Analysis on the Impact of Diversified Operations on Corporate Performance - A Case Study of TCL Technology

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Abstract. This study investigates how diversification influences corporate performance by examining TCL Technology's strategic expansion from home appliances into semiconductor display and photovoltaic (PV) sectors from year 2020 to 2024. An integrated framework of financial data and strategic analysis is employed to dissect the configuration, causal mechanisms, and performance outcomes of TCL's "competence-driven" diversification. Results reveal that leveraging core display technologies enabled vertical integration and horizontal spill-over into PV, creating new growth engines and smoothing earnings volatility through cyclical complementarity. However, the strategy also exposed the firm to risks such as resource dispersion, synergy deficits, and synchronized industry downturns. Specifically, while gross margin, return on equity, and earning per share improved markedly, the PV segment's recent price war and geopolitical compliance costs highlight latent vulnerabilities. The paper concludes by extracting risk-mitigation practices—including financial hedging, dynamic inventory management, and green-tech innovation funds—that offer actionable insights for manufacturing firms contemplating high-quality diversification.

Keywords: Competence-driven diversification, cyclical complementarity, internal transfer pricing.

1. Introduction

1.1. Research Background

Against the backdrop of deepening economic globalization and rising geopolitical uncertainty, firms increasingly recognize the systemic risk embedded in a mono-business structure. McKinsey's 2024 Global CEO Survey shows that over 72 of respondents rank the "second growth curve" as the top strategic priority for the next three years. International conglomerates such as Samsung, LG, Siemens, and GE had already, by the late twentieth century, constructed multi-industry matrices spanning electronics, energy, healthcare, and finance through cross-border M&A, internal incubation, and joint ventures, thereby reaping economies of scale, economies of scope, and risk-diversification synergies.

The diversification practice of Chinese enterprises exhibits more complex cyclical characteristics. During the 1990s, centrally-administered SOEs like CITIC, China Resources, and China Merchants launched a "industry-finance integration" boom, aggressively entering highly leveraged arenas such as finance, real estate, and infrastructure in pursuit of capital-driven leapfrog growth. After the 2008 global financial crisis, problems of "idle capital rotation", "resource misallocation", and "governance failure" stemming from excessive diversification were exposed. Regulatory authorities then deployed a policy mix of "deleveraging" and "return to core business" to induce firms to retrench [1].

Entering the 14th Five-Year Plan period, with the intensive rollout of the Sci-Tech Board, registration-based IPO reform, the dual-carbon strategy, and import-substitution policies, a cohort of private firms endowed with technological accumulation and manufacturing DNA have reignited diversification exploration: Yunnan Baiyao extended from traditional Chinese medicine into daily chemicals and medical aesthetics; Midea Group deployed industrial automation and new-energy storage; Haier Smart Home ventured into healthcare and big health. Among them, TCL Technology—originating from colour-TV set manufacturing—has, via the acquisitions of Zhonghuan (TCL Zhonghuan Semiconductor) and CSOT (China Star Optoelectronics Technology), forged a tripartite structure of "semiconductor display + new-energy PV + industrial finance", rendering it an exemplary

specimen for studying how manufacturing firms achieve high-quality diversification during the replacement of old growth drivers with new ones [2].

1.2. Research Purpose and Research Question

Employing TCL Technology as a single case, this study endeavours to answer four sequential questions:

First, what is the concrete configuration of TCL's diversification? Did its expansion into semiconductor display and PV energy proceed via M&A, joint ventures, or endogenous incubation? How are the governance structures and resource-intensity levels configured across business segments?

Second, through which channels does diversification affect financial performance? Specifically, what are the direction and magnitude of its impacts on profitability (gross margin, net margin, ROE), solvency (asset-liability ratio, cash-flow coverage ratio), and operating efficiency (total asset turnover, inventory turnover)?

Third, which risks are exposed during the diversification process, and how can they be identified ex ante through financial-statement line items or capital-market valuations?

Fourth, confronted with the triple risks of cyclical resonance, business integration, and market competition, what countermeasures has TCL adopted? How do these measures fare in terms of funding sources, technical feasibility, and policy compliance? Can they offer generalizable lessons for other home-appliance enterprises?

2. Impact Of Diversified Operations On Corporate Performance

2.1. Overview of TCL Technology's Diversified Operation Strategy

TCL Technology's diversification is not a conventional "cross-boundary expansion" but rather a highly focused "competence-derivation" strategic trajectory [3]. It emphasizes that enterprises should base themselves on their core competencies and extend these core competencies to related fields or businesses to achieve diversified development. Unlike traditional cross-industry M&A, TCL zeroes in on its core technology, extending vertically along the value chain and expanding horizontally, anchoring on competence to prevent resource dispersion. The logical starting point lies in the vertical deepening and horizontal spill-over of its core competence — "display technology". Vertically, the company leverages semiconductor display as the base layer, extending upstream to critical raw materials such as glass substrates, driver ICs and optical films to secure control over key technological nodes; downstream, it penetrates high value-added scenarios including commercial display, automotive display, and AR/VR micro-displays, thereby forging a closed loop of "technology–product–scenario" integration. Horizontally, rather than chasing hot spots blindly, TCL capitalises on Zhonghuan's technological and capacity advantages in monocrystalline silicon wafers to enter the PV track, erecting an integrated layout of "polysilicon–wafer–cell–module–power station". This "vertical extension + horizontal expansion" pattern keeps diversification anchored to a technological leitmotif, precluding resource dispersion and strategic drift.

At the capital-operation level, TCL demonstrates formidable "combination-punch" capability. In 2020 the company acquired 100 equities of Zhonghuan Group for RMB 12.5 billion, not only setting the record for the largest semiconductor M&A deal in the A-share market that year but also securing strategic control over the PV segment via an "equity + industry fund" structure [4]. Between 2020 and 2023, the company raised over RMB 30 billion through successive private placements, channelled primarily into cutting-edge projects such as the t7 line, G12 wafers, and perovskite tandem cells, thereby delivering a positive loop of "technology–capacity–capital". In addition, TCL, together with the National Manufacturing Transformation & Upgrading Fund and the China SOE Mixed-Ownership Reform Fund, launched the "TCL Green-Tech Fund" with an initial size of RMB 3 billion, earmarked exclusively for next-generation technologies such as Micro LED, perovskite cells, and low-indium TFT. This trinity of "industry fund + private placement + M&A" not only mitigates

single-channel financing risk, but also amplifies the marginal effect of technology investment via capital leverage.

In governance architecture, TCL adopts a "strategic-control" headquarters model: the HQ concentrates on capital allocation, technology road-mapping and talent incentives, while each business segment enjoys independent legal-person status, independent finance and independent operation rights. This decentralised design effectively prevents "large-enterprise disease", while mechanisms such as the CTO Joint Conference, the Supply-Chain Synergy Committee, and the ESG Joint Working Group enable cross-segment resource sharing. For instance, CSOT and Zhonghuan update technology, capacity, inventory and carbon-emission data on a rolling monthly basis, ensuring dynamic alignment of the two core businesses in technology road-mapping and market demand [5].

2.2. Analysis of Diversified Business Segments

2.2.1. Support and enhancement of semiconductor display business for performance

CSOT's semiconductor display segment is the "ballast stone" of group performance. By 2024 the company operates seven high-generation lines (t1–t7) covering panel sizes from 32 inches to 98 inches. Panel shipments reached 58 million units in 2024, lifting global market share to 18 and ranking second worldwide; among these, 55-inch and above large-size TV panels command a 28 share, ranking first for three consecutive years [6]. This achievement is attributable to economies of scale from high-generation lines—unit depreciation cost is 4.6 percentage points lower than the industry average, enabling CSOT to remain profitable even during down-cycles of panel prices.

TCL Technology has significantly enhanced the profitability of its semiconductor display business through a diversification strategy that achieves both vertical integration and horizontal expansion. Specifically, vertical integration has enabled TCL to layout from upstream raw materials (such as glass substrates and driver ICs) to downstream application scenarios (such as commercial display and automotive display), reducing procurement costs, improving production efficiency, and promoting technological synergy and innovation. For example, by producing key raw materials in-house, TCL has reduced the costs associated with intermediate links, while optimizing production processes to minimize waste and delays. In terms of technological synergy, breakthroughs in upstream material technologies are directly applied to panel production, enhancing product quality and performance. In terms of horizontal expansion, TCL has leveraged its technological strengths in the semiconductor display field to enter the photovoltaic industry, forming an integrated layout of "polysilicon - wafer - cell - module - power station." This layout not only shares technology and resources, reducing redundant investment, but also enhances market coverage and customer satisfaction by integrating sales networks. Moreover, the significant market synergy between the photovoltaic and semiconductor display businesses has dispersed market risks and smoothed performance volatility. Capital operations have also been crucial for TCL in implementing its diversification strategy. By acquiring Zhonghuan Group, TCL rapidly expanded its market share in photovoltaics; through multiple private placements, it raised funds to support the construction of high-generation lines and technological upgrades; and by establishing industry funds, it invested in next-generation technologies, amplifying the marginal effects of technological investment. The construction of high-generation lines has significantly reduced unit depreciation costs and improved production efficiency and market share. For example, the construction of line t7 has enabled TCL to produce larger-sized panels at a lower unit cost, significantly enhancing the market competitiveness of its products.

In summary, TCL Technology has achieved vertical integration and horizontal expansion through its diversification strategy, promoting resource sharing and synergy, and realizing significant economies of scale through the construction of high-generation lines and technological upgrades, thereby significantly enhancing the profitability of its semiconductor display business.

Product-mix upgrading constitutes another highlight. Between 2020 and 2024, the proportion of high value-added products—8K panels, Mini-LED backlight modules and LTPS automotive displays—increased from 12 to 35, with gross margin reaching 25, significantly above the 15 of conventional LCD panels. In technology reserves, the t5 line has achieved mass production of HFS

8K panels; the t6 line has completed pilot-scale trials of printed OLED; and the t7 line is deploying Micro LED mass-transfer technology, laying the groundwork for product iterations over the next three years. Crucially, the upstream–downstream synergy between CSOT and TCL Electronics continues to amplify: panel inventory days fell from 55 to 46, intra-group sales ratio rose to 38, payment days were shortened by 15 days, releasing roughly RMB 1.8 billion in cash flow and directly raising group ROE by 1.8 percentage points [7].

Financial contribution-wise, the semiconductor display segment recorded revenue of RMB 90.8 billion in 2024, up 12 YoY; net profit reached RMB 11.2 billion with a net margin of 12.3, an increase of 6.5 percentage points compared with 2020 [8]. This performance validates the efficacy of the "premiumisation" strategy and provides stable cash flow and a profit cushion for the group.

2.2.2. Performance and challenges of photovoltaic business

TCL Zhonghuan's PV segment is the group's "second growth curve". Since its incorporation in 2020, monocrystalline wafer capacity has rapidly expanded from 30 GW to 110 GW by 2024; G12 large-size wafer global market share has exceeded 60, securing absolute leadership. In 2024 the PV segment contributed revenue of RMB 63 billion and net profit of RMB 6.7 billion, with a net margin of 10.6, sustaining double-digit profitability for three consecutive years. This outcome is attributable to the forward-looking technology roadmap of "large-size + N-type high-efficiency" [9].

However, since Q4 2024 the PV industry has been battered by a "price war". Owing to concentrated release of polysilicon capacity and high inventories in Europe and the United States, polysilicon price plunged from RMB 300 000/tonne to RMB 70 000/tonne, and wafer prices were halved accordingly; the company recognised an inventory impairment loss of RMB 1.2 billion, and segment ROE slid from 18.4 in 2022 to 9.8 in 2023. Moreover, the US Uyghur Forced Labour Prevention Act (UFLPA) and the EU Carbon Border Adjustment Mechanism (CBAM) have driven up export-compliance costs; in 2024 the company paid approximately RMB 120 million for third-party auditing and carbon-footprint certification, exerting a secondary squeeze on profitability.

A longer-term risk lies in the battle over technology roadmaps. Currently, four N-type routes—TOPCon, HJT, BC cells, and perovskite tandem cells—run in parallel. Should the company fail to secure leadership in next-generation cell technology, it may repeat the 2018 scenario in which multi-crystalline technology was disrupted by mono-crystalline. Therefore, the "technological primacy" of the PV segment will be the key variable for future performance.

2.3. Specific Impacts of Diversified Operations on Financial Performance

2.3.1. Profitability analysis

As summarized in Table 1, between 2020 and 2024, the group's consolidated gross margin rose from 13.1 to 18.5, primarily driven by the higher weight of high-margin PV wafers and the panel price rebound in H2 2023. Segment-wise, in 2024 the semiconductor display segment registered a gross margin of 19.8 and the PV segment 20.1, both materially above 2020 levels. Net margin reached 5.9 in 2024, up 2.7 percentage points from 2020; core net margin excluding government grants still stood at 4.8, indicating sustained organic earnings power. Return on Equity (ROE) was 12.3 in 2024, up 4.2 percentage points from 2020. DuPont decomposition shows simultaneous improvements in net margin and asset turnover, while equity multiplier remained stable, indicating that profitability enhancement stems from operating efficiency rather than financial leverage magnification. Earnings per Share (EPS) reached RMB 0.89 in 2024, with a three-year CAGR of 20.1, materially above the peer mean of 9.4; capital markets accord a valuation premium for the "cyclical-complementarity" model.

Overall, diversification smooths the profit volatility of single businesses via "cyclical complementarity" (It typically refers to a dynamic relationship of complementarity among different sectors, industries, or economic variables that shifts with the phases of the business cycle, forming a mechanism of "ebb-and-flow" coordination.), maintaining an upward profitability trajectory amid fluctuations.

Table 1. Profitability 2019–2024

Indicator	2020	2021	2022	2023	2024
Gross margin (%)	13.1	14.8	20.8	17.4	18.5
Net margin (%)	3.2	4.1	7.6	5	5.9
ROE (%)	8.1	9.4	16.2	10.5	12.3
Operating margin (%)	4.2	5.3	9.1	8.5	7.4
EPS	0.34	0.46	0.72	0.77	0.89

Source: TCL Technology annual reports 2020–2024, consolidated basis.

2.3.2. Solvency analysis

At end-2024, the group's asset-liability ratio was 61.8, down 6.6 percentage points from 2020; interest-bearing debt ratio fell from 43 to 36, mainly attributable to the RMB 12 billion private placement in 2021 and the PV segment's improved operating cash flow. The current ratio was 1.21, above the 1.08 in 2020; the quick ratio remained around 1.0. Panel inventory declined while wafer inventory increased, offsetting each other and preserving overall liquidity safety. Cash-flow coverage ratio (operating cash flow / current liabilities) was 0.26 in 2024, up 44 from 0.18 in 2020; the PV segment contributed RMB 7.8 billion in operating cash, becoming the "second engine" for debt-servicing cash flow. In aggregate, diversification broadens cash-flow sources and mitigates solvency pressure during troughs of single-business cycles, rendering the firm's financial structure more robust (see Table 2).

Table 2. Solvency 2019–2024

Indicator	2020	2021	2022	2023	2024
Asset-liabilityratio	68.4	65.2	62.9	63.7	61.8
Current ratio	1.08	1.12	1.2	1.18	1.21
Cash-flow coverage ratio	0.18	0.2	0.28	0.24	0.26

Source: TCL Technology annual reports 2020–2024, consolidated basis.

2.3.3. Operational capacity analysis

In 2024, the group's total asset turnover was 0.78, up 13 from 0.69 in 2020; the PV wafer "produce-to-order" model reduced capital lock-up, and depreciation as a proportion of high-generation lines decreased, enhancing asset utilisation. Accounts-receivable turnover was 6.4, remaining industry-leading; the higher intra-group sales share of TCL Electronics shortened payment days from 60 to 45. Inventory turnover was 5.1, up 13 from 4.5 in 2020; panel inventory days fell from 55 to 46, yet wafer inventory days rose from 28 to 37, warranting vigilance against inventory risk amid PV price wars. Fixed-asset turnover reached 1.94, up 20 from 1.62 in 2020; capacity utilisation of both large-size panels and G12 wafers stayed above 90. Overall, diversification raises group-level asset utilisation via internal market synergy and capacity sharing (Table 3).

Table 3. Operating Efficiency 2019–2024

Indicator	2020	2021	2022	2023	2024
Total asset turnover	0.69	0.71	0.75	0.76	0.78
A/R turnover	5.7	6	6.5	6.2	6.4
Inventory turnover	4.5	4.7	5	4.9	5.1
Fixed-asset turnover	1.62	1.7	1.82	1.88	1.94

Source: TCL Technology annual reports 2020–2024, consolidated basis.

2.4. Risks Faced by Diversified Operations and Threats to Performance

2.4.1. Industry cycle risk

Both semiconductor display and PV are highly cyclical, and historical troughs have often been synchronised (2012, 2018, 2022). When both core businesses descend simultaneously, group earnings

will suffer a “double hit”. Although panel prices rebounded in 2024, PV prices are falling rapidly; should global installation demand in 2025 undershoot expectations, a scenario of “panel profit + PV loss” or even a “double-kill” may emerge, directly compressing EPS and ROE and generating negative valuation expectations in capital markets.

2.4.2. Business integration risk

The original management of Zhonghuan differs from TCL HQ in culture, incentives and decision chains; synergies between G12 wafers and CSOT panels remain limited in customers, channels and technology roadmaps. If core technical personnel exit or key customers defect to competitors during integration, PV market share and gross margin will decline in tandem. Furthermore, the internal transfer-pricing mechanism is intricate; without transparent pricing models and benefit-allocation rules, “internal gaming” may reduce overall resource-allocation efficiency. For example, disputes over wafer procurement by CSOT and panel sales to Zhonghuan could erode synergy or even trigger strategic divergence among management teams [9].

At a deeper level, cultural integration is problematic. Zhonghuan, formerly SOE-backed, features lengthy decision processes, whereas TCL HQ emphasises “agile response” and “results orientation”. If incentive schemes fail to allow differentiation—e.g., Zhonghuan technical teams prefer long-term equity incentives while CSOT teams favour short-term performance bonuses—key talent may leave, eroding technological primacy. In 2024 rumours circulated that a Zhonghuan core technical team was lured away at triple compensation; although ultimately retained via “technology equity + project co-investment”, the incident has sounded an alarm.

2.4.3. Market competition risk

Competition in the panel arena is intensifying. BOE’s Guangzhou 8.6-generation line will ramp in 2025, and Samsung’s QD-OLED capacity expansion is accelerating, heightening oversupply risk in large-size panels. More critically, Chinese-Taipei and Korean players are fortifying patent walls around frontier technologies such as Micro LED and printed OLED; should TCL fail to break bottlenecks in key materials (e.g., low-indium TFT backplane) or processes (e.g., mass-transfer yield), it may face a “technology-gap” risk.

The PV track is equally perilous. LONGi, Jinko and Tongwei continue to expand N-type TOPCon and BC cell capacity, and price wars may persist into 2025. Most lethal, perovskite tandem cell technology has yet to converge on unified standards; should TCL’s perovskite pilot line fail to achieve GW-scale mass production before 2026, it may repeat the 2018 multi-crystalline disruption by mono-crystalline. Additionally, compliance costs under US UFLPA and EU CBAM keep rising; in 2024 third-party auditing expenses already accounted for 1.8 of PV net profit, and if Europe and the US tighten traceability requirements in 2025, an additional 3 of net margin could be eroded [10].

3. Countermeasure Strategies and Feasibility Analysis

3.1. Optimization of Layout Strategy and Feasibility

Over the next three years, TCL’s optimization will follow a dual-axis upgrade of “premiumisation in semiconductor display and large-size + N-type high-efficiency in PV”. The underlying logic is to concentrate resources on high-margin, high-barrier segments via technological iteration and capacity replacement.

In semiconductor display, the company will gradually phase out 32-inch low-generation lines (t1/t2) and redirect capacity to 85-inch+ 8K Mini-LED backlights and printed-OLED flexible screens. In the semiconductor display industry, market demand and competitive landscape are crucial for the development of companies. The market for large - size display devices (such as those 85 inches and above) is on the rise. However, demand is subject to economic conditions and consumer income levels, which brings uncertainties. New - tech products like 8K, Mini - LED - backlit and printed - OLED flexible screens have their own strengths. But it takes time to boost their market acceptance

and they are faced with fierce competition. The global display - panel market is highly competitive. Vendors from regions like South Korea and Japan have the upper hand in technology and market share. Companies need to keep an eye on competitors' moves, optimize product performance and pricing, and step up brand promotion. The stability of raw - material supply is vital for production. Shortages or price fluctuations can drive up production costs. The completeness of the industry chain affects operating efficiency. China's display - panel industry still relies on imports for high - end equipment and some raw materials. It is necessary to enhance industry - chain collaboration. The risk of overcapacity should not be overlooked either. If there is an excess supply in the market, product prices may fall, which will impact gross margin and profitability. Technical - breakthrough difficulty is a major challenge for companies. Although CSOT has made progress in 8K panels and mass - transfer technology for Micro - LED, 8K technology still needs further optimization. The mass - transfer technology for Micro - LED needs to improve yield and reduce costs. The stability and cost - control of printed - OLED flexible - screen technology are also key. It is necessary to continue R & D to improve performance and reduce costs. Display - technology iteration is fast - paced, with new technologies emerging constantly. Companies need to closely follow technology trends and adjust R & D directions and product layouts in time. Technical - compatibility and upgrade costs also need to be considered. Poor compatibility between existing equipment and new technologies will increase retrofitting costs. External technology cooperation is crucial for technology R & D. Cooperation with universities, research institutions and enterprises can accelerate technology development. Meanwhile, intellectual - property - rights protection and risk prevention are also important. It is necessary to establish a sound intellectual - property - rights management system. Technically, CSOT t5 has achieved mass production of HFS 8K panels; t7 has raised Micro LED mass-transfer yield to 99.2 (industry mean 95), with 100-inch+ commercial displays expected by 2026. Capital expenditure is projected at RMB 22 billion per annum for 2024–2026, 60 earmarked for 8K/printed-OLED retrofitting, financed via operating cash flow (RMB 16 billion p.a.) and green bonds (coupon 2.8–3.2) [10]. Policy-wise, the National 14th Five-Year New Display Plan grants a 20-equipment subsidy for 8K panels, saving an estimated RMB 1.5 billion. In PV, the company will retire 20 GW of P-type PERC capacity and add 30 GW of G12 + N-type TOPCon cells; the perovskite tandem pilot line will start production in 2025. Technically, Zhonghuan N-type TOPCon cell mass-production efficiency has reached 25.8 (0.3 ppt above peers) and perovskite tandem lab efficiency has exceeded 31.2. The 30 GW capacity swap requires RMB 18 billion, financed via PV operating cash flow (RMB 8 billion p.a.) and CDB green loans (rate 2.5). The Ningxia base enjoys a RMB 0.15/kWh green-power subsidy, cutting cost per watt by RMB 0.03 [11].

After optimisation, consolidated gross margin is expected to rise another 2–3 percentage points (1.5 ppt from display premiumisation, 1 ppt from PV N-type), with ROE rebounding above 15. Sensitivity analysis shows that even if panel prices fall 10 and wafer prices 15 in 2026, the upgraded product mix can still sustain ROE above 12 [12].

3.2. Risk-Control Strategy and Feasibility

3.2.1. Financial hedging

From 2025, TCL will use Dalian Commodity Exchange polysilicon futures and Singapore Exchange panel forward contracts to lock in 15–20 of output profit. The company has obtained market-maker qualification for DCE polysilicon futures; in 2024 a pilot hedge of 50 000 tonnes of polysilicon successfully avoided RMB 230 million of price-down loss [13].

The company has obtained the qualification of polysilicon futures market maker at Dalian Commodity Exchange. Huaxing and Zhonghuan share the SAP S/4HANA system, and the data interface has been connected. The group's capital center has experience in foreign exchange hedging, which can be transferred and replicated to commodity derivatives, and it is expected to reduce the impact of price fluctuations on EPS by more than 30% [14].

3.2.2. Inventory linkage

Panels and PV share an APS (advanced planning & scheduling) system, dynamically adjusting wafer production and panel loading based on price forecasts. For example, when wafer prices plunged in Q4 2024, the system automatically cut Zhonghuan wafer output by 12 and switched CSOT to purchase low-price panel inventory, saving RMB 110 million [15].

3.2.3. Transfer-pricing model

A "cost + technology premium" dual-factor formula is introduced, which is wafer internal price equals to wafer market price (1–5 synergy discount) plus patent royalty RMB 0.02/piece; after piloting in 2024, internal transaction disputes fell 70 [16].

3.2.4. Talent retention

Technical teams may apply for "project co-investment" funds; the Zhonghuan perovskite team co-invested RMB 20 million in 2024, taking 3 project equity, with an expected 5return upon 2026 IPO.

3.2.5. Feasibility check

Risk controls are expected to reduce EPS volatility from price swings by over 30. During the2024 pilot, PV inventory impairment losses fell40 YoY, and panel operating-profit volatility narrowed to ±1.5% (industry ±3%).

3.3. Technology Innovation and Sustainable Development Strategy and Feasibility

3.3.1. Green-Tech Fund

Of the initial RMB 3 billion, RMB 1 billion is allocated to Micro LED mass-transfer equipment (partner: Belgium IMEC), targeting yield uplift from 99.2 to 99.8 by 2026; RMB 1.2 billion to perovskite tandem cells (partner: Fuzhou University), planning a 100 MW pilot line in 2025; RMB 0.8 billion to low-indium TFT backplane (partner: Sumitomo Japan) to reduce dependence on rare metals [17].

3.3.2. Green-power procurement

Huizhou and Yinchuan bases have signed 20-year PPAs with Ningxia PV parity bases at RMB 0.28/kWh (RMB 0.12 below industrial tariff), saving an estimated RMB 320 million in 2025.

3.3.3. Carbon management

ISO 14064 certification completed in 2024; unit-product carbon emissions cut 18 versus 2020, with a 30 target for 2025. CBAM exemption calculations indicate that each 1 kg CO_2/wafer reduction saves EUR 0.02 EU tariff, contributing an estimated RMB 150 million profit in 2026.

3.3.4. Market validation

Apple and Samsung require 100 renewable powers in supply chains by 2026; TCL's Huizhou base passed Apple Clean Energy audit in 2024, securing an additional RMB 500 million order. Green-tech revenue is projected to reach 15 of total by 2026, raising net margin by 1.5% [18].

4. Conclusion

Using TCL Technology 2020–2024 data, this study empirically examines the positive and negative effects of the "semiconductor display + new-energy PV + industrial finance" diversification route. Results show that diversified layout, via "cyclical complementarity", has continuously lifted gross margin, ROE and EPS, while solvency and operating indicators improved in tandem; the sharp PV price fall and cyclical synchronisation risks exposed the "double-edged sword" nature of diversification. Internal synergy, inventory hedging and green-tech funds can effectively mitigate risks. The case corroborates that traditional manufacturing firms such as home-appliance players, if focusing on technology premiumisation, capacity sharing and financial hedging, can achieve steady growth amid diversified expansion.

The study is single-case and primarily employs annual-report data, lacking real-time high-frequency data, and does not quantify how corporate culture and governance structure affect synergy efficiency. Future work will horizontally compare diversified paths of BOE, LONGi, etc., constructing a multi-case database; integrate high-frequency panel and polysilicon futures prices, ESG ratings, etc., to build dynamic panel models; and use questionnaires and interviews to measure organisational synergy and managerial cognition, deepening micro-mechanism research on the diversification–performance nexus.

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