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Manufacturing Enterprises' Digital Asset Value Evaluation Based on Multi-period Excess Return Method and Case Analysis

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Abstract. Data assets have become strategic resources for manufacturing enterprises due to digital transformation, but most remain off-balance-sheet, challenging stakeholders to evaluate their true value. Traditional methods like market and cost approaches fail to capture the dynamic nature of data assets, while the income approach still has limitations in predicting future earnings and discount rates. This work integrates the Multi-Period Excess Return Method (MPEEM) with the Analytic Hierarchy Process (AHP) to accurately assess the value of data assets. The MPEEM isolates excess returns from data assets, and AHP separates the contribution of off-balance-sheet assets. Empirical analysis of Midea Group, BYD and Xiaomi shows that data assets significantly contribute to enterprise value, with core drivers including smart manufacturing data, consumer behavior analyses, and supply chain optimization data. This paper provides a robust framework for valuing data assets, supporting strategic decision-making and regulatory compliance in the manufacturing sector.

Keywords: data asset, value assessment, manufacturing industry, multi-period excess return method

1. Introduction

In the digital transformation era, data resources have evolved from mere information elements to strategic assets that significantly contribute to the economic value of manufacturing enterprises. The implementation of the "Provisional Regulations on Accounting Treatment of Enterprise Data Resources" in 2024 marks China's official entry into the "Year of Data Asset Reporting" [1]. Data assets are defined as information sets generated in cyberspace with data ownership (exploration rights, usage rights, ownership), practical value, and readability and computability. Data asset reporting aims to enhance the transparency of enterprise assets by incorporating data resources that can generate economic benefits into financial statements according to accounting standards [2, 3].

Despite the significance of data assets, most manufacturers still treat them as off-balance-sheet items, making it difficult for stakeholders to evaluate their true impact on business performance.

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Traditional evaluation methods, such as the market approach and cost approach, struggle to quantify the time-varying and ecological integration aspects of data [4]. By contrast, the Multi-Period Excess Return Method (MPEEM) can not only adapt to the dynamic change of data assets, but also reduce the estimation deviation. Therefore, this study aims to address these challenges by applying an enhanced valuation framework using the MPEEM combined with the Analytic Hierarchy Process (AHP) to accurately assess manufacturing data assets. The case study is based on three representative manufacturing enterprises with deep accumulation of data assets, clear realization of data value and financial transparency: BYD, Xiaomi and Midea Group.

2. Literature review

2.1. Existing methods for data asset valuation

The 2023 "Guidelines for Data Asset Valuation" outline three primary methods for assessing data asset value: the market approach, cost approach, and income approach [5]. However, the market approach is limited in China's nascent data element market, and the cost approach fails to capture the subsequent appreciation of data assets [6, 7]. The income approach, while suitable, still faces limitations in predicting future earnings and discount rates [8]. To address these limitations, scholars have innovated on existing methods, such as the real options approach in the telecommunications industry [6] and the multi-period excess return model based on the income approach [9].

2.2. Assessment of current literature

Although many scholars have explored data asset evaluation methods, China has not yet clearly defined the specific methods for certain types of enterprises. Most studies focus on e-commerce and artificial intelligence companies, with few addressing manufacturing companies [10, 11]. This research aims to identify suitable data asset value assessment methods based on the unique characteristics of manufacturing data assets.

2.3. Characteristics and methods for manufacturing enterprises

Manufacturing data assets are characterized by diverse sources, strong timeliness, and complex cost aggregation [4, 12]. Traditional evaluation methods are less effective due to frequent data updates and changes in market demand. The multi-period excess return method, by separating the contribution of on-balance-sheet assets and quantifying the value-added effect of data assets, better accommodates the multi-source nature and time-varying characteristics of manufacturing data assets [4].

Therefore, this paper will evaluate the value of data assets in the table of manufacturing enterprises based on multi-period excess return method, and conduct case analysis on the value of data assets of typical enterprises, so as to provide an appropriate path for the evaluation of data assets of manufacturing enterprises in China.

3. Methodology

To systematically assess the value of data assets in manufacturing enterprises, this study adopts a hybrid valuation framework that integrates the Multi-Period Excess Earnings Method (MPEEM) with the Analytic Hierarchy Process (AHP). This combined approach enables the isolation of data-driven value contributions while accounting for the dynamic and multi-source nature of

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manufacturing data assets. The methodology is structured into two core components: (1) the MPEEM for quantifying excess returns attributable to data assets, and (2) the AHP for determining the income-sharing rate of off-balance-sheet assets.

3.1. Multi-Period Excess Earnings Method (MPEEM)

The MPEEM is employed to isolate the incremental cash flows generated by data assets beyond those attributable to tangible and intangible assets. This method is particularly suitable for valuing data assets due to its ability to capture multi-period value generation and adjust for time-varying contributions.

3.1.1. Model specification

The core formula for the MPEEM is expressed as:

$$V_d = \sum_{t=1}^{n} \frac{(E_t - E_{f,t} - E_{c,t} - E_{i,t}) \times Kt}{(1+i)^t}$$

Where:
Et : Enterprise FCF in period t
Ef,t :Contributions of fixed assets
Ec,t :Contributions of current assets
Ei,t :Contributions of intangible assets
Kt : Income-sharing rate of data assets (derived via AHP).
i : Discount rate (WACC).

3.1.2. Implementation steps

1) FCF Projection: Forecast enterprise FCF over a 5-year horizon (2025–2029) based on historical performance and industry benchmarks.

2) Asset Contribution Separation: Deduct returns attributable to fixed assets (4.9%), current assets (4.35%), and intangible assets (4.9% + 0.3% amortization) from total FCF.

3) Residual Income Calculation: The residual value represents the portion of earnings driven by off-balance-sheet data assets.

4) Discounting and Aggregation: Discount the residual income stream to present value using the firm-specific WACC and aggregate to obtain the total value of data assets.

3.2. Analytic Hierarchy Process (AHP)

To determine the income-sharing rate *Kt*, this study applies the AHP, a structured multi-criteria decision-making method that decomposes complex problems into hierarchical levels. The AHP enables the systematic weighting of data assets' contributions relative to other off-balance-sheet factors such as innovation capability and brand value.

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3.2.1. Hierarchy construction

The AHP model is structured into three layers:

1) Goal Layer: To determine the contribution rate of off-balance-sheet assets to enterprise value.

2) Criteria Layer: Three key criteria are identified:

Revenue growth (weight: 56%)

Cost reduction (weight: 32%)

Competitiveness enhancement (weight: 12%)

3) Sub-criteria Layer: Includes data assets, innovation capability, human capital, brand value, and corporate culture.

3.2.2. Pairwise comparison and weighting

A judgment matrix is constructed based on pairwise comparisons among criteria and sub-criteria. The consistency ratio (CR) is calculated to ensure the validity of the comparisons (CR < 0.1). The resulting weights are used to compute the composite weight of data assets under each criterion.

3.2.3. Calculation of Kt

The income-sharing rate Kt is derived by aggregating the weighted contributions of data assets across all criteria. For example:

1) Midea Group: $Kt = 21.2\%$

2) BYD: $Kt = 25.0\%$

3) Xiaomi: $Kt = 27.0\%$

These values reflect the varying degrees of data dependency across firms, with Xiaomi showing the highest reliance on data-driven value creation.

3.3. Data sources and parameter calibration

All financial and operational data are sourced from publicly available annual reports, industry databases, and institutional forecasts. Key parameters such as discount rates, asset return benchmarks, and amortization rates are calibrated based on historical averages and sector-specific standards [13-17]. Sensitivity analyses are conducted to test the robustness of the model under varying assumptions.

3.4. Methodological advantages

The integration of MPEEM and AHP offers several methodological strengths:

1) Dynamic Valuation: Captures the time-varying nature of data assets.

2) Component Isolation: Distinguishes data-driven value from other asset contributions.

3) Context Sensitivity: Allows firm-specific customization of parameters and weights.

4) Policy Relevance: Supports regulatory compliance and strategic decision-making by quantifying previously off-balance-sheet assets.

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4. Result

4.1. Midea group

4.1.1. Midea group evaluation background

Evaluation object: Midea Group (000333.SZ) data assets, including intelligent manufacturing data, user behavior data, supply chain data and IoT platform data, etc.

4.1.2. The prediction process and parameter setting

4.1.2.1. Yield period and discount rate

• Income period: 5 years (2025-2029) based on the timeliness of data assets and industry practices.

• Discount rate (WACC) :

Cost of equity *(Re)* : the risk-free rate (Rf, taking the 10-year yield 2.5%) + beta (0.91) by the market risk premium (5.5%) = 7.5% [18, 19].

Debt cost *(*Rd) : five-year LPR rate 4.2% (1 - rate of 15%) = 3.57%.

Capital structure: equity accounted for 60% ($585 billion), claims 40% rate (62.33%).

WACC = 7.5% 40% = 5.89% 7.5% 60% + 3.57% + 60% to 3.57% 40% = 5.89% round (6.0%).

4.1.2.2. The enterprise free cash flow forecast (2025-2029)

Based on the consistency prediction and historical trend:

• Revenue and net profit, revenue in 2025, 55.561 billion yuan (+ 12.5%), and net income of 43.371 billion yuan (+ 12.5%); In 2026-2029 CAGR of 8% [16].

• Free cash flow (FCFF) :

FCFF = before interest and tax profit x (1 - rate) + Depreciation amortization - Capital expenditures - Changes in working capital

Reference FCFF/net profit ratio of 85% in 2024, 2025-2029 FCFF forecast is as follows: [17]

Table 1. 2025-2029 FCFF forecast

year	Net income ($one hundred million)	FCFF (100 million yuan)
2025	433.71	368.65
2026	473.07	402.11
2027	515.65	438.30
2028	562.06	477.75
2029	612.65	520.75

4.1.2.3. Separation assets contribution values in the table

1. Contribution to fixed assets:

Return: a five-year loan interest rate of 4.9%.

Compensation: depreciation account for 2.5% of the revenue ratio (historical average).

2. Contribution from current assets:

Return: One-year loan rate 4.35%.

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3. Intangible assets contribution:
Return: 4.9% + amortization compensation (0.3% of revenue).

Table 2. Calculated assets contribution value(2025 examples) [15]

Types of assets	Benchmark value	Rate of return	Return on investment	The compensation	Total contribution
Fixed assets	1200	4.9%	58.80	30.00	88.80
Total current assets	1,800	4.35%	78.30	-	78.30
Intangible assets	300	4.9%	14.70	1.22	15.92
Total	-	-	-	-	183.02

4.1.2.4. Off-balance-sheet assets contribution separation (AHP)

1. Construction of evaluation system:
Target layer: off-balance sheet asset value contribution.
Rule layer: operating income increased (0.56), operating cost reduced (0.32), the enterprise competitive power promotion (0.12).
Scheme layer: data assets, innovation ability, human capital, brand value, corporate culture.
2. Judgment matrix and weight calculation:

Table 3. Criterion layer judgment matrix (consistency test CR=0.02<0.1)

indicators	Increase in operating income	Lower operating costs	Increased competitiveness	Weight
Operating income increased	1	2	4	0.56
Lower operating costs	1/2	1	3	0.32
Improved competitiveness of enterprises	1/4	1/3	1	0.12

Table 4. Solution layer weight (contribution of data assets under each criterion)

guidelines	Data asset weights	Total weight calculation
Operating income increased (0.56)	0.19	0.56 0.19 = 0.10640.56 0.19 = 0.1064
Operating cost reduced (0.32)	0.24	0.32 0.24 = 0.07680.32 0.24 = 0.0768
Competitiveness improvement (0.12)	0.24	0.12 0.24 = 0.02880.12 0.24 = 0.0288
Aggregate (*Kt*)	-	0.2120 (21.2%)

4.1.2.5. Calculation of contribution value of data assets

• Residual income = FCFF of the enterprise - contribution value of assets in the balance sheet.
• Data assets contribution value = rate of residual income x into *Kt* (21.2%).
Example: in 2025

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Residual income = 368.65-183.02 = 18.563 billion yuan
Data assets contribution value = 185.63 x 21.2% = 3.935 billion yuan
3). Data assets value calculation results

Table 5. The contribution value of data assets from 2025 to 2029 is discounted to the base date at WACC=6%

year	Contribution value of data assets (100 million yuan)	The discount factor (6%)	Present value (one hundred million yuan)
2025	39.35	0.9434	37.13
2026	42.92	0.8900	38.20
2027	46.80	0.8396	39.28
2028	51.02	0.7921	40.42
2029	55.62	0.7473	41.56
combined	-	-	196.59

4.1.3. Conclusion

1. Data assets value: $19.659 billion (as of June 16, 2025 in present value).
2. Proportion of total value:
Midea group the current value of 585 billion yuan 1, data assets accounted for 3.36%.
3. Core Drivers:
Smart manufacturing data: 28 green factories, 5 lighthouse factories reduce production costs by 15% [20].
User data: COLMO high-end brands after purchase rate is 58%, AI algorithms promote overseas electrical business growth rate of 50%.
Supply chain data: VMI mode to reduce warehouse cost 15%, Andrew at partitioned offering release logistics data value.

4.2. BYD group

4.2.1. Evaluation background of BYD group

1. Appraisal object: BYD Data Assets, covering:
Manufacturing data: real-time production data of 35 smart factories around the world (such as Xi 'an Base), supporting production efficiency of 76 seconds per vehicle.
User data: There are more than 6 million new energy vehicles, covering high-value scenario data such as charging behavior and driving habits.
Technical data: blade battery cycle life data (more than 15,000 times), Tianshen Eye intelligent driving system road test data (cumulative mileage of 200 million kilometers).
Ecological data: light energy network ChuChong integration operational data (super filling station planning + 4000).

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4.2.2. Core parameter setting and prediction process

4.2.2.1. The earnings period and discount rate

• Revenue period: 5 years (2025-2029), matching the iteration cycle of data assets and the landing window of intelligent technology.

• The discount rate (WACC) :

Cost of equity (*Re*) : the risk free rate (2.5% of China's 10-year bond yields) + beta (1.1) by the market risk premium (5.5%) = 8.55%.

Debt cost (r Dr *D)* : five-year LPR rate 4.2% (1 - rate of 15%) = 3.57%.

Capital structure: 65% equity ratio (market value HK $1.55 trillion), 35% debt ratio (debt ratio 62.3%).

WACC = 8.55% 35% = 6.8% 8.55% 65% + 3.57% + 3.57% 35% = 65% to 6.8%.

4.2.2.2. The enterprise free cash flow forecast (2025-2029)

Table 6. Adjusted based on institutional sales volume and profit forecast 69

Year	Revenue (100 million yuan)	Net income ($one hundred million)	FCFF (100 million yuan)	Basis
2025	10,500	565	480 (85% conversion rate)	Citi forecasting sales of 5.75 million vehicles, driving permeability ascend [19].
2026	12,600	730	621	Day super charging platform landing, the high-end car share rose to 25%.
2027	14,700	843	716	Overseas factories reached production (Hungary/Brazil), accounting for 30% of exports.
2028	16,800	992	843	Full stack since the authors research think tank drive, bike profits rebounded to 9400 yuan.
2029	19,000	1,150	978	Energy network data to liquidate (light ChuChong integration)

FCFF calculation logic: FCFF = net income by investment rate (1 -) reinvestment rate refer to the historical average of 15%.

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4.2.2.3. Assets contribution values in the table separation (2025 examples)

Table 7. Assets contribution values in the table separation

Types of assets	Benchmark (one hundred million yuan)	Rate of return	Return on investment ($one hundred million)	Compensation (one hundred million yuan)	Total contribution (100 million yuan)
Fixed assets	2500 (factory)	4.9%	122.5	62.5 (depreciation)	185.0
Current assets	3800 (stock)	4.35%	165.3	-	165.3
Intangible assets	900 (patents)	4.9%	44.1	27 (amortization)	71.1
Total in the table	-	-	-	-	421.4

Note: compensation is based on the history of depreciation account for 2.5% of the revenue and amortization (0.3%).

4.2.2.4. Off-balance-sheet assets contribution separation (AHP)

1. Construction of evaluation system:

Target layer: off-balance sheet asset value contribution.

Rule layer: operating income increased (0.56), operating cost reduced (0.32), the enterprise competitive power promotion (0.12).

Scheme layer: data assets, innovation ability, brand value, supply chain network, energy ecology.

2. Data assets into rate (*Kt)* calculation:

Source of weight of criterion layer: Same Ely model (judgment matrix CR=0.02<0.1).

Scheme layer weights adjustment based on BYD's characteristics :

Table 8. Scheme layer weights adjustment based on BYD's characteristics

Criteria	Data asset weights	Basis	Total weight contribution
Revenue increase (0.56)	0.23 write	Think tank driving data to improve the high-end car premium (look series ASP exceeds 800000) 4	0.56 0.23 = 0.1290.56 0.23 = 0.129
Cost reduction (0.32)	0.28 write	Manufacturing data authors (xi 'an factory efficiency 15%)	0.32 0.28 = 0.0900.32 0.28 = 0.090
Competitive power promotion (0.12)	0.26 write	Barriers to energy network data (super filling station IRR 20% increased) 7	0.12 0.26 = 0.0310.12 0.26 = 0.031
Aggregate (*Kt*)	-	-	0.25

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3. - > data assets into rate 25% (higher than traditional car companies, reflect its "technology + data" double drive mode).

4.2.2.5. Calculation of contribution value of data assets

• Residual income = FCFF - assets contribution values in the table.

• Data assets contribution value = residual income x KtKt (25%).

Example for 2025:

Residual income = 480-421.4 = 5.86 billion yuan

Contribution value of data assets = 58.6 × 25% = 1.465 billion yuan

3). Data assets value calculation results

The 2025-2029 data assets contribution value according to the WACC = 6.8% discount to the base date:

Table 9. The 2025-2029 data assets contribution value (WACC = 6.8%)

year	Contribution value of data assets (100 million yuan)	Discount factor (6.8%)	Present value (one hundred million yuan)
2025	14.65	0.9363	13.71
2026	49.93 (residual income (25%)	0.8767	43.77
2027	73.70	0.8208	60.49
2028	105.38	0.7685	80.98
2029	139.25	0.7194	100.19
combined	-	-	299.14

4.2.3. Conclusion

1. Data assets value: $29.914 billion (as of June 24, 2025 present value).

2. Proportion of total value:

Byd's current market value of hk $1.55 trillion (1.42 trillion yuan), data assets accounted for 2.11%.

3. Value driver decomposition:

Eye of the think tank driving data: contribution rate of 40% (the gods system to reduce accident rate 30%).

Manufacturing data: contribution rate 35% (production efficiency increase pressure drop bicycle cost 8%).

Energy data: contribution rate of 25% (light ChuChong network energy efficiency 22%)

4.3. Xiaomi

4.3.1. Xiaomi evaluation background

Assessment object: millet group (1810 HK) data assets, include:

User data: 900 million portrait AIoT equipment connected to user behavior.

76 seconds/car manufacturing data: car factory production data (Beijing e-town factory).

AI model: the research MiMo model (7 b parameters, end side reasoning delay < 300 ms).

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Ecological data: interactive data of "human-vehicle-home whole ecology" scenario (91% of SU7 users are bound to Mijia ecology).

4.3.1.1. Core parameter setting and prediction process

(1) the earnings period and discount rate

• Earnings period: 5 years (2025-2029), consider data assets timeliness and automotive business turnaround period.

• Discount rate (WACC) :

Cost of equity (*ReRe*) : the risk free rate (2.5% of China's 10-year bond yields) + beta (1.25) by the market risk premium (5.5%) = 9.38%.

Debt cost (r Dr *D)* : five-year LPR rate 4.2% (1 - rate of 15%) = 3.57%.

Capital structure: equity accounted for 70% (value of hk $1.4 trillion), claims 30% rate (55%) [14].

WACC = 9.38% 30% = 7.5% 9.38% 70% + 3.57% + 3.57% 30% = 70% to 7.5%.

(2) Enterprise Free Cash flow forecast (2025-2029)

Table 10. The prediction and resolution 4610 of business

YEAR	Revenue (one hundred million yuan)	Adjusted net profit (100 million yuan)	FCFF (one hundred million yuan)
2025	6,500	300 (neutral)	85% of the 255 (conversion)
2026	7,800	400	340
2027	9,360	520	442
2028	11,232	650 (neutral)	553
2029	13,478	800	680
Predictive logic:			

Mobile phone business: 2025 shipments of 177 million (citigroup forecast), high-end machine than higher ASP ascension to 1300 yuan.

Auto business: 2025 300000 (SU7 / YU7), revenue in 90 billion, back in 2026.

AIoT business: everybody electricity grew 113.8% (2025 q1), the next three years 30% CAGR 57.

4.3.1.2. Assets contribution values in the table separation (2025 examples)

Table 11. Assets contribution values in the table separation (2025 examples)

Type of assets	Benchmark value (100 million yuan)	Rate of return	Return on investment (100 million yuan)	Compensation (100 million yuan)	Total contribution (100 million yuan)
Fixed assets	800 (factories/stores)	4.9%	39.2	20 (depreciation)	59.2

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Table 11. (continued)

Current assets	2,000 (inventory/cash)	4.35%	87.0	-	87.0
Intangible assets	500 (patents/brands)	4.9%	24.5	15 (amortization)	39.5
In-table total	-	-	-	-	185.7

Note: Compensation items are based on historical proportions (2.5% of revenue for depreciation and 0.3% for amortization).

4.3.1.3. Separation of contributions from off-balance sheet assets (Analytic Hierarchy Process)

1. Construction of evaluation system:

Target layer: off-balance sheet asset value contribution.

Rule layer: operating income increased (0.56), operating cost reduced (0.32), the enterprise competitive power promotion (0.12).

Scheme layer: data assets, innovation ability, human capital, brand value, open ecology.

2. Data asset sharing rate (*KtKt)* calculation:

Source of weight of criterion layer: Same Ely model (judgment matrix CR=0.02<0.1).

Scheme layer weight adjustment (based on millet characteristics) :

Table 12. Scheme layer weight adjustment (based on millet characteristics)

Criteria	Data asset weights	Basis	Total weight contribution
Revenue increase (0.56)	0.25 write	Car /IoT data driven high premium (SU7 average 529,900) 2	0.56 0.25 = 0.140.56 0.25 = 0.14
Cost reduction (0.32)	0.30 write	Manufacturing data Cost reduction (76 seconds/roa efficiency) 2	0.32 0.30 = 0.0960.32 0.30 = 0.096
Competitiveness improvement (0.12)	0.28 write	AIoT ecological barrier (900 million device connections) 8	0.12 0.28 = 0.0340.12 0.28 = 0.034
Total (*Kt*)	-	-	0.27

3. → Data asset sharing rate 27% (higher than Yili's 21%, reflecting Xiaomi's stronger data dependence).

4.3.1.4. Calculation of contribution value of data assets

• Residual income = FCFF - contribution value of assets in the balance sheet.

• Data asset contribution = residual income × KtKt (27%).

Example: in 2025

Residual income = 255-185.7 = RMB6.93 billion

Contribution value of data assets = 69.3 × 27% = 1.871 billion yuan

3). Calculation results of data asset value

The contribution value of data assets from 2025 to 2029 is discounted to the base date at WACC=7.5% :

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Table 13. The contribution value of data assets from 2025 to 2029 (WACC=7.5%)

Year	Contribution value of data assets (100 million yuan)	Discount factor (7.5%)	Present value (100 million yuan)
2025	18.71	0.9302	17.40
2026	41.76 (residual income ×27%)	0.8653	36.14
2027	69.23	0.8049	55.71
2028	99.31	0.7488	74.36
2029	133.38	0.6966	92.91
Total	-	-	276.52

4.3.2. Conclusion

1. Value of data assets: RMB 27.652 billion (present value as of June 24, 2025).

2. As a percentage of overall value:

Xiaomi's current market value is 1.4 trillion Hong Kong dollars (about 1.26 trillion yuan), with data assets accounting for 2.19%.

3. Value-driven analysis:

User data: contribution rate of 45% (900 million AIoT device connections, improving cross-selling).

Manufacturing data: contribution rate of 30% (automobile production efficiency of 76 seconds/unit, cost reduction of 10%+).

AI model: contribution rate 25% (MiMo large model saves 40% of cloud reasoning cost).

4.4. Key findings of methodology

(1) Assessing logical validity:

The multi-period excess return method successfully quantifies the long-term value of data assets. By separating the contribution of on-balance sheet assets (fixed assets, current assets, intangible assets) and off-balance sheet data assets, the independent value of data assets is highlighted.

Analytic hierarchy process (AHP) distribution of science data assets into rate (Kt), weight set conforms to the enterprise features (such as millet ecological data dependence is strong, Kt by 27%; Byd Technology is data-driven, Kt is 25%).

(2) Reasonableness of parameters:

Discount rate (WACC) differences reflect the enterprise risk: beauty (6.0%) < byd (6.8%) < millet (7.5%), consistent with the stability of the business (millet car business risk is higher).

The sharing rate (Kt) is in the range of 21%-27%, higher than traditional manufacturing enterprises (such as Toyota 12%), but lower than pure technology enterprises (such as Tesla 35%), which is in line with the positioning of "manufacturing + data" transformation enterprises.

4.5. Industry commonalities and differences

(1) Commonalities:

The value of data assets accounts for 2%-3.5% of the market value, indicating that it has become an important part of enterprise value.

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Intelligent manufacturing data and user behavior data is the core of the three big enterprise value, driven directly related authors efficiency and income growth.

(2) Differences:

Midea: focuses on supply chain and IoT data, accounting for the highest value (3.36%), reflecting the potential of digital transformation of traditional manufacturing industry.

BYD: smart driving and energy data made outstanding contributions (65% in total), reflecting the dual barriers of "technology + data" for new energy vehicle companies.

Xiaomi: user ecological data (45%) and AI model (25%) dominated, highlighting the data synergy advantage of Internet ecological enterprises.

4.6. Risk and sensitivity

(1) Core risks:

Data compliance costs: The EU AI Act may lead to BYD/Xiaomi's annual compliance expenditure increasing by RMB 800 to 1 billion, weakening net income.

Uncertainty of business implementation: The penetration rate of BYD's smart driving and the delivery volume of Xiaomi's vehicles are lower than expected, which may lead to a 15%-20% downward revision of the value.

(2) Sensitivity analysis:

The sharing rate of ±10% has a significant impact on the value (the change is about ±20%), such as millet value range of 24.887 billion to 30.417 billion;

WACC±1% led to a value fluctuation of about 5%-10%, reflecting the sensitivity of discount rate setting.

7. General conclusions

Data assets have become a new engine of value creation for manufacturing giants. The value of data assets of Midea, BYD and Xiaomi reached 19.659 billion yuan, 29.914 billion yuan and 27.652 billion yuan respectively, accounting for 2percent to 3.5 percent of the market value. The evaluation results verify the applicability of multi-period excess return method combined with AHP in quantifying the value of data assets, and reveal that traditional manufacturing industries (such as Midea) release value through supply chain and production data optimization; Technology-driven enterprises (such as BYD and Xiaomi) rely on ecological data and AI models to build barriers to competition. In the future, it is necessary to pay attention to data compliance costs and technology implementation risks to dynamically revise the evaluation model [21].

5. Discussion

The findings of this study demonstrate that data assets constitute a significant value component for manufacturing enterprises, contributing 2%–3.5% of their market capitalization. This aligns with prior research emphasizing the growing role of data in value creation, yet our results reveal critical nuances across industries and operational models. Below, we discuss three key implications of our findings.

5.1. Methodological robustness

The MPEEM-AHP framework effectively isolates the incremental value of data assets by separating contributions from tangible and intangible assets. The consistency of our results across firms—despite variations in WACC (6.0%–7.5%) and income-sharing rates (21.2%–27%)—validates the

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model's adaptability to diverse manufacturing contexts. For instance, Midea's lower WACC (6.0%) reflects its stable cash flows from mature IoT applications, while Xiaomi's higher WACC (7.5%) accounts for risks in its nascent automotive sector. Sensitivity analyses further confirm the model's reliability: a ±10% change in Kt alters valuations by ±20%, while a ±1% WACC shift impacts results by 5%–10%. These findings address limitations of traditional methods by quantifying dynamic data-driven value.

5.2. Industry-specific value drivers

The study identifies distinct data asset profiles tied to operational focus. Firstly, Midea (3.36% of market cap) derives value from supply chain and smart manufacturing data (e.g., 15% cost reduction via lighthouse factories), highlighting the potential of digital transformation in traditional manufacturing. Then, BYD (2.11%) relies on technology-integrated data, such as smart driving systems (40% contribution) and energy networks (25%), underscoring the dual barriers of "technology + data" in electric vehicles. Lastly, Xiaomi (2.19%) leverages user and AI ecosystem data (e.g., 900M AIoT devices driving 45% of contributions), showcasing synergies between internet platforms and hardware. These differences suggest that data valuation frameworks must account for industry-specific value chains and risk profiles.

6. Conclusion

This study establishes the MPEEM-AHP framework as a robust tool for quantifying data asset value in manufacturing enterprises, addressing gaps in traditional methods. Three conclusions emerge. Firstly, Data as a Strategic Asset, contributes 2%–3.5% of market capitalization for leading manufacturers, with value drivers varying by industry. Moreover, the research developed the methodological advancement. The MPEEM-AHP combination successfully isolates data-driven value while accommodating industry-specific risks. Furthermore, our research has policy and practice implications. Enterprises must balance data utilization with compliance costs and operational uncertainties. Future research should explore longitudinal data value trends and sector-specific valuation benchmarks. By bridging theoretical rigor and practical applicability, this study provides a foundation for data asset valuation in the manufacturing sector, supporting strategic investment and regulatory decision-making.

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