# The Impact of Digital Transformation on the Company's Financial Growth

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***Abstract*: The article substantiates the relevance of scientific understanding of those changes in the activities of companies that are observed during the development and application of digital technologies. The article highlights the positions of dialectical logic, explains the reasons for the transformation processes in the digital age, in accordance with which today the conditions for the activities of companies are changing. It is clear that the digital transformation includes purchases, sales, management of logistics, expenses, promotion of advertising, production. An model for maximizing profits for an enterprise using the apparatus of fuzzy sets is constructed, parameters that affect profit are determined..***

***Keywords : fuzzy set apparatus, pricing, digital technologies, business model, digitalization, profit.***

## I. INTRODUCTION

To ensure success in dynamically changing conditions, the digital age introduces new rules of the game, and management models that provide performance, innovation, flexibility and adaptability enter the competition. Currently, most enterprises see management as a continuous evolutionary process in which strategic planning and human capital management is accompanied by a progressive digital transformation that requires radical methods that will redefine the traditional paradigm of doing business into an advanced technological branch. The modern approach to enterprise management is the interaction of three main factors – human resources, systems and legal procedures. Today, long-term success and sustainability of the enterprise can be ensured through the use of advanced digitalization methods with competent and efficient management. [1].

Digital technologies and their widespread use have created opportunities for radically new business models, unique experience working with Internet resources and optimizing the internal processes of the enterprise. Under the influence of various factors, modern business is undergoing non-trivial changes, leading to a change in management models. This is primarily due to a change in consumer thinking - an increase in the requirements for convenience and speed of shopping for various services and goods within the personal comfort zone; - the possibility of access to assessing the quality of the services and goods provided or exchanging opinions with other consumers; - the ability to pay with modern electronic means of payment; - receipt of goods and services in the place indicated by the consumer; - an approach to selling a product or service through the "digital interface" of a mobile smartphone, bypassing the intermediary function of a classic sales manager by ensuring the greatest efficiency (that is, convenience, high productivity, high quality of the service provided, the ability to lower prices).

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## II. LITERATURE REVIEW AND PROBLEM STATEMENT

The Internet today is a convenient and effective channel for disseminating information related to the activities of an enterprise [16]. The digital transformation of the enterprise is the ability to make purchases and sales of products (services) using the Internet. We propose to consider digital transformation as a broad concept, which includes: purchases, sales, management of logistics, expenses, promotion of advertising, production [3].

Digital transformation has become an important tool that helps to disseminate information about what the company is doing around the world and increase its profit. Many researchers study factors and tools that contribute to effective digital transformation. So in their work [18] investigated the quality of the Internet, as one of the factors affecting the digital transformation. In the work [19] assessed the quality of the sites of companies that sell online and revealed customer satisfaction from working with these sites. The article [24] identified the main goals and tools that contributed to the effective digital transformation of enterprises.

The paper [26] developed a methodology for assessing the effectiveness of digital transformation of enterprises, focusing on building a company's communication through the site with customers, linking it to the number of transactions concluded. The author in his work [8] conducted research

related to the ease of use of enterprise sites. In the article, the author [15] proposed the author's fuzzy hybrid model, which allows one to evaluate the effectiveness of digital transformation through the use of company websites.

In their work, the authors [7] developed a transaction process based on a model scale that measures the quality of service in the provision of services by companies through websites or a mobile application. In the work, the author [23] estimated the quality of sites (usability, expended resources creating a platform) of enterprises that conduct Internet-based trading operations in Taiwan.

In the literature there are different views on what criteria and methods should be used in assessing the quality of enterprise sites. The criteria for evaluating the usefulness, usability, and quality content of the site include both tangible and intangible methods, solving the problem through multicriteria methods (MCDM-Multiple Criteria Decision Making). Many methods exist in the literature that are used to solve MCDM problems. The Analytic hierarchy process (AHP), developed by Saaty T. Sa. [22], is one of the most practical method most commonly used in the literature, including judgments about tangible and intangible data. The AHP method is based on the assessment of criteria and alternatives for paired comparative matrices using a scale of 1-9. The AHP method allows decision makers (clients, website users) to structure data in order to choose the best of various alternatives.

One of the drawbacks of using MCDM is the lack of clear data for modeling solutions to real-life problems, due to the subjectivity of human judgments and the uncertainty of data. The theory of fuzzy sets developed by [27] can be used in the decision-making process, namely when decision makers are based on pairwise comparison. In the classical sense, AHP may not include numerical values due to the uncertainty and lack of information. Therefore, AHP is well combined with the theory of fuzzy sets [17]. It is also worth considering the problem of using the method, which consists in the fact that it requires cumbersome calculations. In his work [9] used the geometric mean method to obtain fuzzy values. In the paper, the author [10] proposed a new approach, including the use of triangular fuzzy numbers and the method of analysis of extents for synthetic values of extents pairwise comparisons. Very successfully, the author [11] proposed a new algorithm for evaluating a fuzzy analytical process by implementing it on tactical missile systems of the navy [6]. A team in [28] developed a modified fuzzy AHP model to assess the risks of a project being implemented in the process of enterprise digitalization.

The purpose of this study is to justify the need and describe the digital transformation of the enterprise based on the construction of a mathematical model of profit formation in the context of the digitalization of the economy [4]. Achieving this goal is possible by solving the following tasks: to characterize key tools (indicators) affecting the effectiveness of digital transformation of enterprises; using fuzzy rules of inference, model the tasks of pricing products (services) of the enterprise, which will lead to increased profits and an effective business model.

## III. RESEARCH

### *3.1. Economic-mathematical model for maximizing the profits of an enterprise that works on the Internet*

If products are denoted by *xi, i = 1, n*, where n is the number of types of products, and the profit from sales from the *i* product through *bi*, then the goal of the company can be mathematically represented as follows:

$$\sum_{i=1}^{n} b_i x_i \to max \quad (1)$$

The profit from the implementation of the *i* product in the context of the digital transformation of the enterprise depends on many qualitative and quantitative indicators (product price, Internet access market, long-term tendency to change the potential size of the market, seasonal fluctuations in business activity, quality of Internet service providers, price attractiveness of providers, the impact of the speed of access to Internet resources, sources of influx and outflow of customers, etc.), which have fuzzy descriptions. A fuzzy description may turn out to be more adequate to reality than, in a certain sense, an arbitrarily accepted clear description [5]. All these indicators are limited and take values from the intervals specified by the expert. Thus, the limitations of fuzzy indicators are taken into account. At a certain stage, the resulting fuzzy output variables are dephased and the most acceptable clear values are selected that provide the best solutions for each specific case [2].It is obvious that if the digital transformation of an enterprise is not an oligopolistic or monopolistic process, then the business operates on the basis of prices established in the market [14]. And this price within the company is divided into two main parts - the price of the previous link and the price premium:

$$c_i = c_{i_{pr}} + c_{i_{sh}}, \quad i = \overline{1,n}, \quad (2)$$

where *Ci*, is the market price of the *i* type of product; *Cipr* - price of the previous link for the *i* type of product; *Cjsh* - price premium for an enterprise that works on the Internet for the *i* type of product. In turn, the price premium consists of costs and profits, i.e.:

$$c_{i_{sh}} = K + B_i, \quad i = \overline{1,n}, \quad (3)$$

where *K* is the cost of the company that works on the Internet per unit of product; *Bi* profit from the sale of the unit of the *i* product.

Since *Cish* is established by the previous link, the owner of the company that works on the Internet can only control *Cish*. Suppose that the market price of the *i* type of product

$$c_i^*: c_i^* = 10{,}5 \ y.e.$$

Assume that the exogenous parameter defined by the previous link $c_{i_{pr}}$ - set as $c_{i_{pr}}^*$ = *6 y.e.*

Then from (2) we obtain $c_{i_{sh}}^* = 4{,}5 \ y.e.$

Considering that the profit from the sale of the unit of the type of product is determined by subtracting the costs per unit of product from the price, we calculate the costs below.

Since the total costs of the company that works on the Internet consist of the costs of a web page, advertising and procedural costs, therefore, the total costs per unit of product are determined by the following formula:

$$K = \frac{A+M+P}{N}, \quad (4)$$

where A, M and P are the costs of a web page, advertising and procedural operations; N is the number of products.

In fact, the indicators A, M and P are fuzzy, so we will set them as linguistically represented fuzzy variables:

1. The cost of a web page is A (5000-25000 man).

2. Advertising costs - M (30000-100000 man).

3. The costs associated with procedural operations - P (2500-4000 man). Each of the above input values, in turn, is the output of the block, expressed in quantitative and qualitative indicators:

1. Cost of a web page - A:

a) the number of bases - A1;

b) the number of functions - A2;

c) the number of pages - A3;

d) the degree of complexity of the functions - A4.

2. Advertising costs - M:

a) TV - $M_1$;

b) Internet - $M_2$;

c) billboard - $M_3$;

d) the media - $M_4$;

e) promotion - $M_5$.

3. In order to simplify, the model will use the dephasing value of expenses P associated with procedural operations: P = 3000.

For the remaining linguistically given indicators, we define the term sets:

For A: “very low”, “low”, “medium”, “high”, “very high”. For M: “low”, “medium”, “high”.

The interval values of the terms of the sets of linguistic variables *A* and *M* are given, respectively, in table. 1 and 2.

**Table 1. Interval values of term sets of the linguistic variable M, author's development**

| | | Low | Medium | High |
|---|---|---|---|---|
| **Advertising Costs** | M | [4.851e+004 5000] | [4.851e+004 1.478e+005] | [4.851e+004 2.905e+005] |
| **TV** | $M_1$ | [1.869e+004 9e+004] | [1.869e+004 1.45e+005] | [1.869e+004 2e+005] |
| **Internet** | $M_2$ | [3398 2e+004] | [3398 3e+004] | [3398 4e+004] |
| **Billboard** | $M_3$ | [152 9 9000] | [1.53e+003 1.35e+004] | [1529 1.8e+004] |
| **Mass media** | $M_4$ | [3.721e+004 6000] | [3.721e+004 1.155e+005] | [3.721e+004 2.2 5e+005] |
| **Promotion** | $M_5$ | [849.4 5000] | [849.4 7500] | [849.4 1e+004] |

**Table 2. Interval values of the term sets of the linguistic variable A, author's development**

| | | Veery low | Low | Medium | High | Very high |
|---|---|---|---|---|---|---|
| Cost of a web page | A | [2123 5000] | [2123 1e+004] | [2123 1.5e+004] | [2123 2e+004] | [2123 2.5e+004] |
| The number of bases | $A_1$ | 58.39 50] | [58.39 187.5] | [58.39 325] | [58.39 462.5] | 58.39 6 00] |
| The number of functions | $A_2$ | [1274 2] | [1274 3002] | [1274 6001] | [1274 9001] | [1274 1.2e+004] |
| The number of pages | $A_3$ | [2654 2] | [2654 6252] | [2654 1.25e+004] | [2654 1.875e+004] | [2654 2.5e+004] |
| The degree of complexity of the functions | $A_4$ | 0.9555 1] | [0.9555 3.25] | [0.9555 5.5] | [0.9555 7.75] | [0.9555 10] |

After this, fuzzification for fuzzy sets is carried out. The membership functions for these fuzzy sets are constructed in the form of a Gaussian function.

*3.2. Methodological approaches to the construction of logical rules based on expert reasoning*

The next step is to build logical rules based on expert reasoning. For example, for advertising costs, expert reasoning can be described as follows:

If the costs of TU, Internet, billboards, media and promotion are low, then advertising costs are low.

1. If expenses for technical specifications, Internet, billboards, mass media and promotion are average, then advertising expenses are average.

2. If the costs of TU, Internet, billboards, media and promotion are high, then advertising costs are high.

3. If the costs for TU, Internet are average, and for billboards, media and promotion low, then advertising costs are average.

4. If expenses for technical specifications are average, but for Internet, billboards, mass media and promotion are high, then advertising expenses are average.

Using the above notation, linguistic rules can be formulated as follows:

Rule 1. *If $M_1$ = "low", $M_2$ = "low", $M_3$ = "low", $M_4$ = "low" and $M_5$ = "low", then M = "low".*

Rule 2. *If $M_1$ = “medium”, $M_2$ = “medium”, $M_3$ = “medium”, $M_4$ = “medium”, $M_5$ = “medium”, then M = “medium”.*

Rule 3. *If $M_1$ = “high”, $M_2$ = “high”, $M_3$ = “high”, $M_4$ = “high”, $M_5$ = “high”, then M = “high”.*

Rule 4. *If $M_1$ = “medium”, $M_2$ = “medium”, $M_3$ = “low”, $M_4$ = “low”, $M_5$ = “low”, then M = “medium”.*

Rule 5. *If $M_1$ = “medium”, $M_2$ = “high”, $M_3$ = “high”, $M_4$ = “high”, $M_5$ = “high”, then M = “high”.*

Thus, the rules are constructed using linguistic variables for advertising costs - M. Transforming the above rules, for each rule we get fuzzy sets for the endogenous variable *M*.

The composition method gives a fuzzy set, which is the range of the fuzzy output variable *M*, and through defuzzification by the centroid method we get a clear numerical solution.

As a result of solving this problem for each linguistic variable *A* and *M*, we obtain the following clear values:

1. If $L_1$ = 120, $L_2$ = 500, $L_3$ = 10000, $L_4$ = 5, then A = 9.71 x 103 y.e.

2. If $M_1$ = 100000, $M_2$ = 35000, $M_3$ = 12000, $M_4$ = 8000, $M_5$ = 10000, then M = 1.8 x 105 y.e.

3. P = 3000 y.e.

*3.3. The results of studies of indicators of fuzzy conclusions to determine the costs of a web page and advertising, their graphical dependence on input indicators.*

The results of fuzzy conclusions for determining the costs of a web page (*A*) and advertising (*M*), their graphical dependence on input indicators are respectively shown in Fig. 1-4.

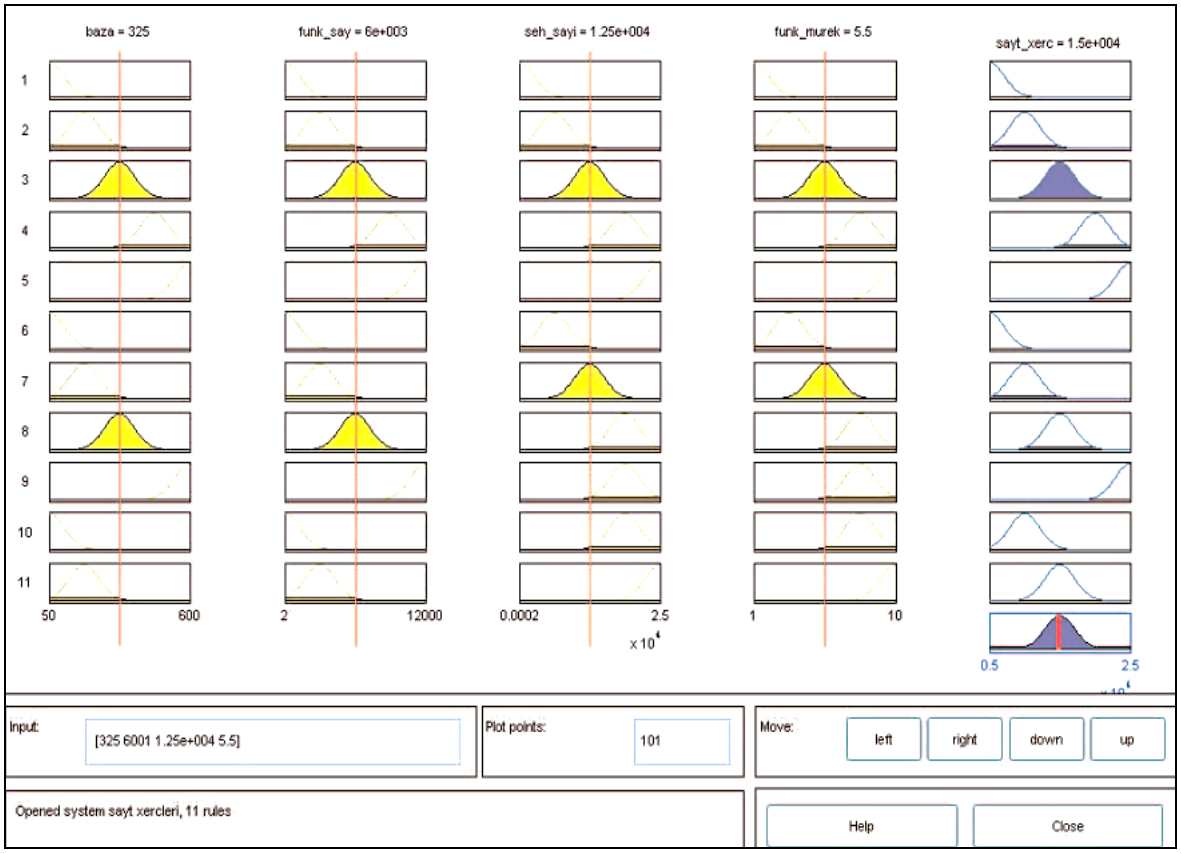


**Fig. 1. Fuzzy conclusion to determine the cost of a web page 9 authoring**

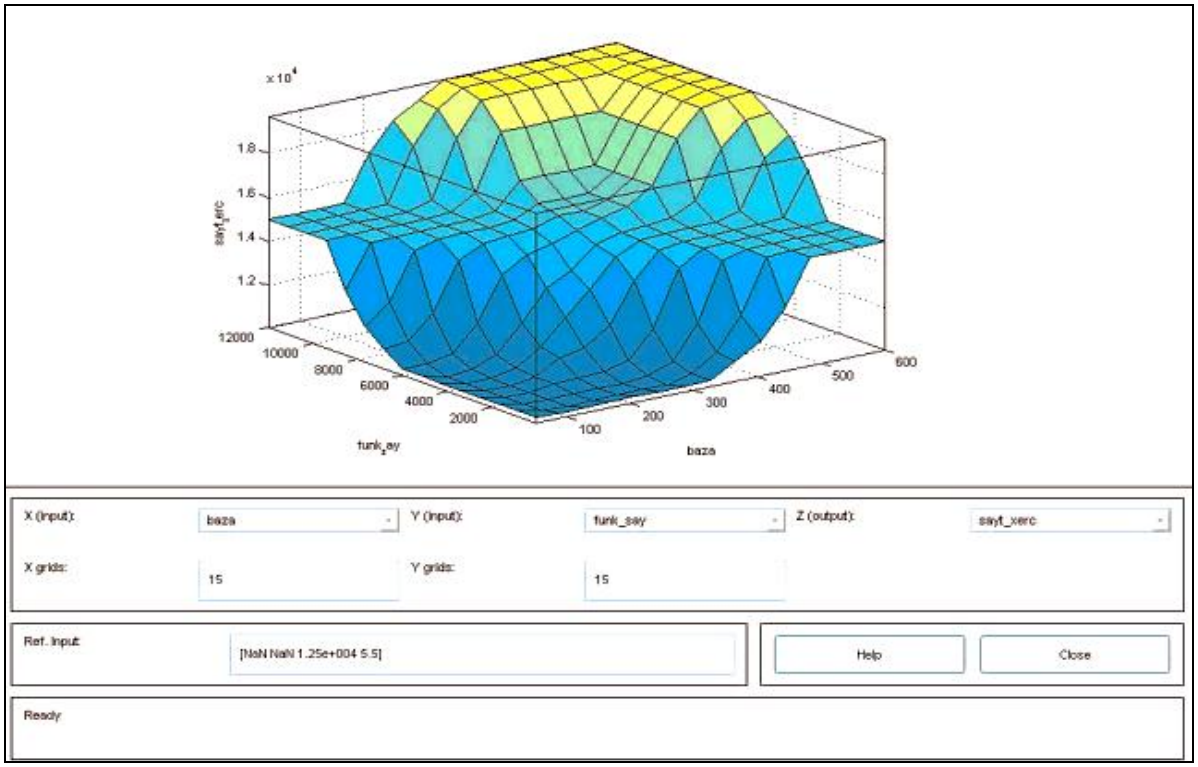


**Fig. 2. Graphical dependence of the cost of a web page on input indicators, authoring**

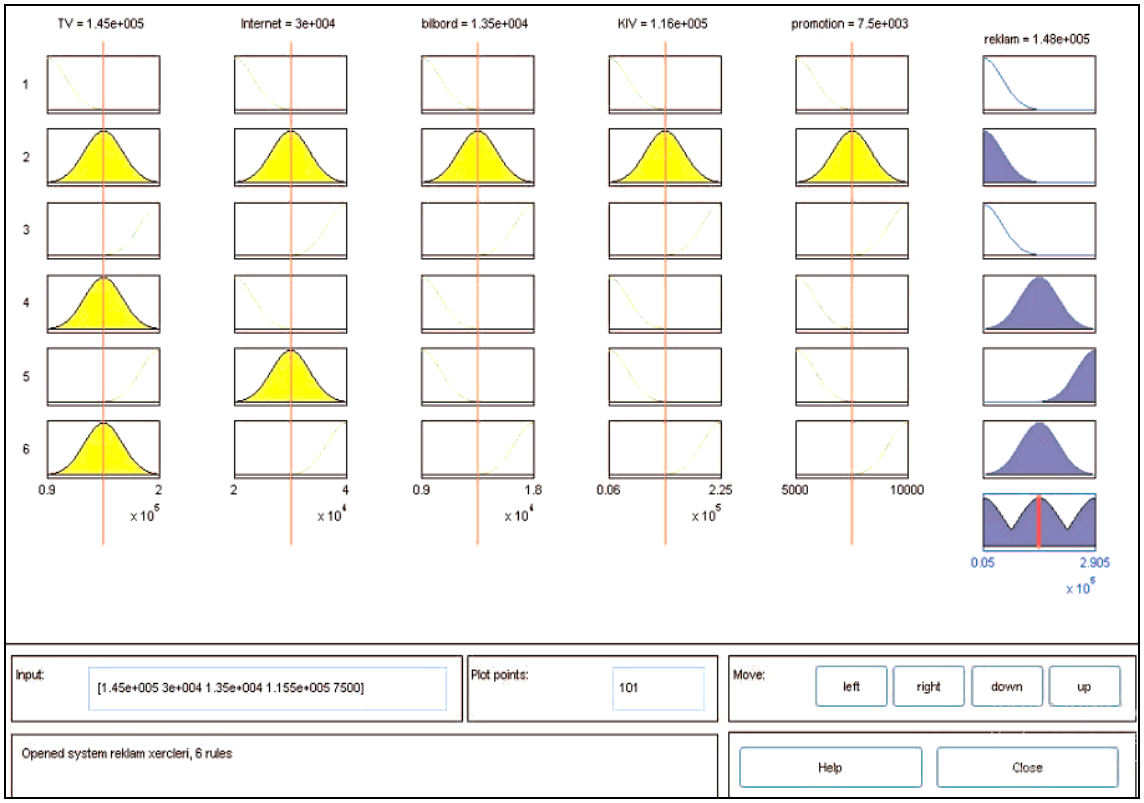


**Fig. 3. Fuzzy conclusion to determine the cost of advertising, authoring**

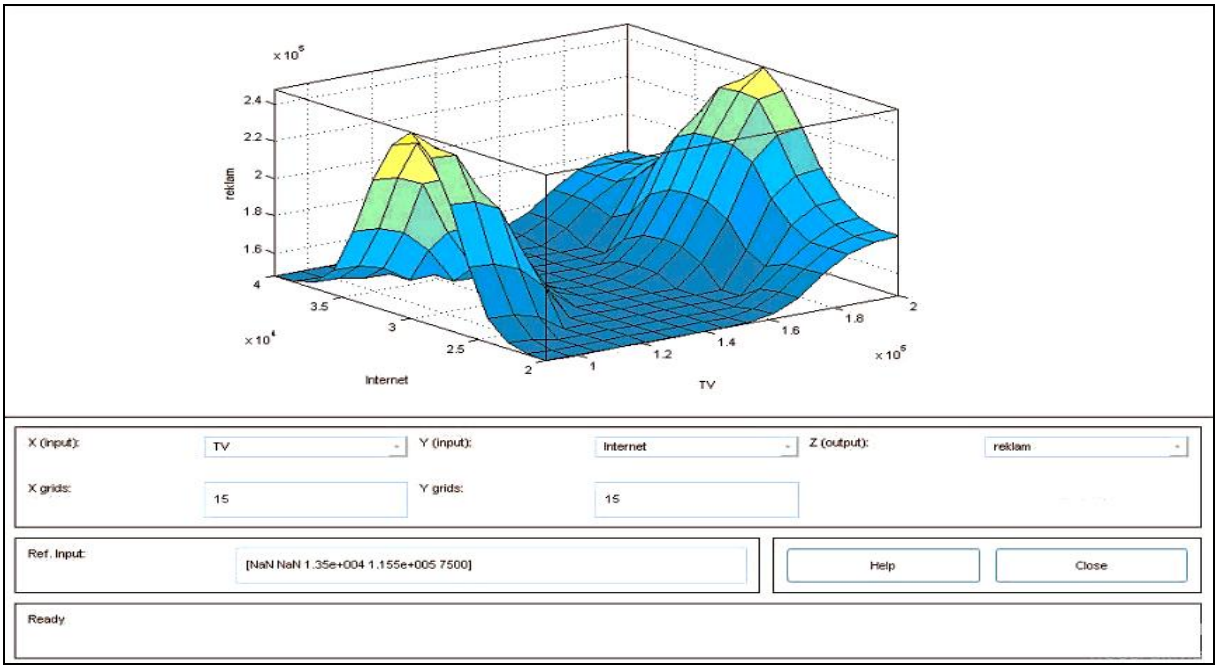


**Fig. 4. Graphic dependence of advertising costs on input indicators, authoring**

Thus, from formula (4) at $N = 100000$ we find $K$:

$$K = \frac{9710 + 180000 + 3000}{100000} = 1{,}927.$$

Therefore, from (3) we find the profit from the sale of a unit of the ith product type: $Bi = ci - K = 4.5 - 1, 927 = 2.573$.

Based on the prices set on the market, the owner of an enterprise that works on the Internet can determine the profit from the sale of units of each type of product $xi$, $i = 1, p$. The use of fuzzy inference rules leads to a more adequate modelling of the pricing problem at the firm and finding a more effective managerial decision [21]. The use of fuzzy logic allows us to analyse the qualitative characteristics of pricing in more detail and leads to the development of an effective business model.

Modern business needs an integrated approach to the formation of product and pricing policies, the choice of promotion methods (marketing communications) and points of sale (distribution channels) [25]. The main principles of digital transformation management are customer

focus, the market situation (supply and demand) and company capabilities; combining strategic and tactical efforts to achieve maximum effect; continuous updating of products and services, their timeliness (integrated 4P approach).

According to a study published in the journal Science [13], the digital era began in 2002. At the same time, it is specified that digital technologies began to prevail in telecommunications since 1990 (99.9% as of 2007), and since 2002 (94% in 2007) - among information carriers [13]. It is known that in the same year the total capacity of digital storage media exceeded the same figure for analog devices. This moment is a turning point in the development of information technologies and their impact on all spheres of economic and social activities of people. By 2007-2008, digital communications are becoming the basis for the interaction of almost all economic entities of the modern world. According to the Microsoft / OpinionWay study "Les décideurs et l'entreprise numérique" (2013) in the coming years, digital transformation will become a critical challenge for companies and will require strong leadership action. 84% of top managers said that the transition to digital is a strategic decision (Microsoft / OpinionWay) [20]. However, most respondents believe that digital technology will significantly improve communication with customers, suppliers, partners.

According to a McKinsey study in 2015, top management of the world's leading companies associates the company's future growth with digital technology. 71% of respondents expect that over the next three years they will be able to increase revenue [12]. At the same time, the majority of managers personally support corporate projects in the field of digital technologies, as they integrate into the business and radically change the existing process management model in the company. Increased attention to digital technology is not only coming from companies in this field.

## 4. CONCLUSION

The article substantiates the relevance of scientific understanding of those changes in the activities of companies that are observed during the development and use of digital technologies.

1. Implemented the construction of a mathematical model of profit formation in the enterprise in the digitalization of the economy. Key indicators are defined (product price, market for Internet access services, long-term trend of potential market size, seasonal fluctuations in business activity, quality of Internet service providers, price attractiveness of providers, impact of Internet access speed, sources of customer inflow and outflow, etc..) affecting the formation of pricing policies and the formation of profits in the enterprise.

2. The fuzzification of fuzzy sets is carried out constructed in the form of a Gauss function. The next step is to build logical rules based on expert reasoning. The developed model using the apparatus of fuzzy set theory allows an enterprise that works on the Internet to determine the profit from the sale of units of each type of product. The use of fuzzy rules of inference leads to a more adequate modelling of the pricing problem in the company and finding a more effective solution. The use of fuzzy logic will allow us to analyse the qualitative characteristics of pricing in more detail and lead to the development of a more efficient business model.

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