, before rebounding in 2023, rising from 11.50 in 2022 to 16.81.

5.3.2. Inventory turnover ratio.

Table 3. NIO Inventory Turnover Ratio, 2019-2023

Item / Year	2019	2020	2021	2022	2023
Inventory(Unit: 100 million CNY)	8.89	10.81	20.56	81.91	52.77
Cost	-90.24	-143.85	-293.15	-441.25	-525.66
Turnover Ratio	7.66	14.60	18.68	8.61	7.81

Source: NIO Financial Reports, Forward Industry Database

Accounting to *Table.3*, NIO's inventory balance exhibited sustained expansion during 2019-2022, peaking at CNY 8.191 billion before contracting to CNY 5.277 billion in 2023.

Conversely, cost of revenue maintained consistent annual growth, reaching CNY 52.566 billion by December 2023. The inventory turnover ratio evolved through two distinct phases: demonstrating improvement from 7.66 to 18.68 times/year during 2019-2021, then declining to 7.81 times/year by 2023. In the post-pandemic operating environment, enhancing working capital efficiency necessitates reduced inventory holding periods, accelerated inventory turnover velocity, and compressed operating cycles - critical measures for improving capital liquidity and strengthening profitability margins.

5.3.3.Total Asset Turnover Ratio

Table 4. NIO Total Asset Turnover Ratio, 2019-2023

Item / Year	2019	2020	2021	2022	2023
Total Asset(Unit: 100 million CNY)	145.82	546.42	828.84	963.50	1173.85
Revenue(Unit:100 million CNY)	78.25	162.58	361.36	492.69	556.18
Turnover Ratio	0.47	0.47	0.53	0.51	0.46

***So*urce:** NIO Financial Reports, Forward Industry Database

From 2019 to 2023, NIO's operating income has consistently increased year by year, rising from RMB 7.825 billion in 2019 to RMB 55.618 billion in 2023. Similarly, the company's total assets have shown a continuous upward trend, growing from RMB 14.582 billion in 2019 to RMB 117.385 billion in 2023. During this period, the total asset turnover ratio fluctuated within a narrow range, varying between 0.46 and 0.53 times, with a relatively mild fluctuation trend and no significant directional change. Overall, the total asset turnover ratio has remained at a relatively low level over the past five years, indicating that the company's asset utilization efficiency has not met expected standards. The data further suggests that there is a time lag in converting core assets into operating income. This inefficiency directly constrains the company's ability to create value and limits its capital return rate, which in turn may have negatively impacted its market competitiveness. Additionally, the financial safety factor has also exhibited a declining trend.

5.4. NEV Industry Comparison Analysis

5.4.1. Accounts receivable turnover comparison.

After systematically calculating NIO's turnover ratio of account receivable, inventory turnover and total asset. The average figures for the automotive manufacturing industry were used as a benchmark for horizontal comparison. By analyzing the differences between the industry average and NIO's actual performance, this study identifies the distinctive characteristics and specific trends in NIO's asset operational efficiency. Such comparative analysis facilitates an evaluation of the strengths and weaknesses of NIO's asset utilization.

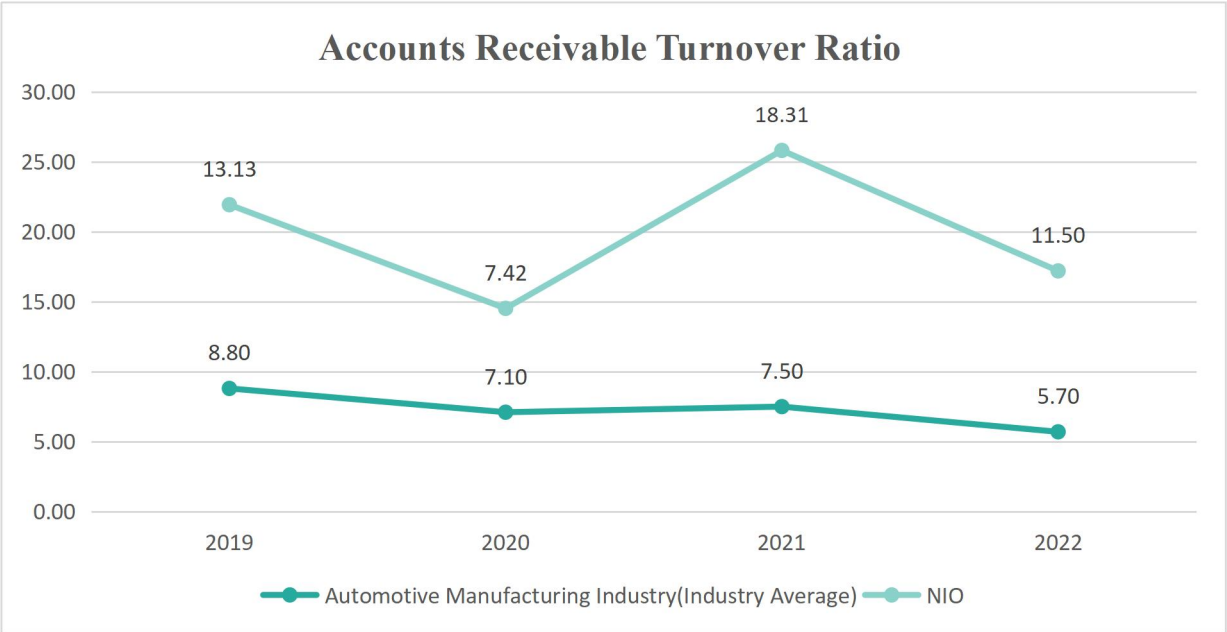


Figure 7. Comparison Chart of Accounts Receivable Turnover Ratio, from 2019 to 2022

Sources: NIO's financial report, State-owned Assets Supervision and Administration Commission

NIO's accounts receivable turnover trajectory mirrored the broader automotive manufacturing sector, exhibiting a consistent three-phase pattern of decline, recovery, and secondary contraction between 2019 and 2022. Both entities experienced significant deterioration during the 2019-2020 and 2021-2022 periods, with the latter phase coinciding with the peak pandemic impact. Specifically, NIO's turnover ratio fell sharply from 18.31 to 11.50 times a year during 2021-2022, representing a 6.81-time decrease that exceeded its 2019-2020 decline of 5.71 times by 1.1 times. Concurrently, the industry average recorded its steepest reduction during 2021-2022 with a 1.8-time contraction. This synchronized underperformance stemmed from persistent macroeconomic constraints under COVID-19, which impaired operational efficiency and extended collection cycles across automotive manufacturers. Nevertheless, NIO maintained consistently higher turnover ratios than industry benchmarks throughout this period, demonstrating superior working capital governance through enhanced risk controls and more efficient capital deployment relative to sector peers.

5.4.2. Inventory turnover comparison.

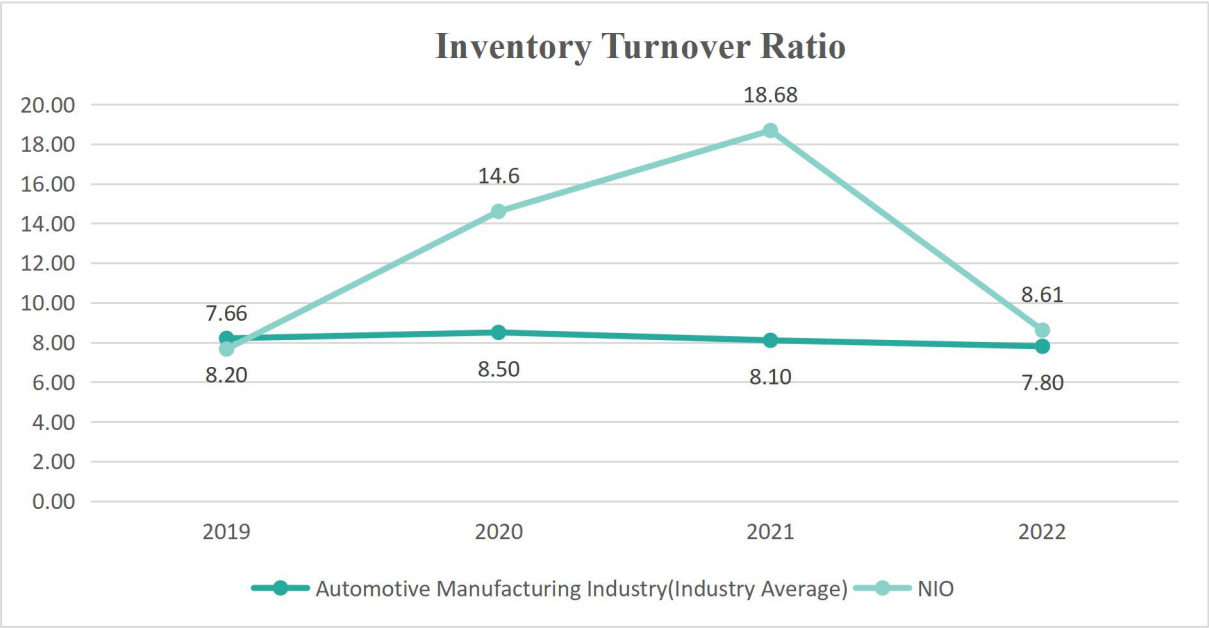


Figure 8. Comparison Chart of Inventory Turnover Ratio, from 2019 to 2022

Sources: NIO's financial report, State-owned Assets Supervision and Administration Commission

While the automotive manufacturing sector exhibited marginal inventory turnover fluctuations with relative stability during 2019-2022, NIO demonstrated pronounced cyclical volatility despite sharing the same pattern of initial growth followed by contraction. Quantitatively, NIO consistently outperformed industry averages after 2019, with the performance gap peaking in 2021 at a 10.58-turn differential (NIO: 18.68 turns vs. industry: 8.10 turns). This indicates progressive enhancement in NIO's inventory management capabilities since inception. Nevertheless, persistent turnover volatility necessitates strategic adjustments to inventory protocols, accelerated conversion velocity, and strengthened operational efficiency.

5.4.3.Total Asset Turnover Comparison

A horizontal comparative analysis of the total asset turnover ratio between NIO and the broader automotive manufacturing industry is presented in Figure.9 below.

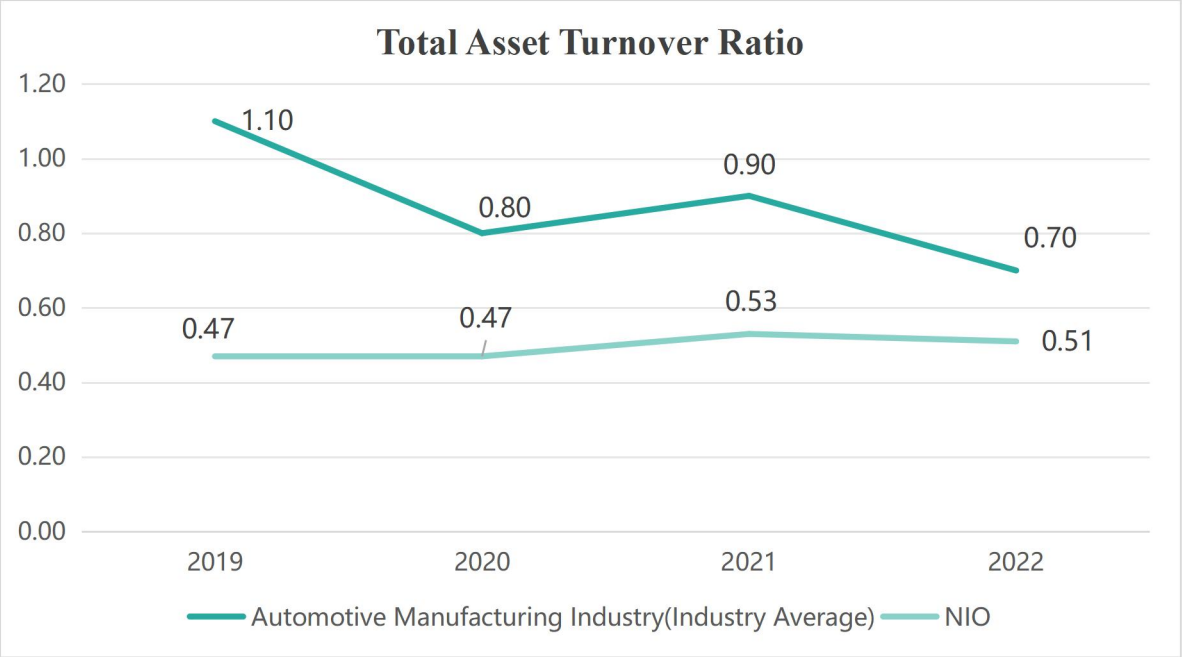


Figure 9. Comparison Chart of Total Asset Turnover Ratio, from 2019 to 2022

Sources: NIO's financial report, State-owned Assets Supervision and Administration Commission

From the perspective of changing trends, the total asset turnover rate of the automotive manufacturing industry exhibited significant volatility between 2019 and 2022, whereas NIO's rate demonstrated a relatively stable pattern. Despite this difference, the overall trend in both cases was broadly consistent. From a numerical standpoint, NIO's total asset turnover rate remained below the industry average from 2020 to 2022. The largest disparity occurred in 2019, when NIO's total asset turnover was 0.47 times, compared to the industry average of 1.10 times, resulting in a gap of 0.63 times.

6. Operational Challenges at NIO and Root Causes

6.1. Identified Operational Problems

6.1.1. High volatility in accounts receivable turnover with bad debt risks.

Comparative analysis of NIO's accounts receivable metrics from 2019-2023 reveals that while the company's receivables turnover consistently exceeded industry averages, it exhibited significant volatility. Particularly during 2020-2023, the ratio surged from 7.42 (2020) to 18.31 (2021), followed by a substantial decline to 11.50 (2022) - dipping below the

pre-pandemic level of 13.13 (2019).This pattern primarily stems from lenient credit policies implemented during 2020-2021 to drive sales volume expansion.[17] While temporarily boosting short-term sales, these measures consequently increased receivable balances and elevated bad debt exposure, ultimately compressing overall profit margins through heightened credit risk.

6.1.2. Inventory turnover volatility revealing supply chain issues.

Comparative analysis of NIO's operational data against automotive industry benchmarks during 2019-2022 reveals that while NIO maintained higher-than-average inventory turnover ratios, these metrics exhibited significant volatility. Inventory balances demonstrated consistent annual growth from 2019 through 2022, peaking at RMB 8.191 billion in 2022 before declining to RMB 5.277 billion in 2023. This pattern indicates deficiencies in inventory control precision and suboptimal supply chain coordination.[18] Notably, despite the 2023 inventory reduction, cost of sales continued rising substantially to RMB 52.566 billion. This divergence reflects considerable cost pressures in production and operations, where inadequate inventory management contributed to elevated warehousing and logistics expenditures. Furthermore, potential obsolescence risks from rapid technological upgrades could exacerbate inventory accumulation, ultimately impairing capital turnover efficiency and market responsiveness.

6.1.3. Suboptimal total asset turnover indicating low asset utilization.

Comparative analysis of NIO's 2019-2023 total asset turnover ratio reveals consistent underperformance against industry benchmarks, indicating suboptimal asset allocation and utilization efficiency. During the company's operational expansion phase, total assets demonstrated sustained growth while revenue expansion failed to match this asset base inflation, resulting in significant deterioration of turnover efficiency. This divergence is likely attributable to disproportionate capital commitments toward investment expansion and product development activities, coupled with market returns falling short of expectations. Furthermore, these findings underscore the need for enhanced managerial capabilities in asset stewardship and operational oversight.

6.2. Underlying Causes

6.2.1. Drivers of receivables volatility.

During the pandemic, NIO implemented comparatively lenient credit policies to expand sales and market share. Particularly during new product launches, the company offered extended credit terms and flexible payment conditions to attract customers. However, these measures consequently increased accounts receivable balances and prolonged collection cycles, thereby elevating bad debt exposure. Furthermore, intense competition within the NEV sector compelled NIO to maintain or further relax credit standards to preserve market position, which adversely impacted receivables turnover efficiency. Following the full

relaxation of pandemic restrictions during 2022-2023, receivables turnover demonstrated measurable recovery. This improvement aligned with broader economic normalization as consumption patterns gradually reverted to pre-pandemic levels, reflecting restored consumer confidence and stabilized purchasing behaviors.

6.2.2. Supply chain disruptions affecting inventory.

Throughout the pandemic, containment measures substantially intensified supply chain management complexities across the automotive sector. Simultaneously, NIO's multi-tiered supply network—characterized by numerous supplier dependencies—exacerbated coordination challenges within its production ecosystem. Consequently, when strategic suppliers across Jilin, Shanghai, and Jiangsu provinces sequentially suspended operations commencing March 2021, this vulnerability manifested acutely. The resulting production disruption persisted without timely resolution, ultimately compelling NIO to implement a complete vehicle assembly suspension during critical periods.

Specifically, two major supply chain failures materialized in early 2021. Initially, semiconductor shortages triggered NIO's first-ever five-day production halt in March. Subsequently, insufficient supply of STMicroelectronics' electronic stability program (ESP) chips precipitated an August delivery decline to approximately 5,000 monthly units.[19] Furthermore, these disruptions exposed structural vulnerabilities formally documented in NIO's HKEX prospectus, which confirmed predominant single-source procurement for core components through exclusive supplier arrangements without established contingency sourcing alternatives.

Therefore, this procurement framework inherently generates unavoidable disruption risks during exogenous shocks. Although NIO implemented preventive countermeasures, inventory turnover volatility during the period nevertheless demonstrates their limited efficacy. Moreover, accelerated product refresh cycles driven by rapid technological obsolescence and evolving consumer preferences have compounded inventory management complexity, thereby increasing associated carrying costs throughout the NEV sector.

6.2.3. Root causes of low asset utilization.

NIO maintains disproportionately high capital commitments in heavy assets. The company aggressively invests in battery-swap stations globally to address user demand for convenient charging solutions. As of April 2024, NIO operates 2,411 battery-swap stations across China. However, according to public disclosures, per-station construction costs range between RMB 1.5-3.0 million: approximately RMB 2.5-3.0 million for first-generation stations and RMB 1.5 million for second-generation units. The total investment per station averages RMB 7 million, encompassing infrastructure, battery procurement (RMB 60,000 per unit), and electrical systems - with battery costs constituting 47% of total expenditure. Consequently, these substantial construction and operational expenses generate limited economies of scale in the short term, resulting in significant fixed asset investments that suppress total asset turnover.

Moreover, NIO sustains exceptionally high R&D expenditure. Public data indicates

2023 R&D investment reached RMB 13.43 billion - the second consecutive year exceeding RMB 10 billion and substantially above industry averages. While demonstrating NIO's commitment to technological innovation and yielding tangible performance improvements, this intensive R&D allocation immobilizes substantial working capital, adversely impacting liquidity.

6.3. Recommendations for Enhancing NIO's Operational Capabilities

Analysis reveals opportunities for improvement in NIO's credit management, inventory control, and asset utilization. Implementing refined credit systems, optimized inventory strategies, and enhanced asset operation efficiency will strengthen operational capability, boost market competitiveness, and solidify sustainable development foundations. These evidence-based recommendations provide actionable solutions for the NEV industry and offer practical insights for improving sector-wide resource efficiency.

6.3.1. Refining credit management to accelerate receivables turnover.

NIO should establish a data-driven dynamic risk control system integrating multidimensional CRM data—including financial stability assessments, transaction histories, and industry credit ratings and using machine learning algorithms generate dynamic credit scores incorporating innovative metrics like battery swap frequency and community engagement, enabling tiered credit limits and flexible financing solutions. Concurrently, implement blockchain-based smart contracts for real-time receivables tracking and risk alerts, supplemented by time-series analysis for dynamic aging reports. Prioritize monitoring high-risk accounts while linking sales team compensation to collection rates, with progressive penalties for policy violations. Industry studies indicate this approach reduces bad debt by 35-40% and improves capital turnover by >20%, facilitating NIO's transition from policy reliance to market orientation.

6.3.2. Optimizing Inventory Management Through Diversified Sourcing

To optimize inventory management, NIO should implement precision control through cross-departmental coordination with clearly defined accountability frameworks, deploying advanced systems for real-time synchronization of sales forecasts, production plans, procurement schedules, and logistics data. Establishing optimal stock levels requires analyzing historical sales patterns, market trends, and capacity constraints, supplemented by regular inventory audits. The company must adopt lean inventory philosophies including JIT and VMI methodologies, executed through supplier integration via shared forecasts and production plans to enable demand-driven replenishment, enhanced production coordination ensuring scheduling continuity to reduce work-in-process inventory, and logistics optimization through provider partnerships that streamline distribution networks. Continuous supply chain diagnostics should identify operational constraints while process improvements enhance systemic responsiveness, collectively boosting inventory turnover and overall supply chain efficiency.

6.3.3. Enhancing Asset Utilization to Improve Total Asset Turnover

To enhance total asset turnover, NIO should implement an integrated capital allocation strategy balancing battery swap infrastructure investment with R&D expenditure. For swap station deployment, the company must optimize site selection through big data analysis of charging demand hotspots, ensuring maximal station utilization. Concurrent technological innovation and supply chain optimization should continuously reduce construction and operational costs, alleviating financial burdens. Additionally, NIO could establish mutually beneficial partnerships with energy providers and commercial property developers to share infrastructure costs, while generating ancillary revenue through value-added services like advertising partnerships and retail space leasing.

In the part of Regarding R&D operations, implementing a milestone-driven framework with clear evaluation mechanisms will ensure efficient resource allocation and project acceleration. Strategic collaboration with academic institutions and supply chain partners through resource sharing and joint development initiatives can reduce R&D costs while accelerating technology commercialization. Establishing dedicated innovation funds would further stimulate internal breakthroughs, enhancing both research efficiency and output quality.

For comprehensive asset management, NIO should conduct systematic audits to identify underutilized assets for divestment or repurposing, thereby improving operational efficiency. Deploying advanced asset tracking systems would enable real-time monitoring and precision management, minimizing asset impairment risks. Exploring financial instruments such as asset securitization could convert fixed assets into more liquid forms, ultimately boosting total asset turnover efficiency.

7. The Challenges and Future Development Pathways for NEVs industry

7.1. NEV Industry-Wide Operational Challenges

NIO’s current situation reflects similar challenges across the new energy vehicle industry. Like Tesla, the global leader in battery technology and supply chain integration, also faces instability in battery material supplies. Despite its scale advantages, Tesla’s premium positioning and substantial R&D investments result in persistently high production costs. Moreover, XPeng, a major emerging automaker, relies heavily on external suppliers for critical components like batteries and chips, creating significant supply chain risks. Then, BYD, representing traditional automakers transitioning to NEVs, maintains relatively higher inventory turnover but faces inventory management complexities due to its multi-business operations.[19] These cases demonstrate that virtually all NEV manufacturers encounter core component supply instability (batteries, chips). Additionally, due to volatile market demand and rapid technological iteration, unstable inventory turnover, heavy R&D expenditures, and elevated production costs represent industry-wide phenomena.

Operational capability challenges in the NEV sector are universal, primarily manifested in supply chain management, inventory turnover volatility, high operating costs, and capital constraints. While NIO’s issues mirror those of peers, companies are adopting diverse

strategies to address them. As the industry matures, competence in precision management and supply chain coordination will become critical competitive differentiators.

7.2. Future Development Pathways for NEVs

7.2.1. Addressing Range Anxiety through Technological Advancement

The NEV industry continues to face critical bottlenecks, primarily manifested in range limitations and inadequate energy replenishment infrastructure. Despite rising global market penetration, disparities in power battery performance across environmental conditions significantly constrain user experience. Concurrently, lagging charging infrastructure development has resulted in an imbalanced vehicle-to-charger ratio and insufficient maturation of high-power charging technologies, adversely affecting mobility efficiency. To overcome technical constraints in energy density enhancement and thermal management optimization, Chinese NEV manufacturers must implement a Three-Dimensional Break through Strategy: Pioneering solid-state battery materials; Developing holistic thermal management algorithms; Strategically deploying ultra-fast charging networks. Establishing an integrated intelligent thermal control + ultra-fast charging dual-drive framework will reshape global NEV competitive dynamics. [20]

7.2.2. Strengthening International Technological Collaboration

As economic globalization progresses, cross-border technology exchange intensifies, positioning the NEV sector as a pivotal force in redefining global industrial divisions. should adopt a Dual-Track Development Model combining indigenous innovation with open collaboration: Building proprietary innovation systems in core technologies (solid-state electrolyte energy density, intelligent thermal management) through dual-circulation strategy; Establishing global R&D centers to participate in international standard-setting; Transitioning from technology follower to standard leader. This Technology-Standards-Market trinity approach mitigates path dependency in technology transfer, fosters global innovation alliances, and Jointly build a global industrial and supply chain system that is safe and stable, smooth and efficient, open and inclusive, and mutually beneficial and win-win.[21]

7.2.3. Reducing Reliance on Government Subsidies

With fiscal support entering a phase-down period—marked by 40% year-on-year reductions in subsidies since 2022 and imminent expiration of purchase tax exemptions—the industry faces structural transformation. Market analysis reveals heightened consumer price sensitivity (increasing by 17 percentage points post-subsidy reduction) and declining price elasticity (from 0.8 to 0.6). This transition necessitates that enterprises establish a Technology-Value Creation dual-drive model through breakthroughs in solid-state battery mass production, development of intelligent energy management systems, and expansion of ultra-fast charging networks. Concurrent implementation of full lifecycle value management via OTA updates and battery-as-a-service models will enhance brand loyalty, ultimately

enabling the critical shift from policy-dependent to market-driven industrial upgrading.

8. Conclusions

Amid the rapid expansion of the new energy vehicle (NEV) market, intensified industry competition has emerged with proliferating market entrants. Consumer choice diversification is accelerating market consolidation, exposing manufacturers with inadequate technological reserves and innovation capabilities to exit risks. NEV producers must therefore closely monitor supply-demand shifts, accelerate product portfolio enhancement, and sustain competitiveness through strengthened R&D capabilities.

Furthermore, management imperatives require enterprise leaders to prioritize operational efficiency evaluation through optimized asset management models, systematized accounts receivable management, strengthened inventory control mechanisms, and refined debt structures. This integrated approach enables efficient financial resource allocation and enhanced market competitiveness. Accordingly, this study selects NIO Inc. as its empirical focus, examining 2019-2023 operational efficiency metrics to identify operational vulnerabilities and propose improvement pathways. Strategic recommendations for NIO include enhancing credit sales collection mechanisms, implementing dynamic inventory monitoring systems, improving fixed asset utilization efficiency, and developing management's working capital coordination capabilities-initiatives that collectively support sustainable competitive advantage. Moreover,other automakers in the new energy vehicle industry can also appropriately monitor and adjust their operational strategies in accordance with their own specific circumstances and the findings of this case analysis, thereby enhancing their competitiveness and contributing to the robust development of the industry.

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