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A Study on the Optimisation of Cost Management in TCL Group's Value Chain

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Abstract: Against the backdrop of the digital economy empowering the real economy, manufacturing enterprises can leverage digital transformation to break through the limitations of traditional cost control and achieve cost reduction and efficiency gains across the entire value chain. Taking TCL Group—a company undergoing digital transformation—as a case study, this paper draws upon value chain cost management theory to analyse the implementation models and existing shortcomings of cost control during the enterprise's digitalisation process, and proposes corresponding optimisation strategies.The research reveals that through measures such as the implementation of its 'AI×IoT' strategy and the construction of an industrial internet platform, TCL Group has largely completed the digital transformation and system upgrades of its cost control mechanisms. This applies to both internal value activities—including R&D and design, procurement, manufacturing and marketing—and the external value network linking upstream and downstream suppliers with end customers.However, during this process, the company has encountered practical bottlenecks, including a continuous decline in the marginal returns on digital resource investment, insuffi cient data interoperability across business processes, and a severe shortage of multi-skilled professionals possessing both digital technical capabilities and cost management expertise.In light of this, this paper outlines a systematic improvement pathway and response strategy across three dimensions: top-level strategic coordination, digital technology-driven initiatives, and organisational mechanism support. It aims to provide TCL Group and similar manufacturing enterprises with actionable practical guidance and a basis for decision-making to further drive in-depth digital transformation and eff ectively enhance cost control across the entire value chain.

Keywords: Digital Transformation; Value Chain Cost Management; Manufacturing Enterprises; TCL Group

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1. Introduction

1.1 Research Background

At present, new-generation information technologies driven by cloud computing, big data, artificial intelligence and the Internet of Things are profoundly transforming the established production operations and management philosophies of the manufacturing sector, accelerating its evolution from traditional models towards intelligent and digital directions.Global competition in the manufacturing sector has shifted from competition over individual products to competition across the entire value chain [1]. As a key component of a company's core competitiveness, the perspective of cost management has expanded from traditional cost control at the production stage to encompass value chain-wide cost coordination, covering

R&D and design, procurement and supply, manufacturing, marketing and services, as well as upstream and downstream partners.Traditional cost management models, which rely on manual accounting and ex-post analysis, suffer from drawbacks such as information lag, limited dimensions and insufficient coordination. They are increasingly unable to meet the higher demands and urgent needs of enterprises in the digital era regarding real-time cost monitoring and dynamic adjustment, as well as data-driven, scientific and refined decision-making.

As a leading Chinese home appliance manufacturer, TCL Group has continuously deepened its digital transformation process since formally adopting its "AI×IoT" strategy in 2018. Through a series of key initiatives—including the establishment and deployment of an industrial internet platform, the upgrading and modernisation of smart production workshops, and digitalised collaboration across the upstream and downstream supply chain—the company has progressively built a digital cost control system that spans all stages of the value chain, from R&D and design through procurement and logistics to manufacturing and marketing.Against this backdrop, exploring TCL Group's practical approaches and optimisation directions for value chain cost management holds significant reference value for similar manufacturing enterprises.

1.2 Significance of the Study

1.2.1 Theoretical Significance

This study organically integrates the theories of digital transformation and value chain cost management. By selecting TCL Group as a representative case for in-depth analysis, it systematically examines the transmission mechanisms and impact pathways of digital technologies on costs across various stages of the value chain [2]. This approach expands theoretical exploration in the field of value chain cost management within a digital context, providing robust case evidence and empirical support for the organic integration of management accounting theory with digital practice.

1.2.2 Practical Significance

By comprehensively and systematically summarising and analysing TCL Group's practical experience in value chain cost management and the prominent challenges it currently faces, and on this basis proposing optimisation and improvement plans that are highly targeted and actionable, this study will, on the one hand, assist TCL Group in further enhancing the overall effectiveness of its cost control on the existing foundation, fully tapping into and realising the deep-seated value and potential benefits brought about by digital transformation;on the other hand, it will provide replicable practical pathways and decision-making references for other manufacturing enterprises seeking to establish a full-value-chain cost management system against the backdrop of digital transformation [4].

2. Current Status of Value Chain Cost Management at TCL Group

2.1 Overview of TCL Group

TCL Group was founded in 1981. After more than four decades of development, it has evolved into a globally influential smart technology industrial group, with operations spanning three core sectors: smart terminal devices, semiconductor display panels, and new energy photovoltaics and semiconductor materials.By 2024, TCL had established a total of 42 R&D centres and 32 smart manufacturing bases worldwide, with products and services sold in over 160 countries and regions, and full-year revenue exceeding RMB 260 billion.Since 2018, TCL Group has prioritised digital transformation as a core strategy. Centred on the development directions of "digitalisation, intelligentisation and greening", the Group has established a digital support system centred on the "TCL Industrial Internet Platform", achieving digital coverage across the entire value chain, including R&D, production, supply chain and marketing[3].

2.2 Achievements in Value Chain Cost Management

TCL Group's value chain cost management system is underpinned by digital technology and covers two key dimensions: the internal value chain and the external value chain:

2.2.1 Internal Value Chain Cost Management

1.R&D and Design: A digital R&D collaboration platform has been established to integrate and enable seamless connectivity and efficient data sharing across all stages of a product's lifecycle, from conceptual design to end-of-life recycling [5]. By leveraging cutting-edge technologies such as simulation-based design and digital twins, the overall R&D cycle for new products has been reduced by approximately 30%, whilst trial-and-error costs during the R&D process have been effectively

reduced by around 25%.

2.Procurement and Supply Stage: Establish a digital procurement platform to fully digitise the entire process—from supplier onboarding, tendering, and pricing to settlement. Centralised procurement coverage has been increased to over 90%, with annual procurement costs reduced by 4%–6%.

3.Production and Manufacturing: Vigorously advancing the construction and deployment of smart factories, and actively introducing automated production lines and industrial internet management systems [6]. This has led to an approximate 40% increase in overall production efficiency, a reduction of approximately 15% in unit manufacturing costs, and a decrease of approximately 20% in product defect rates.

4.Smart Logistics: A comprehensive logistics management system has been developed to enable end-to-end visual management of warehousing, transport and distribution. Inventory turnover has increased by 35%, whilst the proportion of logistics costs relative to operating revenue has fallen from 8.2% to 5.7%.

5.Integrated Marketing: A user big data platform has been established to gain precise insights into user needs, enabling targeted marketing and personalised recommendations. The return on marketing investment has increased by 28%, whilst channel inventory turnover days have been reduced by 22 days.

2.2.2 External Value Chain Cost Management

1.Supplier Collaboration: 1. We have established a supplier collaboration platform, enabling real-time sharing of production plans, inventory and quality data with key suppliers. Supplier delivery accuracy has reached 98%, and the response speed of the entire supply chain has increased by 50%.

2.Customer Service Level: We established an omnichannel customer service system, integrating pre-sales, in-sales and after-sales data. This has improved the timeliness of resolving customer issues by 60%, reduced after-sales service costs by 20%, and raised customer satisfaction to 92%.

3. Issues in TCL Group's Value Chain Cost Management

Although TCL Group has achieved significant results in the digital transformation of its value chain cost management, as the transformation enters a more challenging phase, it still faces a series of issues that require urgent resolution:

3.1 Diminishing Marginal Returns on Digital Investment

TCL Group's initial digital investments were primarily focused on infrastructure development and the roll-out of core systems, yielding clear short-term cost-saving effects. However, as the transformation deepens, the costs of subsequent digital upgrades continue to rise, whilst marginal returns are showing a declining trend. The return on investment for digital upgrades in certain non-core business processes has fallen short of expectations, and some factories have exhibited a tendency to pursue digitalisation for its own sake [7]. Consequently, investments in digitalisation have not been fully translated into tangible results in terms of cost control.

3.2 Insufficient Cross-Functional Data Coordination

Currently, the digital systems across TCL Group's various business processes operate relatively independently. Data standards are not unified across R&D, procurement, production, marketing and other functions, and barriers to data integration exist. This makes it difficult to achieve real-time sharing and linked analysis of cost data across the entire value chain. For example, product design data from the R&D phase has not been fully communicated to the production phase, resulting in a still-high proportion of additional costs arising from design changes during production; market demand data from the sales end has not been synchronised in a timely manner with the supply chain, which can easily lead to risks of inventory build-up or stockouts [8].

3.3 Insufficient Capacity for Dynamic Cost Control Across the Value Chain

Currently, TCL Group's cost management remains primarily focused on ex-post accounting and analysis, with insufficient capabilities for real-time cost forecasting and dynamic optimisation. The system for identifying and quantifying cost drivers across the entire value chain is not yet fully developed, making it difficult to accurately trace the underlying causes of cost fluctuations at each stage. Consequently, cost optimisation measures lack data support, and it is not possible to implement dynamic control of costs throughout the entire process from start to finish.

3.4 Significant Shortage of Multidisciplinary Talent

Value chain cost management in a digital context requires multi-skilled professionals who possess expertise in both cost management and digital technologies and business processes. At present, TCL Group's internal cost management staff lack sufficient digital skills, whilst digital specialists do not have a sufficiently deep understanding of cost management logic and business processes. Barriers to collaboration between these two groups of professionals are hindering the implementation and full realisation of the potential of digital cost management tools.

3.5 Insufficient Depth of External Value Chain Collaboration

Digital collaboration between TCL Group and its upstream and downstream partners remains limited to data sharing, with no in-depth cost-sharing or profit-sharing mechanisms yet established. The digital capabilities of small and medium-sized suppliers vary considerably; some suppliers struggle to integrate with TCL's digital collaboration platform, thereby constraining the overall efficiency of digital supply chain collaboration. Consequently, the potential for cost optimisation within the external value chain has not yet been fully realised.

4. Strategies for Optimising Value Chain Cost Management at TCL Group

In response to the issues outlined above, and in light of the broader trend towards digital transformation and relevant theories of value chain cost management, we propose the following optimisation strategies:

4.1 Optimising the Digital Investment Strategy to Enhance Return on Investment

1.Establish a full-lifecycle evaluation mechanism for digital projects, conducting pre-project cost-benefit analyses, mid-project progress monitoring, and post-project benefit assessments for all digital transformation initiatives. Prioritise support for projects with high cost-benefit ratios and those that significantly drive value chain cost control.

2.Adopt a digital transformation approach of "pilot first, gradual roll-out". After verifying the cost-saving effectiveness of digital solutions in core business processes, replicate and roll them out across the entire Group to minimise trial-and-error costs.

3.Explore lightweight digital solutions; for non-core business processes and small-to-medium-sized factories, promote low-cost, easy-to-deploy digital tools to avoid excessive investment.

4.2 Build a Value Chain Data Hub to Break Down Data Collaboration Barriers

1.Establish a unified Group-wide data hub, formulate standardised data standards and interface specifications, and achieve data integration and sharing across all value chain segments, including R&D, procurement, production, marketing, supply chain and services.

2.Establish a cost data model covering the entire value chain, enabling real-time collection, integration and analysis of cost data across all stages. This will provide a unified data foundation to support decision-making in cost management.

3.Establish cross-departmental data collaboration mechanisms, clarify the responsibilities and obligations of each department regarding data sharing, and promote the smooth flow and value realisation of data across all stages of the value chain.

4.3 Strengthen Dynamic Cost Control Capabilities to Achieve End-to-End Cost Optimisation

1.Construct a dynamic cost monitoring and early warning system based on real-time data, set thresholds for key cost indicators at each stage, and issue real-time alerts for abnormal cost fluctuations to ensure early detection and resolution of cost issues.

2.Refine the cost driver analysis system by utilising big data and artificial intelligence technologies to conduct in-depth exploration and quantitative analysis of cost drivers across the entire value chain. This will enable the accurate identification of areas where costs can be further optimised, followed by the formulation of targeted optimisation measures for these specific areas.

3.Drive the transformation of cost management from 'post-event accounting' to 'pre-event forecasting and in-process control', embedding cost management throughout the entire product lifecycle—from R&D and design through to production and sales—to ensure that costs can be dynamically optimised throughout the product's entire lifecycle.

4.4 Strengthen the Development of Multi-Skilled Talent and Improve the Organisational Support System

1.Establish a training system for multi-disciplinary talent that integrates "cost management, digital technology and business processes". Provide digital skills training for cost management personnel and cost management and business knowledge training for technical staff to build a cross-disciplinary talent pool.

2.Establish cross-departmental cost management collaboration teams, incorporating personnel from finance, business operations, technology and other fields to jointly advance the optimisation of value chain cost management.

3.Refine the cost management assessment and incentive mechanisms, incorporating the outcomes of value chain cost optimisation into the performance appraisal systems of all departments to fully mobilise the enthusiasm of personnel at every stage to participate in cost management.

4.5 Deepen External Value Chain Collaboration and Establish a Cost-Sharing and Benefit-Sharing Mechanism

1.Establish a digital empowerment system for suppliers, providing low-cost digital solutions and technical support to small and medium-sized suppliers. The overall digitalisation level of the supply chain must be raised so that costs across the upstream and downstream sectors can be coordinated and optimised collectively.

2.We are exploring the establishment of strategic cooperation mechanisms with key suppliers and key customers based on shared costs and shared benefits, to jointly undertake product R&D, inventory optimisation, logistics coordination and other initiatives. Together, we will share the costs associated with digital transformation, whilst also sharing the benefits derived from optimising costs across the value chain.

3.Establish a comprehensive ecosystem-wide value chain cost management system, extending value chain cost management to upstream and downstream partners to achieve overall cost optimisation across the entire ecosystem.

5. Conclusion

Digital transformation presents manufacturing enterprises with numerous new opportunities in value chain cost management, though it also brings significant challenges. TCL Group is considered one of the early adopters of digital transformation within the manufacturing sector. By establishing a digital support system, the group has indeed achieved notable results in value chain cost management; however, it also faces issues such as diminishing marginal returns, insufficient data coordination and weak dynamic control capabilities.By optimising its digital investment strategy, building a data middle platform for the entire value chain, strengthening dynamic control capabilities, enhancing the development of multi-skilled talent, and deepening external collaboration, TCL Group can further unlock the value of digital transformation, improve the efficiency of value chain cost management, and establish a sustainable cost competitive advantage.The conclusions drawn from this study are also of reference value to other manufacturing enterprises, particularly those seeking to upgrade their value chain cost management against the backdrop of ongoing digitalisation, which can draw considerable useful insights from it.

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Conflict of Interests

The authors declare that there is no conflict of interest regarding the publication of this paper.

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