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ADAPTIVE MANAGEMENT SYSTEMS FOR ENHANCING PRODUCTION ENTERPRISE EFFICIENCY

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ABSTRACT

Purpose: The study aims to investigate adaptive management systems for enhancing production enterprise efficiency.

Design/Methodology/Approach: The research employed analytical-bibliographic methods and economic-statistical methods for processing statistical data to study the scientific literature on adaptive management and analyse and process data related to the research topic.

Research Limitation: Although the analysed adaptive management models provide valuable information on adjusting production, their application may be limited to manufacturing enterprises, and therefore, they do not cover other economic or service-oriented industries. Given this, the study's main limitation is its focus on the regional context, particularly Ukraine's industrial sector.

Findings: The study results have identified the main critical theoretical aspects of applying adaptive management models and revealed the practical characteristics of different models developed by scientists. The study examined the conceptual basis of adaptive management, investigated the integration of innovative strategies that are key to ensuring the flexibility and sustainability of manufacturing enterprises, and analysed the interrelationships of the management system's components, which allows the creation of an adaptation mechanism.

Practical Implication: The effect on the sector is the improvement of toughness and flexibility within manufacturing firms, enabling them to navigate market uncertainties efficiently and maintain creativity, thereby propelling sectoral expansion and stability.

Social Implication: The results' social impact is that increasing investment in scientific research can contribute to technological and economic development, social well-being, and sustainable growth.

Originality/ Value: This study's novelty lies in advancing methodologies for utilising adaptive management to augment enterprises' efficiency by implementing novel mechanisms and constructing models considering the external environment's dynamic nature.

Keywords*: Adaptive management. bayesian analysis. behavioural economics. cognitive biases. management of asset*

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INTRODUCTION

The current conditions, marked by increasing global challenges, include digital transformation, technological advancements, economic instabilities, and fluctuations in global markets. These require enterprises to develop comprehensive plans and implement appropriate procedures to combat external threats. According to Buniak et al. (2023), such measures should primarily include adaptive management tools and innovative management approaches to ensure the sustainability and competitiveness of representatives of the modern business sphere.

In particular, modern enterprises are forced to operate in a volatile economy and market in Ukraine. The main problems accompanying Ukrainian business activities in the context of war include excessive liberalisation of the market, foreign economic relations, imperfections in current legislation and regulatory policy, and high competition in the market. Farhshatova et al. (2019) paid special attention to the problem of changes in production, trade, science and technology, which require the management of enterprises to pay increased attention to the dynamic conditions of functioning and management decision-making using flexible, adaptive tools.

Including resource dependence among the global problems that apply to the Ukrainian context is vital. Given that obtaining external resources is a key component of tactical and strategic management in any enterprise, the failure of small businesses in South Africa, as noted by Mahembe (2011), is mainly due to an ineffective management approach. It should be noted that countries that are primarily dependent on non-renewable natural resources are usually more susceptible to market fluctuations.

According to the Sustainable Trade Index in 2024, the countries with the largest share of natural resources in trade are Brunei (85.0%) and Australia (78.4%). For example, in the period 2020–2021, the five largest export goods in Australia included iron ore and concentrates (33.3% of total exports), coal (8.5%), natural gas (6.6%), tourist services related to education (6.0%), and gold (5.7%). Therefore, to ensure long-term stability for economies dependent on trade in natural resources, it is necessary to implement adaptive management to diversify exports, intensify investments in sustainable technologies, and develop sectors resistant to fluctuations in the global market (Lu, 2024).

From a business perspective, it should be noted that according to the demographic data of a quantitative study by Saah et al. (2024), 73% of owners and managers of small and medium-sized businesses have only a twelfth degree or less, which determines the need to implement strategic management of the company and an adaptive approach to overcoming obstacles. Furthermore, according to Davis and Cobb (2010), the resource dependence theory encourages applying adaptive strategies, such as efficient management, to reduce dependence on external parties, enhance organisational autonomy, and promote the growth and sustainability of businesses.

This study of the adaptive management system of a functioning enterprise in the conditions of the formation of market relations showed its direct connection with the formation of flexible

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organisational and functional mechanisms and the creation of a management decision-making system considering market factors. It should be noted that such conclusions are supported by modern research; in particular, a recent study by McKinsey indicated that companies that adapt their strategies often outperform their competitors by 25% in terms of profitability. Also, it is worth noting that, according to a Harvard Business Review study, teams with adaptive leaders show a 30% increase in overall productivity compared to those managed by traditional methods (Psico Smart, 2024).

Ensuring the effectiveness of entrepreneurial activity in this study is also related to the adaptation of the production structure to various conditions of the external environment, the development of a strategy for manoeuvring the distribution and redistribution of resources, the consistency of strategies, tactics and processes for managing the capital structure, and the formation of the ability of the system to effectively achieve functional goals. Therefore, according to Xu and Liu (2024), the external uncertainty of the environment negatively affects the entry and result of corporate technological innovations, a compelling adaptation of business to the conditions of the industry and increasing the relevance of the general policy of companies allow ensuring their competitiveness and efficiency.

The gap in this study lies in the limited scope of adaptive management models that focus predominantly on production adaptation without adequately addressing broader aspects critical to enterprise efficiency. While the models explore essential areas of management adaptation, such as market responsiveness and exogenous variables, they do not sufficiently integrate innovation-driven adaptation strategies, particularly in the context of declining innovation activity in Ukrainian industrial enterprises.

LITERATURE REVIEW

According to the analysis of existing scientific and methodological literature on the research topic, there is no clear and unified interpretation of the concept of adaptive management. However, according to most researchers, it is a set of actions and methods characterised by the ability of the management system to respond to changes in the external environment. According to another perspective, adaptive management is management that adapts to changes in the managed object and is used to enhance its characteristics. At the same time, adaptive management can be considered an independent type of management, namely flexible and innovative management of companies capable of adapting to new conditions of the external and internal environment through new management tools and methods (Conz & Magnani, 2020; Elia et al., 2021; Zinchenko et al., 2022).

Adaptive management aims to search for the most effective options for decision-making and their implementation aimed at the functioning and development of companies in a competitive environment (Dzhyhora & Gasimov, 2022). The main task of adaptive management is to maintain the internal stability of the system in a constantly changing external environment. The functional mechanism of an adaptive management system creates rules that regulate the interaction of system elements and parameters. Since the improvement of the system is

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associated with establishing spatial, synthetic, temporal, and functional connections, one of the main tasks in creating an adaptive management system for a company is the synthesis of the mechanism and structure of the system's functioning, as well as the selection of the management goal for the adaptive system (Thomann et al., 2022; Branicki et al., 2018; Timchuk & Evloeva, 2020).

The functions of the adaptive management system are directly related to such essential management functions as forecasting and planning, labour organisation, activation and stimulation, coordination and regulation, control, accounting, and analysis (Williams & Brown, 2018; Büyüközkan & Göçer, 2018).

The mechanism of adaptive management of a company in a competitive environment consists of a set of principles, tools, and technologies for decision-making and implementation. Their implementation is determined by the enterprise's information system, which is defined as a unified complex of software, technical, and organisational solutions capable of collecting information about the state of affairs in the company and covering areas of production, technology, finance, logistics, marketing, HR, and other processes that unite all areas of the company's activities into a single information space (Finahina et al., 2019; Ammirato et al., 2019; Kan et al., 2022).

Developing and implementing an adaptive enterprise management system requires determining which organisational system criteria, style, and characteristics of management and marketing policies allow for achieving the most effective results and which may hinder the enterprise's development (Akimova et al., 2020; Qian et al., 2022).

The main elements of adaptive management include internal variables that shape a company's potential and "survival," allowing the assessment of current adaptability and the capacity for adaptive development. Internal variables are called socio-technical systems with social and technical components (Ievdokymov et al., 2021). However, the defining characteristic is the concept of comprehensive technology.

The implementation of the adaptive management system model at enterprises requires as follows:

i. to conduct monitoring of the external and internal environment and continuously diagnose the company's management system;
ii. to establish an effective process for dealing with resistance to change;
iii. to implement modern information technologies to support planned management systems;
iv. to carry out strategic management;
v. to utilize the key features of the management system's organisational process in the enterprise's ongoing activities (Mansson et al., 2020; Cappiello, 2020; Zhang et al., 2022).

The starting point for assessing the adaptive potential of an enterprise is the selection of key criteria elements, classical characteristics, or organizational units, namely production-technical,

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organisational-economic, and social components. These elements are characteristics of specific aspects of the enterprise's activities, collectively determining its overall state (Corvello et al., 2022). It is also worth paying attention to the regional aspects of the modernisation of the economy, using the example of qualitative data from the countries of the European Union (Ladonko et al., 2022).

The main task of adapting to changing conditions is forming a flexible management system capable of self-organisation and restructuring. This task involves synthesising a management system for the production system. Such a system should meet the optimality criterion of organisational management – to characterise the system's goal in terms of defined quality indicators under given constraints (Maslak et al., 2020; Ahn et al., 2018).

This article examines and evaluates adaptive management approaches to enhance the effectiveness of manufacturing organisations. This research aims to assess the critical theoretical aspects and practical features of adaptive management models, focusing on their application to optimise strategic change processes, use organisational potential, and improve the adaptability of manufacturing enterprises to external influences.

MATERIALS AND METHODS

This study's methodological and informational basis are scientific research, periodicals, and Internet resources, which are the basis for a thorough analysis of literary sources regarding the theoretical foundations of adaptive management, mainly its purpose, functions and key mechanisms. The authors employed the methodology of information synthesis to integrate diverse concepts and theoretical approaches to attain a comprehensive comprehension of the fundamental principles of adaptive management and its impact on the efficacy of production enterprises. To achieve the research objectives, the following methods were applied in a structured sequence:

The inductive method was employed to formulate general conclusions based on specific statistical data on the adaptation trends of manufacturing companies.
The deductive method was used to formulate specific conclusions to substantiate specific adaptation models for manufacturing companies.

The systematic-structural method was used to identify the relationships between the management system's key elements in developing a model based on exogenous variables.

A comparative analysis was conducted to identify optimal adaptive management models by comparing different approaches for specific production conditions. The logical-linguistic method was used to form the conceptual apparatus of the study and systematise the knowledge about adaptive management available in the modern literature. The methods of abstraction and idealisation are used to systematise knowledge about the functioning and models of adaptive management at a manufacturing enterprise. The economic-statistical method was also used to process statistical data on the number of innovatively active industrial enterprises in Ukraine.

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RESULTS AND DISCUSSION

Based on the results of studying the scientific literature on the research topic and analyzing management practices, various adaptive management models have been examined, identifying those most suitable for a manufacturing enterprise. When constructing an adaptive management model, researchers predominantly focus on production adaptation, which refers to the timely response of the enterprise to market changes (Figures 1-4).

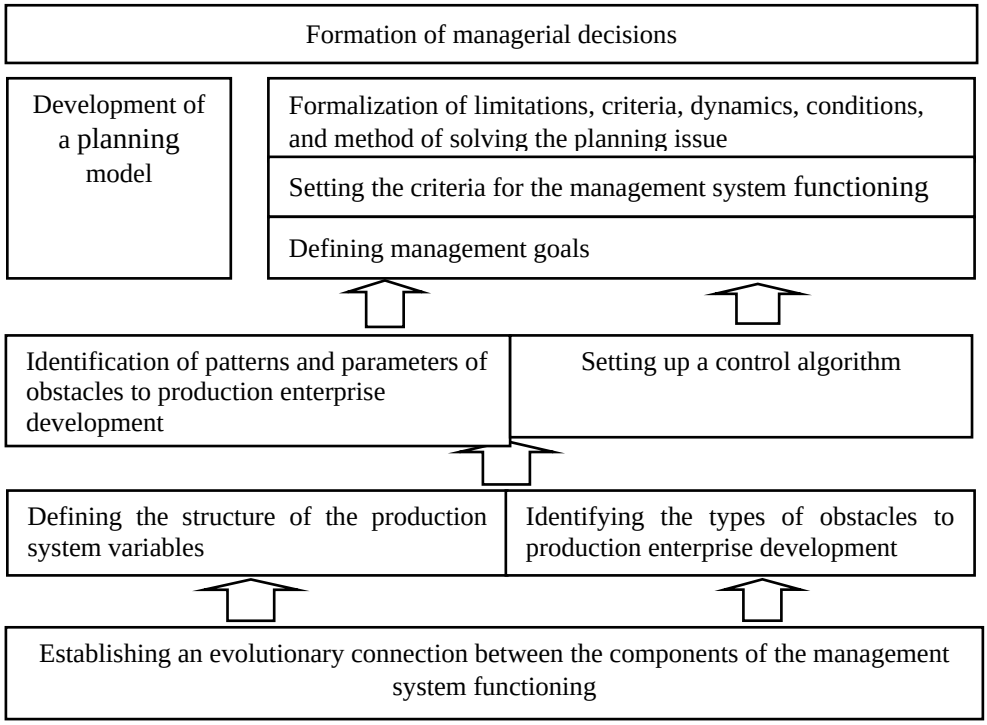

Figure 1: Adaptive management based on the establishment of an evolutionary connection between the management system components, %
Source: authors' elaboration

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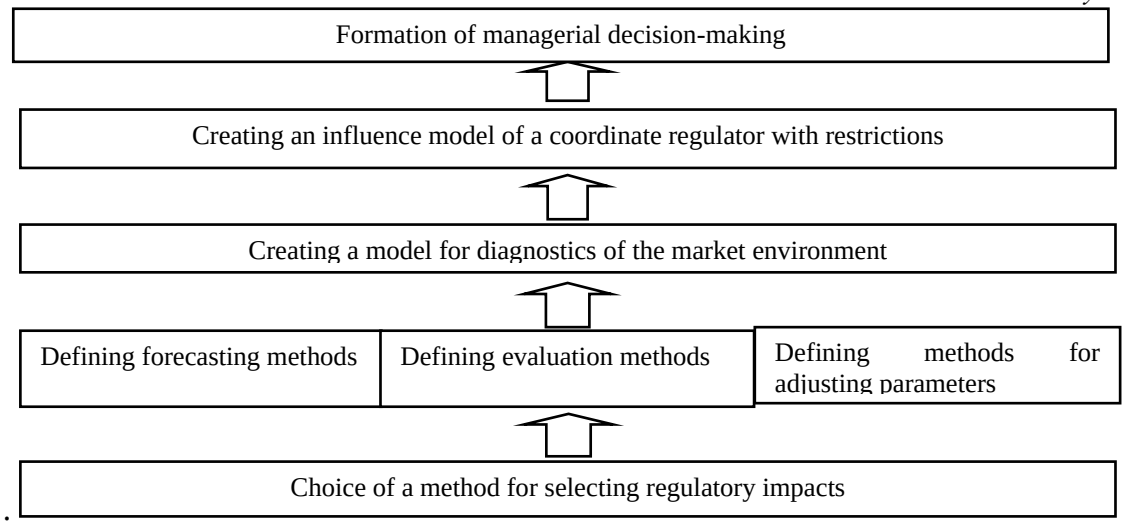

Figure 2: Control based on a regulatory adaptation model, %
Source: authors' elaboration

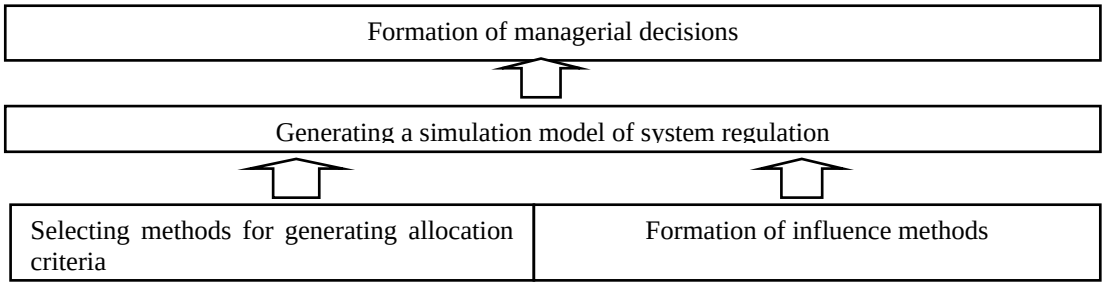

Figure 3: Development of a simulation model of adaptation management, %
Source: authors' elaboration

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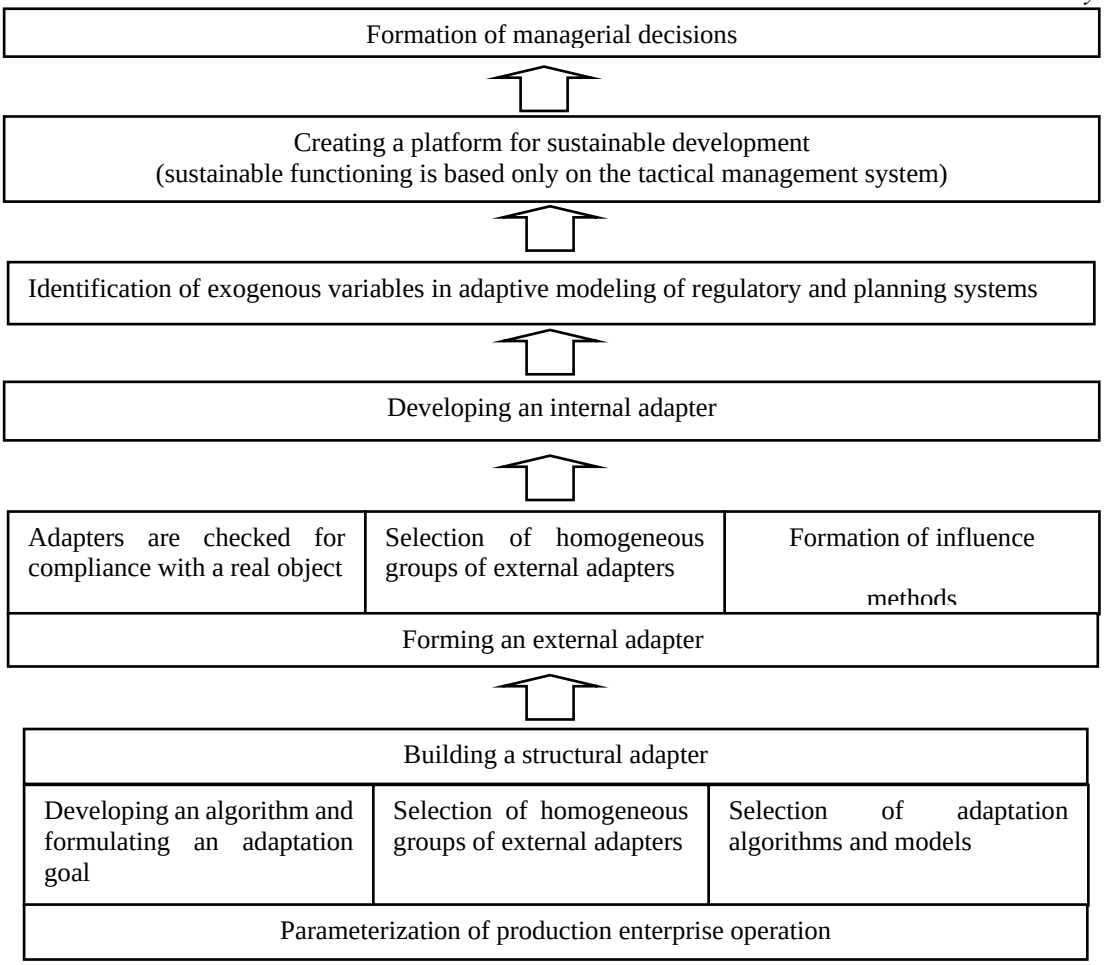

Figure 4: Development of an administrative model based on the identification of exo genous variables in adaptive modeling, %
Source: authors' elaboration

As seen from Figures 1-4, these models cover only certain areas that characterize the degree of enterprise management adaptation to the conditions of its operating environment.

One of the most critical areas of adaptation processes is the number of innovatively active enterprises. The dynamics of the number of Ukrainian production companies are shown in Figure 5.

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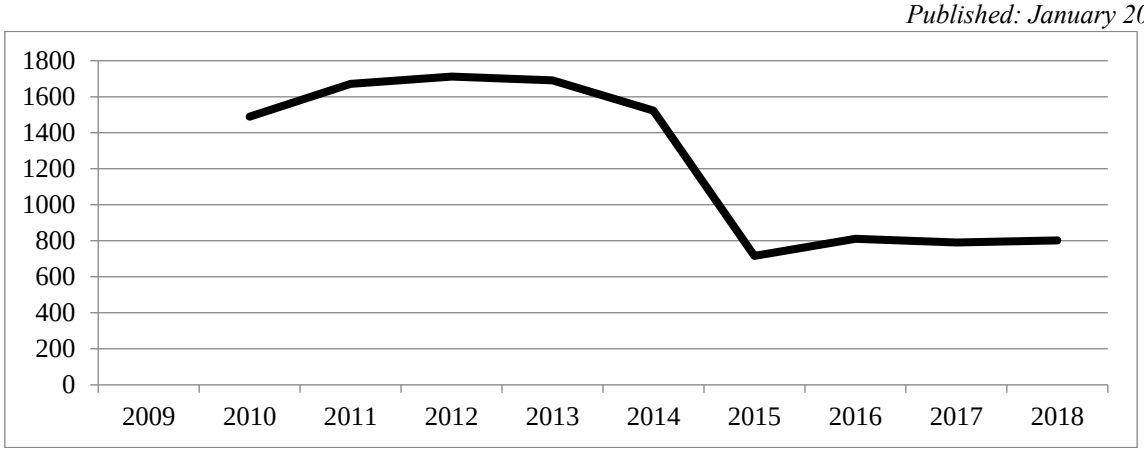

Figure 5: Number of innovatively active industrial enterprises in Ukraine (2010–2018), units

Source: authors' elaboration according to Scientific and innovative activity of Ukraine (2019)

Based on the data from Figure 5, the absolute number of innovation-active industrial companies decreased significantly from 2013 to 2018, indicating a reduction in the trend toward adaptive industrial development.

It should be noted that the increasingly challenging business environment and intensified competition in the markets for manufactured products limit companies' ability to finance innovative developments independently (Mazurenko et al., 2023). In this regard, it is relevant to increase the share of expenditure on scientific research in GDP through the state budget, local budgets, grants, and foreign investments, as this indicator directly determines the value of innovative production in the GDP of the subsequent period. Empirically, it has been proven that a country's level of technological development is highly dependent on the knowledge-intensive share of GDP. This indicator is calculated as the expenditure ratio of scientific research to GDP. Thus, with a value of this indicator between 0,4% and 0,5%, science serves a sociocultural function; between 0,6% and 0,9%, it supports developed technological potential; and with a value exceeding 0,9%, it ensures the economic development of enterprises (Vahonova et al., 2020).

Discussion

The tendencies in the development of production enterprises are determined by socio-economic changes taking place in the country and the focus on achieving several important goals simultaneously: occupational safety, workforce competitiveness, creating a conducive market environment, shaping a market economy, structural transformation of the economic sector, and enhancing societal and environmental protection (Asamoah et al., 2020).

The leading indicators of management system quality include accuracy, reliability, stability, usability for managers, an optimal number of hierarchical levels, cost minimisation, operational speed, etc. Reliability of operation refers to the system's ability to perform its functions correctly while maintaining accuracy within acceptable limits (Danyliuk et al., 2020; Mironova et al., 2022; Sumets et al., 2022).

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Adaptive systems, as opposed to systems with fixed parameters, automatically adjust their parameters, ensuring the fulfilment of the primary condition (the quality indicator) during regular system functioning (Furman et al., 2023; Kuzior et al., 2023).

Adaptation and adaptive management are closely related to companies' market activities in a competitive environment, as this type of management shapes not only the process of their functioning in the sales markets but also the results obtained during this process (Audretsch & Belitski, 2021; Genari et al., 2018).

The purpose of adaptation is to ensure the survival and effective functioning of the company in a changing external environment and to achieve strategic stability in the business unit (Pradhan et al., 2019).

Implementing an adaptive management system becomes one of the key factors in improving the efficiency of production and commercial activities of economic entities, as it requires a high level of management implementation. The adaptive management system of the financial resources of the enterprise consists of a complex of measures, methods, and tools that ensure the financial and organisational stability of the business unit and the ability to adapt to changes in the external environment by implementing the most effective management solutions. Among the external environmental factors that affect the financial activities of the enterprise and financial management, it is necessary to highlight the impact of crisis processes occurring in the external operational environment, the interests of corporate divisions' owners, and changes in the regulatory framework that regulates financial relations (Ercan & Samet, 2018; Goldfarb & Tucker, 2019).

The adaptive management model is a system of multidirectional processes. The core interaction of these processes is the adjustment of enterprise activities, which determines the behaviour of economic entities and changes their economic development strategy (Autio et al., 2021).

CONCLUSION

Therefore, the analysis of scientific literature on the research topic and the results of the questionnaire survey have shown that adaptive management of a company is a managerial activity organised as an interconnected complex of actions by the subjects of functioning and aimed at supporting the level of competitiveness through the implementation of mechanisms of innovative management processes. Thus, the outcome of adaptive management enhances the company's competitiveness.

The theoretical part of this research justifies the characteristics of adaptive management from the perspective of applying this type of decision-making to enhance development efficiency in production structures. As per the research aim, the practical part of the study includes examining various adaptive systems and their peculiarities in managing a production enterprise. Based on the research results, the peculiarities of adaptive management have been studied, and the necessity of implementing modern adaptation technologies in the management processes of the

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enterprise to ensure its long-term survival by countering destabilising factors from the external environment has been justified. The authors considered various studies that interpret the essence of the "adaptive management" concept and its models, and conclusions have been drawn regarding the issues raised. The practical application involves developing and implementing adaptive management models incorporating innovation-driven strategies, enabling manufacturing enterprises to enhance their efficiency and competitiveness in a dynamic business environment. The social application promotes technological and economic development through increased investment in scientific research. It contributes to a knowledge-intensive economy, societal well-being, and sustainable growth.

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