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DIGITAL TOOLKIT FOR INDUSTRIAL AND SERVICE MANAGEMENT: FEATURES AND STRUCTURE

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ЦИФРОВИЙ ІНСТРУМЕНТАРІЙ ПРОМИСЛОВОГО ТА СЕРВІСНОГО МЕНЕДЖМЕНТУ: ОСОБЛИВОСТІ ТА СТРУКТУРА

The relevance of the research is driven by the fact that the digital toolkit of industrial and service management includes various means of data collection, analysis, visualization, and management, enabling enterprises to engage in more precise planning, efficient resource utilization, process optimization, and improved customer service. Thus, the article is aimed at identifying and visualizing the characteristics of the formation of digital tools in industrial and service management. Within the study, attention is drawn to the fact that considering a wide range of functionalities, the digital toolkit of industrial and service management is a synthesis formed as a complex of technologies, software tools, and information systems integrated together to achieve a common goal — optimizing, automating, and enhancing the efficiency of its core processes. Consequently, the conclusion is drawn that among the components of the digital toolkit for industrial and service management, there is a wide set of tools, including monitoring and diagnostic tools, analytical instruments, data management tools, production, and service management tools, customer relationship management tools, enterprise resource planning tools, mobile applications, and user interfaces. These tools are further detailed within the framework of three fundamental elements, which constitute the basis of digitizing core production and service processes, as well as operational management processes within the production and service systems. It has been demonstrated that the fundamental functional structure of the digital toolkit for industrial and service management should contribute to automation, optimization, and enhancing efficiency. Thus, within the framework of the basic functional structure of digital tools for industrial and service management, there are functional elements of industrial and service management automation, functional elements of optimization of industrial and service management, and functional elements of enhancing efficiency in managing industrial and service management processes.

Актуальність дослідження обумовлена тим фактом, що цифровий інструментарій промислового та сервісного менеджменту охоплює різноманітні засоби збору, аналізу, візуалізації та управління даними. Це дозволяє підприємствам здійснювати більш точне планування, ефективніше використовувати ресурси, вдосконалювати виробничі процеси та покращувати якість обслуговування клієнтів. Отже, стаття спрямована на ідентифікацію та візуалізацію загальних та структурних особливостей формування цифрового інструментарію промислового та сервісного менеджменту. У межах дослідження звернуто увагу на той факт, що, враховуючи широкий спектр дії, цифровий інструментарій промислового та сервісного менеджменту є синтетичною структурою, яка формується як комплекс технологій, програмних засобів та

інформаційних систем. Ці елементи інтегруються разом для досягнення спільної мети — оптимізації, автоматизації та підвищення ефективності базових управлінських та основних процесів. При цьому зроблено висновок, що серед складових цифрового інструментарію промислового та сервісного менеджменту широке коло інструментів, зокрема: моніторингу та діагностики, аналітичних та засобів управління даними, управління виробництвом та сервісом, управління відносинами з клієнтами, планування ресурсів підприємства, мобільні додатки та інтерфейси для користувачів. Ці інструменти деталізуються у межах трьох базових блоків, які є основою цифровізації базових виробничих та сервісних процесів, а також процесів управління функціонуванням виробничої та сервісної систем. Доведено, що базова функціональна структура цифрового інструментарію промислового та сервісного менеджменту основа його автоматизації, оптимізації та підвищення ефективності. Констатовано, що у складі базової функціональної структури цифрових інструментів промислового та сервісного менеджменту наявні такі функціональні елементи: автоматизації промислового та сервісного менеджменту; оптимізації промислового та сервісного менеджменту; підвищення ефективності управління процесами промислового та сервісного менеджменту.

Key words: precise planning; data management; efficiency; resource utilization; automation; optimization.

Ключові слова: точне планування; управління даними; ефективність; використання ресурсів; автоматизація; оптимізація.

TARGET SETTING

The digital toolkit for industrial and service management is a set of technologies, software tools, and information systems aimed at automating, optimizing, and enhancing the efficiency of production and service processes in industry and service sectors. It encompasses various tools for data collection, analysis, visualization, and management, enabling enterprises to achieve more precise planning, efficient resource utilization, optimization of production processes, and improvement of customer service. Therefore, the use of digital tools is becoming increasingly important for enterprises in any industry, considering its direct impact on competitiveness, adaptability, and flexibility in fast-paced market environments.

ANALYSIS OF RESEARCH AND PUBLICATIONS

Significantly, digital transformation has become one of the key topics in the modern world, including Ukraine. Most researchers, including Mashika Hanna, Zelic Victoria, Kiziun Alla, Maslyhan Roman, and others, emphasize the importance of understanding digital transformation and the need for in-depth study not only of strategies and methods but also of specific digital tools used to transform management practices concerning human resources, production resources, and customer service. However, it is worth noting that this process is extremely broad and complex, and it is best defined by describing the characteristics and structure of the digital toolkit, which forms the basis of this outlined process.

THE WORDING OF THE PURPOSES OF ARTICLE (PROBLEM)

The article aims to identify and visualize the general and structural characteristics of forming the digital toolkit for industrial and service management.

THE PAPER MAIN BODY WITH FULL REASONING OF ACADEMIC RESULTS

Given its wide-ranging action, the digital toolkit for industrial and service management is a synthesis formed as a complex of technologies, software tools, and information systems integrated to achieve a common goal: optimizing, automating, and enhancing the efficiency of its core and managerial processes. We are talking about:

1. Primary production processes. Namely, a series of specialized actions and operations aimed at transforming input materials or resources into finished products or services, such as raw material processing, component assembly, product assembly, quality control, packaging, and others (depending on the specific type of product [4]);

2. Primary service processes. Specifically, a series of specialized actions aimed at providing a service and encompassing all aspects of its delivery (from service ordering to execution and post-sale servicing [1]).

3. Processes of managing the functioning of production and service systems. Specifically, a series of processes resource utilization, ensuring product or service quality, and achieving the organization's strategic goals [1].

Thus, among the possible components of such a toolkit, there is a wide range of tools, including (see Figure 1) monitoring and diagnostic tools, analytical tools and data management tools, production and service management tools, customer relationship management tools, enterprise resource planning tools, mobile applications, and user interfaces.

Let's further elaborate on the components of the digital toolkit for industrial and service management mentioned above:

1. Monitoring and diagnostic tools — a set of technologies aimed at continuously tracking the condition of equipment, processes, or systems to detect potential issues or malfunctions. To integrate industrial and service operations, technologies such as equipment unit

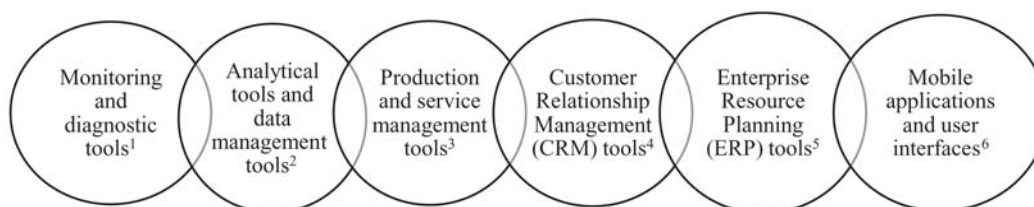


Figure 1. Components of the digital toolkit for industrial and service management

Note:

1 These tools are key to supporting the efficient and safe operation of technical systems in industrial and service sectors, helping to prevent accidents and optimize maintenance and repair processes.

2 These tools allow enterprises to effectively utilize their data for making informed decisions, refining production processes, improving product quality, and enhancing competitiveness.

3 These tools enable the coordination of production processes, task allocation among workstations, and performance monitoring.

4 These tools enable the collection and analysis of customer information, order management, and provision of quality service.

5 These tools integrate order management, inventory, finances, and resources to ensure optimal resource utilization within the enterprise.

6 These tools provide convenient access to information and the ability to manage processes from various devices and locations.

Source: formed based on [1; 4; 6].

Table 1. Visualization of the operation of analytical tools and data management tools in the field of industrial and service management

Tools	Description of tools
Data collection and integration	Analytical systems are capable of collecting data from various sources such as databases, sensors, web servers, and integrating them into a unified platform for further processing
Data cleansing and preparation	The process of detecting and correcting errors in data, its structure, as well as converting data into a format suitable for further analysis
Data analysis	The process of applying various methods and algorithms to uncover useful information, trends, patterns, and insights within a dataset
Data visualization	The process of displaying analysis results in the form of graphs, charts, dashboards, and other visual elements for convenient information perception
Forecasting and modeling	The process of using data to build predictive models or simulation analyses to forecast future events or assess decision-making options
Information flow management	The process of data management, ensuring efficient management of information flows, data access, and security

Source: formed based on [1; 2; 4].

Table 2. Visualization of the operation of production and service management tools in industrial and service management

Tools	Description of tools
Planning and differentiation of production tasks	Resource allocation process, determining the time and sequence of task execution to optimize production processes
Inventory and supply chain management	Inventory tracking process, raw material and component procurement planning, and supply chain optimization
Quality management	Establishment and control of product quality standards and service delivery
Monitoring and control of production processes	Equipment condition monitoring process, product quality control, and response to issues
Inventory and supply chain management	Inventory tracking process, raw material and component procurement planning, and supply chain optimization
Performance analysis and reporting	Analysis of the productivity of production and service processes, generation of reports and statistics for managerial decision-making

Source: formed based on [2; 4].

identification (via microchips with unique identifiers), monitoring changes in equipment operation (through specialized sensors), data processing and storage from sensors (via embedded computers), information exchange between devices (via wireless network technologies), and data transmission (optimized and lightweight protocols like MQTT) are employed.

2. Analytical and data management tools — a set of software, technologies, and methods designed for the collection, storage, processing, analysis, and utilization of large volumes of data to obtain valuable insights for decision-making and optimization of production or business processes. These tools, according to their inherent scope of action (see Table 1), are utilized for the analysis and visualization of large volumes of data collected from various sources, aiming to identify trends, forecast events, and facilitate decision-making.

3. Production and service management tools comprise an integrated suite of software and technologies aimed at efficiently managing manufacturing processes and service operations within an enterprise. These tools, in accordance with their inherent scope of action (see Table 2), are utilized for coordinating production and service processes, distributing service and production tasks, and monitoring productivity.

4. Customer Relationship Management (CRM) tools — integrated software and strategies designed for effective management of customer relationships within an enterprise. These tools, according to their inherent spectrum of action (Table 3), enable the collection and analysis of customer information, order management, and provision of quality service.

5. Enterprise Resource Planning (ERP) tools are integrated software solutions that enable the automation and optimization of managing various aspects of a company's operations, including production, logistics, finance, inventory management, human resources, and more. These tools, according to their characteristic scope of action (Table 4), enable the integration of order management, inventory, finances, and resources management to ensure the optimal utilization of enterprise resources.

6. Mobile applications and interfaces for industrial and service management systems — software designed for use

on mobile devices such as smartphones and tablets. They provide users with the ability to interact with various services, functions, and features through a convenient interface. These tools, according to their characteristic range of action (Table 5), provide convenient access to information and the ability to manage processes from different devices and locations.

In fact, the synthetic toolkit is created based on various technologies, software tools, and information systems, detailed within the framework of three basic elements, which form the basis of digitizing fundamental production and service processes and management processes of the functioning of production and service systems.

The basic functional structure of the digital toolkit for industrial and service management aims to perform the functions of automation, optimization, and efficiency enhancement (Figure 2).

This is because these functions constitute the functional scope of each digital tool, reflecting qualitatively new processes synthesized by these tools in production or customer service. Thus, it includes: functional elements for automation of industrial and service management (function — automation of routine actions and operations); functional elements for optimization of industrial and service management (function — improvement of processes and resource utilization); functional elements for enhancing efficiency in managing processes of industrial and service management (function — enhancement of managerial processes and decision-making).

So, the subsystem of industrial and service management automation encompasses various tools and technologies aimed at creating self-regulating systems for executing routine operations, as well as management control systems for production and servicing. It is used to automate manufacturing processes (including raw material processing, component and product assembly, and packaging), monitor equipment status, process orders (requests for specific services), and many other tasks, which help increase efficiency and reduce costs at the enterprise.

The subsystem of optimization in industrial and service management is aimed at finding optimal solutions and utilizing resources in the most efficient manner possible.

It includes data analysis, process modeling, forecasting, and other methods to determine the most optimal strategies and actions in the field of production and service.

The subsystem of improving efficiency in industrial and service management is oriented towards enhancing productivity and performance of production and service processes. It includes tools for implementing management standards and procedures, as well as reducing costs and resource utilization.

CONCLUSIONS FROM THIS STUDY AND PROSPECTS FOR FURTHER EXPLORATION IN THIS AREA

Within the study, attention is drawn to the fact that the digital toolkit of industrial and service management is a synthesis formed as a complex technology, software tools, and information systems integrated to achieve a common goal — optimization, automation, and enhancement of the efficiency of its core processes. The following conclusions have been drawn:

Table 3. Visualization of the action of customer relationship management (CRM) tools in industrial and service management

Tools	Description of tools
Collection and storage of customer information	The process of gathering and storing diverse information about customers, including contact details, interaction history, past purchases, preferences, and other pertinent data
Analysis and segmentation of the customer base	The process of analyzing customer information to identify their needs, behavior, and segmentation for more effective management of interactions
Management of contacts and interactions with customers	The process of planning, tracking, and managing all types of customer interactions, including phone calls, emails, personal meetings, and other communication channels
Automation of marketing processes	The process of automating marketing processes, including email campaigns, managing advertising campaigns, and analyzing results.
Sales management and tracking of potential deals	The process of tracking the entire product and service lifecycle (from production to actual sale), as well as planning and forecasting sales.
Analytics and reporting	The process of analyzing data and creating reports on the effectiveness of marketing and sales activities, customer satisfaction, and other performance metrics

Source: formed based on [3—4; 6].

Table 4. Visualization of the action of enterprise resource planning tools

Tools	Description of tools
Integration of all departments and functional areas	The process of integrating all aspects of the company's operations into a unified system, enabling efficient interaction between different departments and optimizing workflow processes
Centralized database	The process of storing information about the company's activities, ensuring its integrity and accuracy
Process automation	The process of automating routine operations, reducing the need for manual work, and increasing operational efficiency
Standardization of processes	The process of implementing standard procedures and practices to improve the quality and efficiency of operations.
Ensuring access to information	The process of providing access to various types of information to different users according to their roles and permissions
Decision support	The process of analyzing data and making informed decisions based on real data.
Elimination of isolated systems	The process of eliminating isolated systems and platforms, which facilitates management and reduces the risk of data loss

Source: formed based on [3—5].

Table 5. Visualization of the action of mobile applications and interfaces for users of industrial and service management systems

Tools	Description of tools
Adaptability for accessing the service from various devices	The process of adaptive access to services from different devices, allowing them to work efficiently on various devices
Service functionality	A wide range of functions, including access to information, communication, financial transactions, entertainment, organizing work processes, and so on
Service personalization	The process of personalizing services for each user by customizing the functionality and format of the application according to individual needs
Productivity optimization	The process of enhancing users' productivity by providing access to tools for working with documents, calendars, tasks, etc.
Updates and support	Continuous updates and support, enabling to enhance their functionality and ensure security of use

Source: formed based on [4].

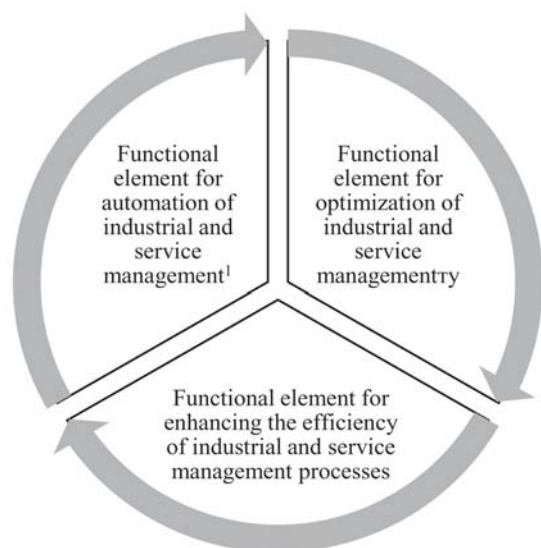


Figure 2. The basic functional structure of the digital toolkit for industrial and service management

Note:

1. Generalizes all tools that contribute to automating production processes, monitoring equipment status, processing orders, and many other tasks, helping to increase efficiency and reduce costs in the enterprise. This category of tools can be summarized under the term "integrated system for automating production processes".

2. Generalizes all tools that provide data analysis, process modeling, forecasting, and other methods to determine the most optimal strategies and actions in the field of production and services.

3. Generalizes all tools that provide implementation of management standards and procedures, as well as cost reduction and resource utilization.

Source: formed based on [1; 4; 6].

1. Among the components of the digital toolkit for industrial and service management, there is a wide range of tools, including: monitoring and diagnostic tools, analytical tools, data management tools, production and service management tools, customer relationship management tools, enterprise resource planning tools, mobile applications, and user interfaces. These tools are detailed within the framework of three fundamental elements that form the basis of digitizing core manufacturing and service processes, as well as management processes for the functioning of production and service systems.

2. The fundamental functional structure of the digital toolkit for industrial and service management should perform the functions of automation, optimization, and efficiency enhancement, as these functions constitute the functional core of each digital tool. Thus, it includes: functional elements of industrial and service management automation (based on self-regulating technical means, econometric tools, and control systems for production and service actions and operations); functional elements of industrial and service management optimization (based on various tools for improving the quality of production and service processes to ensure competitiveness and meet customer needs); functional elements of improving the efficiency of industrial and service management processes (based on tools and systems that contribute to achieving better performance results).

According to the obtained results, further research perspectives lie in exploring contemporary trends and challenges in the development of digital tools for industrial and service management.

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