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Exploring operational and management strategies for medical technology enterprises

Xiao Lin

Shanghai Qiaofei Medical Technology Co., Ltd. Shanghai, China

846528206@qq.com

Abstract. With the in-depth advancement of the "Healthy China" strategy and the accelerating aging of the population, China's healthcare industry has entered a period of unprecedented development opportunities. As the core drivers of this sector, medical technology enterprises are benefiting from market expansion while simultaneously facing multiple challenges, including tightening regulatory policies, intensified competition, and rapid technological iteration. Traditional management models are increasingly inadequate for meeting these new demands. Based on observations of operational practices in medical technology enterprises, this paper systematically analyzes common issues in financial management, cost control, human resource management, and quality management. It further proposes a set of comprehensive management strategies from multiple dimensions, including optimizing capital management, implementing comprehensive budgeting, strengthening cost control, establishing dual-factor incentive mechanisms, improving quality management systems, and promoting digital transformation. The aim is to provide both theoretical references and practical insights for enhancing core competitiveness and achieving high-quality development in medical technology enterprises.

Keywords: medical technology enterprises, business management, financial management, cost control, human resource management

1. Introduction

In recent years, China's healthcare system reform has continued to deepen, with a series of policies aimed at encouraging innovation and standardizing industry development being successively implemented. From the *Healthy China 2030 Planning Outline* to the *Good Manufacturing Practice for Medical Devices*, policy guidance has not only driven industrial upgrading but also imposed higher requirements on the management of medical technology enterprises. Medical technology enterprises must cope with the high investment and risk associated with technological research and development, while also balancing multiple competing priorities in an increasingly competitive market environment. These include expansion versus financial security, product innovation versus cost control, and talent acquisition versus performance management.

However, many enterprises have exposed significant weaknesses in their management practices during rapid growth. For instance, some companies still rely on traditional financial management models, neglecting the efficiency of working capital [1]. Others demonstrate a limited understanding of cost management and

have failed to establish effective comprehensive budgeting systems. Additionally, deficiencies in systematic incentive mechanisms within human resource management have led to the loss of key talent. If not properly addressed, these issues may become critical bottlenecks hindering sustainable development. Therefore, a systematic exploration of operational and management strategies for medical technology enterprises is of substantial practical significance. This paper examines such strategies from the perspectives of financial management, cost control, human resources, quality management, and digital transformation, with the aim of providing valuable references for industry practitioners.

2. Major challenges in the operation and management of medical technology enterprises

2.1. Low efficiency in capital management and elevated operational risks

The medical technology industry is characterized by long R&D cycles, substantial capital investment, and slow capital recovery. In the early stages of development, enterprises allocate significant financial resources to product development and technological innovation. After commercialization, however, downstream clients—primarily medical institutions—often occupy a dominant position within the industrial chain, resulting in extended payment cycles and a persistently high proportion of accounts receivable relative to sales revenue. This mismatch between "long investment cycles and slow recovery" can easily lead to liquidity constraints. Although many enterprises achieve revenue growth, much of the increase is tied up in accounts receivable and inventory rather than being converted into actual cash flow. As a result, firms may report strong book profits while facing severe cash flow pressures in practice. Moreover, some enterprises rely on overly concentrated financing channels, particularly bank loans. Under conditions of tightened macroeconomic policy or declining credit ratings, such reliance can quickly lead to financing difficulties, further exacerbating operational risks [2].

2.2. Extensive cost management systems and difficulty in achieving cost reduction and efficiency gains

Cost management is critical to enhancing profitability in medical technology enterprises; however, many firms continue to exhibit significant deficiencies in this area. First, there is often a cognitive bias among management, where cost control is narrowly interpreted as reducing material costs or simplifying production processes. This approach overlooks broader cost categories such as R&D, after-sales services, and indirect expenses, potentially undermining product quality and long-term development capacity [3]. Second, comprehensive budgeting systems are frequently underdeveloped. Budget preparation is often treated as a formality, while execution lacks effective monitoring, resulting in substantial deviations between actual costs and budget targets. Third, in the core domain of R&D, many enterprises lack refined project-based cost accounting mechanisms. When multiple projects are conducted simultaneously, it becomes difficult to accurately allocate costs such as materials and labor hours. Consequently, the input-output ratio of R&D investment remains vague, weakening the data foundation for managerial decision-making. Finally, cost inefficiencies are also prevalent in production and after-sales processes. Issues such as equipment aging, insufficient worker skills leading to material waste, and disorganized after-sales maintenance management contribute to resource wastage, thereby eroding profit margins.

2.3. Lagging human resource management and insufficient incentives for core talent

As a knowledge-intensive industry, the core competitiveness of medical technology enterprises depends heavily on R&D, technical, and managerial talent. However, in some enterprises, human resource management strategies remain misaligned with employee needs. On the one hand, compensation structures are often overly rigid and lack flexibility, making it difficult to attract high-caliber external talent or motivate internal employees effectively. On the other hand, opaque promotion mechanisms and unclear career development pathways contribute to professional burnout, particularly among R&D personnel, reducing their long-term commitment to the organization. In addition, companies frequently neglect the optimization of "hygiene factors", such as working conditions and interpersonal relationships. When these fundamental needs are not adequately met, employee satisfaction declines significantly, directly affecting team stability. For R&D-driven enterprises, the loss of key personnel not only increases replacement costs but may also result in the leakage of critical technologies and disruption of ongoing projects, leading to incalculable losses.

2.4. Rigid quality system operation and persistent compliance risks

With increasingly stringent requirements under regulations such as the *Good Manufacturing Practice for Medical Devices* and standards like ISO 13485, quality management has become the "lifeline" of medical technology enterprises. Although most firms have established quality management systems, their practical implementation often reveals a disconnect between documentation and execution. In some cases, while quality system documentation appears comprehensive, actual operational practices fall short, resulting in a significant gap between formal procedures and real-world execution. Certain enterprises also lack sufficient emphasis on quality management, with inadequate internal audit and management review mechanisms, preventing timely identification and correction of system deviations. In terms of raw material quality control, weaknesses in supplier management and incoming inspection processes may allow substandard components to enter the production line, creating latent quality risks. Furthermore, due to the absence of a culture and mechanism for continuous improvement, enterprises often respond reactively to major quality incidents rather than proactively preventing them. This not only increases compliance costs but also amplifies overall operational risk.

3. Optimization of operational and management strategies for medical technology enterprises

In response to the aforementioned challenges, medical technology enterprises must adopt a strategic perspective to build a systematic management framework. This involves the organic integration of financial management, cost control, human resources, quality management, and digital transformation, thereby generating synergistic effects.

3.1. Establishing a robust capital management system to enhance operational efficiency

Capital functions as the "lifeblood" of an enterprise; thus, medical technology firms must elevate capital management to a strategic priority. First, a diversified financing strategy should be implemented. In addition to traditional bank loans, enterprises should actively explore equity financing, venture capital introduction, and government special funds to diversify financial risks and ensure adequate support for R&D and expansion. Second, working capital management must be treated as a core focus. To address the issue of high accounts receivable caused by credit sales to downstream clients, firms should establish a rigorous customer credit

management system. This includes credit rating assessments, differentiated credit terms and limits, and dynamic monitoring and collection jointly managed by finance and sales departments. Drawing on the concept of the "Other People's Money (OPM) strategy", enterprises may optimize supply chain management by moderately leveraging supplier credit—extending accounts payable turnover periods under the premise of maintaining good partnerships—while remaining vigilant against excessive reliance that could lead to credit risk [4]. At the same time, inventory management should be strengthened through refined control methods, such as setting safety stock levels and optimizing procurement batch sizes, in order to balance supply assurance with reduced capital occupation.

3.2. Implementing comprehensive budgeting and refined cost management

Cost management should not be confined to the finance department but rather embedded throughout the entire value chain, including R&D, procurement, production, and sales. First, management must shift its perception of cost control, abandoning the narrow view that equates it solely with cost reduction, and instead adopting a value-oriented approach in which cost management serves to create greater overall value. Second, a comprehensive budgeting system should be fully implemented. Enterprises need to establish an integrated budget framework covering operations, capital, projects, and taxation. Strategic objectives should be decomposed into specific budget indicators, while advanced methods such as zero-based budgeting and rolling budgeting should be introduced to enhance scientific rigor and adaptability. The budgeting process must break down departmental silos, ensuring deep participation from business units, while execution requires continuous monitoring and variance analysis to enable timely corrective actions. Third, for R&D activities, a refined project-based cost accounting system should be established. Direct costs—including labor, materials, and equipment—must be accurately allocated to individual projects, with indirect costs reasonably apportioned. This provides a reliable basis for project evaluation and decision-making. Finally, in the production phase, lean manufacturing principles should be introduced to reduce waste through process optimization, improved equipment utilization, and enhanced workforce skills. Meanwhile, enterprises should also strengthen the management of selling expenses and after-sales costs by setting clear expenditure standards, reinforcing collection performance assessments, and standardizing maintenance material usage to prevent cost overruns caused by inefficient management practices.

3.3. Human resource incentives based on the Two-Factor Theory

To effectively attract, motivate, and retain core talent, medical technology enterprises may adopt Herzberg's Two-Factor Theory to construct a systematic human resource management framework [5]. At the level of "hygiene factors", enterprises must focus on eliminating employee dissatisfaction. This includes designing competitive compensation systems with transparent structures, providing comprehensive benefits such as supplementary medical insurance and equity incentives, and fostering a comfortable, safe, and fair working environment characterized by mutual respect and trust. At the level of "motivators", firms should actively enhance employee satisfaction and intrinsic motivation. On the one hand, enterprises should create innovation platforms, such as internal innovation funds, encouraging employees to propose ideas and providing corresponding resource support. A culture that encourages experimentation and tolerates failure is essential. On the other hand, attention must be given to employees' personal growth and career development. Organizations should establish dual career pathways—managerial and technical—offering clear promotion channels for different talent types. A comprehensive training system should also be implemented, including regular internal and external training and technical exchanges, to enhance professional competencies and broaden perspectives. By granting employees greater autonomy, recognizing achievements, and assigning

challenging tasks, enterprises can effectively stimulate individual potential and align personal value realization with organizational objectives.

3.4. Optimizing resource allocation and strengthening the quality management system

For medical device manufacturers, optimizing the quality management system is fundamental to survival and development. First, a strong organization-wide awareness of quality must be established, particularly among senior management. Quality management should be elevated to a top-level priority, with sufficient resources allocated accordingly [6]. Enterprises should develop comprehensive and operable quality management documentation, clearly defining departmental responsibilities and interfaces in quality planning, control, and improvement, and updating these frameworks in response to internal and external changes. Second, quality supervision must be reinforced. Enterprises should build a highly competent internal audit team to conduct regular audits and management reviews, comprehensively evaluating the suitability, adequacy, and effectiveness of the quality system. Identified nonconformities should undergo root cause analysis, followed by the implementation of effective corrective and preventive actions. Third, critical control points must be tightly managed. At the raw material stage, strict supplier admission and performance evaluation mechanisms should be established, with joint failure mode analysis conducted to mitigate risks at the source. During production, standardized equipment management systems and digital maintenance platforms should be implemented to ensure optimal equipment performance and reduce quality issues arising from malfunctions. Finally, enterprises should continuously cultivate a quality-oriented culture. Through training and incentive mechanisms, the principle of "quality first" can be internalized by employees and translated into consistent behavioral norms.

3.5. Accelerating digital transformation to empower management upgrading

In the digital economy era, digital transformation has become an inevitable pathway for medical technology enterprises to enhance management efficiency and core competitiveness. First, digital technologies should be leveraged to improve financial management efficiency. By establishing integrated financial management systems, enterprises can automatically consolidate data from procurement, production, and sales processes, enabling real-time data collection and analysis, thereby strengthening data integration and supporting more timely and accurate decision-making [7]. Second, financial processes should be automated and intelligentized. The introduction of Robotic Process Automation (RPA) can streamline repetitive tasks such as invoice processing, expense reimbursement, and account reconciliation, freeing financial personnel to focus on higher value-added activities such as budget analysis, cost control, and tax planning. Third, big data and artificial intelligence technologies can be utilized to develop financial risk early warning models. By analyzing historical and real-time operational data, enterprises can predict risks related to cash flow and customer credit, shifting from ex post analysis to ex ante forecasting and in-process control, thereby significantly enhancing risk management capabilities. Moreover, digital transformation can break down "information silos", fostering deep integration between finance and business functions such as R&D, production, and sales. This integration facilitates more precise resource allocation and cost control, ultimately enabling the realization of business-finance integration [7]. However, during the process of digital transformation, enterprises must place great emphasis on data security and privacy protection. A robust data governance framework is essential to safeguard core financial data and sensitive patient information.

4. Conclusion

In the face of opportunities and challenges arising from policy shifts, market dynamics, and technological transformation, medical technology enterprises must abandon traditional extensive management models and transition toward refined, systematic, and digitalized operational management. This paper has systematically analyzed the common issues faced by medical technology enterprises in capital management, cost control, human resource management, and quality management, and has proposed corresponding optimization strategies. The findings suggest that enterprises should regard the establishment of a robust capital management system as the foundation of survival. Through diversified financing and refined working capital management, firms can ensure stable financial liquidity. Comprehensive budgeting and refined cost management should be treated as the primary drivers of profitability, enabling enterprises to enhance value creation through full-process and multi-dimensional cost control. Furthermore, human resource incentives based on the Two-Factor Theory should be viewed as a source of organizational vitality. By balancing hygiene factors and motivators, enterprises can effectively stimulate employees' intrinsic motivation. The optimization of quality management systems should serve as the cornerstone of sustainable development, with strengthened quality awareness and improved supervisory mechanisms forming a solid compliance safeguard. Finally, accelerating digital transformation should be regarded as a critical enabler of growth. Through data-driven empowerment and process reengineering, enterprises can significantly improve management efficiency and organizational agility.

Looking ahead, competition in the medical technology sector will extend beyond technology and products to encompass management capability and operational intelligence. Only by effectively implementing systematic management strategies and continuously optimizing internal governance structures can medical technology enterprises maintain steady progress in a complex and dynamic environment. Ultimately, this will enable them to achieve high-quality, sustainable development and contribute meaningfully to the advancement of the "Healthy China" strategy.

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