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Service Business Model - a New Approach to Improving Efficiency in the Digital Economy

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ABSTRACT
Active development of digital technologies (cloud, big data processing, business analytics, etc.), communication technologies, the Internet of things, which is based on a wide offer and the possibility of using a variety of sensors, and other machines that allow you to remotely transmit various data in real time about the operation of equipment, led to the emergence of a new model of business organization - a service model. The concept of the aggregate supply of industrial products and services for their operation, and the provision of them "as services" is gaining high development speed in the modern economy, capturing more and more new areas and areas of business. The article shows the essence, main features and benefits of predictive services, as the basis of the service model of a business, directions and prospects of its development. It is shown that the service business model provides a new level of competitiveness for both enterprises - manufacturers of equipment, and all participants in the value chain. The active development of modern intelligent digital systems allows to consider the service business model as a very promising direction for increasing the efficiency of production chains and building business ecosystems.
Keywords: *digital economy, business transformation, service model of business, remote monitoring, predictive analytics, predictive maintenance*

1. INTRODUCTION

The modern development concept of Industry 4.0 [1] is fundamentally changing the requirements for the organization of industrial companies. Production companies should ensure not only the release of modern high-quality products, but also a high level of operational efficiency.
One of the factors that have a significant impact on the productivity and costs of industrial enterprises in the b2b sector is equipment breakdown or failure, and as a result, unplanned downtimes leading to production shutdowns, supply disruptions, cost increases, loss of customers, etc.
For example, according to a 2006 report by Nielsen Research, stopping a conveyor at an automobile plant costs the enterprise up to $ 1.3 billion per hour. As a result of a survey conducted in 2017 by Oneserve consulting agency, British manufacturers lose up to 3% of their working days per year due to breakdowns.
According to Deloitte consulting company reports, downtime around the world costs $ 50 billion to organizations around the world and 42% of them are caused by equipment breakdowns.
On average, the cost of maintenance and repair of equipment, depending on industry, the size of the enterprise and the age of the equipment is from 10 to 40% of the cost of production, and the proportion of unplanned work can reach up to 60%. Therefore, the management of the operation of the equipment, the optimization of its maintenance and repairs are the most important aspect of attention in modern world industrial practice.

2. SHORT BREAKDOWN OF THE HISTORY

Historically, the first type of equipment maintenance was its restoration (repair or replacement) upon the fact of its failure - Reactive Maintenance. Equipment downtime cause significant material and image losses for enterprises. The next step was the introduction of preventive scheduled maintenance and repairs (PSM, TS) in accordance with a pre-compiled plan (Preventive Maintenance). This allows to anticipate equipment failure and reduce the associated losses, but at the same time, in some cases, it is redundant (the equipment could still work) and requires significant costs for the maintenance of the spare parts stock. In addition, the consequences of failure of various types of equipment vary from critical to minor.
Today, the basic concept of equipment maintenance is a rational combination of previous types of services, ensuring the safety of its operation on the basis of continuous or periodic assessment of its operation, and economic cost-effectiveness - RCM (Reliability Centered Maintenance), which underlies predictive maintenance (anticipating failures predicted) (Predictive maintenance) (Fig. 1).

Technical management of 20th century

Equipment exploitation till failure	**Reactive Maintenance**	**Preventive Maintenance**

Modern Technical management

Reactive Maintenance	**Preventive Maintenance**	**Predictive Maintenance**

Figure 1 Change in equipment maintenance approaches

The RCM methodology consists in defining the moment when the performance of the equipment begins to deteriorate and can lead to its failure. Maintenance is carried out at a time when it is most appropriate and cost-effective. Digital technologies in 24×7 mode allow you to monitor the current condition of the equipment, report on the need for its maintenance before its breakdown, and timely organize the work of service departments.
This concept was proposed by S. Noulan and G. Hill [2], and was applied first in the aviation industry, where the consequences of critical node failure are catastrophic [3], and then in nuclear and hydropower in the 1980-1990s. Since the mid-2000s, it has become widespread at wind power enterprises, enterprises of the electric grid, oil and gas complex, etc. [4].

3. THE NATURE AND BENEFITS OF PREDICTIVE MAINTENANCE

Predictive maintenance is a digital service, and it consists in remote automated monitoring of equipment (machines, mechanisms, components) in real time based on wireless sensors, streaming data analytics that provide early, high accuracy detection of signs of potential failures, and the formation maintenance programs for each type or item of equipment depending on its condition, resource optimization.
According to international experience on average this provides the following effects:

- savings on maintenance costs from 10% up to 40%;
- reduction in warranty costs;
- reduction of breakdowns, failures and delays in equipment operation - up to 25%;
- reduction of equipment downtime - up to 50%, as a result - its greater productivity and greater output of products or services;
- an increase in the service life of equipment to 5%, a decrease in the frequency of its maintenance, and a reduction in the cost of its replacement;
- higher quality equipment setup - improving product quality;
- greater customer satisfaction. [5].

Data on the operation of the equipment, obtained remotely in the 24 × 7 mode, combined with the capabilities of digital modeling of its operation, can significantly protect the production from human factors, quickly make informed decisions to reduce potential operational and financial risks and prevent situations with a threat to personnel and work processes, to ensure efficient uninterrupted operation of enterprises and optimization of production processes.
A predictive monitoring system using artificial intelligence and machine learning technologies allows not only to carry out current diagnostics, but also to track and identify an unusual combination of parameters, unexpected surges, and simulate potential difficulties, predict their impact on the work. The system allows you to constantly develop, learn and interpret current data through the model. At the same time, modeling and analysis can be carried out both in the company and remotely, in the "cloud".
The generation and analysis of "big data" on the operation of this and identical equipment allows us to simulate realistic scenarios of its operation, and due to this, reduce the risks of accidents, including those with adverse environmental impacts, and reduce losses to eliminate adverse consequences. And, in addition, it is the basis for the modernization of equipment and the extension of its life cycle.
The analytical capabilities of modern intelligent digital systems allow the use of data on technological production processes to improve the technical and economic indicators of both manufacturers and the entire value chain as a whole.
According to Markets and Markets, the global predictive services market in 2020 will reach $ 1.9 billion (compared to 582 million in 2015). Key players in the world are General Electric, Siemens, ABB, Emerson, IBM, SAS, Schneider Electric and others.

4. SERVICE BUSINESS MODEL - A NEW TREND IN THE DIGITAL ECONOMY

The service business model is a relatively new phenomenon in the world economy, based on a comprehensive offer of industrial products and services for their operation (maintenance, repair, etc.) during their service life. It is based on high standards of product and service quality to increase the efficiency of work, primarily for customers, provides for new integrated forms of its interaction with the manufacturer.

The concept of combining customers' business processes, data collection infrastructure, remote monitoring applications and predictive analytics, and providing them "as services" is very actively developing in the modern economy.

The service business model requires the introduction of special software that allows you to receive information from industrial sensors, analyze the actual condition and predicted performance of the equipment, and, on this basis, provide constant feedback with the consumer and service departments.

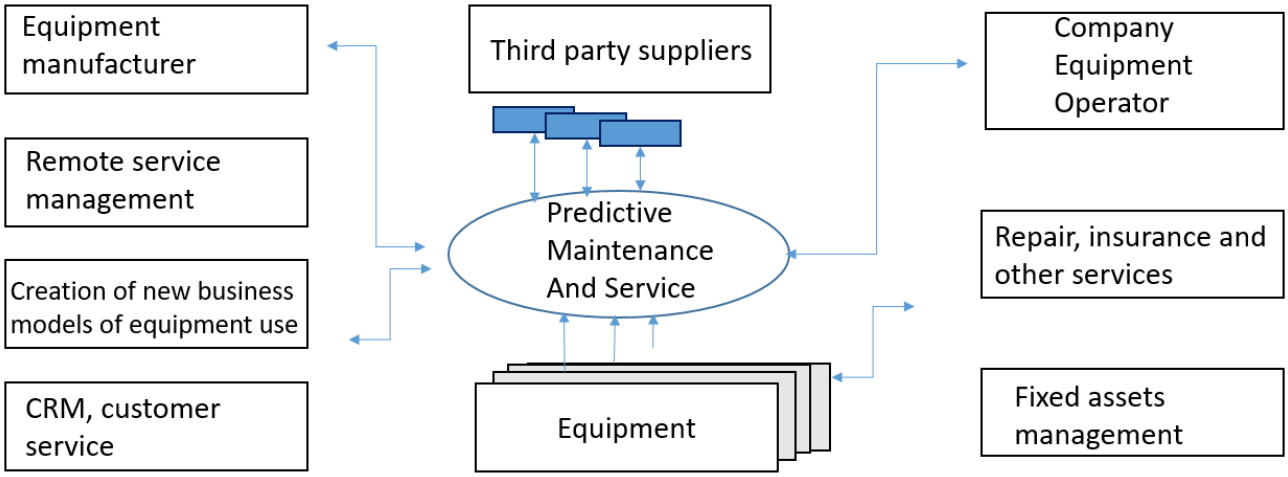

Figure 2 Service business model

The main participants of the partnership in the service business model are: specialized suppliers of comprehensive solutions for the analysis of statistical data (vendors, system integrators), companies engaged in the development, production, service warranty and after-sales service of equipment, service companies specializing in equipment maintenance and repair, insurance companies etc. Service can be performed either by the manufacturer company itself or be outsourced.

The integrated interaction of participants allows you to switch to a different type of organization and production management, to form an integrated customer-oriented business ecosystem, focused on a new level of service and communication development.

For example, the French company Michelin - a manufacturer of tires for heavy vehicles, sells to customers not tires, but their mileage. Consumers get tires for free. The combination of sensors and analytical data allows companies to control the driver's work, fuel consumption and tire wear to provide comprehensive services [1].

Thus, Michelin moved into a new segment of the value chain, offering not the product itself - tires, but its consumer value in the form of a service. Customer pays mileage. Tires as part of the service, users receive for free. Partner companies (services, insurance, etc.) provide service, tire replacement, tracking on the basis of the received data the appropriate replacement points.

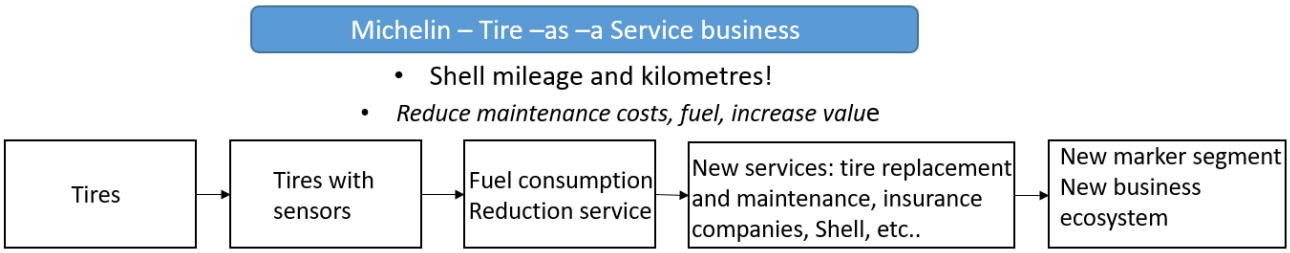

Figure 3 Michelin Service Business Model [6] .p.289

Rolls-Royce created a business service model based on intelligent machine learning services and the "Internet of Things" Microsoft Azure cloud, offering customers to pay for operating hours rather than aircraft engines themselves. It has equipped over 13,000 of its commercial turbine

aircraft turbines with sensors that transmit data to a system that monitors and analyzes their condition.

TotalCare service includes: monitoring the technical condition of equipment, overhaul of the engine, work to increase its reliability, as well as transportation of the engine, maintenance of spare engines, technical data management, support line. [7].

An analysis of the data received from each item of equipment of the aircraft and its engine, comparing them with data from other aircraft, allows you to pre-warn about the ineffective operation of a particular element and recommend its replacement or maintenance until the passport service life is reached, as well as postpone ongoing maintenance or replacement parts stable operation in normal mode.

Airlines using Rolls-Royce predictive service solutions can identify operational problems and subtle flight data errors, develop solutions to prevent future crashes, and make recommendations for improving flight and maintenance schedules and others [8].

Changing the approach to aircraft diagnostics and servicing, a significant accumulated data on equipment operation and its maintenance experience, allow the company to avoid equipment malfunctions, optimize its operation, significantly improve flight safety, preventing serious breakdowns, and reduce fuel consumption, which saves air carriers in $ 250,000 a year on one plane.

The manufacturer itself also benefits significantly as a result of this strategy: Rolls-Royce was able to “conclude larger contracts and create a more sustainable production program, its business became more predictable, and it is growing both in the sales segment of its own spare parts and in the service segments the market, the turnover from which for Rolls-Royce exceeds the turnover from the equipment segment by more than four times. " [7].

In the electric power industry, the transition to a predictive analytics system allowed generating companies not only to reduce equipment maintenance costs by more than $ 4.5 million, to avoid 90% unplanned shutdowns and, consequently, energy generation losses, and to reduce specific fuel consumption by optimizing modes equipment operation (by 0.5%), but also reduce the size of the insurance premium by 40%. [9].

For the customer, service contracts radically change the situation in the following areas:

- service becomes part of the overall asset management process;
- the consumer value of the product is paid: they used to buy equipment, and then, as necessary, paid for its maintenance, today customers pay for the equipment to work flawlessly.
- ensuring the optimal working process of production equipment - the customer receives customized services of an agreed level for individual maintenance of the equipment and each of its components with regular feedback, ensuring the reliability and safety of the equipment, its efficiency and high productivity;
- ensuring the optimal workflow of the entire technological production chain due to the coordinated analytics of data received from equipment and other systems and elements of the entire production system;
- a change in the predictability, magnitude and structure of costs: from the category of capital costs for the purchase of equipment, they move into the category of predictable operational costs for its maintenance, which significantly reduces both the total costs themselves and the total cost of ownership.

Manufacturing companies also win:

- this model significantly increases the competitiveness of equipment manufacturers. Large arrays of data on products and their use allows you to develop new, improved versions and attract more different customers;
- predictability of demand for equipment and spare parts for it;
- optimization of own production, resource and sales management;
- increases the speed and flexibility of responding to changing business conditions;
- the economies of scale of reducing costs for the use of equipment allows for an increase in the share of extended contracts and a high customer focus on the business;
- reduces the cost of maintaining warranty centers by reducing the need for warranty repairs;
- creation of new profit centers. Growth in producer incomes both in equipment segments and in service sales segments;
- new opportunities for entering the market, which previously were not available;
- business diversification in the direction of creating service centers and training users of service companies;
- reducing costs and increasing the speed of equipment modernization and innovation.

Higher value is created from a combination of assets. The partnership work model provides significant benefits for all participants in the service business model.

5. PROSPECTS FOR APPLYING THE SERVICE BUSINESS MODEL

The service business model is universal, it is actively developing in various areas of the B2B segment.

The most common forms of payment for services are:

- payment for the operation of the equipment;
- payment for mileage;
- hourly pay for equipment;
- payment for the output of products from equipment (minimum guaranteed volume of production);
- payment for work under load (transformer production);
- payment for transported weight (rocks in the mining industry);
- payment for coffee beans purchase volumes (sale of office coffee machines), etc.

In each case, for the use and development of the service model can be selected its own way of measuring consumer value, tied to the unique results of the business. And for each client there may be an agreement on the level of service.

Today, predictive maintenance is used in situations when the equipment used in the production process is considered complex, expensive, and critical (the price of the issue of failure, equipment downtime, reliability of production and technological processes critical for the enterprise's activities, etc.).

The main areas of application of the service business model in world practice are: mechanical engineering, electric power, chemical, mining, oil and gas, metallurgy, transport.

However, the possible areas of application and prospects for the development of the service model are much wider. This is not only all branches of mechanical engineering and instrument engineering, focused on the B2B sector. Improving security and reducing the influence of the human factor on business results determine the relevance of creating such models in the B2C sector.

For example, Bosch today offers car manufacturers an innovative predictive diagnostic software solution that continuously monitors, evaluates and reports on the status of components and systems in the car. Based on the data of the connected vehicle, malfunctions can be predicted, the probable remaining life and service life of each node and component can be calculated, a notification of the driver is made, maintenance is planned, etc.

In the production of electric vehicles, the manufacturer, using predictive maintenance, can evaluate not only the condition of the car, but also the behavior of the driver, and ask him to come for service when necessary. Individual, unobtrusive service enhances customer satisfaction.

The implementation of the service model is quite actual in medicine, including to hospitals and clinics, utilities, telecommunications systems, mobile communications, trade, etc.

With the active development of the systems such as "smart home", smart city "," smart government ", etc. the demand for a service business model will increase.

The development of various self-service systems also requires a high level of preparation for flawless operation.

The rapidly evolving digitization of production requires reliable service.

Predictive service provides not only an increase in the consumer value of industrial products, but also acts as a separate value proposition and an independent source of income. Today, in the conditions of the international division of labor and the internationalization of production, the prerogative of state development of countries is no longer the development of their own mechanical engineering and instrument making. Service centers and structures, service business infrastructure, being new profit centers in the value development chain, can provide accelerated development of other industries.

Stimulation in the form of state regulation programs for creating service structures with world leaders in the production of certain equipment, partnership programs for the transition to predictive services, can provide various effects of the development of country systems of national economy:

- the multiplicative effect of the development of various industries and fields of activity;
- the growth of national income and increased employment through the development of service, repair centers, country services;
- cost reduction in industries monopolists interested in the cost-based approach to business organization;
- identification of fraud in a number of business structures, etc.

In the near future, most companies will improve their activities based on forecasts of equipment maintenance.

6. SUMMARY

The active development of methods and tools for digital monitoring and predictive maintenance of industrial equipment provides new opportunities for creating new, more efficient business organization models.

The concept of a comprehensive offer of industrial products and services for their operation "as services" is being implemented today by an increasing number of companies in various fields of activity in the form of a service model for organizing a business.

The service business model becomes a new tool for ensuring the competitiveness of modern business, allows you to create an integrated customer-oriented partner ecosystem of business, combining various parts of the value chain: production, operation, service, design of industrial products into a single solution.

The integrated interaction of participants allows us to switch to a different type of organization and production management, eliminate the most acute problems of company inefficiency: eliminate hierarchy, transfer market interactions into large horizontal networks and structures, efficiently use total assets, avoid overproduction crisis, reduce costs.

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