

## ECONOMIC MECHANISMS FOR INCREASING PRODUCTION EFFICIENCY IN INDUSTRIAL ENTERPRISES

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### Abstract

This article examines the principal economic mechanisms for increasing production efficiency in industrial enterprises. In the contemporary industrial economy, production efficiency depends not only on capital renewal and technology adoption, but also on managerial quality, workforce skills, energy performance, innovation capacity, and the ability to reorganize production systems under changing market conditions. Recent OECD and UNIDO materials show that productivity growth depends on both the incentives and the capabilities of firms and workers, while recent empirical studies indicate that digital transformation, energy-management practices, and managerial best practices can significantly improve manufacturing efficiency. The article argues that sustainable efficiency gains arise when technological, organizational, financial, and human-capital mechanisms are combined rather than applied in isolation.

**Keywords:** production efficiency, industrial enterprises, productivity, manufacturing, economic mechanisms, energy efficiency, innovation, digital transformation, industrial competitiveness.

### Introduction

Production efficiency is one of the central determinants of the competitiveness and long-term sustainability of industrial enterprises. In economic analysis, productivity is commonly understood as the ratio between output and inputs, and OECD materials treat labour productivity and multifactor productivity as key indicators for understanding enterprise and economy-wide performance [1]. At the same time, UNIDO emphasizes that manufacturing remains a major driver of productivity growth and technological development, which means that improving industrial efficiency remains a core issue of economic policy and enterprise strategy [3].

In the current stage of industrial development, production efficiency can no longer be explained only by scale, mechanization, or cost minimization. OECD's 2024 review on reviving productivity growth stresses that productivity depends on both the incentives and the capabilities of firms and workers [2]. This broader view implies that industrial enterprises need a system of economic mechanisms that includes investment, management, digitalization, skills, and resource efficiency.

The purpose of this article is to identify and systematize the main economic mechanisms through which industrial enterprises can increase production efficiency and to propose an integrated framework for enterprise-level productivity improvement.

### Literature Review

Recent literature shows that digital transformation has become an important mechanism of industrial efficiency growth. A 2024 empirical study reports that digital transformation plays a significant role in improving the production efficiency of manufacturing enterprises, with stronger effects in some categories of firms than in others [4]. This finding is important because it shows that efficiency gains increasingly come not only from physical modernization, but also from digital coordination, information processing, and process optimization.

Another important strand of literature concerns energy efficiency. A 2025 study on industrial manufacturing finds that the stages of digital transformation, including computerization, connectivity, visibility, transparency, predictive capacity, and adaptability, are closely linked to improvements in energy efficiency [5]. A separate 2025 study on the UK industrial sector



concludes that management-based best practices also improve energy efficiency, confirming that organizational routines matter alongside technological change [6].

Human capital is another major efficiency determinant. UNIDO's materials on skills development emphasize that productivity improvement requires practical competencies aligned with industrial demand and stronger links between training systems and employers [7]. OECD's productivity review supports the same logic by highlighting that enterprise performance depends not only on external incentives but also on firm-level and worker-level capabilities [2].

Recent studies also suggest that innovation and strategic upgrading are relevant. Research on the servitization of manufacturing firms indicates that digital transformation can support higher-value activities and broader enterprise upgrading, implying that production efficiency should be viewed not only in narrow operational terms but also in strategic and value-creation terms [8].

### **Analysis and Discussion**

#### **1. Technological modernization as an economic mechanism**

The first major mechanism is technological modernization. Industrial enterprises improve production efficiency when they renew equipment, adopt digital production systems, and reduce information frictions in production processes. The 2024 manufacturing study shows that digital transformation significantly improves production efficiency, which indicates that technology contributes not only through automation, but also through better coordination and information flows [4].

However, technological modernization should not be interpreted narrowly. The energy-efficiency literature suggests that efficiency gains become larger when industrial technology develops from isolated tools into integrated and intelligent systems that support connectivity, visibility, transparency, and predictive capability [5]. Thus, technological modernization is an economic mechanism because it increases the output that can be generated from a given set of resources.

#### **2. Organizational and managerial best practices as an economic mechanism**

A second mechanism is managerial and organizational improvement. Technology alone does not guarantee higher efficiency if production planning, maintenance routines, process control, and operational discipline remain weak. The 2025 UK industry study shows that management-based best practices contribute to lower energy intensity and better industrial efficiency [6]. This means that managerial quality directly affects how effectively capital and labour are used inside the enterprise.

From an economic point of view, this mechanism works by reducing waste, improving process consistency, lowering coordination costs, and increasing the return on productive assets already installed in the enterprise. OECD's productivity work supports this broader interpretation by emphasizing that productivity outcomes depend on how firms and workers use their capabilities under given incentives [2].

#### **3. Human capital and skills as an economic mechanism**

A third mechanism is human-capital development. Industrial production becomes more efficient when workers and managers possess the technical, process, and leadership skills needed to operate and improve modern production systems. UNIDO explicitly links skills development with higher productivity and stronger alignment between training systems and industrial demand [7].

This mechanism becomes even more important in digitally transforming industry. If digital tools, data systems, and intelligent equipment are introduced without corresponding workforce capability, their productivity effect remains limited. Therefore, investments in machinery and software produce stronger results when they are accompanied by investments in workforce knowledge, technical training, and managerial competence [2], [5], [7].

#### **4. Energy and resource efficiency as an economic mechanism**



A fourth mechanism is better energy and resource use. In many industrial enterprises, energy intensity, material waste, downtime, and maintenance losses directly reduce production efficiency. Recent research shows that energy efficiency can be improved through more advanced digital-technology stages and through better management practices [5], [6]. This confirms that resource efficiency is both a technological and an organizational issue.

Economically, this mechanism increases output efficiency by lowering the volume of energy and materials required per unit of production. It also strengthens resilience because firms that use energy and materials more efficiently are less vulnerable to cost volatility and external shocks. Thus, energy and resource efficiency should be treated as a core economic mechanism of industrial productivity growth, not merely as an environmental concern [3], [5], [6].

#### 5. Innovation and strategic upgrading as an economic mechanism

A fifth mechanism is innovation-based upgrading. Production efficiency is improved not only when existing production is made faster or cheaper, but also when industrial enterprises move toward higher-value forms of activity. Research on digital transformation and servitization suggests that industrial firms can improve their overall performance by combining manufacturing with higher-value services and upgraded business models [8].

This means that efficiency should be evaluated not only in operational terms, but also in strategic terms. If a firm uses its resources to generate greater value added, improve product quality, or strengthen market differentiation, then production efficiency rises in an economically meaningful sense. In that respect, innovation and strategic upgrading are part of the broader mechanism through which industrial enterprises increase competitiveness and productivity [3], [8].

#### 6. Incentives and productivity-oriented investment as an economic mechanism

A sixth mechanism is the incentive and investment environment. OECD's 2024 review states that productivity growth depends on both incentives and capabilities [2]. For industrial enterprises, this means that efficiency-improving measures such as modernization, training, energy systems, and digital infrastructure often require upfront investment and a business environment that rewards productivity-enhancing behavior.

Without financial flexibility and appropriate incentives, even technically sound efficiency strategies may not be implemented. Therefore, productive investment and institutional incentives should be treated as part of the economic mechanism of efficiency growth, especially in capital-intensive industrial sectors [2], [3].

Table 1.

Main economic mechanisms for increasing production efficiency

Economic mechanism	Main content	Expected effect on industrial enterprise efficiency
Technological modernization	Equipment renewal, digital production systems, integrated data use	Higher output per unit of labour and capital
Organizational best practices	Better planning, maintenance, process discipline, and control	Lower waste and stronger utilization of existing assets
Human-capital development	Technical, process, and leadership skills	Better operation and improvement of production systems
Energy and resource efficiency	Lower energy intensity, better resource use, less material loss	Lower production costs and stronger resilience
Innovation and strategic upgrading	Product/process innovation, servitization, higher-value activities	Greater value generated from the same resource base
Incentives and productive investment	Access to finance, modernization incentives, productivity-oriented governance	Faster adoption of efficiency-improving measures



### Integrated Framework

Based on the reviewed evidence, industrial enterprises can increase production efficiency most effectively when they combine the above mechanisms into a single management framework. Such a framework may include six interrelated stages:

Efficiency diagnosis – measuring labour productivity, multifactor productivity, energy intensity, and process losses [1];

Technological assessment – identifying where modernization and digitalization can raise productive efficiency [4], [5];

Managerial redesign – improving production planning, maintenance, and operational control [6];

Skills upgrading – aligning workforce competencies with technological and process requirements [2], [7];

Innovation integration – linking efficiency improvement with product, process, and business-model upgrading [3], [8];

Continuous monitoring – using productivity and efficiency indicators to update decisions over time [1], [2].

This integrated view is consistent with the OECD argument that productivity growth requires both incentives and capabilities, with UNIDO's emphasis on industry as a driver of productivity, and with recent empirical findings on digital transformation and industrial efficiency [1], [2], [3], [4].

Table 2.

Integrated framework for increasing production efficiency in industrial enterprises

Stage	Main task	Strategic purpose
Efficiency diagnosis	Measure productivity, energy use, and process losses	Identify the real efficiency baseline
Technological assessment	Evaluate modernization and digitalization opportunities	Target investment toward high-return areas
Managerial redesign	Improve workflows, maintenance, and production control	Strengthen operational efficiency
Skills upgrading	Train technical, process, and leadership capabilities	Increase the return on technology and systems
Innovation integration	Connect efficiency with product/process upgrading	Raise value creation, not only speed
Continuous monitoring	Track indicators and revise decisions	Sustain long-term efficiency gains

### Conclusion

The analysis shows that production efficiency in industrial enterprises is shaped by a system of interacting economic mechanisms rather than by one factor alone. Technological modernization, managerial best practices, human capital, energy efficiency, innovation, and productive investment all contribute to higher efficiency when they are aligned within an integrated enterprise strategy. Official OECD and UNIDO materials, together with recent empirical studies, support the conclusion that productivity growth depends on both firm capabilities and the incentives that shape their use.

Therefore, industrial enterprises should treat efficiency improvement not as a one-time technical project, but as a continuous economic and managerial process. The most effective path is not isolated equipment replacement or isolated cost cutting, but the coordinated use of technological, organizational, financial, and human-capital mechanisms. Under this approach, production efficiency becomes a strategic foundation for industrial competitiveness and long-term development.

### References



1. OECD. OECD Compendium of Productivity Indicators 2024.
2. OECD. Reviving Productivity Growth: A Review of Policies. 2024.
3. UNIDO. Industrial Development Report 2024.
4. Wang, D. (2024). Research on the impact of digital transformation on the production efficiency of manufacturing enterprises.
5. Schmitt, T. (2025). Achieving energy efficiency in industrial manufacturing.
6. Ali, M. (2025). The impact of best practice on energy efficiency in the UK's industrial sector.
7. UNIDO. Skills Development materials.
8. Sui, X. (2025). The impact of digital transformation on the servitization of manufacturing firms.

