Marketing Communications in the Logistics System of Information and Innovation Technologies of the Consumer Market

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Abstract: The article considers marketing communications in the logistics system of information and innovation technologies of the consumer market. The determinant of the development of marketing communications of the enterprises-participants of the consumer market with prospect of introduction of information and innovative technologies, considering conditions of formation of their logistic system for an estimation of qualitative protection of results of financial activity, is defined. Stages of transformation of marketing communications of enterprises are substantiated, depending on the degree of high-tech development of logistics systems in the world and the chosen strategy of promotion of information-innovative technologies, which creates both internal system of Intranet-environment and external system of Extranet-environment. The stages of clustering of enterprises according to the level of the development of marketing communications in the logistics system of information and innovative technologies of the consumer market of the food industry are systematized. A comprehensive assessment of the level of the development of marketing communications of food industry enterprises in logistics systems of information and innovation technologies of the consumer market is made. The world level of the development of marketing communications in the logistics system of information and innovative technologies of the consumer market of the food industry is analyzed. The share of the population of the world by language affiliation of the use of information and innovative technologies of the consumer market of the food industry is determined. Taxonomic indicators of the level of development of marketing communications at the enterprises of the food industry are used.

Keywords: Food industry enterprises; financial activity; information and innovation technologies; investors; logistics system; marketing communications.
JEL Classification: F01, F15, F21, F23.

1. INTRODUCTION

The modern driver of the world economy is information and innovation technologies that not only change industries, but also ensure the introduction of new types of marketing communications in production systems, connecting real objects with virtual ones through information networks. Bio-, nanotechnology, artificial intelligence, self-driving cars and airplanes, "smart" 3D technologies are becoming goods in the global digital platform and are forming new business models. The introduction and active dissemination of marketing communications in the consumer market of information and innovation technologies contributes to the welfare of the population, balanced technological, economic and sociocultural development of society, ensures a high level of competitiveness in the world market.

The rapid pace of production of goods and high information and innovation technologies on a global scale contribute to the formation of the global consumer market as a new segment of the economic space with its own characteristics and contradictions. The study of marketing communications and their activation in the consumer market of information and innovation technologies provides the formation of its structural elements, which are based on a set of principles and theories of marketing, development, humanization, greening, informatization, given the dynamism and instability of international economic integration. At the same time, they inten-

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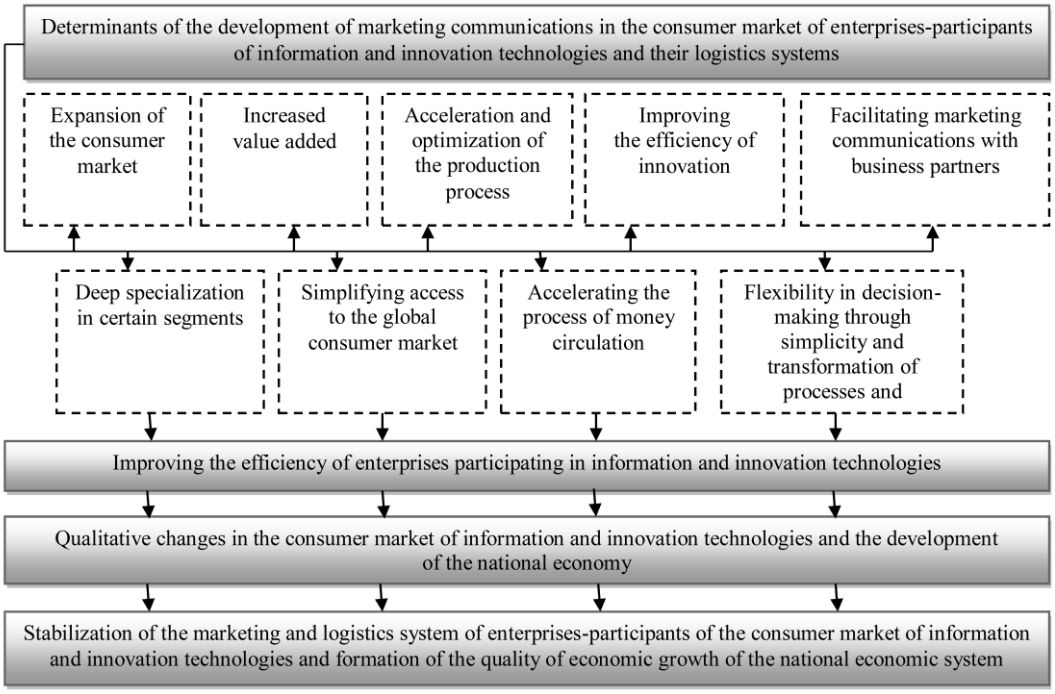

Fig. (1). Determinants of the development of marketing communications of enterprises in the logistics systems of the consumer market of the national economy.
Source: developed by the authors according to data (Saeed, 2013; Venkatesan *et al.*, 2013; Allen *et al.*, 2017).

sify the development of business structures for the constant updating of ideas, development and promotion of innovative technological goods (services) at the mega-, macro- and micro-levels, through stimulating levers of marketing activities of economic entities in their countries of origin to enhance communication processes of companies-sellers.

Fundamental problems of the development of marketing communications were investigated in the works of Z. Brzezinski (1970), D. Cyr (2004), H. Trevor-Smith (2004), M. Hermeking (2006), C. Hill (2013), G. Hofstede, G. Hofstede, M. Minkov (2010), T. Kramer, L. Block (2008), P. Krugman (2009), W. Mitchell (1914), M. Solomon (2018). Specifics of realization of separate tools of marketing communications are enlightened in the works of M. Adamska, M. Minarova (2014), L. Balabanova, B. Kholod (2006), I. Belyavskiy (2001), G. Belch, M. Belch (2004), O. Berezan, A. Krishen, S. Tanford, C. Raab (2007), P. Berger, N. Nasr (1998), M. Cioppi, A. Buratti (2009), P. Coelho, J. Henseler (2006). Detailed functions of internationalized marketing activities were studied by M. Allen, M. Kearney, V. Cramér (2006), S. Gupta, D. Hanssens, B. Hardie, W. Kahn, V. Kumar, N. Lin, N. Sriram (2006), K. Keller (2009), C. Krum (2012), S. Luxton, M. Reid, F. Mavondo (2015), J. Sheth, N. Malhotra, P. Kitchen, I. Burgmann [22]. The specifics of the behavior of market entities and the peculiarities of the functioning of information and innovation technologies and the promotion of innovative products were studied by L. Malär, H. Krohmer, W. Hoyer, B. Nyffenegger (2001), H. Maycotte (2015), M. McHugh (2013), V. Mittal, W. Kamakura (2013), M. Ramasobana (2017), R. Saeed, B. Naeem, M. Bilal, U. Naz (2013). The priority of our study is to determine the determinants of the development of marketing communications of enterprises-participants of the consumer market with the prospect of implementing information and innovation technologies, taking into account the conditions of formation of their logistics system to assess the quality protection of financial performance.

2. MATERIALS AND METHODS

Modern marketing communications as a set of methods, technologies and forms of promotion of goods and services, include numerous tools: advertising, sales promotion, sponsorship, public relations, personal sales, direct marketing, which provide signals from companies to various audiences. The formation of global network marketing communication and expansion of its scale determines the development and dissemination of information and innovation technologies, transfer to the electronic environment of marketing activities with a timely process of transformation of traditional economic entities (enterprises) into network structures. The innovative marketing development of the "new economy" is characterized by the socialization of the latest developments, primarily in the field of information and innovation technologies, i.e. their implementation and use throughout society. In turn, the innovative marketing development of industries is the level of the development of the national economy. At the same time, the development of each industry significantly depends on the actions of enterprises, management entities, the level of competitiveness and the amount of profit in the implementation of the innovation strategy (Bucalew, 1982; Venkatesan, 2004). Therefore, in our opinion, information and innovation technologies can qualitatively increase the key indicators of marketing communications of enterprises and their impact on the logistics systems of the consumer market of the national economy (Fig. **1**).

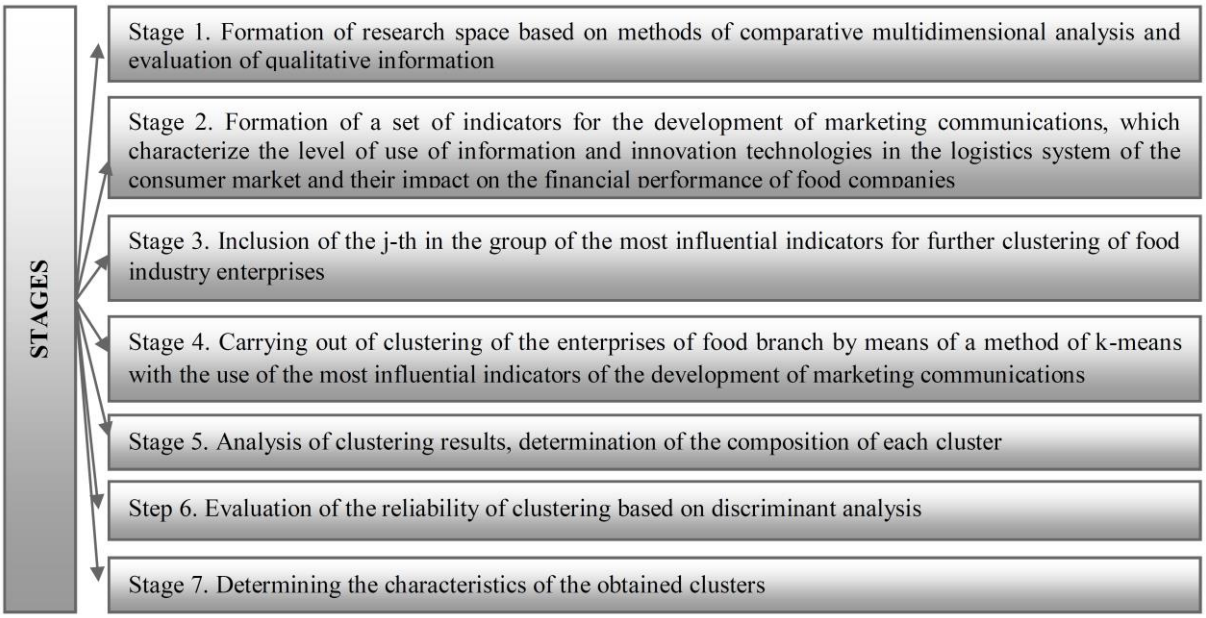

Fig. (2). Stages of clustering of enterprises by the level of the development of marketing communications in the logistics system of information and innovation technologies of the consumer market of the food industry.

Stages of transformation of marketing communications of enterprises, depending on the degree of high-tech development of logistics systems in the world, according to the chosen strategy of promotion of information and innovation technologies, are created as an internal system of Intranet environment(at this stage, information and innovation technologies are used as a tool for implementing an effective system of internal marketing communications of the enterprise in the country) and an external system such as Extranet environment (transparent to partners customer service system, which works as a business card or business directory in the world market). Involving consumers in the logistics system through feedback (ordering system through information and innovation technologies) expands the opportunities and improves the quality of marketing communications in the automated procurement process and promotion of goods to the end consumer through their own e-shops (Saeed, 2013; Venkatesan et al., 2013; Allen et al., 2017). Evaluation of the efficiency of information and innovation technologies in the consumer market, in particular, the use of SAGE technology based on the comparison of the main parameters of implementation of logistics systems and indicators of net present income, taking into account the criteria justifying the efficiency of such systems (specific sales of information and innovation goods and services per employee of the marketing department per year, sales of information and innovation goods and services from cash flow at the enterprise, the economic effect of reducing the time to perform routine operations by employees of the marketing department), allows assessing the effect of the implementation of SAGE and generally determine the efficiency of investment (Allen et al., 2017).

Source: developed by the authors according to data (Gupta et al., 2006; Sheth et al., 2010; Malär et al., 2011 Krum, 2012).The use of information-innovation technologies in the activities of economic entities at the stage of development of the national economy ensures the development of e-commerce and electronic payment systems (Luxton et al., 2015). Automation of the main processes of marketing activities of enterprises, increasing the speed and volume of sales, provides synchronization of sales data with information systems, thus improving the quality of service and reducing operating costs for staff, as well as information support of marketing activities of economic entities (Luxton et al., 2015); creating a consumer base of enterprises participating in the logistics system of information and innovation technologies to support innovative projects and their automation (purchasing, turnover, communication policy, sales, after-sales service) to make management decisions without losing their quality, saving resources and reducing overall labor costs (Ramasobana, 2017; Saeed et al., 2013); development of models, algorithms and complex business processes that require constant use of information and innovation technologies in the logistics system of the consumer market to reduce labor costs for marketing communications, including the involvement of external experts from anywhere in the world to flexibly manage pricing policy goods (Sargeant et al., Villanueva et al., 2007; Smaoui et al., 2011). The network of marketing communications in the logistics system of information and innovation technologies of the consumer market opens opportunities for the production of new products and new models of economic activity within the virtual value chain or because of developing a new sector of the market space (Venkatesan et al., 2004; Eurostat Statistics Explained, 2018).

It is implied that the company does not need any additional resources to ensure sales; the consumer himself will provide all the necessary resources for each individual consumer. The site can work with hundreds of thousands of users at the same time. The sequence of introduction of methodical tools on estimation of determinants of the development of marketing communications in logistic systems of information and innovative technologies of the consumer market through clustering of the enterprises of food branch is offered (Fig. **2**).

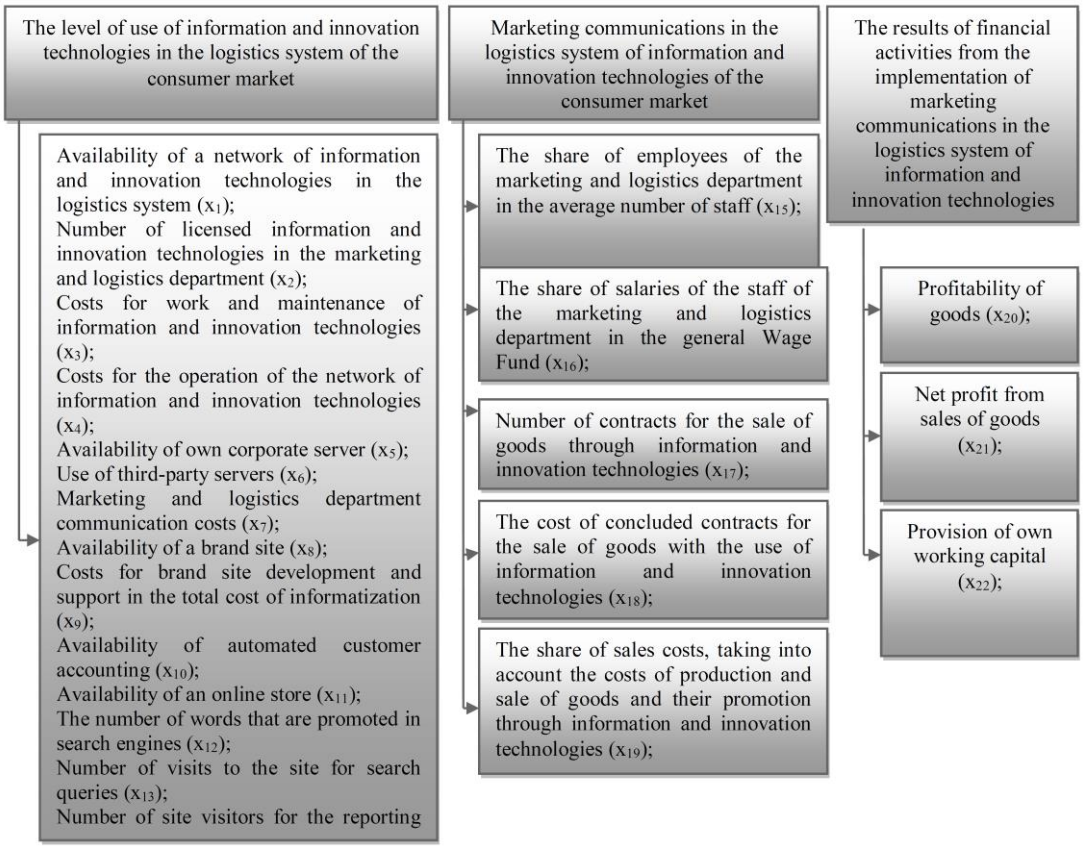

Fig. (3). Comprehensive assessment of the level of the development of marketing communications of food industry enterprises in logistics systems of information and innovation technologies of the consumer market.
Source: developed by the authors.

The sequence of stages of its implementation is based on a harmonious combination of methods of multidimensional analysis and methods of qualitative assessment of the first group of factors – "results of financial activities from the introduction of marketing communications in the logistics system of consumer information technologies": profitability, the ratio of own working capital; net profit from sales of goods. Priority directions of the development of marketing communications of food industry enterprises should be focused on improving the efficiency of information and innovation technologies in the logistics system, which optimize data processing and analysis, establish individual communication capacity of enterprises in the consumer market to promote goods, given stable relationships with Intranet and Extranet-environment (Venetis et al., 2004; Belch et al., 2004).

The second group of clustering factors according to the "level of use of information and innovation technologies in the logistics systems of the consumer market" is formed by the following indicators: the presence of a network of information and innovation technologies in the logistics system; the number of licensed information and innovation technologies in the marketing and logistics department; costs of operation and maintenance of information and innovation technologies; operating costs of the network of information and innovation technologies; availability of own corporate server; use of third-party servers; communication department costs for communication; availability of a brand site; costs for brand site development and support in the total cost of informatization; availability of automated customer accounting; availability of an online store; the number of words that are promoted in search engines; the number of visits to the site for search queries; the number of site visitors for the reporting period. Marketing communications in logistics systems of information and innovation technologies of the consumer market are a set of actions and measures of technical, organizational and economic nature, which reduce the degree of participation or completely eliminate direct human participation in a function of the production process, management process (Gupta et al., 2006; Krum, 2012; Sheth et al., 2010).

Therefore, the third group of factors – "marketing communications in the logistics system of information and innovation technologies of the consumer market", includes the following indicators: the share of employees of the marketing and logistics department in the average number of staff; the share of salaries of the staff of the marketing and logistics department in the general Wage Fund; the number of contracts for the sale of products through information and innovation technologies; the cost of concluded contracts for the sale of products using information and innovation technologies; the share of sales costs, taking into account the costs of production and sales and its promotion through information and innovation technologies (Malär et al., 2011).

Given the above, Fig. (**3**) presents a set of indicators that allows a comprehensive assessment of the level of the devel-

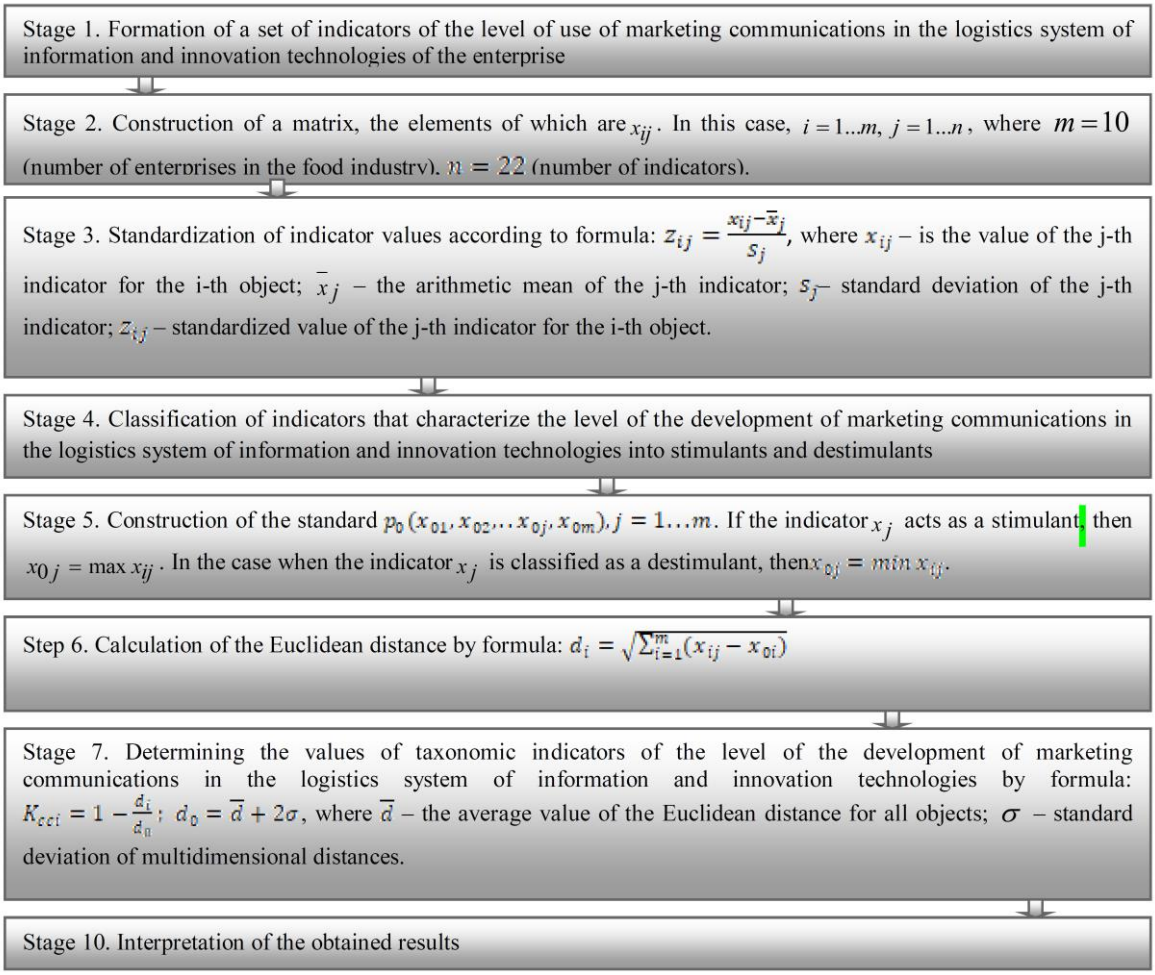

Fig. (4). Algorithm for sequential calculation of the level of the development of marketing communications of enterprises in logistics systems of information and innovative technologies of the consumer market of the food industry.
Source: developed by the authors.

opment of marketing communications of food companies in logistics systems of information and innovation technologies of the consumer market, the target of which is the use of taxi metrics method of multidimensional statistics and calculation of two integrated indicators: integrated financial performance and integrated indicator of the level of the development of marketing communications in the logistics system of information and innovation technologies of the consumer market. The taxonomic method allows factor analysis of "multidimensional objects" (statistical units (structural units)), using a set of features of given values and a matrix of distances (Solomon, 2018; Sargeant et al., 2004). In order for the indicator of the level of the development of marketing communications in logistics systems of information and innovation technologies of food industry enterprises to take high values at higher values of stimulants and low values at low values of stimulants, it is converted by formula (1):

$$K_{cc} = 1 - \frac{d_i}{d_o}, \quad (1)$$

Thus, the economic interpretation of the taxonomic indicator of the level of the development of marketing communications of enterprises in logistics systems of information and innovation technologies in the consumer market of food industry enterprises is as follows: the closer the value to 1, the higher the financial performance of economic entities and higher effect from the use of information and innovation technologies in the logistics system.

3. RESULTS

The dynamism of globalization and integration in the functioning of economic mechanisms of different countries contributes to the creation of single information and economic space. Over the past 25 years, with the advent of global logistics systems, information technology and marketing communications, vast amounts of information have been accumulated and moved to any part of the world at a tremendous speed and low cost. Algorithm for sequential calculation of the level of development of marketing communications in logistics systems of information and innovative technologies of food industry enterprises is presented in Fig. (**4**).

Thus, in Asian countries, China demonstrates the highest rates of the development of marketing communications in the logistics system of information and innovative technolo-

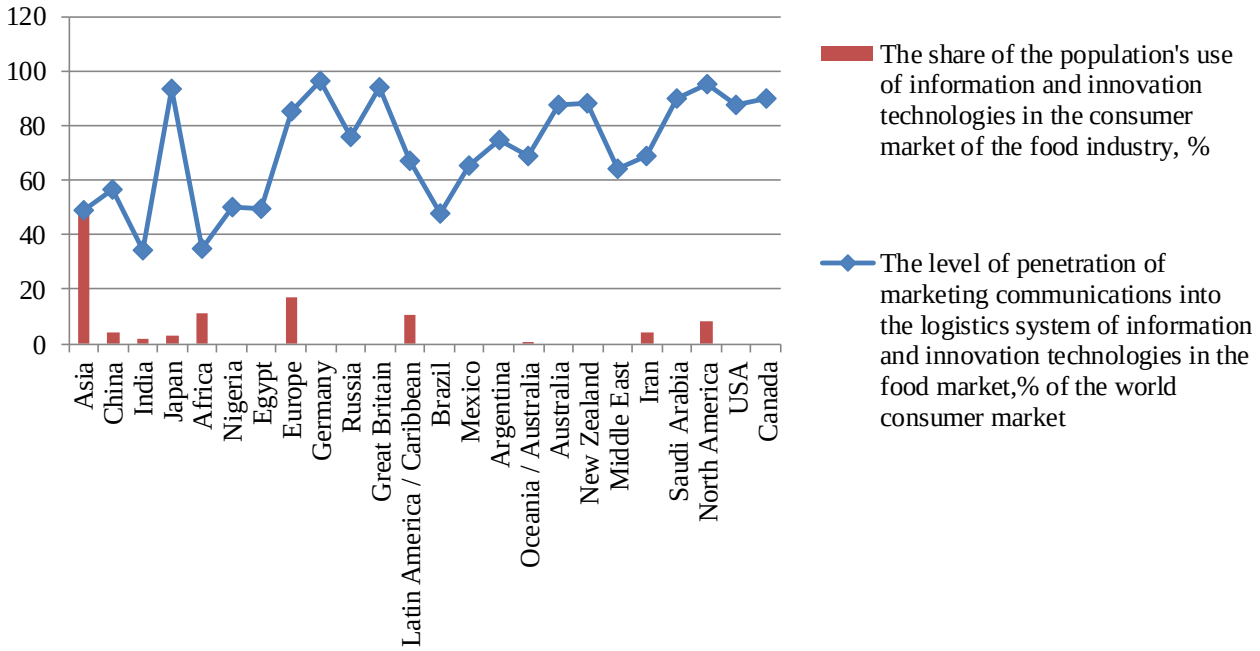

Fig. (5). The world level of the development of marketing communications in the logistics system of information and innovative technologies of the consumer market of the food industry.
Source: built by the authors according to data (Belch et al., 2004; Coelho et al., 2012).

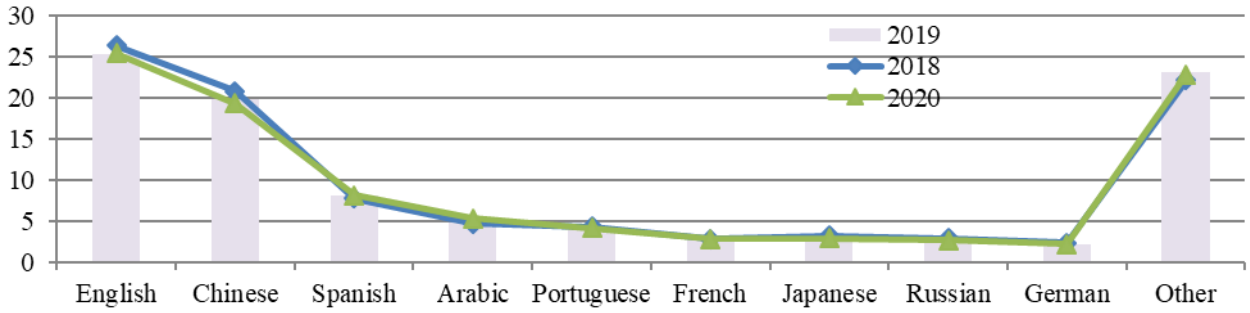

Fig. (6). The share of distribution by the world's population by language of the use of information and innovative technologies of the consumer market of the food industry, %.
Source: built by the authors according to data (Belch et al., 2004; Coelho et al., 2012).

gies of the consumer market of food products. In 2020, the country increased its share of services through information and innovation technologies in the food industry to 802 million people (or 49% of the world level), in the regions of Europe – about 705 million people (16.8% of the world level). In the regions that unite Oceania and Australia, the level of penetration of marketing communications in the logistics system of information and innovation technologies in this industry is 68.9% of the world consumer market. However, in these regions, the share of public use of the latest technologies in the studied market of goods is only 0.7%. In the regions of the Middle World, these indicators fluctuate within 64.5% and 3.9% respectively. In North America, the level of the development of marketing communications in the food market is 95% with the share of the audience that uses the logistics system of information and innovation technologies 8.2%. In the combined regions of Latin America and the Caribbean, these indicators are 67.2% and 10.4%, in Africa – 35.2% and 11% respectively (Fig. **5**).

A very important aspect of the influence of factors that stimulate the development of marketing communications in the logistics system of information and innovation technologies of the consumer market of the food industry is the distribution of the audience by language (Fig. **6**). During the period 2018-2020, the most common language for marketing communications in the logistics system of information and innovative technologies of the consumer market of the food industry is English. The Chinese language was 19.3% of the total language distribution in the system.

Europe ranks last in the number of users of information and innovation technologies in the consumer food market. At the

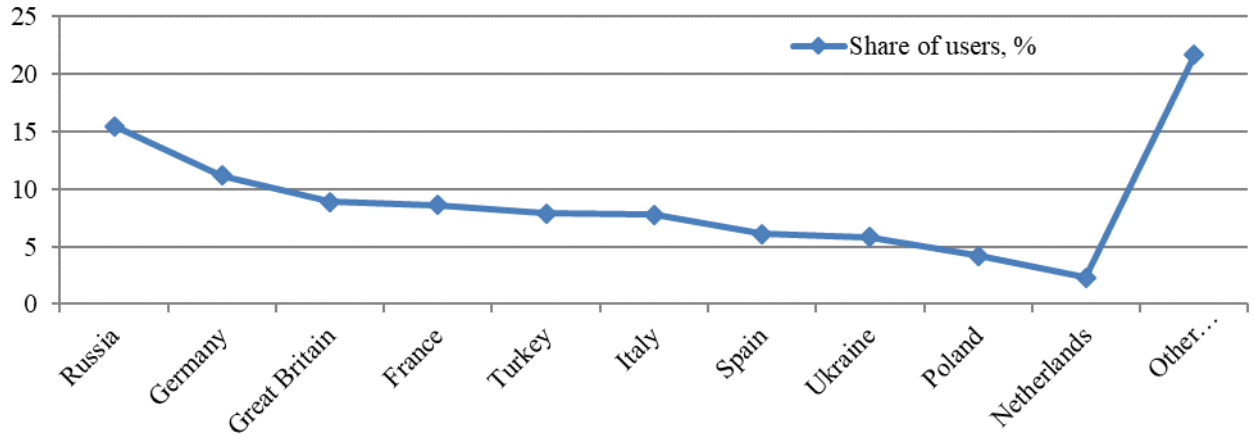

Fig. (7). The share of the population of European countries that has access to the logistics system of information and innovation technologies in the consumer market of the food industry, %.
Source: built by the authors according to data (Belch, et al., 2004; Coelho et al., 2012).

same time, Ukraine is located in the central part of Eastern Europe. Therefore, there is a need for a more detailed analysis of the countries included in this region in terms of the intensity of the development of marketing communications of the food industry through the logistics system of information and innovation technologies (Fig. 7).

It should be noted that the largest number of users of information and innovation technologies in the logistics system of the food industry is in Russia (15.5%), as well as in Germany (11.2%). Other countries have a share of users below 10% of the total in Europe. Ukraine actively integrates into the international Extranet-environment and ranks eighth among European countries, has 5.8% of information and innovation technologies in the food industry network from the total number of users of the logistics system of marketing communications in Europe.

4. DISCUSSION

Studies of the international network of marketing communications in the food industry show a close link between the level of the development of innovative technologies of enterprises in this area and the economic well-being of the country. The large-scale deployment of high-speed information and innovation technologies in the logistics system of food companies allows the sale of goods in the consumer market, thus multiplying the multiplier effect on other sectors of the national economy to accelerate technological progress. This ensures GDP growth in both individual regions and the country as a whole. In addition, developing countries with a better level of marketing communications in the logistics system of information and innovation technologies of the consumer market of the food industry attract more foreign investment (Adamska et al., 2014; Eurostat Statistics Explained, 2018).

We should note that the level of profitability of investors affects the intensity of the implementation of marketing communications of economic entities and their use of information and innovation technologies in the food industry. Spatial access of goods of food enterprises with an average level of investment capacity, especially at the stage of realization of their new types is especially attractive for a group of investors (Eurostat Statistics Explained, 2018), who invest their own funds in the operating cycle and provide an average level of financial performance of economic entities by such interrelated indicators as profitability of goods (x20), the ratio of own working capital (x21) and net profit from sales of goods (x20) (Fig. **8**).

Implementation of a comprehensive assessment of taxonomic indicators of the level of development of marketing communications in the food industry. This allows their clustering by financial performance and the level of use of information and innovation technologies in marketing and logistics departments, thus expanding innovation opportunities and ensuring the introduction of foreign and domestic investment in the industry through groups of investors to improve the functionality of the relationship and access to international and world level (Table **1**).

Thus, in 2016-2020, there was a significant improvement in the implementation of marketing communications and the use of information and innovation technologies in marketing and logistics departments of food companies. The highest level of the integrated indicator of financial activity is received by the enterprises, which interact with I and III groups of investors, the lowest level is traced between subjects of food branch with II and IX groups of investors.

This is because the first two groups of investors have changed their investment policy in the direction of expanding their influence on the financial capabilities of food companies to find new markets. Investors who have the least impact on the financial performance of economic entities in the studied consumer market are most committed to the European market, which is now almost closed for Ukrainian companies.

In order to determine the relationship in the system of indicators that characterize the effectiveness of financial activities of enterprises from the introduction of marketing communications in the logistics system of information and innovation technologies in the food industry, the authors implemented multidimensional statistical methods (factor and canonical

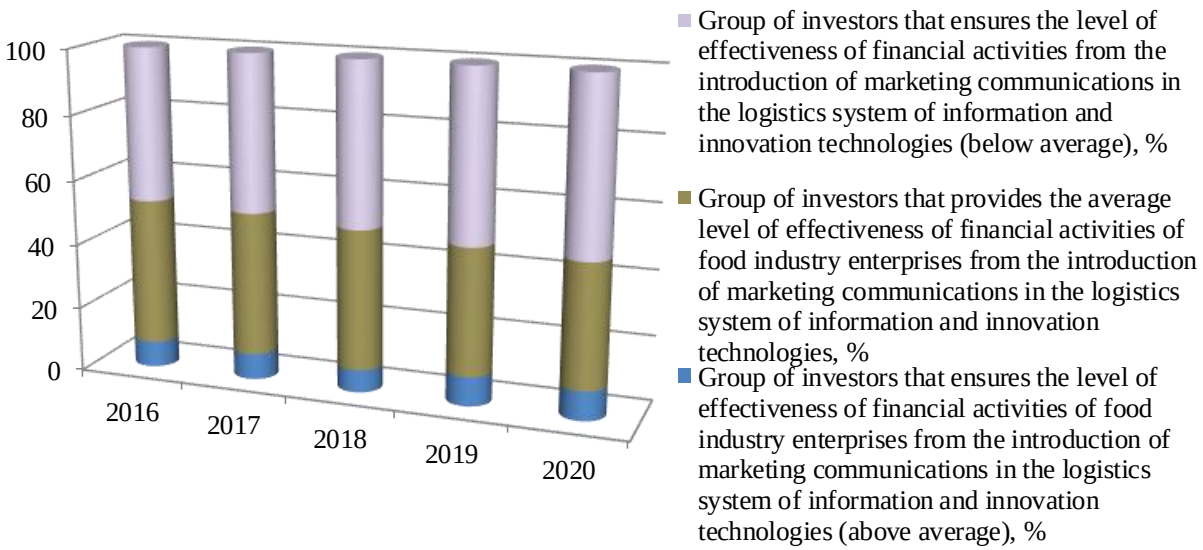

Fig. (8). Grouping of investors that ensure the level of effectiveness of financial activities of food enterprises of Ukraine and marketing communications in the logistics system of information and innovation technologies (the share of own funds entered into the operating cycle), %.

Source: built by the authors according to data (Belch, et al., 2004; Coelho et al., 2012).

analysis) which allow determining the relationship between partial indicators and their components, as well as to build a rating of the intersystem relationship of indicators. Because of the manifestation of internal causes – latent factors, mathematical models of these factors are built, and their number is much smaller than the number of initial indicators describing financial activities, marketing communications and the use of information and innovation technologies. Thus, this system of indicators can be replaced by a some number of factors that have the same in formativeness as the system of indicators.

Table 1. Integral performance indicators of financial activity of food industry enterprises of Ukraine from the introduction of marketing communications in the logistics system of information and innovation technologies and the level of use of information and innovation technologies in marketing and logistics departments in cooperation with a group of investors for 2016-2020.

Group of investors	An integrated indicator of financial activity from the introduction of marketing communications in the logistics system of information and innovation technologies of food industry enterprises	Integrated indicator of the level of use of information and innovation technologies in marketing and logistics departments of food industry enterprises
I Group of investors	0.623575	0.69231
II Group of investors	0.14248	0.4984
III Group of investors	0.566799	0.50146
IV Group of investors	0.242577	0.46153
V Group of investors	0.289653	0.52196
VI Group of investors	0.375236	0.26153
VI Group of investors	0.298347	0.35130
VI Group of investors	0.163715	0.33853
IX Group of investors	0.4754	0.289
X Group of investors	0.206301	0.4001

Source: calculated by the authors.

The algorithm of factor analysis provides the following stages: 1) for the matrix of input data (x) the correlation matrix is calculated (r); 2) the problem of commonality (r_h) of the studied factors (A) is solved; 3) rotation of factors in time (W) and direct assessment of factors (f). Recognition of factors and formulation of their name is carried out based on weighting factors a_{jr} from the reflection matrix A. Based on the values of these weights a_{jr} the rating of mutual influence of indicators and factors is established (Krugman, 2009; Varadarajan, 2010; Venetis et al., 2004).

Thus, the identified latent factors in each component of the financial stability of the food industry allow us to identify the root causes that cause changes in the values of indicators and provide close relationships. As input information for the implementation of factor analysis, the values of 22 indicators, structured by three components were chosen (Fig. **3**).

The model of latent factors in the development of marketing communications in the logistics system of information and innovation technologies consists of six equations, i.e. the first six factors by 76.51% explain the variability of the entire initial system of indicators. Significant and insignificant indicators should be considered to determine the internal relationship between indicators. The factor load is $a_{ij} \geq 0.7$. Thus, the equations of latent factors in the development of marketing communications in the logistics system of information and innovation technologies are:

$$f_1 = 0.717x_{13} + -0.77x_{15} + -0.792x_{16} + -0.926x_{18} + -0.907x_{22} \quad (2)$$

$$f_2 = 0.769x_s + 0.811x_6 + 0.827x_{10} \quad (3)$$

$$f_3 = 0.775x_3 + 0.721x_4 \quad (4)$$

$$f_4 = 0.889x_4 \quad (5)$$

$$f_5 = 0.717x_1 + 0.731x_{17} + 0.919x_{21} \quad (6)$$

$$f_6 = -0.779x_{12} \quad (7)$$

According to the calculations of factor analysis, the determining factor is the first one, because it explains 24.22% of the variability of indicators and is determined by the rating of the following indicators: the value of contracts for the sale of goods using information and innovation technologies (x18); net profit from sales of goods (x21); the share of salaries of the staff of the marketing and logistics department in the general Wage Fund (x16); the share of employees of the marketing and logistics department in the average number of staff (x15); the number of visits to the site for search queries (x13);

To determine the internal relationships directly between the use of information and innovation technologies, marketing communications and financial performance of food companies, the authors used canonical analysis, because this method allows assessing the relationship between two systems of random variables, which are systems of indicators that describe each subsystem. The stages of the algorithm for calculating the canonical analysis are as follows: 1) a matrix of values of the initial variables is formed, which are indicators, that consists of two parts: factor features (x_i) and performance features (yj); 2) the covariance or correlation matrix is calculated taking into account two groups of features; 3) the vectors of coefficients in the schedule of new canonical variables U and V are determined according to the corresponding indicators; 4) the canonical correlation coefficients r_{uv} are calculated; 5) the significance of canonical correlations is estimated. Analysis of the structure of canonical variables and the magnitude of canonical correlations allows the selection of the most informative variables by the characteristic of the closeness of the relationship between the two sets of variables and the content of the process (Venetis et al., 2004; Krugman, 2009; Varadarajan, 2010).

Only three equations need to be left to analyze the relationship between marketing performance and IT support, as these canonical variables have the closest relationship. Based on these equations, we will determine the rating of the intersystem relationship of indicators. Thus, the models of the relationship between the indicators of marketing communications and their information and innovation support are as follows:

$$r_{u_1^1 v_1^1} = 0.92357 \quad (8)$$

$$\begin{cases} U_1^1 = 0.146x_1 + 0.764x_2 + 0.000008x_3 + 0.057x_4 - 0.651x_5 - 0.8675x_6 - \\ -0.15x_7 + 0.017x_9 + 0.082x_{10} - 0.125x_{12} + 0.707x_{13} - 0.407x_{14}; \\ V_1^1 = 1.321x_{15} - 0.732x_{16} - 0.268x_{17} + 0.27x_{18} \end{cases} \quad (9)$$

$$r_{u_2^1 v_2^1} = 0.844 \quad (10)$$

$$\begin{cases} U_2^1 = -0.526x_1 + 0.254x_2 - 0.105x_3 + 0.088x_4 - 0.127x_5 - 0.34x_6 - \\ -0.307x_7 + 0.092x_9 + 0.319x_{10} - 0.504x_{12} + 0.506x_{13} - 0.109x_{14}; \\ V_1^1 = 0.364x_{15} - 1.095x_{16} - 0.609x_{17} + 0.826x_{18} \end{cases} \quad (11)$$

$$r_{u_3^1 v_3^1} = 0.746 \quad (12)$$

$$\begin{cases} U_3^1 = 0.055x_1 + 0.172x_2 - 0.033x_3 + 0.011x_4 - 0.703x_5 - 0.725x_6 - \\ -0.171x_7 + 0.127x_9 + 0.363x_{10} - 0.45x_{12} + 3.273x_{13} - 3.757x_{14}; \\ V_1^1 = -0.196x_{15} - 0.336x_{16} - 0.44x_{17} - 1.15x_{18} \end{cases} \quad (13)$$

Models of interrelation between indicators of marketing communications and effective indicators of financial activity are as follows:

$$r_{u_1^2 v_1^2} = 0.9923 \quad (14)$$

$$\begin{cases} U_1^2 = 0.02x_{15} - 0.023x_{16} + 0.015x_{17} + 0.992x_{18}; \\ V_1^2 = 0.066x_{19} - 0.02x_{20} - 0.008x_{21} + 0.967x_{22}. \end{cases} \quad (15)$$

$$r_{u_2^2 v_2^2} = 0.791 \quad (16)$$

$$\begin{cases} U_2^2 = -0.447x_{15} - 0.169x_{16} + 0.819x_{17} - 0.556x_{18}; \\ V_2^2 = 0.112x_{19} - 0.083x_{20} + 1.006x_{21} + 0.248x_{22}. \end{cases} \quad (17)$$

$$r_{u_3^2 v_3^2} = 0.429 \quad (18)$$

$$\begin{cases} U_3^2 = 1.326x_{15} - 0.0962x_{16} + 0.318x_{17} - 0.011x_{18}; \\ V_3^2 = 1.104x_{19} + 0.167x_{20} + 0.063x_{21} + 0.583x_{22}. \end{cases} \quad (19)$$

Models of interrelation between indicators of the use of information and innovative technologies and effective indicators of financial activity are as follows:

$$r_{u_1^3 v_1^3} = 0.929 \quad (20)$$

$$\begin{cases} U_1^3 = 0{,}12x_1 + 0{,}205x_2 + 0{,}154x_3 - 0.215x_4 - 0.654x_5 - 0.867x_6 - 0.145x_7 - 0.033x_9 - \\ -0.087x_{10} + 0.035x_{12} + 1.051x_{13} + 0.152x_{14}; \\ V_1^3 = 0.151x_{19} - 0.087x_{20} - 0.23x_{21} + 0.993x_{22}. \end{cases} \quad (21)$$

$$r_{u_2^3 v_2^3} = 0.929 \quad (22)$$

$$\begin{cases} U_2^3 = -0{,}695x_1 - 0.067x_2 - 0.209x_3 + 0.173x_4 + 0.373x_5 + 0.572x_6 + 0.044x_7 - 0.123x_9 - \\ -0.118x_{10} - 0.315x_{12} + 0.403x_{13} - 0.114x_{14}; \\ V_2^3 = -0.06x_{19} + 0.074x_{20} + 0.994x_{21} + 0.396x_{22}. \end{cases} \quad (23)$$

To continue the study of the impact of factors on the financial performance of enterprises we should calculate regression models of net profit from the sale of goods (y) from the most influential factors, namely, the value of contracts for

the sale of goods using information and innovation technologies (x18); the share of salaries of the staff of the marketing and logistics department in the general Wage Fund (x16); the share of employees of the marketing and logistics department in the average number of staff (x15); the number of visits to the site for search queries (x13);

The multifactor regression model has the form:

$$y = -20175.6 + 0.3965x_{13} + 3231.4x_{15} + 0.8636x_{18} \quad (24)$$

The model is statistically qualitative, as evidenced by the coefficient of determination $R^2 = 0.9933$, Fisher's criterion is $F = 2266.34$.

According to the model of increasing the number of impressions on search queries by one, will increase the net profit from the sale of goods by 0.3965; a thousand USD; increase in the share of employees of marketing and logistics departments of food industry enterprises in the average number of staff by 0.01 thousand USD will increase net income by 32.314 thousand USD, as well as increasing the value of contracts for the sale of goods by only one will increase net profit by 0.8636 thousand USD.

There is a need for analysis of the dependence of net profit on sales of goods (y) on the value of contracts for the sale of goods using information and innovation technologies (x18):

$$Y = 441.62 + 0.912x \quad (25)$$

The coefficient of determination $R^2 = 0.9869$, Fisher's criterion, $F = 3613.88$. According to this model, an increase in the value of concluded contracts for the sale of goods using information and innovation technologies by only one unit would increase the net profit from the sale of goods by 0.912 thousand USD.

At the same time, the dependence of the value of concluded contracts for the sale of goods using information and innovation technologies on the number of visits to the site for search queries (x13) is nonlinear and has the form:

$x_{18} = (366.595 + 0.0026x_{13})^2$, with the coefficient of determination $R^2 = 0.6336$, Fisher's criterion – $F = 82.99$. Thus, an increase in the number of visits to the site for search queries by one will increase the cost of contracts for the sale of goods using information and innovation technologies by 0.0016 thousand USD.

Clustering of the relationship between the studied groups of investors and food companies was performed by the method of Ward – on the criterion of a set of indicators: net profit from sales of goods (x21); the cost of concluded contracts for the sale of goods using information and innovation technologies (x18); the share of salaries of the staff of the marketing and logistics department in the general Wage Fund (x16); the number of visits to the site for search queries (x13).

Table 2. Average Values of Indicators in Clusters for 2016-2020.

Indicators	Cluster 1	Cluster 2	Cluster 3
x13	-3619.56	79996	-80129.5
x15	0.716937	0.316002	1.73154
x16	0.423011	0.070679	0.740436
x18	100354	450531	31644
x21	86197.6	409254	24660

Source: calculated by the authors.

The results of cluster analysis allow identifying the invariant core, i.e. the functional relationship between investors and enterprises that have been part of the same cluster for several years and have a stable position in the consumer market of food products (Table **2**).

Thus, the first cluster (functional relationship between a group of investors and enterprises that have the same benefits from marketing communications in the logistics system of information and innovation technologies of the consumer market of food products) includes: X, IV, I, V and VI; the second cluster – III, II, VIII; the third cluster – VII and IX. That is, the functional relationship between a group of investors and food companies (second cluster) is characterized by the highest values of such factors as x21, x18, x13. It should be noted that for the first and third clusters, the factor x13 received negative values. This is due to the fact that in the presence of invested resources in the operating cycle of cash flows, foreign investors and food companies direct funds not to the introduction of new information and innovation technologies in general and the development of marketing communications through brand sites, they do not allocate funds to attract new consumers through search queries.

Thus, the analysis of the average values of factors for clustering for 2016-2020 showed that further research should be based on the values of the second cluster. First, unlike the others, the second cluster is an invariant nucleus, i.e. has a stable position. Secondly, financial factors (profit from sales of goods), the factor of marketing communications (the cost of contracts for the sale of goods using information and innovation technologies) and the factor of information and innovation support of marketing and logistics department (number of visits to the site for search queries) five years in this cluster have positive indicators. Taking into account the results of the cluster analysis using the method of taxonomy, it becomes possible to build a graph of the integrated financial performance of food companies in Ukraine from the introduction of marketing communications in the logistics system of information and innovation technologies and the level of use of information and innovation technologies in marketing and logistics departments when interacting with a group of investors. This dependence can be described by the equation: $I_{efa} = 0.58 + 0.29I_{uiit}$. It follows that with increasing the level of use of information and innovation in the marketing and logistics departments of the food industry by 0.1, the level of financial efficiency will increase by 0.029.

5. CONCLUSIONS

Recent studies have shown that the pace of globalization and integration in the functioning of economic mechanisms of different countries contribute to the creation of a single informational and economic space. Thus, the current economic conditions of food industry enterprises are characterized by difficult levels of technological and economic development, intensification of competition in the consumer market be-

tween countries. From a macroeconomic point of view, food companies are at a low level of marketing communications, and in this case, the direction of the development of economic entities is to optimize budget expenditures for the introduction and use of information and innovation technologies. This significantly optimizes the cost of marketing communications and increases the complex of operational marketing. Such optimization of budget expenditures should be based on a thorough study of alternatives for the development of marketing communications in the logistics system of information and innovation technologies, and which is most suitable for a particular food company, taking into account its capabilities and the specifics of promoting goods on the consumer market of food products.

The research determined the aspects of influence that stimulate the development of marketing communications in the logistics system of information and innovation technologies of the consumer market of the food industry and proved the importance of these factors. Marketing communications in Europe, which includes Ukraine, are not very developed. Therefore, there is an urgent need to research the system of information and innovation technologies and establish international relations. In the logistics system of the food industry, Ukraine took 8th place and has well-developed neighboring states that are the most users of information and innovation technologies. The need to use the field of marketing communications in the logistics system of information and innovation technologies of the consumer market requires expanding the network aimed at building sustainable business relationships with customers, a business strategy that is aimed at using advanced management and information technologies, with the help of which companies collect information about their customers at all stages of the life cycle (attraction, retention), using the interests of your business by building mutually beneficial relationships.

The need to use the field of marketing communications in the logistics system of information and innovation technologies of the consumer market convinces to expand its network through the "CRM-system", which went beyond just a software product and grew into a concept aimed at building sustainable business relationships with customers, business strategy, which aims at using advanced management and information technologies, through which companies collect information about their customers at all stages of the life cycle (attraction, retention), using the interests of their business by building mutually beneficial relationships. In addition, the "CRM-system" reflects the communication capabilities of the logistics system of information and innovation technologies, the tools of which are the study of competitors, analysis of consumer preferences, and the behaviour of potential consumers. This allows increasing business, competitiveness and development of new markets, expanding the range of products offered in accordance with the needs of the consumer market of the food industry.

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