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Logistical modelling of managerial decisions in social and marketing business systems

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Abstract. Logistical modelling of business systems within the context of mathematical logistics, logistical management, operational research as well as rationalistic provision of logistics at an enterprise have been considered in the article. The research was carried out on the methodological basis which included the authors' developments and implied conveying familiar knowledge on new objects within the field of linear programming. Scientific novelty concerns the development of categorical toolkit as well as the existing methodical approaches of rationalistic logistics to managerial decisions. Rational areas of using terms "logistical model" and "model of logistics" in business environment have been determined. The authors' methodology of constructing logistical models in management of separate social and marketing systems of enterprises according to minimization and maximization criteria is presented. Ways of using modelling at not conventional objects of logistical support for managerial decisions have been suggested in the context of studying the moral psychological climate of staff and complex estimation of socioeconomic measures of staff management improvement. The procedure of logistical optimization in the system of distributing and advertising activity of the enterprise has been developed. Approbation of the developed models has been carried out and possibilities for further model's complication by output data, variables, and limitations under specific practical conditions have been grounded.

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1. INTRODUCTION

Management is a complex and versatile field of professional knowledge and skills with a wide range of positions and approaches. The term "logistical modelling" in the system of management has been used in many contemporary scientific researches (Bonanno et al., 1998; Xin et al., 2007; Kalinina & Hardin, 2012; Caffrey et al., 2015; Velychko & Velychko, 2017). Moreover the category "model of logistics" has also been considered essential (Sarder et. al., 2011; Aksyonov et. al., 2013b; Schumann-Bölsche et. al., 2015; Postan, 2016; Vasylieva & Pugach, 2017).

Analysis of the previous scientific research makes it possible to generalize the unsolved parts of the research issue. Particularly: in economy there is no difference between terms "logistical model" and "model of logistics", usually the difference is not grounded. Possibilities for logistical modelling of solutions in marketing, particularly in solving problems of staff management, are more limited, as compared to the manufacturing field. A non-linear type of many manufacturing functions in business limits the possibilities for applying linear programming in logistical modelling. Researches on logistical modelling are not focused on studying moral-psychological climate among staff and complex estimation of socioeconomic measures towards the improvement of staff management at enterprises. The already known logistical models used in the systems of distribution and advertising do not sufficiently consider limitations in businesses' production capacities, possible efficacy of each separate type of advertising, size of the involved target audience of potential consumers, minimally required amounts of applying certain advertising sources and a set of other factors.

In general, the fields of staff management and marketing at an enterprise along with the potential of logistical modelling remain insufficiently studied. Therefore, the approach to application of modelling in relation to unconventional objects of logistical support to managerial solutions is a new one. In particular, this is the research of moral-psychological climate and a systematic evaluation of socioeconomic measures concerning staff management improvement. Novelty includes the development of alternative complex procedures for logistical modelling with the aim of business processes' optimization in distribution and advertising fields.

Hence, the purpose of the research is development and presentation of the authors' methodology of forming a set of logistical models in management of social and marketing business systems as well as demonstration of its practical implementation.

2. LITERATURE REVIEW

At the moment in the business environment there are many ways of using and applying logistical models. These models have been studied and implemented, but it mainly concerns the field of production, storage and transportation. Among the latter the researches made by I. V. Morozova et al. (2013), M. Longbanga et al. (2013), P. Mirchandani et al. (2013), S. Yan et al. (2014), R. Bortolini et al. (2015), J. Nelles et al. (2015), N. Vasylieva (2016), N. Vasylieva & A. Pugach (2017) should be considered.

At that modelling in social systems is mainly not of a logistical type. It has been confirmed by the researches carried out by T. Jung and K. A. S. Wickrama (2007), J. B. Nezlek (2011) and others. However S. Seuring (2013) notes that, social factors are vice versa insignificantly considered in logistical systems. But certain efforts in studying logistical modelling in social business systems took place before. For example: modelling of the hiring process (Karsak, 2000); cost for labor resources' optimization (Matthews, 2004); scheduling staff's work (Topaloglu & Selim, 2010); increase in workers' productivity (Ighravwe & Oke, 2014) and so on. Meanwhile these studies are not focused on studying moral-psychological climate and complex estimation of socio-economic means concerning staff management improvement at enterprises.

Logistical modelling of marketing decisions is more widespread in comparison with social business-systems. It was confirmed by scientific works by L. K. Oliveira et al. (2010), F. A. Ficken (2015), M. Postan (2016) and many others. However there are studies on modelling systems for stimulating product sales. W. K. Ching et al. (2006), as well as B. Pérez-Gladish et al. (2010) suggested linear logistical models in the field of advertising with the function of efficiency– maximization of a general amount of sales. Studies by K. C. Lee et al. (2013) and C. Karande et al. (2013) are focused on optimization of costs in the internet-advertising environment. Logistical models which ignore limitations on production capacities, possible efficiency of each separate type of advertising, amount of covering the target audience of potential consumers, minimal necessary volumes of using certain sources of advertising and a set of other factors have been suggested.

3. METHODOLOGY

Scientific research work was carried out on the methodological base which considers the authors' development. The research implies applying the known knowledge to new objects. The authors' hypothesis has been used as the basis for the research considering the dualistic type of business logistics (rationalistic and providing types) – (Velychko, 2014; Velychko, 2015; Velychko & Velychko, 2017). Besides, the paradigm appeared that classical mathematic logistics did not lose the connection with economic processes and they became relevant to business logistics first of all due to economic mathematic modelling. And when the mathematical model is filled with certain content, it becomes a digital logistical model.

K. Aksyonov et al. (2013a), I. Heckmann et al. (2015) and B. Ghilic-Micu et al. (2016) pay attention to the fact that logistical modelling is an essential factor for supporting managerial decisions in contemporary business systems. At that the term "logistical modelling" as "logistical regression" is a certain development of logic as a science about features and methods of thinking (Mihalovič, 2016). However in a significant sense they are not equal. Logistical modelling to a bigger extent correlates with the research of operations and is one of the ways for rationalistic business-logistics (Vasylieva et al., 2015; Soto-Silva et al., 2016).

Based on the rationalistic type of business logistics' development, the term "logistical model" should be used for defining the systems of logic, which represents an attempt to create logistical approaches to formal calculation. Therefore this term should be reasonably considered in the system of rationalistic business logistics toward mathematical, algorithmic, matrix and other informational models, which are used in the process of solving separate managerial tasks both in providing logistics (supply, maintenance of production, distribution), as well as in other functional fields of enterprises' activity (production, marketing, finances, staff management and so on). And within the environment of the providing logistics it is reasonable to use the term "model of logistics" as an image which performs the role of the substitute for a certain logistical approach or logistical system in a certain object.

Due to this research the further developments of managing business systems with rather limited possibilities for logistical modelling have been achieved. The main attention was focused on separate social and marketing systems of enterprises. Among the social ones there are moral psychological climate inside staff and general staff management. Among the marketing ones there is advertising activity and distribution.

The basis for the logistical modelling of such decisions has been considered as the method of linear programing, which is focused on description of existing limitations using the system of linear equations. At that the authors' logistical model with two types has been constructed: minimization and maximization.

At the *first stage* the logistical system has been developed. The system is focused on optimization and carrying out researches within the moral psychological climate in enterprise's staff (*first type)*. Such diagnostics can be carried out by experts of a consulting company with the help of special methods of sociological research (surveying, testing, questioning, interviewing, observation and so on). The model considers the complex laboriousness, cost price, and effectiveness of the corresponding measures.

Mathematical setting of a logistical task. We will denote I as multitude with elements which are indices of different research methods. The value of 1 man-hour in case of carrying out social psychological research by i method shall be equal c_i $(i \in I)$, and the probability to receive reliable information using that method is p_i $(i \in I)$. Among all methods of the research we can define k groups, each of them includes selective methods of the research, which can be applied to the total $(k \in J)$. J will be multitude which elements are indices of different groups of such methods, L_k $(k \in J)$ is multitude which elements are indices of k-group. For each group we know the minimal necessary total time needed for carrying out the research. We will denote it as T_k $(k \in J)$. For receiving more objective results we use several groups of such methods. Top managers of an enterprise can receive tasks from customers, so that the general probability of receiving reliable information while carrying out social psychological investigations with different methods will be less than γ. Through the graph of loading by other orders, the experts of the consulting organization as a rule cannot allocate more than M man-hours to provide services. At the same time one of the tasks of this process is minimization of the research budget for the ordering enterprise. It is necessary to know the optimal totality of research methods which can satisfy the conditions mentioned above and minimize the general costs of an enterprise for those researches. To make up the mathematical model of the task we use the indeterminates. We will denote x_i $(i \in I)$ as labor losses for carrying our social psychological researches with i-method.

Considering the lower limit for general probabilities of receiving reliable information to carry out social psychological researches with different methods we receive the first limitations to the task

$$\frac{\sum_{i \in I} p_i x_i}{\sum_{i \in I} x_i} \geq \gamma \tag{1}$$

This inequality could be simplified as follows:

$$\sum_{i \in I} (p_i - \gamma) x_i \geq 0 \tag{2}$$

Hence the general resource of the experts' work on social psychological researches cannot exceed the top limit. Thus we obtain the following inequality (second limitation to the task):

$$\sum_{i \in I} x_i \leq M \; . \tag{3}$$

The third group of limitations includes those inequalities which consider minimal labor costs for the certain groups of methods specified above,

$$\sum_{j \in L_k} x_j \geq T_k \;\; (k \in J). \tag{4}$$

The group of trivial limitations which correspond to not negative numbers of the needed values of variables should be added,

$$x_i \geq 0 \; (i \in I). \tag{5}$$

Since the criterion for optimality of the task is the minimal general costs for carrying out all psychological researches with different methods, the efficiency function implies the total cost of all researches as

$$F = \sum_{i \in I} c_i x_i \rightarrow min\,. \tag{6}$$

Hence it is necessary to calculate those not negative x_i, which satisfy the limitation system *k* + 2 and provide minimal efficiency function.

The numerical model is formed on the basis of specific output data and systems of variables and limitations. As output data we can use labor costs for carrying out social psychological researches, prognostic probability indices of receiving reliable information and costs for man-hour while carrying out social psychological studies using different methods.

At the *second stage* the logistical model was developed. This model is focused on optimization of the complex research in the general system of staff management of an enterprise (*second type*). We consider a set of possible solutions towards improving staff management, implementation of which should provide the increase in the existing level of labor productivity. The aim of the logistical solution is to provide the optimal selection of alternative measures and amounts for their implementation (considering the minimal necessary result and maximal reasonability and minimally possible labor costs as well as budget limitations). The output information is considered as the labor value costs for consultative and organizational support to carry out separate measures on improving staff management, predictive indices towards the expected annual level of labor productivity improvement in realization of those measures as well as cost price (if an enterprise carries them out by itself) or contractual costs (if an enterprise uses outside organizations and experts).

Mathematical setting of a logistical task. Minimally necessary labor costs for carrying out *i*-event shall be equal to t_i, and maximal possibilities - T_i $(i \in I)$. We will denote *I* as multitude, which elements are indices of different measures. For each event separately, we know the expected increase in labor productivity which equals $p_i(\%)$, as well as the cost for 1 man-hour. The task is set to achieve the annual increase in labor productivity due to improvement in the staff management system, hence from implementation of most efficient measure – not less than $P(\%)$. The budget of costs on carrying out measures with improvement in staff management should not be more than *M* of money units. It is necessary to carry out optimal selection of measures and their amounts which would provide minimal financial costs and performance of all the mentioned conditions. To build up a mathematical model of the task we will use indeterminates. We will denote x_i $(i \in I)$ as labor costs for carrying out *i*-event if it is selected.

The first group of limitations is represented by inequalities which consider minimal possible labor costs for carrying out certain measures,

$$x_i \geq t_i, \ (i \in I). \tag{7}$$

Considering the maximal available labor costs for carrying out certain events or measures, analogically we will receive the second group of limitations:

$$x_i \leq T_i, \ (i \in I). \tag{8}$$

The need to provide minimal annual increase in labor productivity is modeled by the following inequality

$$\frac{\sum_{i \in I} p_i x_i}{\sum_{i \in I} x_i} \geq P\,. \tag{9}$$

This inequality can be simplified to the form

$$\sum_{i \in I}(p_i - P)x_i \geq 0. \quad (10)$$

Considering budget limitations to carry out events on enhancement of staff management, we will get the third limitation:

$$\sum_{i \in I} c_i x_i \leq M. \quad (11)$$

We should add here a group of trivial limitations that correspond to the not minus values of the needed variables:

$$x_i \geq 0 \ (i \in I) \quad (12)$$

Hence the criterion for the task optimization is a minimum of general costs to provide all measures to improve the staff management system, the efficiency function means the total cost of all measures and it will be

$$F = \sum_{i \in I} c_i x_i \rightarrow min. \quad (13)$$

At the *third stage* the developed logistical model which is focused on optimization of a complex of measures in the field of sales stimulation (advertising) of produce (*third type*). In the process of preparation of such managerial decisions it is necessary to simultaneously provide both maximization of efficiency and minimization of budget costs on implementations of the corresponding measures. This was determined as the subject of constructing a logistical task.

Mathematical setting of a logistical task. To carry out advertising of agrarian produce we chose several of the existing means of mass media. We will denote *I* as a multitude of elements which are indices of those means. By the way of statistical research we determined the expected probability of receiving potential buyers from the target audience, which equals p_i for *i*-means of mass media, the number of customers equals $m_i \ (i \in I)$. The total number of customers in this case should be not more than *M*. The cost for an advertising unit for *i*-means of mass media shall be *C*. For the company's advertising campaign a limited amount of money is planned to be allocated. The total probability of receiving customers from the target audience should be not less than *P*. It is necessary to know optimal multitude of mass media means with the purpose of minimizing costs for the advertising campaign of an enterprise while corresponding to all the conditions mentioned above. To build a mathematical model of the task it is necessary to input the indeterminates. We will denote $x_i \ (i \in I)$ as a number of advertising units for *i*-means of mass media.

To provide the coverage of the planned number of potential buyers, we should use the inequality which is the first limitation to the task,

$$\sum_{i \in I} m_i x_i \geq M. \quad (14)$$

The total probability of receiving customers from the target audience is modelled by the inequality, which is the second limitation to the task,

$$\frac{\sum_{i \in I} p_i x_i}{\sum_{i \in I} x_i} \geq P. \quad (15)$$

This inequality could be simplified as follows

$$\sum_{i \in I}(p_i - P)x_i \geq 0. \quad (16)$$

Hence the amount of money for carrying out the advertising campaign is limited. Thus we receive one more inequality which is included in the system of limitations to the task

$$\sum_{i \in I} c_i x_i \leq C. \tag{17}$$

We also should add the group of trivial limitations which correspond to not negative values for the needed variables,

$$x_i \geq 0 \ (i \in I). \tag{18}$$

Hence the criterion for task optimization is minimal general costs for advertising in different mass media, the efficiency function shall mean the general cost for all advertising campaign and it shall be equal to

$$F = \sum_{i \in I} c_i x_i \to min. \tag{19}$$

At the *fourth stage* the model was developed which is focused on optimization of managerial decisions in the environment of distributing enterprises' logistics (*fourth type*).

Mathematical setting of a logistical task. To sell the produce which is produced by the company, *n* ways of distribution have been planned. The profit from the produce sales depends on distribution channels and sales periods. The whole sales period consists of *m* intervals. The predicted profit from sales per one unit of produce during the *i*-period of time - ($i = \overline{1, m}$) by *j*-channel of distribution ($j = \overline{1, n}$) equals c_{ij} . The multitude of profit constructs the corresponding matrix:

$$C = \begin{pmatrix} c_{11} & c_{12} & \dots & c_{1n} \\ c_{21} & c_{22} & \dots & c_{2n} \\ \dots & \dots & \dots & \dots \\ c_{m1} & c_{m2} & \dots & c_{mn} \end{pmatrix} \tag{20}$$

The limitations for produce demand in each period by a certain channel of distribution imply the possibility of selling during *i*-period shall be not more than P_i units of produce. The limitations by the producing capacities, storing or sales plan in each period imply that sales during *i*-period cannot be more than P_i units of produce. The known constant orders for produce at certain periods of time and at certain channels of distribution in *i*-period for *j*-channel of distribution shall be not less than m_{ij} . Amount of the created produce - $(i \in I, \ j \in J)$. *I* – multitude which elements are indices for time periods with constant orders. Analogically *J* – multitude which elements are indices of distribution channels, when and order was received. At a certain time period by the separate channel of distribution it is possible to sell not less than p_i units of produce. It is necessary to determine which amount of agrarian produce should be sold at each time period by one channel of distribution, so that the expected profit shall be maximal.

To construct a mathematical model of the task we will use indeterminates. x_{ij} $(i = \overline{1, m},$ j=$\overline{1, n})$ - an amount of produce which should be sold in *i*-period by *j*-channel of distribution. The number of indeterminates equals m×n, they can be built as elements of the following matrix:

$$X = \begin{pmatrix} x_{11} & x_{12} & \dots & x_{1n} \\ x_{21} & x_{22} & \dots & x_{2n} \\ \dots & \dots & \dots & \dots \\ x_{m1} & x_{m2} & \dots & x_{mn} \end{pmatrix} \tag{21}$$

Considering the expected demand for the produce during each period by a separate channel of distribution, we will obtain a group of limitations

$$\sum_{i=1}^{m} x_{ij} \le P_i \ (i = \overline{1,m}). \tag{22}$$

The restrictions toward the plan of the sold produce during each period make it possible to construct the following group of limitations

$$\sum_{j=1}^{n} x_{ij} \le P_i \ (\mathrm{j} = \overline{1,\mathrm{n}}). \tag{23}$$

Eventually, the provision of the granted orders requires construction of one more group of limitations:

$$x_{ij} \ge m_{ij} \ \ (i \in I, \ j \in J). \tag{24}$$

Criterion of optimization is the maximal profit from the sales of the corresponding produce. Thus the efficiency function shall be

$$Z = (C, X) = \sum_{i=1}^{m}\sum_{j=1}^{n} c_{ij} x_{ij} \rightarrow \max. \tag{25}$$

The matrixes of the developed logistical models have been constructed based on the provided data and solved with the help of a linear programming method in Microsoft Excel environment.

4. EMPIRICAL RESULTS AND DISCUSSION

The *first type* of a logistical model was used for grounding managerial decisions about conditions for carrying out researches on a moral-psychological climate of staff in "KinLight" LLC. The research should be carried out on use of factual and prognostic data (Tables 1-2). One of the possible contractors of the order is a specialized consulting company "Altek" LLC (Dnipro, Ukraine). The subject of the alternative selection shall be- specific sociological methods of carrying out the research considering the amounts of labor and financial costs and expected efficiency. At that two additional conditions were added to the output data. Besides the task of "KinLight" LLC was to have not less than 60% of total probable received information while carrying out social psychological researches by different methods. Moreover due to the loading schedule because of other orders the experts of a consulting company could not work on the task made by "KinLight" LLC more than 500 man-hours.

Table 1

Minimal labor costs for carrying out social-psychological researches by different methods

Combination of sociological methods	Labor costs, man-hours
Total survey + testing + poll	86
Group survey+ testing + poll	62
Selective survey + testing + poll	55
Total + group + selective interviewing	100
Total + group + selective observation	120

Source: Authors' results.

To solve this task variables were considered as labor costs (man-hours) in management of "KinLight" LLC for: x_1 – total survey; x_2 – group survey; x_3 – selective survey; x_4 – total testing; x_5 – group testing; x_6 – selective testing; x_7 – total poll; x_8 – group poll; x_9 – selective poll; x_{10} – total interviewing; x_{11} – group interviewing; x_{12} – selective interviewing; x_{13} – total observation; x_{14} – group observation; x_{15} – selective observation. The matrix's limitations to the logistical model were combined into four groups.

Table 2

Probability of receiving information and price value per 1 man-hour while carrying out social-psychological researches by different methods

Sociological method	Output data	
	Probability	Cost, UAH
Total survey	0.80	102.5
Group survey	0.75	100.5
Selective survey	0.70	96.4
Total testing	0.60	101.2
Group testing	0.70	94.8
Selective testing	0.40	88.5
Total poll	0.50	106.5
Group poll	0.45	90.0
Selective poll	0.35	82.0
Total interviewing	0.60	71.5
Group interviewing	0.35	65.0
Selective interviewing	0.30	60.0
Total observation	0.95	48.5
Group observation	0.85	45.5
Selective observation	0.80	40.0

Source: Authors' results.

First group of limitations is minimal labor costs for carrying out the research on moral-psychological climate of staff at an enterprise by different methods.

The second group of limitations is probability of receiving information while carrying out social-psychological research by different methods.

The third group of limitations is by not negative values of variables.

The fourth group of limitations is by maximal use of costs for social-psychological researches.

Efficiency function is minimal cost for carrying out the research on moral-psychological climate of staff in an agrarian enterprise by different methods.

As a result of solving this logistical task we found out that while carrying out the research on moral psychological climate of staff at "KinLight" LLC the most optimal variant of the order will be man-hours: total survey – 86; group testing– 50.2; group poll – 4.8; selective poll – 62; selective interviewing – 100; selective observation – 120. It made possible to achieve the set goals while estimating the moral psychological climate of staff and minimize costs on carrying out such researches. For "KinLight" LLC the price tag is 59.884 thousand UAH.

The second type of the logistical model was used for grounding the managerial decision towards optimal selection of limitations for alternatives of improving the general system of staff management in the public joint-stock company "Orion". The expected contractor of the order is hiring agency "Personal Plus" LLC (Dnipro, Ukraine). Construction and solution to such a numerical logistical model has been made based on data of laboriousness for carrying out the corresponding measures and their expected efficiency based on previous work experience (Table 3).

We considered the following variables in this task – labor costs (man-hours) for consultations and organizational support for carrying out the measures towards: x_1 – improvement in the system of labor stimulation; x_2 – improvement in conflict and stress management ; x_3 – improvement in a style and methods of management; x_4 – rotation of linear and functional managers; x_5 – improvement of the moral-psychological climate. We added to the output data conditions that company "Orion" set a task to increase annual efficiency at least by 10 % and allocate the amount of money for carrying out measures on management improvement not more than 100 thousand UAH. The limitations in the matrix of the numerical logistical task model were united into four groups.

Table 3

Output information for creating the matrix of the numerical logistical model for the task of optimizing measures and improving the general system of staff management at an enterprise

Measure	**Labor costs, man-hours**		**Expected annual increase in labor productivity, %**	**Cost, UAH / man-hours**
	minimal	**maximal**		
Improvement in the system of labor stimulation	80		8	100.5
Improvement in management over conflicts and stresses	56		6	170.5
Improvement in a style and methods of management		96	7	129.0
Rotation of linear and functional managers		20	10	124.0
Improvement of the moral-psychological climate	48		12	121.5

Source: Authors' results.

The first group of limitations – by maximal and minimal labor costs for carrying out measures for improving the hiring management system at an enterprise.

The second group – limitations to the minimal annual labor productivity increase due to the implementation of measures based on improvement of the staff management system at an enterprise.

The third group – limitations to the maximal amount of budget costs to improve the staff management system at an enterprise.

The fourth group – limitations to not negative values of variables.

Efficiency function – minimal costs for carrying out measures to improve the staff management system at an enterprise.

As a result of solving this logistical task we found that while planning decisions to improve the staff management system at an enterprise the most optimal costs will be 160 man-hours to improve the system of labor stimulation; 112 man-hours to improve the conflicts and stresses management over and 384 man-hours to improve the moral psychological climate of staff at an enterprise. It will enable managers to achieve the set goals towards the increase in labor productivity up to 81.832 thousand UAH and minimize costs for carrying out the corresponding measures for improving the staff management system at an enterprise.

The third type of the logistical model was used for grounding the managerial decision towards optimal selection of limited alternatives for an organization of the advertising campaign for company "Inter-Module" (Dnipropetrovsk region, Ukraine). While carrying out the advertising campaign the management of the enterprise planned to use local and regional mass media resources. For the advertising campaign it was planned to spend less than 50 thousand UAH. At that the important task of carrying out advertising was to minimize logistical costs under the condition of abiding all qualitative parameters.

In the process of solving this task we denoted variables as: x_1 – amount of advertising in newspaper "Zorya", 1/32 pages; x_2 – amount of advertising in newspaper "Nashe Misto", 1/32 pages; x_3 – amount of advertising in magazine "Propozutsiya", 1/32 pages; x_4 – amount of advertising on radio "Samara", 10 seconds; x_5 – amount of advertising on radio "Nashe Radio", 10 seconds. Each of the advertising was aimed at attracting a certain number of potential clients (wholesalers and retailers, processing enterprises, individual buyers and so on).

The output information for creating this logistical system included: approximate coverage of the target audience for potential buyers of the produce (according to average data of mass media for many years); expected probability of receiving customers for the company from the target audience (according to average data of mass media for many years); expected costs for the advertising unit in the studied mass media; minimal amounts of using different ways to maintain sales for enterprises. The limitations to the matrix in the logistical system of the task were united into five groups.

The first group included the target audience of buyers.

At that an enterprise had a task that the general probability of receiving clients form the target audience should be not less than 25 %. Hence the second group of limitations was to receive potential buyers from the target audience. Pareto principle was considered (80:20). It means that from all customers of the produce only 20 % of the total amount could potentially provide the profit from sales in the amount of about 80 %. Consequently the contribution of other clients will be insignificant. Therefore the requirements to receive customers from the target audience for company's produce in the logistical task will decrease to the level 1/5, that is not less than 5 %. As a result of simplification we obtain the second limitation.

The third group of limitations – with minimal application of advertising means – newspapers and magazines.

The fourth group of limitations – with the maximal amount of costs for the advertising campaign.

The fifth group of limitations – without negative values of variables.

The efficiency function – minimal costs to maintain the sales of the produce through advertising.

Table 4

Project of the logistical decision for a farming enterprise towards distribution of produce by channels of sales within months

Period	**Amount, tons**	
	chain of retailers (supermarkets, groceries and so on)	**local food markets and auctions**
September	90	50
October	80	70
November	75	65
December	65	55
January	50	110
February	69	90
March	60	65
April	50	120

Source: Authors' results.

As a result of the logistical task solution it has been determined that the cheapest variant of maintaining sales of the company through advertising mass media is advertising through commercials in newspaper "Nashe misto" – 9 streaks, total 1/32 pages; magazine "Proposutsiya" – 8 streaks, total 1/32 pages and radio "Samara" – 19 minutes of total air time. At that the minimal costs were 46.735 thousand UAH. The fourth type of the logistical model was used for grounding the managerial decision towards optimal distribution of produce by distribution channels of the farming enterprise "Svitanok" (Dnipropetrovsk region, Ukraine). Amounts of sales for a specific type of produce (onion) with different channels of distribution during the period of 8 months (from September to April) were considered as variables of the matrix. . In this case the logistical task included 16 variables: 8 from sales of onion in the retailing net (supermarket, groceries and so on) and 8 – amounts of onion sales at local food markets.

Target function, maximal profit from production and sale of onion by different types of distribution are as follows.

According to the results of solving the task it has been determined that the maximal profit from sales of onion during 2017-2018 marketing years should be 1.803 550 mln UAH. Thus in the system of management of the farming enterprise the project of the logistical decision towards distribution of the agrarian produce by channels of sales could be developed (Table 4).

Analysis of this project for the farming enterprise confirmed certain unreasonable approaches to satisfaction of the expected demand by both channels during certain periods.

5. CONCLUSION

The method of logistical modelling in social and marketing business systems, despite its rather limited application as compared to manufacturing field, has its own niches for application. However, it is necessary to consider the existence of two controversial approaches. On the one hand, while making the final decision the logistical estimation cannot be absolute, hence, along with rational thinking,it is reasonable to consider other selecting factors (reputation, experience in cooperation, intuition, prospective possibilities, threats and so on). On the other hand – intuitive selection without any grounding cannot be viewed as methodologically correct and/or absolutely efficient. The combination of these two approaches in management will make possible to increase the chances of the correct selection among the alternatives.

Theoretical value. Methodical approaches to projecting managerial decisions based on the complex of measures of rationalistic logistics found their further development here. The developed methodology makes it possible to apply optimization models for new, not conventional objects of logistical decision support in the system of social and/or business systems' management. Besides, it improves and develops the previous researches concerning logistical modelling in its application to management of marketing systems. The matrices of the implemented authors' models can be significantly complicated by output data, variables and limitations.

Practical value. The developed logistical models within the system of staff management can be used for optimization of moral psychological climate among staff and also for taking further separate measures so that to improve the staff management system. In marketing management – those are specific decisions in the area of stimulating sales and distribution. At that, the studied authors' logistical models are focused on creative application, further development and adaptation to the conditions of a particular business.

Further scientific research in this direction should be focusing on studying the possibilities for logistical support of the decisions in the systems of motivational management and network marketing.

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