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FEATURES OF MODELING KINETIC REGULARITIES OF INNOVATIVE DEVELOPMENT OF AN INDUSTRIAL MACHINE-BUILDING AND REPAIR ENTERPRISE

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Abstract: The paper examines the kinetic patterns of innovation processes development at an industrial mechanical engineering and repair enterprise in the context of ensuring its sustainable operation. The paper examines the relationship between the enterprise's production and innovation potential, as well as the innovation receptivity indicator, which determines the enterprise's ability to effectively implement its accumulated innovative potential. The paper analyzes the characteristic stages of the innovation cycle, in particular, the periods of growth, stabilization, decline, and recovery of potential. A relationship is established between changes in innovative potential, economic efficiency, innovative receptivity, and the enterprise's production potential. The paper substantiates the need for systematic management of innovation processes and the creation of a specialized innovation unit within the enterprise structure capable of coordinating scientific, technical, design, and technical and economic projects. The obtained provisions can be used to formulate strategies for the innovative and sustainable development of enterprises in the mechanical engineering industry.

Key words: innovative development, innovative potential, production potential, innovative receptivity, kinetics of innovative processes, innovation cycle, industrial enterprise, mechanical engineering, sustainable development, innovative management.

Introduction.

Innovative industrial development remains the only viable vector for the sustainable functioning of Ukraine's agro-industrial complex. Innovation is generally understood as the final result of innovative activity. A new or improved technological process applied in practice, or a new approach to organizing social services, presupposes the temporary nature of its formation and the passage of all stages from development to industrial implementation. Like most physical, chemical, technological, and thermodynamic phenomena underlying mechanical engineering production, technical and economic processes, including innovation ones, are typically nonlinear and depend on a multitude of variable factors, as confirmed by the nonlinear nature of global macroeconomic cycles of growth, stabilization, and stagnation. This suggests that innovation processes have their own kinetic patterns. This is indicated, in particular, by the rapid development of nanotechnology, which has ensured the emergence of fundamentally new products.

The aim of the work is to study the kinetic features of the development of innovative processes in industrial enterprises of the automotive and tractor engineering industry using the example of the largest manufacturers of cardan shafts, shock absorbers and brake chambers for automotive, railway and agricultural machinery, with similar production capacities.

Results and discussion.

Innovative activity combines the material, technical, technological, managerial and intellectual resources of an enterprise, which makes it possible to describe the kinetics of accumulation of production potential *by* $П_n$ of functional dependencies proportional, decelerating and accelerating (Fig. 1, curves 1-3). For real economic conditions, the most typical dependence is one with saturation (curve 2), caused by equipment depreciation, market saturation, and declining efficiency of production processes.

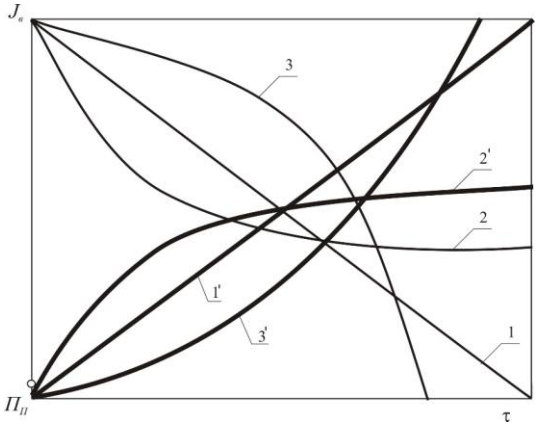


Fig. 1. Kinetics of production potential $П_n$ (1–3) and innovation susceptibility Iv (1'–3') under different sustainable development strategies: 1, 1′ proportional; 2, 2′ decelerating; 3, 3′ accelerating

Production potential serves as the basis for the development of innovative potential a set of resources that provide an enterprise with an advantageous market position. The ability to effectively realize this potential is defined as "innovation receptivity" I_v , the kinetics of which are functionally similar to the kinetics of production potential (curves 1'–3').

The innovative cycle of enterprise functioning τ_{ic} includes four characteristic periods: growth $\Delta\tau_p$, stabilization $\Delta\ \tau_{ct}$, fall $\Delta\tau_p$ and restoration $\Delta\tau_v$ of potential:

$$\tau_{ic} = \Delta\tau_{\text{p}} + \Delta\tau_{ct} + \Delta\tau_n + \Delta\tau_v$$

Growth in initial potential is associated with improvements in corporate culture and intellectual support; stabilization occurs when these capabilities are aligned with current production; decline is due to depreciation and obsolescence of equipment, and market saturation with similar products; recovery is ensured by personnel retraining and the implementation of resource-saving solutions.

For sustainable development of the enterprise, the depth of the potential drop Δh should not exceed the initial level, and should decrease consistently in each subsequent cycle:

$$\Delta h_1 > \Delta h_2 > \Delta h_3 > \ldots > \Delta h_n$$

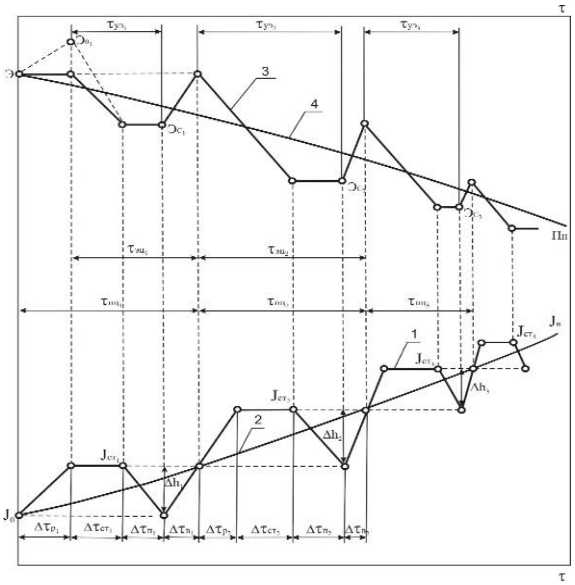


Fig. 2. Correlation of kinetic dependencies of changes in innovation potential (1), economic efficiency (3), innovation receptivity (2) and production potential (4)

Similar kinetic patterns are characteristic of the economic efficiency indicator S_{jk} . The cycle of effective functioning τ_{ys} consists of periods of growth, stable functioning, and a decline in efficiency, while the cycle of sustainable development τ_{ic} additionally includes a recovery period:

$$\tau_{ys} = \tau_{sp} + \tau_{sc} + \tau_{sn}; \quad \tau_{ic} = \tau_{sp} + \tau_{sc} + \tau_{sn} + \tau_{sv}$$

Sustainable development of an enterprise requires that the relative increase in efficiency in successive cycles decreases:

$$\frac{S_1}{S_0} > \frac{S_2}{S_1} > \frac{S_3}{S_2} > \ldots$$

Correlation of the kinetic cycles discussed above (Fig. 2) can be achieved by creating an innovative division within the enterprise's scientific and technical center that coordinates research, design, and feasibility studies. The absence of such a structure leads to operational instability and loss of market position.

Conclusions.

An analysis of the functioning of industrial enterprises with similar levels of production potential and homogeneous product purposes confirms the existence of stable kinetic patterns in the development of innovative potential, which support the implementation of a sustainable development strategy during the transition period. One effective tool for such a strategy is the creation of functional units within the enterprise structure to support intellectual support for innovation.

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MODELING OF CLUSTER STRUCTURES OF INTELLECTUAL SUPPORT OF INNOVATIVE ACTIVITIES OF ENTERPRISES

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Abstract. This paper examines current organizational and methodological approaches to establishing cluster structures that provide intellectual support for the innovation activities of industrial and repair