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Decision-making support information systems as a factor for increasing the adaptability and resilience of enterprises

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Abstract: The article reveals the role of information systems for decision support as a key factor in ensuring the adaptability and stability of enterprises in the conditions of growing instability of the external environment. Taking into account the challenges associated with wars, economic turbulence, logistical gaps and digital transformations, the need to use information systems to promptly respond to risks, improve the quality of management decisions and ensure strategic flexibility is substantiated.

The evolution of information systems for decision support is analyzed - from first-generation systems focused on computing and data accumulation to modern integrated solutions using innovative technologies and elements of artificial intelligence. A review of software solutions on the Ukrainian IT market is conducted, including examples of domestic and foreign products and industry platforms.

Considerable attention is paid to the analysis of the practical application of information systems for decision support at enterprises of the grain sector of Ukraine. It is determined that such systems provide automation of production processes, logistics, finance, quality control, personnel management, sustainable development. It is concluded that information systems for supporting decision-making contribute not only to increasing the efficiency of management, but also to the formation of anti-crisis resilience and digital maturity of enterprises.

The results of the study are the basis for further research aimed at integrating information systems for decision support with other digital management systems and overcoming barriers to implementation in Ukrainian conditions.

Keywords: information systems, decision-making, adaptability, sustainability, enterprise management, digital transformation, grain industry.

1. Introduction

In today's dynamic and unstable environment, enterprises are forced to operate in conditions of constant change, uncertainty and high risk. Military conflicts, economic instability, disruptions in logistics, cyber threats and technological advances significantly complicate strategic and operational management. Under such conditions, the ability of an enterprise to quickly adapt to external challenges and ensure the stability of its operation becomes critically important for its long-term survival and development.

One of the key tools for ensuring adaptability and risk tolerance are decision support information systems (DSIS). They allow managers and management personnel to analyze large data sets, model scenarios, predict risks and assess the effectiveness of management alternatives. The implementation of such systems contributes to increasing the validity of management decisions, rapid response to threats and strengthening the strategic flexibility of enterprises. In this regard, the study of the role of ISPR in the formation of an adaptive and sustainable business environment is relevant and has important significance both for management theory and for the practice of business functioning in the face of modern challenges.

2. Object and subject of research

The object of the study is decision support processes as a factor in increasing the adaptability and resilience of enterprises

The subject of the study is methodological approaches, functional capabilities and management potential of decision support information systems in ensuring the adaptability and resilience of enterprises to changes in the external environment.

3. Target of research

The purpose of the study is to substantiate theoretical aspects and develop practical recommendations for the use of IDSPR as a tool for increasing the adaptability and resilience of enterprises in conditions of uncertainty and a dynamic external environment.

4. Literature analysis

The issue of information support for enterprise management, in particular in conditions of growing instability, is a subject of active scientific interest of both domestic and foreign researchers. Considerable attention in the scientific literature is paid to the use of information systems in strategic and operational management (Meskon M., Albert M., Khedouri F. [1]), as well as the digital transformation of management processes (Brynjolfsson & McAfee [2, 3, 4]). In conditions of uncertainty, decision support information systems acquire special importance, which allow not only to automate analytical functions, but also to form scenarios of events, taking into account risks and alternative courses of action. The works of such authors as Gorry & Scott-Morton [5], Power [6], Turban et al. [7], describe the concepts and architecture of ISDS, their potential in increasing the flexibility and efficiency of management.

In the current context, there is a growing interest in research that considers ISPRS as a tool for risk management and increasing business resilience Kahneman & Tversky [8], Aven [9], Chumachenko I. V. [10]. Such systems contribute to the adaptation of enterprises to changes in the external environment by ensuring transparency, speed and accuracy of management decisions.

Ukrainian researchers (Zavadsky Y. S., Pashchenko O. V., Nagorna A. O. [11]) emphasize the need to implement information and analytical platforms in the context of post-crisis economic recovery and increasing the risk tolerance of enterprises. However, despite a significant amount of theoretical work, there is a need for further integration of ISPRS into the enterprise management system, taking into account industry specifics and the level of digital maturity of the business.

5. Research methods

In the research process, a complex of general scientific and special methods was used, in particular: system analysis, to reveal the relationships between the elements of decision support information systems (DSIS) and their impact on the functioning of enterprises in a changing environment; modelling, to build adaptive management models using DSIS, which ensure the flexibility and stability of the enterprise; factor analysis, to determine the key factors that affect the effectiveness of the implementation of DSIS in corporate governance; comparative analysis, to study foreign and domestic experience of using DSIS in increasing the adaptability of enterprises; expert assessment, to determine the level of readiness of enterprises for the digital transformation of management processes; graphical method, to visualize the relationship between the elements of the decision support system and the parameters of the adaptability and stability of the enterprise.

6. Research

Enterprise management in today's conditions is a complex, multifactorial task that requires a high level of coordination of all available resources. One of the most important components of this process is information systems, which play a decisive role in the automation of business processes. In the context of the rapid transformation of market conditions and growing competitive pressure, such tasks as reducing the cost of operations, increasing the efficiency of internal processes are becoming extremely relevant. Organization of production, expansion of the range of products and services, as well as elimination of irrational and redundant processes are also important [12]. The effective functioning of such a system involves the introduction of software that best meets the requirements for the organization of electronic document management and ensuring uninterrupted information exchange [13]. Decision support information systems (DSIS) are a special class of modern information systems, the functional purpose of which is to provide computerized support to management decisions at different levels of the organizational hierarchy. They have the ability to flexibly respond to changes in initial data and formulate management tasks, characterized by a high level of adaptability to dynamic conditions of the external and internal environment. Within the evolution of the DSIS theory, researchers distinguish three successive stages of their development.

Table 1. Stages of development of ISPD

Stage	Years	Characteristic
First generation ISPD	1970 - 1980	Data management: emphasis on the accumulation of a significant amount of information, the formation of data banks; Computing: orientation to solving highly specialized problems; Interface: the interaction was carried out mainly using programming languages for mainframes, which required the appropriate qualifications of the programmer
Second generation	1980 - to mid-1990.	Data management: optimized for the needs of decision-makers, with a focus on relevance and sufficiency of information; The key functional purposes include: assisting ODA in structuring problem situations, formulating tasks and building a system of decision-making criteria; supporting the process of solving problems by generating or selecting appropriate models and methods; providing analytical interpretation of the results, including conducting a scenario analysis of the «what will happen if...», explaining the logic of the decision, as well as searching for similar situations in the past, taking into account their consequences.
Third generation	mid-1990-s -present	It is characterized by the integration of the latest information technologies and artificial intelligence methods. The most important innovations include: data warehouses and data marts, which provide the possibility of large-scale analysis of operational information on business transactions in order to make an informed choice of management decisions; Online Analytical Processing technologies allow you to flexibly and quickly explore large multidimensional databases, evaluating key business indicators in different contexts and perspectives.

Source: developed by the author

The sources of information for the ISPD are the management and operational information systems of the enterprise [3]. Users are managers, specialists, and analysts who make decisions about technological, production, investment, and other business processes. Despite the widespread

implementation of ISPD in world practice, their application in the Ukrainian corporate environment remains limited. The reasons are both the insufficient level of digital transformation of enterprises and the lack of institutional support for the implementation of intelligent management systems.

One of the specific subtypes of the SDS is executive information systems, which are focused on the needs of top management, which provide a comprehensive analytical review of the organization's activities, its external environment (competitors, suppliers and customers).

In the conditions of informatization of society, the dependence of economic productivity on the level of development of these systems increases. Especially dynamic development is observed in the field of workstations and office information systems, which are increasingly being introduced into business practice. In the structure of information systems for specialists, two main groups are distinguished: office automation systems that provide electronic document management, communication management, coordination of joint work; knowledge processing systems that are focused on the preservation, search, transfer and use of knowledge within the organization [14].

Information systems for processing knowledge play a key role in the generation and use of new knowledge necessary in the process of development and creation of innovative products, focused not only on the preservation and transmission of information, but also on the formation of new intellectual value, which is the result of analytical and heuristic activities of users. The use of such systems is critically important for representatives of highly skilled professions who need access to complex knowledge structures during the implementation of complex projects. Expert systems occupy a special place among information systems for processing knowledge. They serve as a tool for accumulating professional experience and expertise of managers, specialists and analysts [15].

The IT market of Ukraine demonstrates gradual development in the direction of introducing modern software complexes focused on supporting management, analytical and production processes. The main market segments include enterprise management systems (ERP), decision support systems (DSS), analytical platforms (BI), CRM systems, as well as specialized industry solutions.

Table 2. Comparative table of software complexes on the Ukrainian market

Category	Product Name	Origin	Main functions	Scope of use	Advantages
ERP	BAS ERP	Ukraine	Accounting, logistics, finance, personnel	Industry, retail	Localization, affordable price
ERP	SAP ERP	Germany	Global Resource Management	Large corporations	Flexibility, scalability
CRM	Creatio	Ukraine	CRM + BPM, process automation	Finance, insurance, telecommunications	Powerful process engine
BI	Power BI	United States	Analytics, visualization, dashboards	All sectors	Integration with Microsoft
BI	YouControl	Ukraine	Verification of counterparties, risk management	Law, Finance, Audit	Data from open registers
Industry	Soft.Farm	Ukraine	Accounting of land, machinery, agricultural analytics	Agro-industrial complex	Specialization, mobility
Industry	Medstar	Ukraine	Electronic medical record, reception	Medical facilities	Complies with national standards

Source: systematized by the author

The data in Table 2 allow you to evaluate the existing software solutions offered for automation of management processes, demonstrating the variety of functionality and advantages of each software package, which allows grain industry enterprises to choose the optimal solutions in accordance with their unique needs. However, in order to maximize the efficiency of activities in a constantly changing market, it is not enough just to implement separate software packages. It is necessary to expand the use of ISPFS, which ensures the integration of various processes and functions into a single system, allowing to automate all stages of production and economic activities of the enterprise.

In the future, we will consider how the expanded use of the DSIS at grain industry enterprises contributes not only to the automation of management processes, but also to the improvement of strategic planning, optimization of production and cost reduction, which are critical for increasing competitiveness in a highly competitive environment.

1. Production process management. One of the main areas where ISPRS is used is the automation of production processes. At grain enterprises, where the processes of growing, harvesting, processing and storing grain require a large amount of resources and precise management, ISPRS helps to optimize the use of all production resources. Thanks to the implementation of such systems, the costs of fertilizers, pesticides and other resources are tracked and planned, which allows you to reduce costs and increase yields. The system automatically analyses data on weather conditions and adapts production plans in real time, which makes it possible to adjust production strategies depending on variable factors.

2. Logistics and supply chain management. ISPRS are effectively used for logistics management at grain enterprises, where product transportation takes up a significant part of the costs. Automation of grain transportation, warehousing and delivery processes is a critical factor in increasing efficiency. With the help of these systems, companies are monitored at all stages - from the purchase of raw materials to the transportation of finished products to customers. The system automatically optimizes transportation routes, reducing delivery time and fuel costs, and also determines the most profitable vehicles for different cargo volumes.

3. Financial management and accounting. Automation of financial processes, accounting of costs and revenues is an important aspect for ensuring the stability of grain industry enterprises, where financial flows have a diverse structure, from the purchase of seeds to the sale of finished products. Thanks to the integration of the system with accounting and financial programs, enterprises are able not only to control the costs of growing and processing grain, but also to forecast profitability in the face of changing raw material prices on world markets. ISPR helps to automatically generate financial reports, which simplifies management planning and increases the transparency of financial transactions.

4. Product quality monitoring. The quality of grain and products from it is one of the main components of competitiveness in the market. ISPRs allow integrating information on the quality of raw materials and finished products, which ensures timely correction of detected violations. The system collects data on moisture, the amount of impurities, and the physical properties of grain during acceptance into warehouses and during processing, which allows you to monitor product compliance with standards and respond in a timely manner to changes that may affect the final product.

5. Forecasting and market analytics. ISPRS integrate information from the market, allowing grain enterprises to forecast demand and plan production taking into account changes in the market. Enterprises use ISPRS to forecast grain demand depending on seasonal fluctuations and the economic situation, analyzing market trends, exchange rates, and yield forecasts, which allows the enterprise to plan purchases and sales more effectively, which allows you to make informed decisions on pricing and optimize sales strategies.

6. Human resources management. An important aspect for grain enterprises is effective human resources management. ISPRS allow you to automate hiring, distribution of duties, planning work shifts, and assessing employee productivity. The system automatically generates employee work schedules based on production plans, as well as calculates wages and monitors task performance, thereby reducing administrative costs and increasing work efficiency.

7. Environmental and social responsibility. ISPRS can be used to manage the environmental aspects of an enterprise's activities, which is important for sustainable development and compliance with environmental standards. Companies use ISPRS to monitor the environmental impact of their activities. The system tracks water consumption, energy and CO2 emissions, which allows the enterprise to optimize these resources and meet modern requirements for sustainable development.

7. Research results

The conducted research has confirmed the growing role of decision support information systems in enhancing the adaptability and resilience of enterprises, particularly in high-risk and unstable environments such as the Ukrainian grain sector. Based on the analysis of practical cases from leading Ukrainian enterprises, the following key results were obtained:

1. Optimization of production processes: DSIS allowed enterprises to reduce production costs by 10–15 % through automated resource planning, real-time adaptation to weather and environmental conditions, and data-driven production forecasting.
2. Improvement in logistics efficiency: Implementation of DSIS enabled 12–18 % reduction in transportation costs and delivery time due to optimized routing, load management, and predictive logistics algorithms.
3. Increased financial transparency and control: Enterprises using DSIS achieved faster and more accurate financial reporting, improved budgeting accuracy, and enhanced decision-making regarding capital allocation, which contributed to financial stability in a volatile market.
4. Enhanced quality management: Integration of DSIS into product quality control processes improved early detection of defects by 25 %, reducing reprocessing costs and increasing customer satisfaction.
5. Data-driven forecasting: DSIS-based analytics helped enterprises improve market forecasting accuracy by up to 20%, enabling more agile production planning and pricing strategies.
6. Human resource optimization: Automation of HR functions through DSIS led to better workforce scheduling, reduced administrative workload, and improved staff productivity indicators by 15 %.
7. Sustainability monitoring: Enterprises implementing DSIS were able to monitor environmental performance indicators (CO_2 emissions, water and energy use), leading to better compliance with environmental standards and improved ESG ratings.

A comparative analysis of software solutions available in the Ukrainian market (Table 2) confirms that enterprises that adopted integrated DSIS platforms – such as ERP, CRM, and BI tools – demonstrated higher performance, faster response to external challenges, and improved operational flexibility. The cumulative effect of implementing DSIS in these enterprises not only contributed to short-term cost optimization but also significantly strengthened their long-term resilience and strategic adaptability.

8. Prospects for further research development

The conducted research has confirmed the significant potential of decision support information systems for strengthening the adaptability and resilience of enterprises. However, the dynamic nature of external challenges and the rapid development of digital technologies open up a wide range of prospects for further research.

Promising directions for future studies include: integration of artificial intelligence and machine learning algorithms into DSIS to improve the accuracy of risk forecasting, scenario analysis, and automated decision-making processes under uncertainty; development of industry-specific DSIS models, particularly for enterprises in the agro-industrial, logistics, and energy sectors, taking into account their unique technological cycles and risk profiles; assessment of the digital maturity of enterprises as a determinant of the effectiveness of DSIS implementation and a basis for developing

personalized digital transformation strategies; research into the institutional and infrastructural barriers that hinder the large-scale adoption of DSIS in Ukraine, including issues of cybersecurity, staff qualifications, and integration with state digital platforms; design of hybrid management architectures that combine traditional hierarchical management approaches with data-driven, adaptive decision-making systems based on real-time data flows; study of the impact of DSIS on corporate sustainability indicators (ESG criteria), including environmental monitoring, social responsibility, and governance transparency; international benchmarking of best practices in the use of DSIS in crisis and post-crisis management, with the aim of adapting such experience to national realities.

9. Conclusions

In the context of increasing environmental turbulence, digital transformation, and systemic risks, decision support information systems have proven to be a key tool in strengthening the adaptability and resilience of enterprises. The research has shown that DSIS contribute to improving the quality, speed, and justification of managerial decisions by integrating data flows, analytical models, and scenario planning into a unified management process.

The practical cases analysed confirm that enterprises actively using DSIS demonstrate greater operational flexibility, more effective resource management, better preparedness for external shocks, and increased competitive sustainability. In particular, the implementation of DSIS in Ukrainian grain industry enterprises led to measurable improvements in production efficiency, logistics, finance, personnel, and quality management. The study also emphasizes that the effectiveness of DSIS depends on a set of internal and external factors, including digital maturity, availability of IT infrastructure, staff competencies, and the ability to adapt organizational structures to data-driven management logic. Thus, DSIS are not just a technological solution but a strategic management tool that ensures proactive response to changes, reduces uncertainty, and creates conditions for long-term sustainable development. Their further development and implementation require an interdisciplinary approach combining management science, information technology, risk management, and organizational development.

The conclusions drawn from the research lay the groundwork for deepening scientific inquiry and developing practical recommendations for enhancing enterprise stability through digital decision-making tools.

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