

EFFECTIVE USE OF DIGITAL TECHNOLOGIES AND MATHEMATICAL FORMULAS IN APPLYING FOREIGN EXPERIENCE IN WASTE PROCESSING

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ABSTRACT:

Digital technologies are information management and processing technologies, in which work is carried out on operations such as storage, protection, recycling of waste products. Although digital technologies have existed at various stages of human development, the characteristic feature of the current digital and information society is that, for the first time in the history of civilization, the energy, raw materials, materials and material consumption items used for the acquisition and production of knowledge the use of mathematical formulas prevails in the reduction of expenses, that is, digital technologies take a leading place among existing new technologies.

KEY WORDS:

Digital technologies, mathematical formula, work is carried out on operations such as storage, protection, processing of waste products.

INTRODUCTION

The industrial complex of digital technologies consists of computer systems, databases and related fields of activity. based on mathematical equations, it serves to reduce costs and increase the use of modern technologies in the processes of processing waste products, and these technologies are used in the sorting and removal of waste. These technologies (SMART Garbage Trucks) are tasked with the collection, collection and removal of waste, which is done only with the help of digital technologies. The signal is sent to the SMART machine through a special chip, which uses this signal to locate waste and sort it according to quality indicators¹.

In developed countries, that is, in Singapore, automated machines, that is, digital technologies, are being used. In addition, Singapore does not have a problem with waste, and digital technology is a system that greatly contributes to the country's economic development².

ANALYSIS OF LITERATURE ON THE SUBJECT:

¹. Source: <http://www.oecd.org/china>, OECD (2012), China in Focus: Lessons and Challenges, OECD, Paris.

². <https://www.alliedmarketresearch.com>. Халқаро тадқиқот компанияси веб-сайти.

Issues in the formation of solid household waste management programs A. K. Golubin, V. V. Devyatkin, L.Y. Shubov K. Schwab and others have studied new analysis and results on a scientific basis. To date, despite the fact that many studies have been conducted to ensure the stability of regional development, to improve production and consumption waste processes, there is no scientifically comprehensive approach to solving the problem. In the

world, there are no established methods and mechanisms for effective management of this market segment. These circumstances determined the choice of the topic of dissertation research, as well as its goals and tasks. Currently, among the scientists of Uzbekistan are S. S. Gulomov³, B. Y. Khodiyev, B. A. Begalov, A. N. Aripov, T. K. Iminov, M.A. Mahkamova, H.A. Mukhitdinov's high level of development of information technologies and communications.

ANALYSIS AND DISCUSSION OF RESULTS:

Today, digital technologies can be conditionally divided into types that preserve, rationalize, and create. Modern progress and achievements show the need for digitization of all areas of science and human activity. Digitization of society means the development of the digital economy, the use of it as a social asset that ensures the country's scientific and technical progress, the acceleration of the processes of democratization and intellectualization of society. The main tasks of modern technologies for production and management in enterprises are to solve various problems of searching, collecting, processing, storing, developing and optimizing new information. The task is performed not only by selecting and automating time-consuming, regularly repeated, data processing operations, but also by processing them to obtain new information necessary for making effective management decisions. This is a country that has invested in the production of industrial products in the development of processing enterprises of these secondary raw materials. It is to build a waste processing plant with a production capacity of 100,000 tons per year in three shifts in the city of Kyzylorda, Kazakhstan. Along with solving the problems of the city of Kyzylorda, it also fulfills the tasks defined in the state program "Development of production in the Republic of Kazakhstan". The main objectives of this investment project are as follows:

The establishment of a modern waste treatment plant allows not only sorting and neutralization of waste, but also obtaining finished products from waste for the local market. An enterprise with a capacity of processing 100,000 tons of solid household waste per year produces the following volumes of raw materials and finished products for sale at full load in three shifts (Table 1).

(Table 1) Production and cost of secondary resources from waste in the Republic of Kazakhstan

№	Product name	Unit quantity	Production quantity per day	Production amount per month	Annual production
1	Toilet paper.	tons	8,9	250,0	3000
2	Paper napkins	tons			
3	Paper (white)	tons			
4	Compost	tons			
5	PET is crushed	tons			
6	Electricity	mvt			
7	Black metal	tons	8,9.	250,0	3 000
8	Non-ferrous metals	tons	4,5	125,0	1500
9	Countertops and floors	sq. m	47,6	1 333,3	16 000
10	Bricks	tons	9,5	266,7	3200

11	Waste paper	tons	53,6	1500,0	18000
12	Naming costs	Price, thousand KZT			Price, thousand US dollars
13	Plant construction and equipment		7 585 240	20 120,0	

In the research work, it is aimed to determine the daily and monthly costs based on the production volume of the enterprise and thereby earn income and determine the secondary raw material products, then produce products resistant to market requirements.

In the German experience, the increasing use of digital networks in complex industrial processes opens up new opportunities for sustainability. Presents the first empirical findings on the relevance of digitization for improving material efficiency in German industry, based on a unique data set of nearly 600 manufacturing plants in these processes. The results show that the possibilities of the digital network for increasing material efficiency are currently being used to a limited extent, primarily for traditional efficiency improvement measures for the optimization of production processes.

Shifting production and consumption to more sustainable forms of waste has been globally agreed upon as an important part of the United Nations' 2030 Agenda and the Sustainable Development Goals (SDGs). The SDGs are an important impetus for the transition from a linear economy to a circular economy. With 12 of the SDGs directly dependent on the sustainable use of natural resources, improving resource efficiency is a key strategy.

The goals focus on retooling industry to improve resource efficiency by 2030. The goal is to prevent waste through prevention, reduction, recycling and reuse, reinforcing the idea of a circular economy. The rationale behind the circular economy is to use resources as long as possible. The approach is to consider the full life cycle of a resource - from extraction to product design, production, consumption and ultimately waste management, e.g. processing. The circular economy aims to minimize both material consumption and waste generation through resource-saving product design (ecodesign) and the recycling and reuse of products and materials. Through recycling and reuse, waste becomes a resource again.

With the recent launch of the G20 Resource Efficiency Dialogue, G20 countries aim to contribute to the implementation of the 2030 Agenda. The goal is to share best practices and national experiences to improve the efficiency and sustainability of natural resource use throughout the entire life cycle, and to promote sustainable consumption and production models. Before that, the G7 countries recognized the importance of efficient use of resources. 2015, putting this issue on the G7 agenda. Along with the creation of the G7 Alliance for Resource Efficiency, the G7 requested two reports from the International Resource Panel of the UN Environment Program and the OECD to identify the most promising solutions and approaches for resource efficiency. In parallel, the EU a circular economy action plan that aims to achieve greater resource efficiency through eco-design.

Germany was one of the first European countries to develop a comprehensive policy strategy for resource efficiency. At the national level, the policy objective of decoupling natural resource use from economic development is enshrined in the German Sustainable Development Strategy (GSDS) and the German Resource Efficiency Program (GREP). As early as 2002, GSDS set a goal of doubling raw material productivity by 2020 compared to 1994 to improve

resource efficiency in domestic production. To achieve this goal, GREP was implemented in 2012. The current situation and progress in resource efficiency in Germany will be reviewed and the program will then be improved accordingly. The first update was carried out in 2016-2019. The raw material productivity index from the GSDS is still the main reference point for GREP. However, it will now be complemented by a new metric, total raw material productivity, to track resource efficiency improvements, e.g. by adding biotic resources and allowing sufficient quantities for imports. This prevents reporting of productivity gains based solely on offshoring of resource-intensive processes. The goal is to continue this 2000-2020 trend until 2030.

Enterprises: with resource efficiency as a key strategy, a more circular and resource-efficient economy can only be realized with the involvement of all public and non-state parties, particularly the private sector. The industrial sector plays a key role as a source of investment and a driver of technological development and innovation that ensures better and more prudent use of natural resources⁶.

As a highly industrialized economy, Germany must further transform its current production and consumption patterns to conserve resources and avoid waste. Highly integrated in global value chains, industrialized countries such as Germany have a key role to play here, as they can significantly influence production methods in industrialized, developing and emerging countries, giving them a unique opportunity to develop more sustainable global production responsibility. Thus, many Germans see the minimization of the resources produced by consumer companies. In addition, material consumption is a cost factor to create. In order to protect the supply of raw materials in the future, the German economy faces the challenge of working economically with existing resources [9]. In order to counteract the energy consumption of precious resources, it is considered an important source for it, and the production of resources is considered to be an important source, and the production of resources is more ecologically clean. The interplay of modern digital technologies with traditional industrial processes provides a new product for resource-efficient and efficient travel and reloading (i.e. recycling). Medium-sized manufacturing enterprises (20-249 employees) adopt a certain measure strategy that is slightly different from other companies in their sector. Almost half of medium-sized companies optimize their production processes to a high degree and use resource-efficient product design at least moderately to improve efficiency. Large companies (more than 250 employees) generally consider the use of new materials to be a suitable approach, but only a few apply this measure intensively. Almost half of large companies use new materials slightly, and the remaining third use them moderately. This is significantly smaller than that shown in previous German studies. Often the recalculation of material savings potential is related to the cost of materials, as shown in the German study on the cost structure of the manufacturing industry (in manufacturing plants with 20 or more employees). According to the results of this survey, the savings potential of 3.6 percent corresponds to almost 30 billion euros. However, this calculation greatly overestimates the savings potential. This is mainly due to the fact that in the study of the German cost structure, material costs include not only raw materials, auxiliary and working materials, but also purchased intermediate products, such as construction components. In particular, when it comes to finished products that only need to be installed on the product, German companies do not have real opportunities to improve material efficiency. The main reason for this is that 40 percent of the mineral raw material imports collected in Germany are finished products. In the case of ores, it loses 50 percent (Table 2).

(Table 2) The amount of industrial waste processing in the German experience⁷

№	Product name	Unit quantity	Production quantity per day	Production amount per month	Annual production
2	Paper napkins	tons	19,7	591	7092
3	Paper (white)	tons	13,1	393	4716
4	Mining industrial waste	tons	46,5	139.5	16740
5	Plastic	tons	58,4	1752	21024
7	crushed	tons	8,9.	250,0	3 000
8	Black metal	tons	4,5	125,0	1500
9	Non-ferrous metals	sq. m	47,6	1 333,3	16 000
10	Wood materials	tons	9,5	266,7	3200
11	Bricks	tons	53,6	1500,0	18000
	Total:		261,8	6350,5	91272,00

This is a key requirement that international suppliers achieve the same level of material efficiency and fully pass on the resulting cost advantage. However, this is unlikely to happen. Digital strategies to improve materials efficiency enable digitally integrated and collaborative networks within and across value chains to track and optimize resource use.

In recent years, digital technologies have created significant opportunities in business management and management, as they provide managers and leaders of enterprises at all levels with the latest methods of economic and social processing and analysis necessary to make the best and alternative management decisions. is being used [10].

Controlling the percentage of waste loading inside each smart box, the direction of waste collection is formed taking into account traffic in the city, and improving the quality of waste management through the use of an automated system, creating various reports (Figure 3).



Figure 3. Advantages of using smart boxes in foreign countries

The litter box can be powered by solar cells and allows you to save money on electricity and there is no need to run additional electrical cables. Smart trash cans can be installed directly on city streets and shopping malls, educational institutions, hospitals, train stations, airports and business centers.

The industrial waste variable has a mean of 19286.934, a standard deviation of 971.793, a minimum value of 15007.1, and a maximum value of 22298.379. This variable represents some measure of industrial output or production.

The construction waste variable has a mean of 916.746, a standard deviation of 557.79, a minimum value of 118.6, and a maximum value of 1834.44. This variable represents some dimensions of construction activity.

The agricultural waste variable has a mean of 7382.461, a standard deviation of 4491.334, a minimum value of 395.085, and a maximum value of 18053.9. This variable represents some measure of trade or commerce.

The average indicator of the transport process variable is 1450.038, the standard deviation is 192.643, the minimum value is 1057.976 and the maximum value is 2115.

The average of the population waste variable is 22031.358, the standard deviation is 11023.78, the minimum value is 4034.116, and the maximum value is 40606.3.

(Table 3) Analysis of waste processing processes based on the linear regression model

Transportation process	Coef.	St. Khatoli.	t-test	p-test	95%	95% Confidence Interval	Ah
Industrial waste	-.013	.018	-0.73	.466	-.049	.023	
Construction waste	-.267	.088	-3.04	.004	-.443	-.091	***
Agricultural waste	.05	.01	4.99	0	.03	.071	***
Waste from the population	.046	.006	7.72	0	.034	.058	***
Immutable	556.519	455.136	1.22	.227	-355.594	1468.632	
Mean is the dependent variable	1450.038		SD dependent variable		192.643		
R-squared	0.802		The number of observations		60		
F-test	55.726		Prob > F		0.000		
Akaike crit. (AIC)	713.368		Bayesian crit. (BIC)		723.840		

*** $p < .01$, ** $p < .05$, * $p < .1$

**Linear model of waste
processing processes $Y=a_0+a_1x_1+a_2x_2+...+a_nx_n+e$,**

where Y = transport process, x_1 = industrial waste, x_2 = construction waste, x_3 = agricultural waste, x_4 = waste from population, a_0 = constant.

The significance of each independent variable is indicated by an asterisk (*, ** or ***) next to the p-value. The mean and standard deviation of the dependent variable are given along with the R-squared value, number of observations, F-test result and values.

CONCLUSIONS AND SUGGESTIONS

In order to find solutions to existing problems in the processing of waste products and the operation of the production system in digital technologies, it is necessary to carry out fundamental researches based on the principles of reprocessing of the composition of its economic and technical-technological elements, as well as optimization through the improvement of development.

There are a number of fundamental and applied science areas that have the characteristics of integration and adaptation of waste, and one of the most adapted scientific approaches to the characteristics and conditions of production and management and many other types of human activity is its principles.

2. In processing and application, it can increase the efficiency of enterprises, their competitiveness, and lay the foundation for creating a foundation of success. To do this, it is necessary to develop the enterprise using digital technologies, designed to support the corporate strategy. It is the enterprise that determines the subsequent actions and solutions in the field of the system: ensuring the delivery of the required product of a certain quality, in the required volume, to a specific consumer, with minimum costs, at the specified time, to the required place.

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