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Synergistic criteria and indicators for evaluating Small Enterprise Performance

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Abstract
Purpose: This study investigates the criteria and indicators essential for determining the efficiency of small industrial enterprises, a sector crucial for sustainable economic development yet often underserved by traditional evaluation frameworks.
Research methodology: The research draws on existing synergistic efficiency frameworks, particularly those developed by Kondratiev et al. (2022), and integrates insights from production capacity modeling to propose a refined system of indicators suitable for small enterprises. Utilizing a mixed-method approach combining economic-mathematical modeling, statistical analysis, and case study evaluation, the study examines fluctuations in equipment utilization, labor productivity, and material efficiency over a thirty-year period.
Results: Results indicate that while material efficiency remains relatively stable, labor and equipment productivity are highly variable, reflecting inconsistencies in workforce management and capital utilization. These findings underscore the limitations of conventional metrics and the need for multidimensional models that incorporate internal and external performance drivers.
Contribution: This research contributes to the academic discourse by filling a gap in performance evaluation literature for small-scale industry and offers a foundation for future work in developing sector-specific benchmarking systems, performance dashboards, and policy instruments to support sustainable industrial growth.
Implication: The implications are significant: small enterprises require adaptive, real-time efficiency monitoring tools that are both theoretically sound and practically implementable.
Keywords: *Small industrial enterprises, efficiency indicators, synergistic performance, production capacity, labor productivity*
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1. Introduction

In the context of intensified global competition, technological advancements, and evolving market demands, the performance evaluation of small industrial enterprises (SIEs) is critical to ensuring sustainable economic growth. These enterprises, characterized by their agility and capacity for innovation, play a vital role in employment generation, local development, and industrial diversification. However, their limited resource base and structural constraints demand an accurate and multi-dimensional framework for measuring operational efficiency. The current economic landscape necessitates moving beyond traditional financial metrics and embracing comprehensive systems that reflect production potential, resource utilization, and strategic adaptability.

The efficiency of an industrial enterprise is increasingly viewed through the lens of integrated performance criteria encompassing technical, economic, and organizational dimensions. Prior research, such as that by Skrynkovskyi et al. (2019), emphasizes the importance of relative indicators that account for production capacity utilization, technological intensity, and resource productivity. Similarly,

Kondratiev et al. (2022) developed a multi-level system of synergistic performance indicators for assessing production subsystems, incorporating internal and external efficiency factors. Despite such advancements, a significant gap persists in tailoring these models specifically for SIEs, which often differ from large enterprises in their cost structures, innovation cycles, and market behavior. This study aims to address that gap by identifying a refined and adaptive set of criteria and indicators suited to the specific dynamics of small industrial enterprises.

This research adopts a mixed-methods approach that integrates system analysis, statistical modeling, and expert evaluation. The methodological framework is built upon economic-mathematical modeling to derive a hierarchy of efficiency indicators, ranging from capacity utilization coefficients to synergistic and financial performance metrics. Furthermore, the study leverages sector-specific survey data and enterprise-level case studies to contextualize and validate the selected indicators. Emphasis is placed on indicators such as the coefficient of equipment utilization, production labor efficiency, and synergistic productivity, which collectively offer a holistic view of efficiency in small-scale industrial settings.

Preliminary analyses indicate that traditional metrics, such as output per labor hour or cost per unit, often fail to capture systemic inefficiencies or the potential for performance improvement through synergy and innovation. The proposed model, therefore, introduces a dual-axis evaluation system: internal performance indicators that focus on operational effectiveness, and external indicators that assess market responsiveness and investment adaptability. It is expected that these refined indicators will not only enhance monitoring accuracy but also inform policy interventions aimed at capacity building and competitiveness enhancement for small enterprises.

The implications of this research are both practical and theoretical. By establishing a scientifically validated, enterprise-scalable framework, the study contributes to the optimization of resource allocation and strategic planning in the small industry sector. Additionally, the findings provide a basis for future empirical research and policy formulation aimed at supporting SIEs in transitioning to innovation-driven growth models. As global economies become increasingly knowledge-based and digitalized, the ability to assess and improve efficiency in small enterprises will be pivotal to inclusive and resilient industrial development.

2. Research Methodology

The methodology employed in this study is rooted in an integrative approach that combines system analysis, economic-mathematical modeling, and empirical observation to identify and validate the most effective criteria and indicators for assessing the efficiency of small industrial enterprises. Drawing upon the framework proposed by Skrynkovskyi et al. (2019), the research relies on a comprehensive system of relative performance indicators that reflect the structural and functional aspects of production capacity. These include coefficients of equipment utilization, labor productivity measures, and production potential indexes, which are essential for evaluating the internal efficiency of enterprises. Furthermore, the study incorporates key insights from Kondratiev et al. (2022), whose synergistic efficiency model provides a multidimensional lens through which to analyze both internal and external factors influencing enterprise performance. Data collection was conducted through a combination of statistical reports, industry-specific case studies, and expert evaluations from enterprise managers, enabling a contextualized and sector-specific interpretation of performance outcomes. The research also employs graphical and statistical tools to visualize the interaction between production factors and performance results, and to establish functional dependencies that reveal efficiency patterns over time. The methodological emphasis is placed on determining the extent to which production resources—such as labor, raw materials, and equipment—are optimally utilized, and how their integration influences the overall productivity of the enterprise. This approach allows for a nuanced evaluation that accommodates both technical and managerial dimensions, ensuring that the proposed indicators are both empirically grounded and adaptable to the operational realities of small-scale industrial production.

3. Results and Discussions

The analysis of internal production factors in small industrial enterprises, particularly drawn from the case of LLC Sarapul yeast brewery as studied by Kondratiev et al. (2022), reveals significant fluctuations in efficiency indicators over time, highlighting both potential and vulnerability in the operation of such enterprises. The graphical representation of the core efficiency metrics—equipment efficiency, labor productivity, and material usage efficiency—demonstrates that while improvements were periodically achieved, sustainability in performance remains elusive. For instance, equipment efficiency peaked in 2000 and 2015 but experienced declines in subsequent years, indicating possible issues in capital asset renewal or inconsistent maintenance regimes. Labor productivity showed the most dramatic variation, peaking in 2005 at an index of 2.00, before dropping considerably in 2019. These trends suggest that human resource utilization, training, and task alignment remain areas of critical concern for small industrial firms, which often lack robust HR planning frameworks.

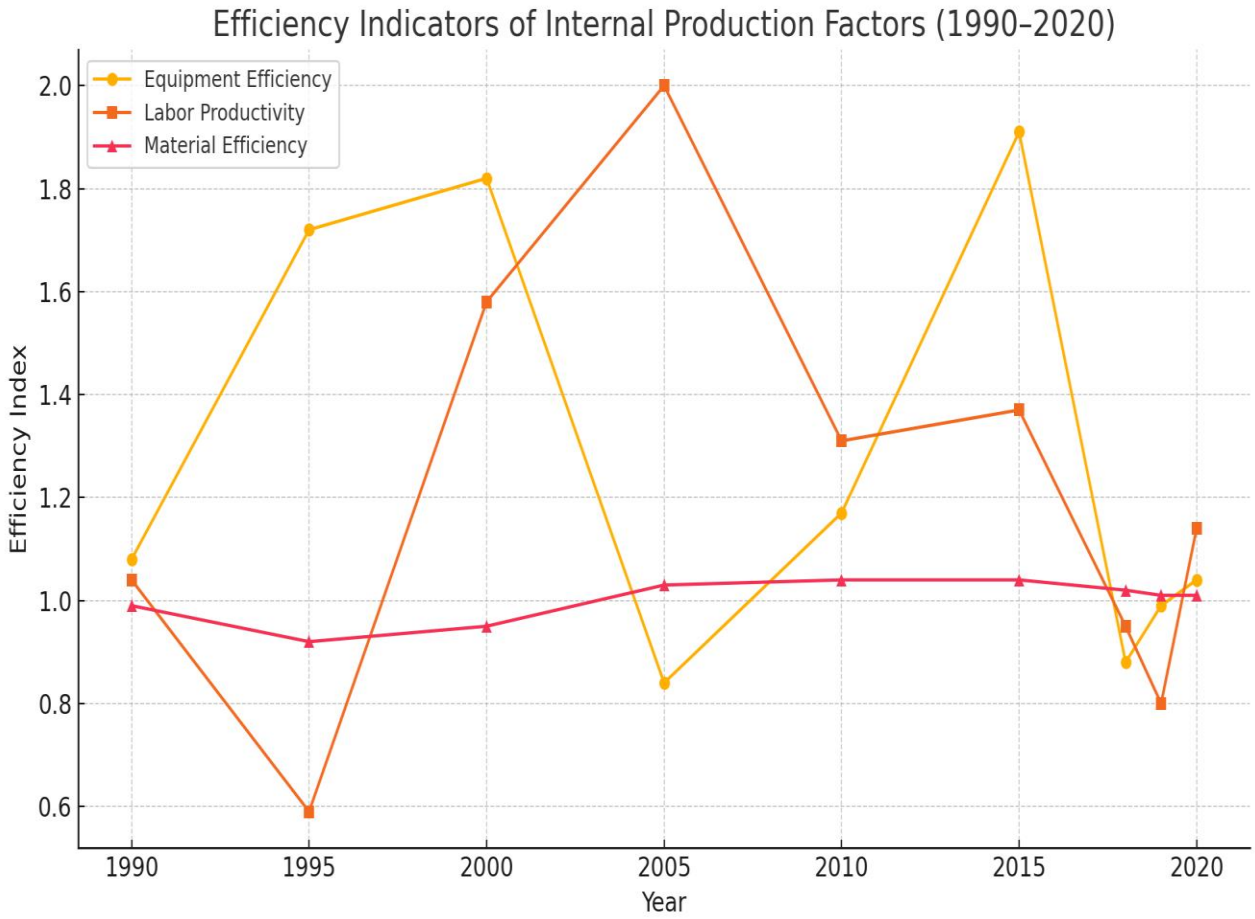

Figure 1. Efficiency Indicators of Internal Production Factors (1990–2020)

Material usage efficiency remained comparatively stable, with a narrow fluctuation band between 0.92 and 1.04, indicating that firms have developed reasonably consistent procurement and inventory control strategies. However, the absence of further growth in this indicator implies a plateau effect, possibly due to technological stagnation or limited innovation in input substitution strategies. Such findings underscore a core knowledge gap: while traditional metrics like labor and material efficiency are monitored, synergistic and systemic integration indicators—those combining technology, human capital, and organizational processes—are either underdeveloped or insufficiently applied. Existing models fail to capture the multidimensional interdependencies that drive long-term efficiency.

Furthermore, although the synergistic efficiency model introduced in Kondratiev et al. identifies complex interactions between internal and external drivers of productivity (e.g., market conditions, innovation levels, investment climate), it is not yet fully operationalized for small enterprises lacking

extensive data infrastructures. The implication is clear: theoretical frameworks must evolve to account for the non-linear, context-dependent nature of efficiency in resource-constrained environments. This entails advancing practical toolkits for real-time diagnostics and strategic recalibration, which currently exist only at a conceptual level.

From a theoretical standpoint, there is a need to deepen the classification and measurement of intangible factors such as knowledge flows, institutional learning, and adaptive capacity, all of which influence synergistic performance but elude quantification through classical economic metrics. Practically, small enterprises require simplified yet robust dashboards to monitor efficiency in real time, with user-friendly interfaces and integrated decision-support systems. These tools must bridge the sophistication of academic models and the operational needs of firms, particularly in developing economies where informational asymmetry and resource scarcity prevail.

Further research should focus on developing adaptive models that allow for comparative benchmarking of efficiency indicators across sectors and enterprise sizes. Moreover, longitudinal studies are necessary to trace the causal relationship between specific management interventions (e.g., lean implementation, digitalization, workforce upskilling) and shifts in efficiency outcomes. Experimental methods such as action research, coupled with case-based simulations, could provide richer insights into dynamic interactions that traditional models overlook.

In conclusion, the findings reaffirm that while basic efficiency metrics remain foundational, they are insufficient for capturing the evolving performance dynamics of small industrial enterprises. A new generation of composite indicators—anchored in systems thinking and synergistic performance analysis—is required to inform more resilient and forward-looking enterprise strategies. These developments have broad implications for policymakers, enterprise managers, and researchers alike, as they work collectively toward the sustainability and competitiveness of the small industry sector in increasingly complex economic ecosystems.

4. Conclusion

The study highlights that while small industrial enterprises demonstrate variable performance across key efficiency indicators—such as equipment utilization, labor productivity, and material efficiency—their long-term operational sustainability is constrained by inconsistent integration of synergistic and systemic performance factors. The findings reveal that although material efficiency remains relatively stable, significant volatility in labor and equipment productivity underscores the need for strategic human resource development and capital renewal. The research affirms the relevance of multidimensional efficiency models, such as those proposed by Kondratiev et al., yet emphasizes their limited applicability in smaller firms without adaptive, real-time diagnostic tools. These insights imply a critical need for tailored performance monitoring frameworks that combine quantitative indicators with qualitative assessments of organizational adaptability and innovation potential. Future research should aim to develop scalable, sector-sensitive efficiency evaluation systems, integrate real-time data analytics into small enterprise management practices, and explore the causal effects of strategic interventions such as digital transformation, workforce training, and lean management on enterprise-level performance outcomes.

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