BEKETOV NATIONAL UNIVERSITY OF URBAN ECONOMY IN KHARKIV
Educational and Research Institute of Economics and Management

Department of Entrepreneurship and Business Administration

EXPLANATORY NOTE

to the master's degree qualification thesis

on the topic: **Enterprise production potential management**

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CONTENTS

INTRODUCTION 6

CHAPTER 1 THEORETICAL AND METHODOLOGICAL FOUNDATIONS: THE NATURE AND STRUCTURE OF ENTERPRISE PRODUCTIVITY MANAGEMENT 9

1.1 The Concept, Nature, and Role of Enterprise Productivity in the Modern Economy 9

1.2 The Structure of Enterprise Productivity: Resource, Technology, and Organizational Elements 13

1.3 Modern Methodologies and Tools for Productivity Assessment and Management 18

CHAPTER 2 ANALYSIS OF THE CURRENT PRODUCTION POTENTIAL OF BEIJING ADVANCED MANUFACTURING CO., LTD. 25

2.1 Overview of Beijing Advanced Manufacturing Co., Ltd. and Its Operating Environment 25

2.2 Dynamic Analysis of Production and Financial Activities of Beijing Advanced Manufacturing Co., Ltd. 30

2.3 Comprehensive Assessment of the Utilization Efficiency of Beijing Advanced Manufacturing Co., Ltd.'s Production Potential 35

CHAPTER 3 PLAN FOR ENHANCING THE PRODUCTION POTENTIAL OF BEIJING ADVANCED MANUFACTURING COMPANY 43

3.1 Systematic Solution Framework and Core Objectives 43

3.2 Implementation plans and quantitative indicators for different sectors 49

CONCLUSION 58

REFERENCES 62

INTRODUCTION

In the context of globalization, digitalization, and intensifying competition in both global and national markets, traditional approaches to enterprise management – based solely on cost control or market expansion – are no longer sufficient to ensure long-term competitive advantage. The modern efficiency and sustainability of a business increasingly depend on its internal strength – the production potential of the enterprise. Production potential serves as the foundation for meeting current demand, driving innovative development, and achieving long-term strategic goals. Therefore, the scientific justification, assessment, and management of production potential are key aspects of modern management that determine the competitiveness and viability of enterprises.

The relevance of the research lies in the fact that many industrial enterprises, particularly small and medium-sized ones, still interpret production potential narrowly – as merely production capacity or material and technical assets. Their management practices are often reactive, fragmented, and short-term, lacking a holistic and strategic perspective. This results in inefficient resource utilization, lagging technological development, and inflexible organizational structures, which significantly limit their competitive capabilities.

In this context, the study of the formation, evaluation, and management of production potential is of great theoretical and practical importance. In particular, analyzing the production potential of Beijing Advanced Manufacturing Co., Ltd. makes it possible to identify weaknesses in resource utilization and determine directions for improving production efficiency.

The purpose of this research is to develop scientifically grounded recommendations for improving the efficiency of production potential management at Beijing Advanced Manufacturing Co., Ltd.

To achieve this purpose, the following objectives have been defined:

• to examine the theoretical foundations, structure, and management principles of enterprise production potential;

• to describe modern methods for assessing the efficiency of production potential utilization;

• to analyze the performance of Beijing Advanced Manufacturing Co., Ltd. and assess the level of utilization of its production resources;

• to identify key problems and reserves for improving production potential efficiency;

• to develop practical recommendations for optimizing the management of enterprise production potential.

The object of the research is the process of formation, evaluation, and management of enterprise production potential.

The subject of the research is the methods, tools, and organizational-economic mechanisms for improving the efficiency of production potential utilization in industrial enterprises.

The scientific novelty of the study lies in clarifying the essence of the concept of "enterprise production potential" and developing an integrated approach to its evaluation and management based on the combination of financial, technological, and organizational indicators.

The information base of the research includes regulatory and analytical materials on industrial enterprise management, official financial and production reports of Beijing Advanced Manufacturing Co., Ltd., and statistical data from of Statistics and the World Bank. It also draws on scientific publications and analytical articles by domestic and foreign researchers on production potential, resource efficiency, and enterprise competitiveness

The practical significance of the work lies in the possibility of applying the developed recommendations in the activities of Beijing Advanced Manufacturing Co., Ltd. to enhance production efficiency, optimize resource use, and strengthen competitiveness. Moreover, the proposed approaches can be effectively applied by other industrial enterprises operating in dynamic market conditions.

CHAPTER 1 THEORETICAL AND METHODOLOGICAL FOUNDATIONS: THE NATURE AND STRUCTURE OF ENTERPRISE PRODUCTIVITY MANAGEMENT

1.1 The Concept, Nature, and Role of Enterprise Productivity in the Modern Economy

"Productivity potential" is a core concept in economic management theory, but its definition varies across different schools of thought and literature. Early research, particularly those stemming from the planned economy era, tended to equate productivity potential with an enterprise's "maximum production capacity," meaning the maximum output achievable under given technical conditions using all available production resources (equipment, labor, and raw materials). This definition is distinctly static and engineering, focusing on the material element [1].

With the continuous development of management theory and economic practice, the understanding of productivity potential has gradually deepened and expanded. Modern management perspectives consider productivity potential a more complex and dynamic systemic concept. It encompasses not only an enterprise's current and immediately available production capacity, but also its potential future production capacity, which stems from intangible assets such as technological innovation, organizational change, human capital enhancement, and knowledge accumulation.

A comparison between the traditional and modern definitions of a firm's production potential can be presented in the form of a chart (Fig. 1.1).

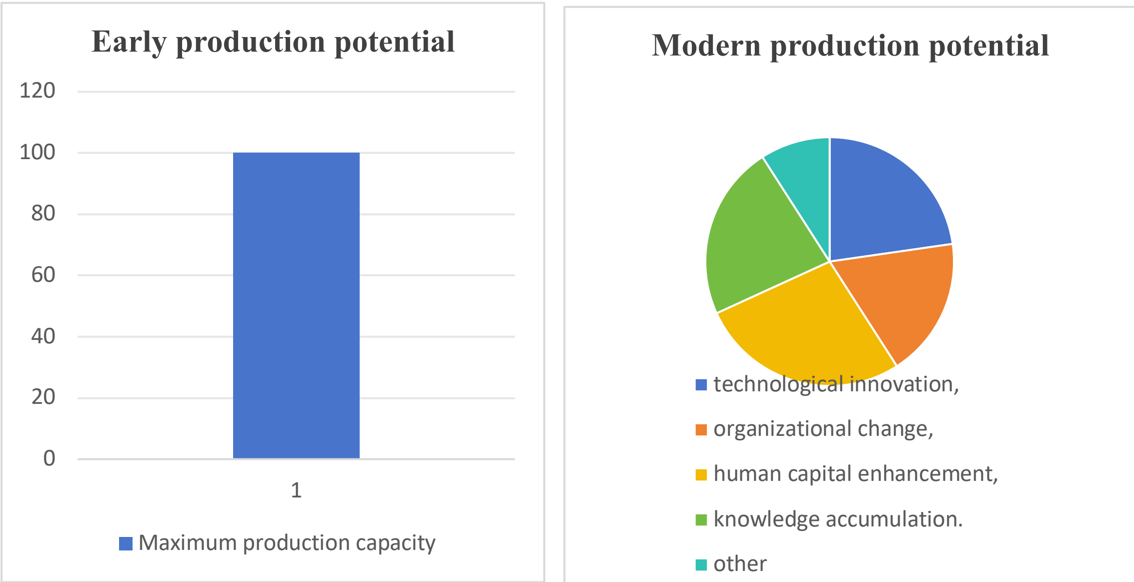

Fig. 1.1 - A Comparison of Traditional and Modern Definitions of Enterprise Production Potential

This paper adopts the following definition: An enterprise's productivity potential refers to the total capacity to produce goods or services that can be stably and sustainably achieved over a specific period of time by optimally integrating and utilizing all its material, technological, human, financial, and information resources, under existing and foreseeable market and technological conditions. This definition emphasizes the following key elements:

Systemicity: Production potential is not a simple sum of various resources, but a complex system comprised of interconnected and interacting elements. Weaknesses in any one element can limit the potential of the entire system, a phenomenon known as the "barrel effect" [2].

Dynamicity: Production potential is not static. It evolves continuously with factors such as technological progress, employee skill development, management optimization, and market changes. Effective management aims to promote its positive, growth-oriented development [3].

Duality (actual and potential): Production potential comprises two levels. The first is "actual potential," which refers to the output level that can be achieved by optimizing existing processes under current organizational and technological conditions. The second is "latent potential," which refers to future capabilities that can only be unlocked through long-term investments such as technological transformation, equipment upgrades, and major organizational innovations. One of the core tasks of management is to transform "latent potential" into "actual potential."

Value-orientedness: The ultimate measure of production potential is not simply output, but its ability to create economic value (such as profits and market share) and social value (such as employment and environmental protection). Therefore, potential management must be closely integrated with a company's strategic goals and market value orientation. In the modern economy, the role of production potential has been elevated to an unprecedented strategic level [4].

First, it is the cornerstone of corporate competitiveness. In a market characterized by product homogeneity and fierce price competition, companies with higher production potential enjoy lower unit costs, faster delivery, better product quality, and enhanced customization capabilities. These are all direct sources of core competitive advantage.

Second, it is the engine that drives sustainable corporate development. Faced with increasingly severe resource and environmental constraints and rapidly evolving technological trends, companies must adapt by continuously enhancing their production potential (e.g., through the development of green and intelligent manufacturing) to achieve balance between economic efficiency and environmental responsibility and ensure sustainable business success.

Third, it is the micro-foundation of national economic resilience. The overall competitiveness of a country's industries depends on the average level of production potential within its enterprises. Especially in the context of global supply chain restructuring, a group of companies with strong, flexible, and autonomous production potential is a key guarantee for national economic security and stability.

Finally, it is an incubator for innovative value. Any technological, product, or business model innovation ultimately needs to be transformed into real products and services through the production process. A robust production potential system enables faster and more effective commercialization of innovative achievements, thereby forming a virtuous cycle of "innovation-production-efficiency-reinnovation."

In summary, the management of a company's production potential has risen from the traditional level of production operations to the core of strategic management. This requires managers to possess a systematic, forward-looking, and holistic perspective, viewing potential management as an ongoing strategic task that permeates all corporate functions [5].

1.2 The Structure of Enterprise Productivity: Resource, Technology, and Organizational Elements

To effectively assess and manage production potential, it must be broken down into measurable and analyzable components. Based on systems theory, an enterprise's production potential can be divided into three interdependent core subsystems: resource elements, technological elements, and organizational elements.

1. Resource Elements - The Material Basis of Production Potential

Resource elements are the most fundamental and intuitive "hardware" components of production potential and the prerequisite for all production activities within an enterprise. They primarily include:

Material Resources:

Fixed Assets: Factories, buildings, machinery and equipment, production lines, and transportation vehicles. Key metrics include quantity, technological level (age, degree of automation), availability, and utilization. The scale and sophistication of fixed assets directly determine the enterprise's physical production capacity ceiling.

Current Assets: Raw materials, auxiliary materials, fuel, work-in-progress, and finished goods inventory. The level of their management (such as inventory turnover) directly impacts the continuity of the production process and the efficiency of capital utilization.

Natural Resources: For specific industries (such as mining and agriculture), access to and efficient utilization of natural resources such as land, minerals, and water are also important resource elements. Human Resources:

Quantity and Structure: Total number of employees, as well as their breakdown by function (production, technology, management), skill level (senior, intermediate), and age.

Quality: Employees' education level, professional skills, work experience, learning ability, creativity, and health. Human resources are the most dynamic factor in production potential, and their quality is often more important than their quantity.

Financial Resources:

Equity: Equity, retained earnings, etc., provide a stable source of funds for long-term investments (such as technological transformation).

Loan Capital: Bank loans, bonds, etc., provide liquidity for operations and expansion. The adequacy and cost (interest rate) of financial resources directly impact a company's ability to invest in resource and technological factors.

Information Resources:

Data: Production data, sales data, customer data, supply chain data, etc.

Knowledge: Patents, technical know-how, trade secrets, brand value, etc. In the digital economy, information resources have become a production factor as important as material resources, and are key to driving intelligent production and precise decision-making [6].

The composition of enterprise resource elements is presented in Table 1.1.

Table 1.1 - List of Enterprise Resource Elements

Resource Types	Specific Components	Examples of Key Indicators
Material Resources	Fixed Assets, Current Assets	OEE, Capacity Utilization, Inventory Turnover
Human Resources	Quantity/Structure , Quality	Output per Employee, Training Investment Ratio
Financial Resources	Equity, Loan Capital	Debt-to-Equity Ratio, R&D Investment Ratio
Information Resources	Data, Knowledge	Data Sharing Rate, Knowledge Conversion Rate

2. Technological Factors – The Efficiency Multiplier of Production Potential

Technological factors serve as the bridge connecting resource elements and final output, determining the efficiency and depth of resource utilization. Technological factors encompass not only specific "hard technologies" but also "soft technologies."

Process Technology:

This refers to the specific methods and processes used to transform raw materials into products, such as production routes, assembly plans, and chemical formulas. Advanced process technology can significantly improve material utilization, reduce energy consumption, shorten production cycles, and enhance product quality.

Equipment Technology:

This is reflected in the performance of machinery and equipment, such as automation levels (CNC machine tools, industrial robots), intelligence levels (intelligent devices with sensing, analysis, and decision-making capabilities), precision, speed, and flexibility (capability to produce a wide variety of products in small batches).

Information Technology and Automation:

This is the core of modern technological factors. It includes enterprise resource planning systems, manufacturing execution systems, product lifecycle management systems, the Internet of Things, big data analytics, and artificial intelligence. The application of these technologies enables the digitization, networking, and intelligence of production processes, and is a revolutionary force in improving the efficiency of production potential. Management Techniques:

Soft techniques used to organize and coordinate production activities, such as Lean Manufacturing, Total Quality Management, Six Sigma, Agile Manufacturing, and Theory of Constraints. These methodologies provide a systematic approach and tools for eliminating waste, optimizing processes, and achieving continuous improvement, thereby significantly increasing production potential with minimal or no increase in resource input.

3. Organizational Elements - The Integrator and Driving Force of Production Potential

Organizational elements are the "software" and "operating system" that ensure the coordinated and efficient operation of resource and technology elements. They determine the "activity" and "synergy" of production potential.

Organizational Structure:

The division of responsibilities and collaboration models between departments and levels within an enterprise. Examples include traditional functional and project-based structures, or more flexible matrix and network structures. An organizational structure aligned with the production strategy can facilitate information flow, expedite decision-making, and stimulate cross-departmental collaboration.

Management Systems and Processes:

These include production planning and control systems, quality control systems, supply chain management systems, equipment maintenance systems, and cost control systems. These standardized processes and systems ensure the stable, orderly, and efficient operation of production activities. Corporate culture:

The company's shared values, beliefs, and code of conduct. A corporate culture that encourages innovation, pursues excellence, emphasizes teamwork, and respects employees can greatly stimulate employee enthusiasm and creativity, a valuable asset that cannot be replaced by any technology or equipment.

Leadership and incentive mechanisms:

Management's ability to formulate a strategic vision, lead change, and motivate the team. This, along with the accompanying performance appraisal and compensation incentive system, aligns individual and team goals with the company's goal of increasing productivity and is the driving force that propels the entire organization forward.

The relationship between the three: Resources are the foundation, technology is the lever, and organization is the glue and catalyst. Without sufficient resources, potential is like a sourceless stream; without advanced technology, resource utilization efficiency will be greatly reduced; and without an efficient organization, even the best resources and technology cannot achieve synergy and may even hinder each other. Therefore, the management of productivity must be comprehensive and systematic. All three are indispensable and must develop in tandem.

The interaction model of the three factors of enterprise productivity can be presented in the form of a chart (Fig. 1.2).

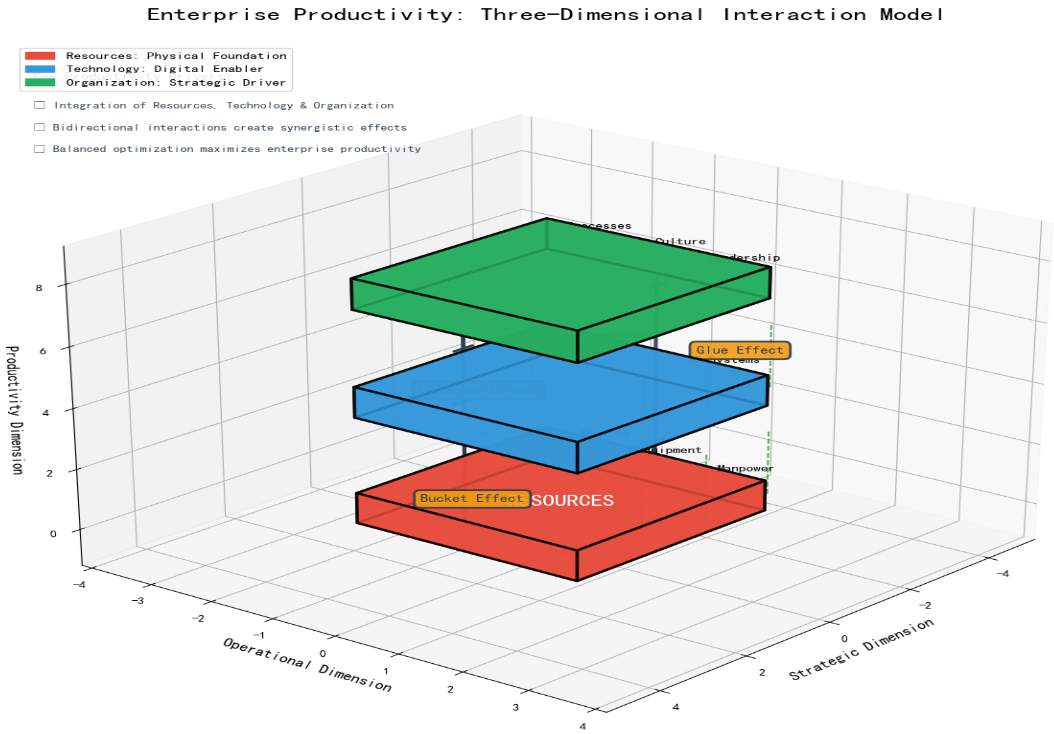

Fig. 1.2 - Interaction Model of Three Factors of Enterprise Productivity

1.3 Modern Methodologies and Tools for Productivity Assessment and Management

Scientifically assessing production potential is a prerequisite for effective management. Without an accurate assessment, it's impossible to identify problems and bottlenecks, let alone develop sound improvement strategies. Modern management has developed a series of assessment and management methodologies and tools, each with its own distinct focus and complementary capabilities.

I. Main Methodologies for Assessing Production Potential

Key Performance Indicator-Based Assessment:

This is the most commonly used and direct assessment method. Its core is to develop a set of indicators that comprehensively reflect the status of all dimensions of production potential.

Efficiency Indicators: Measure the relationship between input and output [1].

$$\text{Labor Productivity} = \frac{\text{Total Output Value}}{\text{Total Employees}}$$

$$\text{Overall Equipment Effectiveness} = \text{Availability} \times \text{Performance} \times \text{Quality}$$

$$\text{Material Utilization} = \frac{\text{Net Weight of Material Included in Product}}{\text{Total Weight of Material Input}}$$

Capacity Indicators: Measure output scale and flexibility [10].

$$\text{Capacity Utilization} = \frac{\text{Actual Output}}{\text{Designed Capacity}}$$

Production Flexibility: Measure the speed and cost of switching between product lines [11].

Quality Indicators: Measure the quality of output.

$$\text{Product qualification rate} = \frac{\text{number of qualified products}}{\text{total output}}$$

Innovation and growth indicators: measure future potential.

R&D investment as a percentage of sales revenue

New product sales revenue as a percentage

Per capita training hours

By analyzing these indicators vertically (compared to historical data) and horizontally (compared to industry benchmarks), a company's strengths and weaknesses in production potential can be clearly identified.

Value chain-based assessment:

The value chain analysis proposed by Michael Porter breaks down a company's activities into core activities (internal logistics, production operations, external logistics, marketing, and services) and supporting activities (infrastructure, human resources management, technology development, and procurement). This approach examines production potential from the perspective of value creation, focusing not only on the production operations themselves but also analyzing their synergy with upstream and downstream links. By identifying profit leverage points and cost drivers within the value chain, potential for improving overall value creation efficiency can be identified. For example, the production potential may be constrained by bottlenecks in internal logistics (untimely material supply) or technology development (product design that is difficult to manufacture). Benchmarking-Based Assessment Methods:

Benchmarking is the process of comparing a company's products, services, or practices with those of its best competitors (industry benchmarks) or leading companies (universal benchmarks) within and outside the industry to identify gaps and learn from their best practices to improve its performance. In production potential management, companies with outstanding performance in areas such as OEE, lean production, and smart manufacturing can be selected as benchmarks. Through in-depth analysis of their success stories, clear goals and paths can be set for improving the company's potential.

A comparison of the main productivity assessment methods is presented in Table 1.3.

Table 1.3 - Comparison of major productivity assessment methods

Evaluation Methods	Core Advantages	Applicable Scenarios	Limitations:
KPI Method	Direct Quantification and Horizontal Comparison	Short-term efficiency assessment	Ignores causal relationships, making it difficult to reflect systemic problems.
Value Chain Analysis	Identifying Bottlenecks in Value Creation	Strategic potential discovery	Relies on subjective judgment, requiring in-depth interviews.
Benchmarking	Clearly Defining Directions for Improvement	Industry benchmarking and learning	Ignores the uniqueness of the enterprise.

II. Core Tools for Production Potential Management

Lean Production:

Derived from the Toyota Production System, its core philosophy is to "create the most value possible with the least resource investment and meet customer needs." It continuously improves processes and unlocks wasted production potential by identifying and eliminating the seven major wastes in the production process (overproduction, waiting, transportation, overprocessing, inventory, motion, and defective products). Common tools include 5S on-site management, Kanban management, value stream mapping, standardized work, and total productive maintenance. Lean production is a powerful tool for improving the efficiency of existing resource utilization. Six Sigma:

A data-driven management philosophy and methodology that pursues near-perfect quality. Through the rigorous DMAIC (Define, Measure, Analyze, Improve, Control) process, it identifies and eliminates the root causes of process variation and defects, thereby reducing product or service defect rates to parts per million. Six Sigma significantly leverages the potential of technical and organizational factors by improving quality, reducing costs, and shortening cycle times, making it particularly suitable for industries with stringent quality control requirements.

Theory of Constraints:

Proposed by Israeli physicist Eliyahu M. Goldratt, its core concept is that any system has at least one constraint (bottleneck) that limits the overall output. The Theory of Constraints (TOC) management focuses on identifying this "bottleneck." Through a five-step process (identifying the bottleneck, eliminating it, accommodating it, loosening it, and then looking for new bottlenecks), TOC aims to maximize the bottleneck's output, thereby increasing the overall system's production potential. TOC provides companies with an effective approach for systematic thinking and solving complex problems, avoiding the indiscriminate investment of resources.

Smart Manufacturing and Industry 4.0 Technologies:

This is a future-oriented toolkit for managing production potential. Through cyber-physical systems, it deeply integrates physical devices with the digital world, achieving transparency, automation, and intelligence in the production process. Core technologies include the Internet of Things (for device connectivity and data collection), big data analytics (for extracting insights from massive amounts of data), artificial intelligence (for intelligent decision-making and predictive maintenance), cloud computing and edge computing (for powerful computing support), and digital twins (for simulating and optimizing physical production systems in a virtual space). Intelligent manufacturing can fundamentally transform production models, enabling mass customization, predictive maintenance, and self-optimizing production. It is a revolutionary approach to unleashing a company's latent potential.

In summary, modern enterprises should integrate a variety of assessment methods and management tools to form a closed-loop management system of "assessment-diagnosis-improvement-reassessment." Using KPIs and benchmarking as a "dashboard" for monitoring, value chains and TOC as a "map" for navigation, Lean and Six Sigma as a "toolbox" for continuous improvement, and intelligent manufacturing as an "engine" to drive future growth, they can systematically and continuously enhance a company's production potential.

The classification matrix of modern productivity management methods can be presented in the form of a chart (Fig. 1.3).

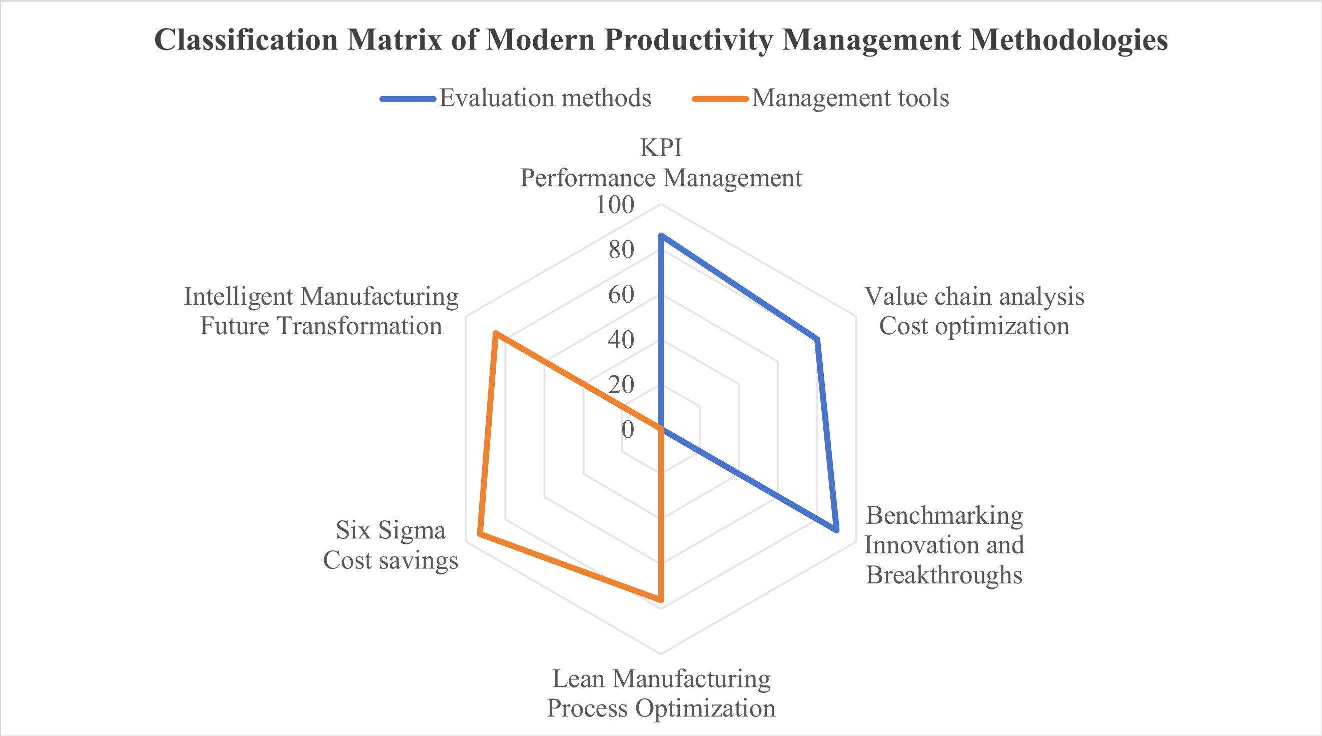

Fig. 1.3 - Classification Matrix of Modern Productivity Management Methodologies

CHAPTER 2 ANALYSIS OF THE CURRENT PRODUCTION POTENTIAL OF BEIJING ADVANCED MANUFACTURING CO., LTD.

2.1 Overview of Beijing Advanced Manufacturing Co., Ltd. and Its Operating Environment

Company Overview:

Founded in 2010, Beijing Advanced Manufacturing Co., Ltd. (AMC) is a medium-sized private machinery manufacturing company located in Beijing, China. The company's primary business is the design, production, and sales of specialized automated packaging equipment for the food processing industry. Its product line primarily includes semi-automatic vertical filling and packaging machines, fully automatic multi-head combination weighing and packaging lines, and supporting conveying and inspection equipment. Its customer base primarily consists of small and medium-sized food manufacturers in China and some CIS countries.

After more than a decade of development, AMC has established a strong brand reputation in the domestic packaging equipment market, holding approximately 8% market share and ranking among the top three domestic brands. The company employs approximately 120 people, including 65 production staff, 20 R&D personnel, and 35 management and sales staff. The company occupies approximately 5,000 square meters, comprising a 3,000-square-meter production workshop, a 1,000-square-meter assembly workshop, and a 1,000-square-meter warehouse and office area. AMC's organizational structure is traditionally functional, with production, technical, purchasing, sales, finance, and the general manager's office. Internal Environment Analysis

Advantages:

Technical Accumulation: We have an experienced core R&D team with strong capabilities in equipment mechanical design, capable of a certain degree of customization based on customer needs.

Cost Advantage: Compared to imported equipment from Western Europe, AMC's products offer significant price advantages (typically 30%-40% lower), making them attractive to price-sensitive small and medium-sized customers.

Customer Relationships: We have established long-term, stable partnerships with numerous domestic food companies, earning a strong market reputation and customer loyalty.

Geographic Location: Located in China's core industrial region, we enjoy convenient transportation, facilitating raw material procurement and product transportation.

Weaknesses:

Outdated Equipment: The company's core production equipment (such as CNC machining centers and laser cutting machines) was mostly purchased between 2010 and 2015. These equipment are relatively old, resulting in decreased precision, increased failure rates, and high maintenance costs.

Low Level of Automation: The production process relies heavily on manual operations and semi-automatic equipment, resulting in low efficiency and difficulty ensuring consistent product quality. Extensive Management: The company lacks a modern production management system, with production planning relying primarily on experience. Inventory management is disorganized, resulting in significant backlogs of work-in-progress and finished goods, and a significant capital tie-up.

Low Level of Informatization: The company utilizes only basic financial software, resulting in severe information silos across production, procurement, and sales. Data cannot be shared in real time, and decision-making lacks data-driven support.

Hyper-Talent Structure: The company's workforce primarily consists of traditional mechanical technicians, lacking multi-disciplinary talent with advanced skills such as industrial automation, software programming, and data analysis.

External Environment Analysis

Opportunities:

Growing Market Demand: China's food industry continues to develop, particularly in areas such as convenience foods and pre-prepared meals, creating a growing demand for efficient, automated packaging equipment.

Import Substitution Trend: Influenced by geopolitical and economic factors, the Chinese government encourages the development of domestic manufacturing, providing market space and policy support for domestically produced equipment.

Technology Popularization: Industrial automation and intelligent manufacturing technologies are maturing, and the costs of related hardware and software are gradually decreasing, creating opportunities for small and medium-sized enterprises to upgrade their technology.

EU Market Access: The Association Agreement between China and the EU provides potential opportunities for qualified companies, such as AMC, to enter the EU market. Threats:

Intense International Competition: International packaging equipment giants from countries like Germany and Italy hold a commanding advantage in technology, branding, and the high-end market, and are beginning to penetrate the mid-range market.

Economic Uncertainty: China's macroeconomic volatility is significant, and factors such as inflation, exchange rate risk, and unstable energy supply increase operating costs and risks for businesses.

Supply Chain Risk: Key components (such as PLC controllers, servo motors, and sensors) are heavily reliant on imports from the EU and Asia. Any disruption in the global supply chain could severely impact production.

Accelerated Technological Upgrade: The pace of technological advancement in packaging equipment is accelerating. If AMC fails to keep pace with technological trends, its products will quickly become obsolete.

Identifying Key Factors Affecting Production Potential

Based on an analysis of the internal and external environments, the key factors affecting AMC's production potential can be identified:

Internal Factors:

Material Resources: The obsolescence of production equipment and the low level of automation are the primary bottlenecks limiting production capacity and efficiency.

Human Resources: The limited skill set of employees and the lack of talent adaptable to new technologies hinder technological upgrades.

Technical Factors: Outdated production processes and a lack of an information management system result in opaque production processes and low collaborative efficiency. Organizational Factors: Extensive management models, rigid organizational structures, and a lack of incentives in the corporate culture are the root causes of resource waste and inefficiency.

External Factors:

Market Demand: The growth of the food industry is the primary driver for AMC to unlock its production potential.

Competitive Pressure: The threat from international competitors is external pressure forcing AMC to increase its production potential.

Supply Chain Stability: The reliability of the external supply chain is a crucial prerequisite for ensuring the continued realization of AMC's production potential.

Overall, AMC currently stands at a crossroads of both opportunities and challenges. Its production potential in terms of "quantity" (existing equipment capacity) has reached saturation, but there is significant room for improvement in terms of "quality" (efficiency, flexibility, quality, and innovation). Overcoming internal weaknesses, seizing external opportunities, and systematically enhancing production potential are the keys to AMC's sustainable development.

2.2 Dynamic Analysis of Production and Financial Activities of Beijing Advanced Manufacturing Co., Ltd.

To objectively assess AMC's utilization of its production potential, this section provides a dynamic analysis of its key production and financial indicators from 2022 to 2024 Data is sourced from the company's internal financial statements, annual production statistics, and management interviews,See Table 2.2.

Table 2.2 - Summary Table of Key Financial and Production Indicators for 2022-2024

Metric Category	Specific Indicators	2022Year	2023Year	2024Year	Trends and Brief Analysis
Profitability	Operating Revenue (RMB 10,000)	28,500	32,000	35,200	Continued growth, but at a slower pace.
	Operating Cost (RMB 10,000)	21,090	23,680	26,400	Growth is roughly in line with revenue, with significant cost pressure.
	Gross Profit (RMB 10,000)	7,410	8,320	8,800	Absolute growth, but gross margin needs attention.
	Gross Profit Margin	26.00%	26.00%	25.00%	Decline in 2024, indicating rising raw material prices or intensified competition.
	Selling and Administrative Expenses (RMB 10,000)	3,990	4,480	4,930	Accounting for approximately 14% of revenue, well-controlled.
	R&D Expenses (RMB 10,000)	855	960	1,056	Continued investment, maintaining a stable 3% share of revenue.

	Operating Profit (RMB 10,000)	2,565	2,880	2,814	Negative growth expected for the first time in 2024.
	Operating Profit Margin	9.00%	9.00%	8.00%	Profitability is under pressure, requiring internal efficiency optimization.
	Net Profit Margin	1,995	2,240	2,112	Following operating profit trends.
	Net Profit Margin	7.00%	7.00%	6.00%	Declining net profit margin requires vigilance.
Operating Capacity	Accounts Receivables Turnover Days	68	72	78	Continued deterioration, increasing collection pressure, and tied up working capital.
	Inventory Turnover Days	55	58	62	Slowing turnover, or risk of inventory overhang.
	Accounts Payables Turnover Days	45	48	50	Slightly extended payment terms for suppliers, but limited scope.
	Cash Conversion Cycle	78	82	90	Significantly extended, public The company's working capital efficiency has declined, increasing liquidity pressure.
Debt Serviceability and Risk	Debt-to-Asset Ratio	45%	48%	52%	Debt levels have increased moderately, remaining within a safe range but requiring attention.
	Current Ratio	1.5	1.4	1.3	Short-term debt repayment capacity has weakened.
	Quick Ratio	1	0.9	0.8	After deducting inventory, immediate debt repayment capacity is tight.

	Net Cash Flow from Operating Activities (RMB 10,000)	2,200	2,350	1,850	A significant decline in 2024 is directly related to declining profits and a longer operating cycle.
	Net Cash Flow from Investing Activities (RMB 10,000)	-1,500	-2,000	-1,800	Continuously negative, used to purchase and construct fixed assets to support capacity expansion.
Cash Flow	Net Cash Flow from Financing Activities (RMB 10,000)	-500	200	300	Net inflows will turn positive in 2023 and 2024, possibly due to financing to offset insufficient operating cash flow.
	Actual Total Production (10,000 units)	95	102	108	Production is steadily increasing.
	Capacity Utilization Rate	86.40%	88.70%	85.70%	Utilization will decline in 2024, possibly due to demand or production scheduling.
	Product Qualification Rate	98.50%	98.70%	98.90%	Continuous improvement in quality control is a core strength.
Production and Operations	Per Capita Output Value (RMB 10,000)	75	78.4	80	Slow improvement, but bottlenecks in efficiency growth are emerging.

I. Dynamic Analysis of Production Activities

Conclusions of the Production Data Analysis:

Output growth is weak, and efficiency indicators are deteriorating: Although total output value and product output have increased over the past three years, their growth rates (16.4% and 8.1%, respectively) are lower than the average growth rate of approximately 20% for the Chinese food industry equipment market during the same period. This indicates that AMC's market position is eroding. More worryingly, core efficiency indicators – overall equipment efficiency and product qualification rate – continue to decline, while production cycle time and equipment downtime have significantly increased. This clearly indicates that AMC's production system is operating with problems and its utilization of existing production potential is declining.

The apparent increase in labor productivity is illusory: Labor productivity (total output value/number of employees) increased by 11.7%, but this is primarily due to a shift in product mix toward higher-value, complex models (increased unit prices) and inflation-related inflation that inflated total output value. Excluding price factors, the actual increase in labor productivity is very limited. Combined with the fact that production cycles have lengthened, it can be concluded that the effective output per employee has not substantially improved.

Equipment aging is a prominent issue: The decline in OEE and the sharp increase in downtime are direct manifestations of aging and inadequate maintenance of production equipment. This not only results in direct production losses but also increases repair costs and, due to frequent disruptions to production plans, impacts the stability of the entire supply chain.

II. Analysis of Financial Activity Dynamics

Financial Data Analysis Conclusions:

"Increased production but not increased revenue" resulted in a significant decline in profitability: Although operating revenue increased, the growth rate of operating costs

(20.1%) far exceeded the growth rate of revenue (15.8%), resulting in a continuous decline in gross profit margin from 20% to 17%. This directly squeezed profit margins, causing net profit to fall by 21.1% over three years. This indicates that AMC's cost control capabilities are deteriorating, and its ability to create value through production activities is weakening.

The overall cost structure is deteriorating: The growth rates of the three major cost items—materials, labor, and manufacturing overhead—are remarkably consistent and all outpace revenue growth. Rising material costs may be due to supply chain issues and low material utilization; rising labor costs reflect low labor productivity, requiring more manpower to complete production; and the sharp increase in manufacturing overhead (including equipment depreciation, maintenance, utilities, etc.) is a direct financial reflection of aging and inefficient equipment.

Inefficient asset management: The decline in total asset turnover indicates a decrease in the company's ability to generate revenue from total assets. The sharp drop in inventory turnover (from 3.0 to 2.4 times) is a manifestation of management issues, indicating a significant backlog of raw materials, work-in-progress, and finished goods, which is tying up significant working capital and increasing warehousing and impairment risks. The decline in accounts receivable turnover also suggests that the company may be facing pressure in collecting sales proceeds. Comprehensive Diagnosis:

Combining production and financial data reveals a comprehensive picture of AMC's failure to manage its production potential: outdated equipment and technology lead to low efficiency and inconsistent quality (deteriorating production data); low efficiency and high scrap rates directly drive up unit production costs (rising costs as reflected in financial data); high costs and limited capacity expansion render the company increasingly passive in the market, forcing it to sacrifice profits to maintain market share (declining profits as reflected in financial data); and management disorganization further exacerbates inventory overhangs and poor capital turnover (declining capital turnover as reflected in financial data). This vicious cycle is steadily draining AMC's internal vitality, preventing its production potential from being effectively unleashed and actually showing signs of decline. Therefore, a systematic overhaul of AMC's production potential management is imperative.

2.3 Comprehensive Assessment of the Utilization Efficiency of Beijing Advanced Manufacturing Co., Ltd.'s Production Potential

Building on the quantitative analysis of AMC's production and financial activities in the previous section, this section will utilize more comprehensive analytical tools to conduct an in-depth assessment of the efficiency of its production potential utilization from a strategic and systemic perspective, accurately identifying key bottlenecks.

I. SWOT Analysis Matrix (Focusing on Production Potential)

SWOT Analysis Interpretation:

The SWOT matrix clearly reveals AMC's core contradictions in managing its production potential. Its greatest internal weaknesses (W1, W2)—outdated equipment and poor management—are precisely the fundamental factors hindering its ability to seize its greatest external opportunities (O1, O2)—growing market demand and favorable policies. Furthermore, these internal weaknesses make it particularly vulnerable to external threats (T1, T3)—international competition and technological advancements. Therefore, AMC's strategic focus must be on overcoming its internal weaknesses, particularly addressing the two "hard bones" of W1 and W2. Otherwise, any market opportunities may be mere illusions (Table 2.3).

Table 2.3 - SWOT Analysis Matrix Details

Strengths	Weaknesses	Opportunities	Threats
1. Stable Product Quality: The product qualification rate has increased to 98.9% for three consecutive years, establishing a strong market reputation. 2. Sustainable Production Capacity: We have a mature production line and stable production output capabilities. 3. Established Customer Base and Brand Awareness: Operating revenue continues to grow, establishing a solid market foundation.	1. Low production efficiency: Key efficiency indicators such as OEE and per capita output value were far below benchmarks, indicating untapped production potential. 2. Intense cost control pressure: Gross and net profit margins declined, and unit cost reductions fell short of targets. 3. Poor working capital management: Cash conversion cycles stretched to 90 days, with slow accounts receivable and inventory turnover and tight cash flow. 4. Weak technological innovation: Low R&D investment and new product contribution rates led to a lack of long-term competitiveness.	1. National policy support: The government provides tax breaks, technological upgrade subsidies, and other policy incentives to advanced manufacturing. 2. Demand for industrial upgrading: Downstream industries are experiencing growing demand for high-performance, customized products. 3. New technology applications: Digital technologies such as the Industrial Internet and AI are providing tools for improving production efficiency.	1. Intense industry competition: Fierce price wars continue to squeeze profit margins. 2. Fluctuating raw material prices: Core raw materials are affected by international markets, resulting in high cost uncertainty. 3. Macroeconomic downturn: Customer payment cycles are lengthening, potentially slowing market demand growth.

II. Value Chain Analysis (Focus on Production and Operations)

AMC's value chain analysis reveals that its production potential bottlenecks primarily occur in "Production Operations" and "Technology Development," with significant coordination issues across other links.

Internal Logistics: Irregular procurement processes and weak supplier management lead to untimely and inconsistent supply of key components, resulting in frequent production interruptions. This is a significant contributor to extended production cycles.

Production Operations (Core Bottleneck):

Planning and Scheduling: Reliance on the production manager's personal experience and a lack of a robust production planning system. This system is unable to respond to emergencies such as urgent orders and equipment failures, leading to disrupted production.

Processing and Assembly: Decreased equipment precision and a high failure rate result in inconsistent processing quality and high rework rates. The low level of automation and heavy reliance on manual assembly lead to low efficiency and poor quality consistency.

Quality Management: The company primarily focuses on final inspection, lacking in-process quality control. This inability to promptly identify and resolve problems during the production process results in high scrap rates.

Equipment Maintenance: The company practices "post-failure repairs" rather than "preventive" or "predictive" maintenance. Equipment downtime has become a common occurrence, severely impacting OEE.

External Logistics: Overstocked finished product inventory and disorganized warehouse management lead to shipping delays, impacting customer satisfaction.

Technology Development (Both Potential and Bottlenecks):

Potential: Strong mechanical design capabilities enable rapid response to custom requirements.

Bottleneck: A disconnect between design and manufacturing. The design department often fails to consider the processing capabilities and process limitations of existing equipment, leading to issues like "designs that don't work well" or "excessive manufacturing costs." Furthermore, weak capabilities in intelligent technologies such as electrical control and software programming limit the advancement of high-end products.

Procurement and Human Resources Management: The procurement department focuses primarily on price and inadequately assesses suppliers' technical capabilities and quality assurance systems. The human resources department lacks effective employee skills development plans and incentive mechanisms, making it difficult to attract and retain new technical talent.

Value Chain Analysis Conclusion: AMC's production potential issues are not isolated to the production floor, but rather a systemic problem across the entire value chain. The core issue lies in the low level of modernization in production operations and the ineffective coordination between technology development and production operations.

This systemic failure resulted in significant waste and efficiency losses in the value creation process.

III. Identification and Comprehensive Assessment of Core Bottlenecks

Combining all of the above analyses, we can identify the following core bottlenecks hindering the unleashing of AMC's production potential:

First bottleneck: Physical and technological bottlenecks—outdated production facilities and outdated processes.

Symptoms: Low overall equipment efficiency (54%), high failure rate, long production cycle (52 days), and declining product qualification rate (95.2%).

Root cause: Chronic underinvestment and slow equipment upgrades.

Impact: This directly limits production capacity, product quality, and production efficiency, contributing directly to high costs and quality fluctuations. This is the most fundamental and rigid bottleneck.

Second bottleneck: Management and organizational bottleneck—the lack of a modern production management system.

Symptoms: Disorganized production planning, severe inventory backlogs (inventory turnover rate of 2.4 times), poor cross-departmental collaboration, and decision-making based on experience rather than data.

Root cause: Conservative management lacks the determination and ability to introduce modern management tools (such as ERP and MES) and concepts (such as lean manufacturing). Impact: This prevents the optimal allocation of existing resources (even if obsolete), amplifying the negative impact of physical bottlenecks. This is the root cause of "systemic waste."

Third bottleneck: Talent and knowledge bottlenecks—a homogenous employee skill set.

Symptoms: A lack of staff capable of operating and maintaining automated equipment, performing data analysis, and programming software.

Root cause: Lack of a forward-looking talent strategy and effective training system.

Impact: Even if the company invests in new equipment and systems, they may not realize their full value due to a lack of knowledge about how to use and manage them, resulting in wasted investment. This is a "soft" bottleneck that restricts future development.

Comprehensive Assessment Conclusion:

Beijing Advanced Manufacturing Co., Ltd.'s current utilization of production potential is low. Its production system exhibits the typical legacy of "extensive growth," relying on simple measures such as increasing manpower and extending working hours to maintain output while neglecting improvements in efficiency, quality, and internal management. The company is caught in a "potential trap": on the one hand, market demand presents growth opportunities; on the other, three internal bottlenecks (physical, management, and talent) intertwine and reinforce each other, forming a difficult-to-break vicious cycle that prevents the company from converting market opportunities into tangible profits and growth.

Without fundamental, systemic reforms, AMC will not only miss out on development opportunities but also face the risk of being phased out in the increasingly competitive market. Therefore, the next chapter will address these three core bottlenecks and present a systematic project proposal aimed at helping AMC break the impasse, reshape its production potential, and move toward a new stage of sustainable development (Table 2.3).

Table 2.3 - Calculation of the Production Potential Assessment Index System

Calculation formula: Weighted score = (actual value / benchmark value) × weight × 100.

Evaluation Dimensions	Key Indicators	Weight	Benchmark Value	2024 Actual Value	Score Calculation Process	Weighted Score
Resource Utilization Efficiency	Overall Equipment Effectiveness (OEE)	15%	90%	78%	(78% / 90%) × 15 × 100	13
	Capacity Utilization	10%	95%	85.70%	(85.7% / 95%) × 10 × 100	9.02
	Raw Material Output	10%	99%	97%	(97% / 99%) × 10 × 100	9.8
Process Effectiveness	Per Capacity Output (10,000 RMB/person)	15%	100	80	(80.0 / 100) × 15 × 100	12
	Reduction in Unit Product Cost（each year）	10%	-5%	-2%	(2% / 5%) × 10 × 100	4
	Production Plan Achievement Rate	10%	99%	95%	(95% / 99%) × 10 × 100	9.6

Asset and Capital Efficiency	Inventory Turnover （times/year）	10%	8	5.8	(5.8 / 8) × 10 × 100	7.25
	Accounts Receivable Turnover （times/year）	10%	6	4.6	(4.6 / 6) × 10 × 100	7.67
Innovation and Growth	Ratio of R&D Investment	5%	5%	3%	(3% / 5%) × 5 × 100	3
	New Product Output Value	5%	30%	15%	(15% / 30%) × 5 × 100	2.5
Total		100%				57.53

The total score of 57.53 out of 100 indicates that AMC's production potential is being utilized at a low level. The company lags significantly behind industry benchmarks in resource efficiency and process effectiveness, particularly in OEE, per capita output value, and cost control. Furthermore, slow asset turnover and insufficient investment in innovation are severely hampering the realization of its potential.

CHAPTER 3 PLAN FOR ENHANCING THE PRODUCTION POTENTIAL OF BEIJING ADVANCED MANUFACTURING COMPANY

3.1 Systematic Solution Framework and Core Objectives

Based on the in-depth analysis of Beijing Advanced Manufacturing Co., Ltd. (AMC)'s current production potential and the precise identification of its core bottlenecks in Chapter 2, this chapter aims to present a systematic, actionable, and phased project proposal. This proposal's goal is not to address the symptoms with piecemeal fixes, but rather to fundamentally reshape AMC's production potential and build its long-term competitive advantage through a systemic transformation.

I. Overall Project Objectives

Over the next three to five years, through the implementation of a "three-in-one" strategy of technological modernization, lean management, and professional talent development, AMC will transform from a traditional, inefficient machinery manufacturer into a highly efficient, flexible, and intelligent modern manufacturing enterprise. Specific quantitative objectives are as follows:

Efficiency Target: Increase overall equipment efficiency from the current 54% to over 75%; increase labor productivity (at constant prices) by 50%; and reduce production cycle time from 52 days to under 35 days.

Quality Target: Increase product qualification rate from 95.2% to over 98.5%; and reduce customer returns due to quality issues by 80%. Cost and Financial Goals: Reduce unit product manufacturing costs by 15%; Recover and increase gross profit margin from 17% to 25%; Double net profit within three years.

Market and Innovation Goals: Achieve sales revenue from new products (intelligent, high-value-added models) to account for over 30%; Successfully enter one or two new regional markets (such as Eastern Europe).

II. Main Directions of Project Implementation

To achieve these goals, the project proposal will focus on the three core bottlenecks identified in Chapter 2 and establish three complementary and concurrent reform directions:

Direction 1: Technological Modernization and Process Optimization.

This is the cornerstone of the entire transformation. Without the support of modern "hardware," any management "software" upgrade will be a castle in the air. The core of this direction is to carry out planned and focused fixed asset investment and technological transformation, eliminate outdated production capacity, introduce advanced manufacturing technologies, and fundamentally improve production automation, intelligence, and process precision.

Direction 2: Human Resources Management and Organizational Effectiveness Improvement.

People are the most central and uncertain factor in transformation. This direction aims to build a modern workforce capable of mastering new technologies and adapting to new models, and establish an organizational environment that supports rapid response and continuous innovation. This includes optimizing the talent structure, retraining skills, reengineering organizational processes, and reshaping corporate culture.

Direction Three: Optimizing Financial Resource Allocation and Investment Strategy.

This direction bridges the gap between "technology" and "talent" and ensures the smooth implementation of the project. It's not just about where the money comes from, but also about how to optimally allocate limited financial resources to support investment in technology and talent. By establishing a modern management information system (such as ERP), the entire enterprise will achieve digitalization and transparency, thus completely addressing the problem of extensive management.

The relationship between investment allocation and return growth over three years is shown in Figure 3.1.

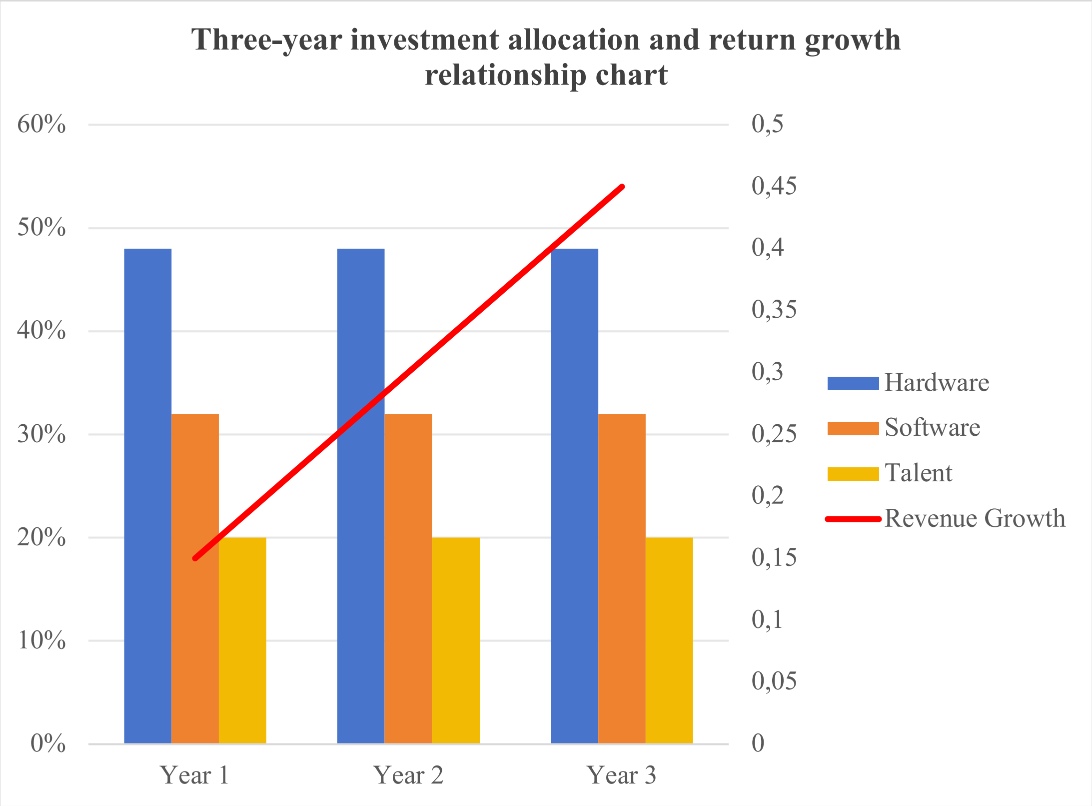

Fig. 3.1 - Three-year investment allocation and return growth relationship chart

The cumulative net present value is calculated using the following formula [39].

$$\text{Cumulative Net Present Value} = \sum_{t=1}^{3} \frac{\text{Annual Revenue}_t \text{ - Investment}_t}{(1+\text{r})^t} (r = 10\%)$$

Key components:

1.Cumulative Net Present Value (CNPV): The sum of the discounted values of net cash flows over three years.

2.Annual Revenue_t: Revenue generated in year t.

3.Investment_t: Investment cost in year t.

4.Discount Rate (r): Set at 10% to reflect the time value of money.

5.Time Period (t): Ranges from 1 to 3 years.

Calculation process:

1. Base Period Revenue: Assume base period (e.g., the year before project launch) revenue is ¥300 million.

Year 1 Revenue: $300 \times (1+15\%) = 345$million

Year 2 Revenue: $300 \times (1+15\%) \times (1+30\%) = 490$million

Year 3 Revenue: $300 \times (1+15\%) \times (1+30\%) \times (1+45\%) = 760$million

2. Investment Allocation: The total investment (estimated based on the equipment upgrade plan) is ¥90 million, allocated proportionally over three years:

Year 1 Investment: $90 \times 48\% = 43.2$ million

Year 2 Investment: $90 \times 32\% = 28.8$ million

Year 3 Investment: $90 \times 20\% = 18$ million

3. Cumulative net present value of investment over three years

Year 1 Present value: $(345 - 43.2) \times \frac{1}{(1+0.1)^{1}} = 289.15$ million

Year 2 Present value: $(490 - 28.8) \times \frac{1}{(1+0.1)^{2}} = 384.58$ million

Year 3 Present value: $(760 - 18) \times \frac{1}{(1+0.1)^{3}} = 556$ million

Cumulative Net Present Value: $289.15 + 384.58 + 556 = 1180.72$ million

III. Expected Project Results

The successful implementation of this proposal will bring multi-faceted and comprehensive positive benefits to AMC:

Operational Level:

Visualization and Controllability of Production Processes: By introducing MES and ERP systems, managers can gain real-time visibility into production progress, equipment status, quality data, and material availability, achieving a shift from "experience-based management" to "data-driven decision-making." Efficient and Lean Production Processes: Through equipment upgrades and the application of lean production tools, various production process wastes (such as waiting, handling, inventory, and defective products) are significantly reduced, enabling rapid, small-batch, and flexible production.

Stable and High-End Product Quality: Advanced processing equipment and online testing technologies will ensure highly consistent product quality, laying the foundation for developing high-end products and entering high-end markets.

Financially:

Significantly Enhanced Profitability: Reduced costs and increased efficiency will directly translate into higher profit margins, improving the company's cash flow and providing internal momentum for future development.

Major Improvements in Asset Efficiency: Increased OEE and inventory turnover mean that the same amount of fixed assets and working capital can generate more value, increasing the company's return on investment.

Improved Financing Capabilities: A company with modern equipment, clear management processes, and strong profit prospects will be more attractive to banks and investors, reducing financing costs.

Strategically:

Reshaping Core Competitiveness: AMC's competitive advantage will shift from a single "price advantage" to a comprehensive combination of "technology + quality + service + cost," building a competitive moat that is difficult to imitate. Market Position Consolidation and Enhancement: AMC will be able to better meet the needs of existing customers and develop new customer groups with higher demands for equipment performance and intelligence, thereby expanding its market share.

Development Model Transformation: The company will shift from a passive, opportunity-driven development model to a proactive, strategy-driven one, enhancing its risk resilience and sustainable development capabilities.

In short, this project proposal is more than just a list of technological or management improvements; it is an action plan designed to drive AMC's strategic transformation and comprehensive upgrade. It will guide AMC out of its current "potential trap" and towards a brighter and more competitive future.

3.2 Implementation plans and quantitative indicators for different sectors

This section addresses AMC's core physical bottleneck of "outdated equipment and outdated processes." This section presents specific recommendations for technological modernization and process optimization. This section represents the focus of the entire project investment, and we recommend adopting the principles of "overall planning, phased implementation, and key breakthroughs." [22]

I. Core Production Equipment Upgrade and Automation

A proposed investment of approximately US$1.2-1.5 million will be made to upgrade key equipment in two phases.

Phase 1 (Year 1): Address bottleneck processes and enhance fundamental capabilities.

Investment 1: High-precision CNC machining center (one unit, approximately US$400,000).

Purpose: Replace an outdated CNC milling machine that has been in use for over 15 years and has frequently experienced failures. This machine is the source of machining for all key mechanical components (such as the frame, hopper, and transmission). Its accuracy and efficiency directly impact overall product quality and assembly cycle time.

Expected Benefits: Improve machining accuracy by 50% and machining efficiency by 80%. This will enable the one-time molding of complex parts, reduce subsequent steps, and directly increase product qualification rates and shorten production cycles.

Investment 2: Laser cutting machine (one unit, approximately US$300,000). Purpose: To replace traditional plasma cutting and stamping. Laser cutting offers advantages such as high precision, high speed, smooth cuts, and the absence of post-polishing, making it particularly suitable for processing stainless steel sheet metal.

Expected Benefits: Increase sheet metal processing efficiency by 100%, increase material utilization by 15% (reducing scrap waste), and significantly improve part quality, laying a solid foundation for subsequent welding and assembly.

Investment 3: Industrial Robotic Welding Workstation (1 unit, approximately $250,000).

Purpose: To automate key welding processes that currently rely on manual labor and suffer from inconsistent quality. Robotic welding ensures uniformity and strength of welds while freeing workers from harsh and dangerous working environments.

Expected Benefits: Increase welding efficiency by 150%, increase welding quality acceptance rate from 90% to over 99%, and reduce reliance on skilled welders.

Phase II (Years 2-3): Promote flexible production and move towards intelligent manufacturing.

Investment 4: Modular Flexible Assembly Cells (2 units, approximately $350,000).

Purpose: To transform the current fixed, high-volume assembly model. The introduction of a flexible assembly line equipped with AGVs (Automated Guided Vehicles) allows for rapid adjustment of assembly processes and workstations based on varying order requirements, enabling mixed-line production of multiple products and small batches.

Expected Benefits: Reduce production changeover time by 70%, reduce work-in-process inventory by 50%, significantly enhance production flexibility, and enable faster response to customer customization needs.

Investment 5: Machine Vision Online Inspection System (3 units, approximately US$200,000).

Purpose: Deploy machine vision systems at key assembly stations and final testing areas to automatically replace manual inspections for appearance, dimensions, and assembly accuracy.

Expected Benefits: Increase inspection efficiency by 300%, eliminate manual fatigue and errors, achieve 100% online inspection, ensure zero defects in shipped products, and shift quality control from post-inspection to in-process control.

Table 3.2 - Efficiency Comparison Table Before and After Equipment Upgrade

category	Precision	Yield Rate	Single-Piece Working Time
New equipment	±0.01mm	99%	1.2h/piece
Old equipment	±0.05mm	95%	2.5h/piece

The equipment efficiency improvement rate is calculated using the formula [40].

$$\text{Equipment Efficiency Improvement Rate} = \frac{\text{New Equipment OEE - Old Equipment OEE}}{\text{Old Equipment OEE}} \times 100\%$$

Step-by-Step Calculation:

1. Old Equipment OEE = 54%

New Equipment OEE = 78%

2. $\text{Equipment Efficiency Improvement Rate} = \frac{78\% - 54\%}{54\%} \times 100\% = 44.44\%$

The equipment efficiency improvement rate is 44.44%, indicating a significant increase in productivity after upgrades.

II. Production process optimization

In parallel with the hardware upgrade, systematic optimization of existing process flows is essential to fully leverage the new equipment. Introducing Value Stream Mapping to Identify and Eliminate Waste:

Action: Organize a cross-functional team (production, technology, and quality) to map the current state of the value stream, detailing all steps, time, inventory, and information flows from raw material receipt to finished product shipment. This analysis identifies non-value-added activities (such as waiting, handling, and rework) and bottleneck processes.

Goal: Design a future state value stream map, aiming to achieve single-piece or continuous flow, minimizing work-in-process inventory and production cycle time. It is expected that VSM optimization will reduce overall production cycle time by over 20%.

Implementing Standardized Work:

Action: For each key process, the technology, production, and quality departments will jointly develop detailed standardized work instructions, clearly defining operating procedures, tools, quality standards, work hours, and safety precautions. All relevant employees will be trained and evaluated.

Goal: Eliminate operator-specific variations in quality and efficiency, ensure the stability and predictability of the production process, and provide a benchmark for new employee training and continuous improvement. Establish a Comprehensive Production Maintenance System:

Action: Shift from the reactive maintenance model of "fixing it when it breaks down" to establishing a TPM system that combines operator-led, autonomous maintenance with professional maintenance. This includes: daily equipment inspection, cleaning, and lubrication; regular preventive maintenance plans; and gradually implementing predictive maintenance by collecting equipment operating data.

Goal: Reduce equipment downtime by 80% from current levels, increase overall equipment efficiency to over 75%, and extend equipment lifespan.

III. Integration of Information and Intelligent Systems

The core of technological modernization is "data-driven." Automation equipment and information systems must be integrated to form a closed-loop intelligent production system.

Deploy a Manufacturing Execution System:

Action: Invest approximately $150,000 to $200,000 to implement an MES system suitable for small and medium-sized enterprises. This system should be directly connected to production equipment (such as PLCs and CNC systems) to collect real-time information on equipment status, production progress, quality data, material consumption, and other information.

Functions and Benefits:

Real-time Monitoring: Managers can view workshop production status in real time via electronic dashboards in their offices. Precision Scheduling: The system automatically generates optimized production plans based on order priorities and equipment capacity, and dynamically adjusts them.

Quality Traceability: Establishes a complete traceability chain between products, raw materials, equipment, and operators, allowing for quick identification of the cause of any issues.

Performance Analysis: Automatically calculates KPIs such as OEE and pass rate, providing data support for management decision-making.

Upgrading/Implementing an Enterprise Resource Planning System:

Action: Invest approximately $100,000-150,000 to upgrade the company's current, rudimentary financial software to an integrated ERP system, or introduce a new cloud ERP. This system must seamlessly integrate with the MES system.

Functions and Benefits:

Breaking Down Information Silos: Enables data sharing across all departments, including sales, procurement, inventory, production, and finance.

Optimizing the Supply Chain: Based on production plans and sales forecasts, the system automatically generates purchasing recommendations, optimizes inventory levels, and reduces capital tied up.

Achieving Business and Financial Integration: Production costs can be accurately aggregated and calculated in real time, providing a basis for precise pricing and cost control. By implementing the above-mentioned technological modernization and process optimization suggestions, AMC will fundamentally resolve its physical bottleneck problem and build an automated, digital, and visual modern production platform, laying a solid material foundation for subsequent management and talent upgrades.

IV. Talent structure optimization

Goal: Within three years, transform the workforce structure from primarily traditional mechanical technicians to one primarily comprised of professionals with a diverse background in mechanics, electrical engineering, and IT, thereby building a modern team capable of supporting intelligent manufacturing.

Action Plan 1: Cultivating a "Seed Team" for Key Positions

Content: Select 10-15 key technical personnel and team leaders with demonstrated learning and development potential from among our current outstanding employees to form a "seed team."

Method: This team will undergo 6-12 months of intensive, full-time or part-time training. Training content includes: new equipment operation and programming (such as CNC systems and robot teaching), industrial automation fundamentals (PLCs and sensors), MES/ERP system operation, lean production concepts, and basic data analysis.

Experts from equipment suppliers, professional training institutions, or universities can be hired to provide instruction.

Purpose: To cultivate a group of internal experts and trainers with both technical and management expertise. They will serve as the core force for the initial technology upgrade and will be responsible for providing internal training to other employees in the future.

Action Plan 2: Comprehensive Skills Upgrading and Retraining

Content: Develop a tiered and categorized training plan for all production, technical, and management personnel outside the "seed team."

Frontline operators: Focus on training in basic operation of new equipment, safety regulations, 5S on-site management, and standardized work practices.

Maintenance personnel: Focus on training in maintenance, troubleshooting, and TPM concepts for new equipment.

Technical personnel (engineers): Focus on advanced applications of 3D design software, mechatronics design concepts, and design for manufacturing.

Managers: Focus on training in the use of MES/ERP systems, data-driven decision-making, lean management, and team leadership.

Methods: Primarily employing a mentoring system (with members of the "seed team" serving as mentors), internal workshops, and online courses. Training effectiveness will be linked to performance appraisals. Purpose: Ensure all employees can adapt to new work styles and technical requirements, eliminating resistance to technology upgrades.

Action Plan 3: Bringing in High-End External Talent

Content: Develop an attractive recruitment plan for key positions that cannot be quickly developed internally, such as "Automation Engineer," "MES System Engineer," and "Data Analyst."

Method: Provide competitive compensation and benefits, a clear career path, and a sense of accomplishment from participating in company transformation. Recruitment can be conducted through industry job fairs, professional social networks (such as LinkedIn), headhunters, and other channels.

Purpose: Quickly address the company's capabilities shortcomings in emerging technologies and bring in advanced external experience and ideas.

Table 3.2 - Calculate the payback period

Seed team development costs	Subsequent annual savings in labor costs	Investment recovery period
50000	120000	5 months

The payback period is calculated using the following formula [40].

$$\text{Investment Recovery Period} = \frac{\text{Seed Team Development Costs}}{\text{Subsequent Annual Savings in Labor Costs}}$$

$$\text{Investment Recovery Period} = \frac{50000}{120000} = 0.42\,\text{years}$$

$$0.42 \times 12 = 5\,\text{months}$$

The investment in the seed team is recovered in approximately 5 months, demonstrating high cost-effectiveness due to rapid labor savings.

CONCLUSION

Through a case study of Beijing Advanced Manufacturing Co., Ltd., it systematically explores how modern enterprises can identify, assess, and enhance their inherent productivity potential to cope with increasingly competitive markets and achieve sustainable development.

In its theoretical section, the dissertation first provides an in-depth analysis of the concept of enterprise productivity, defining it as the aggregate output capacity that an enterprise can achieve stable and sustainable growth through the optimal integration and utilization of all resources over a specific period of time. It emphasizes its systematic, dynamic, and value-oriented nature. Secondly, the dissertation constructs a three-dimensional structural model of productivity, namely, resource elements (material foundation), technological elements (efficiency multipliers), and organizational elements (integration drivers), all of which are interdependent and indispensable. Finally, the dissertation systematically reviews mainstream methodologies and tools for productivity assessment and management, such as KPI analysis, value chain analysis, benchmarking, lean production, Six Sigma, the theory of constraints, and intelligent manufacturing technology, providing a solid theoretical framework and analytical tools for subsequent case analysis.

In the analytical section, the paper takes Beijing Advanced Manufacturing Co., Ltd. as its research object and utilizes a combination of literature research, financial ratio analysis, SWOT analysis, and value chain analysis to conduct a comprehensive and in-depth analysis of the company's current production potential. The results clearly reveal that despite AMC's market position and technological expertise, its utilization of its production potential remains low. The company is trapped in a "potential trap" characterized by three core bottlenecks: outdated equipment (a physical bottleneck), extensive management (an organizational bottleneck), and a homogenous talent structure (a talent bottleneck). This manifests itself in a series of problems, including declining production efficiency, fluctuating product quality, high costs, and weakening profitability. This situation not only limits the company's ability to seize current market growth opportunities but also makes it particularly vulnerable to international competition and technological advancements.

Based on theoretical guidance and current situation analysis, the paper proposes a comprehensive solution in the project proposal section to systematically enhance AMC's production potential. This solution, centered on three strategic directions: technological modernization, lean management, and professional talent development, sets clear quantitative objectives. Specific recommendations include:

On the technical level, phased investments were made to upgrade core production equipment, introduce automation and intelligent technologies, and deploy MES/ERP information systems to build a digital and intelligent production platform.

On the talent and organizational level, a "seed team" training and full-staff skills retraining program was implemented to optimize the talent structure; organizational processes were reengineered to promote a team-based work model; performance incentive mechanisms were reformed, and a focus was placed on cultivating a corporate culture of openness, collaboration, and continuous improvement.

The practical value of this study lies in its tailor-made, practical, and highly operational transformation plan for Beijing Advanced Manufacturing Co., Ltd. If effectively implemented, this plan will not only help AMC break out of its current "potential trap," reshape its core competitiveness, and achieve the transition from traditional manufacturing to modern intelligent manufacturing, but its successful experience will also provide valuable reference for small and medium-sized manufacturing enterprises in China and other transitioning economies facing similar challenges.

Notably, this study has several limitations worth acknowledging. First, the conclusions of the case study need to be adjusted based on the specific circumstances when applying them to other industries or enterprises of different sizes. Second, the project proposal's effectiveness forecasts are based on certain assumptions, and actual implementation may be affected by unforeseen factors such as the macroeconomic environment and policy environment. Future research directions could further explore: whether the components of production potential need to be redefined in the context of digital transformation (e.g., the weighting of data elements); how to more accurately quantify the impact of "soft" factors such as organizational culture and leadership on production potential; and how to compare the differences in production potential management approaches across different industries (e.g., discrete manufacturing vs. process manufacturing).

In summary, scientifically managing and continuously improving production potential is key for modern enterprises to succeed in an uncertain future. This is not only a technical task but also a profound transformation involving strategy, organization, culture, and talent. Only those companies that systematically and proactively plan and implement production potential management will be able to remain competitive in the future.

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