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INTEGRATED MODELING OF SOLUTIONS IN THE SYSTEM OF DISTRIBUTING LOGISTICS OF A FRUIT AND VEGETABLE COOPERATIVE

Oleksandr VELYCHKO

Dnipropetrovsk State Agrarian and Economic University, Voroshilova 25, 49600 Dnipropetrovsk, Ukraine
E-mail: olvel@ukr.net

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Abstract. A mechanism of preparing rationalistic solutions in the system of distributing logistics of a fruit and vegetable cooperative has been studied considering possible alternatives and existing limitations. Belonging of separate operations of the fruit and vegetable cooperative to technological, logistical or marketing business processes has been identified. Expediency of the integrated use of logistical concept DRP, decision tree method and linear programming in management of the cooperative has been grounded. The model for preparing decisions on organizing sales of vegetables and fruit which is focused on minimization of costs of cooperative services and maximization of profits for members of the cooperation has been developed. The necessity to consider integrated model of differentiation on levels of post gathering processing and logistical service has been revealed. Methodology of representation in the economical-mathematical model of probabilities in the tree of decisions concerning the expected amount of sales and margin for members of the cooperative using different channels has been processed. A formula which enables scientists to describe limitations in linear programming concerning critical duration of providing harvest of vegetables and fruit after gathering towards a customer has been suggested.

Keywords: model, logistics, fruit and vegetable cooperative, distribution, DRP, decision tree, linear programming.

JEL Classification: R41, C20, Q13.

Introduction

Modern fruit and vegetable cooperatives are relatively complex objects of management. Management of such cooperative organizations should consider a numeral chain of acting internal and external factors and limitations as well as join many interests of independent members into a sole strategy. One of possible instruments of solving many problems in modern the fruit and vegetable cooperation is logistics.

Classical methodology of entrepreneurial logistics is considered to involve the praxeological approach which is viewed as a science of rational activities. Mathematical, military and entrepreneurial (economical) logistics have been developed jointly based mainly on these ideas.

Logistical management of the supply chain is directed at increasing the level of rationalization of using the latter (optimization of time and resource spending). Consequently such systems of managing operational processes on the supply chain as MRP, DRP, KANBAN, FZ are logistically (rationally) organized. The supply chain itself might be based on principles of logistics.

Nevertheless a logistically organized operation system of the “pushing” type DRP (distribution requirements/resource planning) in multi-level systems of distribution work according to the principle of “reverse cascading” of demand from lower to higher (actual orders and expectations) from local objects to the main subject of the supply. Then the system of DRP requires precise coordinated prognosis of shipment and replenishment for each center and channel of distributing the ready produce in the goods supply chain. In turn the necessity for replenishing the main subject of supply is a basis for creating orders for purchasing and creation

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of main calendar plan of production (Cvetić *et al.* 2013; Enns, Suwanruji 2000; Ho, Carter 1994).

At that the use in the system of preparation of decisions in the fruit and vegetable cooperative on means of rationalistic logistics (concepts, models, methods and so on) enables scientists to optimize cost of services and increase profits of commodity producers of the servicing cooperation.

Problems of preparing and modeling logistical decisions in the system of agrarian as well as the fruit and vegetable business can be found in works of such scientists as Eastwood *et al.* (2004); Folinas *et al.* (2006); Hall *et al.* (2004); Kramar *et al.* (2013); Kristal *et al.* (1997); Li *et al.* (2012); Lobo, Conte 2011; Manikas *et al.* (2011); Montigaud *et al.* (1995); Shufeng *et al.* (2010) and others.

Main features of managing the chain supply in the system of the fruit and vegetable cooperation have been studied by Arcas-Larioa *et al.* (2014); Bijman, Hendrikse (2003); Michelsen (1994); Pascucci *et al.* (2012); Reiche *et al.* (2009); Schlecht *et al.* (2004); Wilson, Dahl (2000) and others.

At that W. W. Wilson and B. L. Dahl (2000) studied features of modeling risks and expenses of the cooperative logistics and marketing in the general supply chain of agrarian produce for export. In their studies along with Schlecht *et al.* (2004) for modeling the movement of agricultural produce on the material flow they applied the logistical method MRP.

Arcas-Larioa *et al.* (2014) focused attention on the fact that rationally prepared decisions in managing the cooperative along with a high level of trust from members of the fruit and vegetable cooperation significantly increase joint factors for effective entrepreneurship.

J. Bijmanand and G. Hendrikse (2003) have studied activity of marketing fruit and vegetable cooperatives in the system of supply chain paying attention to formations of concomitant logistics and other functions.

Epperson, Estes (1999) have studied the link between development of innovative decisions in logistical management over the supply chain of fruit and vegetables and the level of competitiveness in subjects of agribusiness.

However main studies on the system of fruit and vegetable serving cooperation do not consider dualistic character of modern logistics: on the one hand as the approach to management (rationalistic type), on the other hand – as the object of managing (provisional type). As well as the fact that logistics is not equal to the concept of SCM but has only partial mutual background (integrated logistics).

The use of the generalizing term "marketing fruit and vegetable cooperatives" mainly dominates in publications at the same time in practice they are usually not specialized formations in the system of agrarian marketing but multifunctional cooperatives with concomitant logistics, technological, marketing and other activity. Besides logistically (rationally) organized "pushing" systems of management over operational processes in cooperative in the supply chain of fruit and vegetable produce have been insignificantly studied in integration with other methods of modeling.

1. Purpose, materials and methods of study

The purpose of the research is the development of integrated methods and a model of preparing decisions in the system of distributing logistics of fruit and vegetable servicing cooperative concerning possible alternatives and existing limitations in separate technological, logistical and marketing business processes.

Materials for the research have been scientific works on logistical management over cooperative agriformations as well as empiric data concerning activity of separate fruit and vegetable servicing cooperatives.

Methodological basis for the research is the combined use of provisions of the concept DRP as well as the method of linear programming.

2. Results and discussions

The fruit and vegetable cooperative in the system of DRP is the main subject for providing a large amount of ready produce which comes from lower parts from agricultural producers (members of the cooperation). Prognosis of the customer demand and optimal distribution of produce on the basis of types and channels in good-providing chain is also within the competence of the servicing cooperative. At that the use of system DRP requires previous confirmation of producing programs by members of the cooperation.

Along with that variants of modification, storing and organization of fruit and vegetable sales by the servicing cooperative and limits of their distribution are quite versatile. Besides the supply chain of fruit and vegetable produce may have a different level of cooperative control. One of such variants is the limitation in performing cooperative operations of post-gathering processing and partial logistical service. In the research the variant of significant control over the supply chain from the cooperative formation with a wide range of services has been studied.

Along with that the model when members of the cooperative (entrepreneurship by population, farmers and so on) provide individual production of fruit and vegetable produce and to a certain extent carry out orders of the servicing cooperative for different variants of services.

In our opinion taking into account a separate nature and special role in marketing, logistical and technological functions in the system of fruit and vegetable servicing cooperation, they should be studied separately. Such services are reasonable to clearly identify as components of business processes of post-gathering processing (removal of nonmarket fraction from the delivered harvest; sorting; calibration on the extent of size and ripeness; washing), logistical service (packing; cooling or chilling; storing;

distribution; transportation) and marketing (advertising; search for profitable offers; selection of clients; formation of consignment; organization of sales).

At that the ownership is not transferred to the servicing cooperative but is preserved by its member. The cooperative itself provides only separate services for its members at cost price.

It makes possible to form a set of orders which in future might be optimized using alternative and logistical channels in order to achieve the minimal cost price of services of the cooperative and mutual benefits from cooperation for members of the servicing cooperation.

The main purpose of the activity of the servicing cooperative is to minimize expenses for services for its members.

The concomitant purpose of the servicing cooperative is to maximize profits for members of the servicing cooperative.

The cooperative provides services by its each type in accordance with quotas concerning organization of sales of fruit and vegetable produce (it is defined in accordance with the existing facilities of the cooperative and its members as well as the plan of optimal distribution). Additional acceptance of orders is carried out in case of filling quota amounts considering technological and logistical unused reserves of the cooperative and current situation on the market.

The essence of the task is in processing the complex recommended packet of sales diversification in fruit and vegetable produce for members of the servicing cooperative which is oriented at decreasing risks concerning unfavorable situation on the market and minimization of expenses.

Solution of such a task is offered to be carried out using integrated modeling of basic principles of the logistical concept DRP, decision tree method and method of linear programming. The result is the processing of the author's methodological approach concerning combination of its elements into distributing logistics of the fruit and vegetable cooperative.

3. Mathematical problem definition

A set of orders of the imaginary fruit and vegetable cooperative using alternative logistical channels is based in a certain way.

Besides there are n supermarkets available, which organize the sales of the fruit and vegetable produce with the possibility of providing additional services in the following directions:

- complete cycle of post-harvest processing and logistical service;
- partial cycle of post-harvest processing and complete logistical service;
- in the frozen state with the complete cycle of post-harvest processing and logistical service.

Services for sales of fruit and vegetable produce can also be provided by:

- m wholesaler-retailer markets;
- k processing enterprises.

Hence there are several different ways of organizing sales of the fruit and vegetable produce (Fig. 1).

4. Formation of variables in the task

The desired unknown quantities shall be denoted the following way:

- x_i $(i = \overline{1, n})$ – volume of organization of fruit and vegetable produce sales with the complete cycle of post-harvest processing and logistical service by i supermarket;
- x_{i+n} $(i = \overline{1, n})$ – volume of organization of fruit and vegetable produce sales with partial cycle of post-harvest processing and complete logistical service by i supermarket.

Hence we have $2n$ unknown quantities. We will denote $l_1 = 2n$.

x_{i+l_1} $(i = \overline{1, m})$ – volume of organization of fruit and vegetable produce sales without post-harvest processing with partial logistical service on i wholesaler-retailer market.

After denoting we have $2n + m$ unknown quantities. We will denote $l_2 = 2n + m$.

x_{i+l_2} $(i = \overline{1, k})$ – volume of organization of fruit and vegetable produce sales without after-harvest processing with partial logistics service by i processing enterprise.

We will denote $l_3 = 2n + m + k$.

x_{i+l_3} $(i = \overline{1, n})$ – volume of organization of fruit and vegetable produce sales in the frozen state with complete cycle of post-harvest processing and logistical service by i supermarket.

If the total number of the desired unknown quantities equals N, then: $N = 3n + m + k$.

Each of N unknown quantities corresponds to one of the logistical channels which might be used for sales of fruit and vegetable produce.

5. System of the task limitation

We will denote U as a general volume of the produce. In this case the sold produce using all logistical chains cannot exceed U and we have the first limitation of the task:

$$\sum_{i=1}^{N} x_i \le U . \qquad (1)$$

Statistical analysis of the marketing research enables us to define prognostic estimations of the lower and upper limits of the expected demand for fruit and vegetable produce by different logistical channels. We denote the following

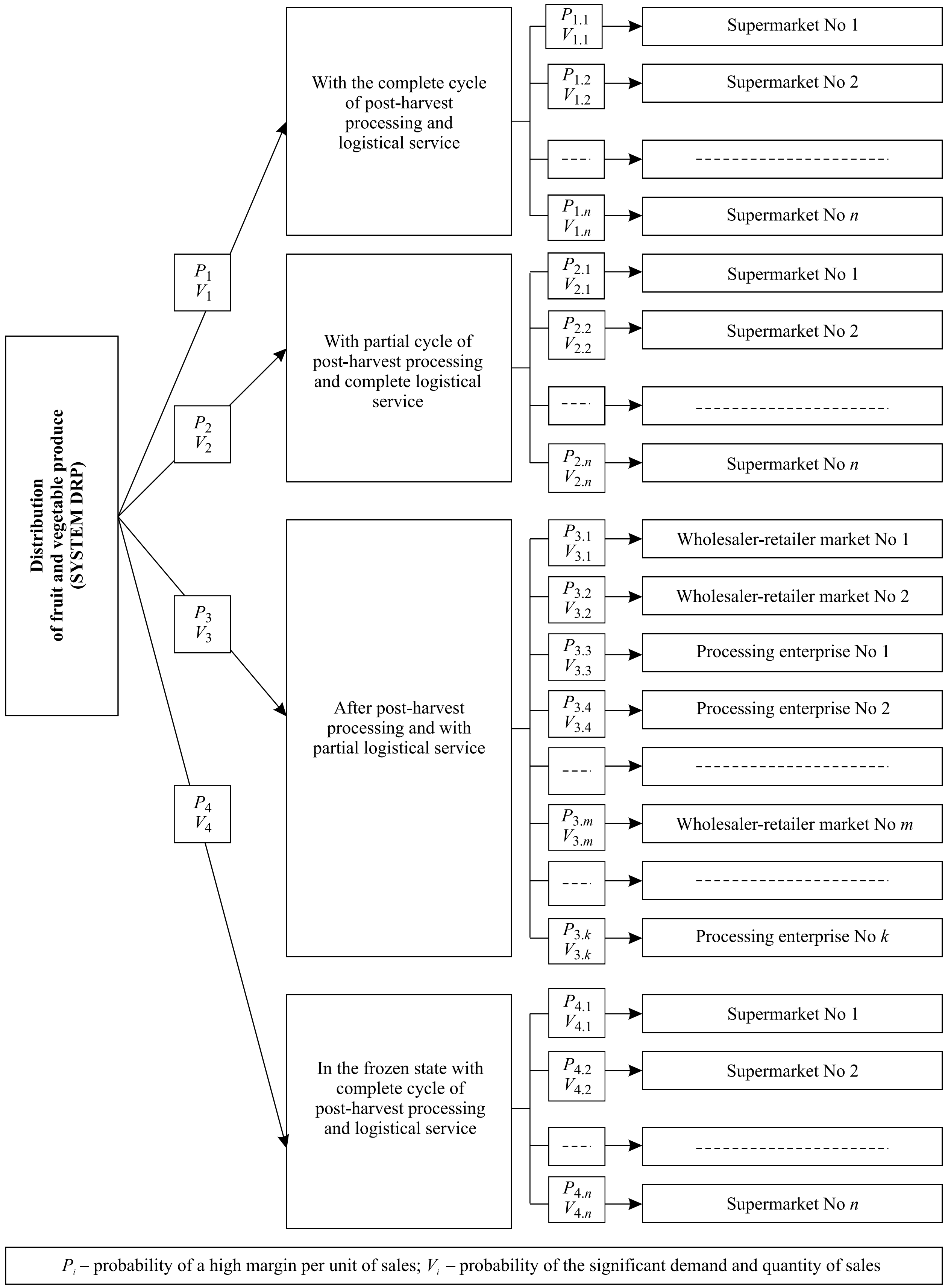

Fig. 1. Logistical chain and decision tree concerning organization of sales of fruit and vegetable produce by the agricultural servicing cooperative(Source: author's development)

indications for four types of providing services on organization of fruit and vegetable produce sales.

b_1 and B_1 – correspondingly a lower and upper limit of the expected demand for fruit and vegetable produce which requires the complete cycle of post-harvest processing and logistical service in supermarkets;

b_2 and B_2 – correspondingly a lower and upper limit of the expected demand for fruit and vegetable produce which requires the partial cycle of post-harvest processing and complete logistical service in supermarkets;

b_3 and B_3 – correspondingly a lower and upper limit of the expected demand for fruit and vegetable produce without post-harvest processing and with the partial logistical service;

b_4 and B_4 – correspondingly a lower and upper limit of the expected demand for fruit and vegetable produce in the frozen state with the complete cycle of post-harvest processing and logistical service for supermarkets.

Then the following eight limitations might be written in the form of four two-sided inequalities, each of them corresponds to a certain type of providing service for organization and sales of fruit and vegetable produce:

– complete cycle of post-harvest processing and logistical services in supermarkets

$$b_1 \le \sum_{j=1}^{n} x_j \le B_1 ; \quad (2)$$

– partial cycle of post-harvest processing and complete logistical service in supermarkets

$$b_2 \le \sum_{j=n+1}^{2n} x_j \le B_2 ; \quad (3)$$

– without post-harvest processing with partial logistical service on wholesaler-retailer markets and processing enterprises

$$b_3 \le \sum_{j=2n+1}^{2n+m+k} x_j \le B_3 ; \quad (4)$$

– in the frozen state with the complete cycle of post-harvest processing and logistical service for supermarkets

$$b_4 \le \sum_{i=2n+m+k+1}^{3n+m+k} x_i \le B_4 \ . \quad (5)$$

Each of the mentioned above inequalities includes two inequalities which in case of solving the task using a computer should be input separately. For example the first two-sided inequality contains the two following inequalities:

$$\sum_{j=1}^{n} x_j \ge b_1 ; \quad (6)$$

$$\sum_{j=1}^{n} x_j \le B_1 . \quad (7)$$

These two inequalities limit correspondingly lower and upper expected demand for fruit and vegetable produce which requires the complete cycle of post-harvest processing and logistical service in all supermarkets. If for example, $n = 3$, then the inequalities are:

$$x_1 + x_2 + x_3 \ge b_1 ; \quad (8)$$

$$x_1 + x_2 + x_3 \le B_1 . \quad (9)$$

The expected demand for fruit and vegetable produce without post-harvest processing and with the partial logistical service on whole saler-retailer markets and processing enterprises in case $n = 3$, $m = 2$ and $k = 2$ is modeled as the following two inequalities:

$$x_7 + x_8 + x_9 + x_{10} \ge b_3 ; \quad (10)$$

$$x_7 + x_8 + x_9 + x_{10} \le B_3 . \quad (11)$$

Then it is necessary to form limitations which consider maximal possible term of harvest delivery duration after picking to the customer.

For that the author's method has been suggested. Consequently we receive the formula and denote the following delivery duration terms of supply for different customers:

– $T^{(1)}_{\max}$ – for the customer with the complete cycle of post-harvest processing and logistical service;

– $T^{(2)}_{\max}$ – for the customer with the partial cycle of post-harvest processing and the complete logistical service;

– $T^{(3)}_{\max}$ – for the customer without post-harvest processing with partial logistical service.

Similarly for each of the three types of customers we define:

– $T^{(i)}_{tr} (i = \overline{1,\ 3})$ – time for transportation of produce to the customer;

– $D_i\ (i = \overline{1,\ 3})$ – expected number of days of delivery for the produce;

– $R_i\ (i = \overline{1,\ 3})$ – coefficient of maximal variation of average volume of the produce from the members of the cooperative per one day;

– $S_i\ (i = \overline{1,\ 3})$ – productivity of equipment of the cooperative for processing and packing the produce, t/hour.

We obtain three more limitations which take into account delivery duration terms of supply after its picking to the customer:

– with the complete cycle of post-harvest processing and logistical service

$$\frac{R_1 \times \sum_{i=1}^{n} x_i \,/\, D_1}{S_1} + T^{(1)}_{tr} \le T^{(1)}_{\max} ; \quad (12)$$

– with the partial cycle of post-harvest processing and the complete logistical service

$$\frac{R_2 \times \sum_{i=n+1}^{2n} x_i / D_2}{S_2} + T_{tr}^{(2)} \le T_{\max}^{(2)} ; \quad (13)$$

– without post-harvest processing with the partial logistical service

$$\frac{R_3 \times \sum_{i=2n+1}^{2n+m+k} x_i / D_3}{S_3} + T_{tr}^{(3)} \le T_{\max}^{(3)} . \quad (14)$$

The probability of obtaining a high margin from sales of fruit and vegetable produce will be denoted p_i $(i = \overline{1,\ 4})$ for *i* type of providing services for organization of sales, and v_i $(i = \overline{1,\ 4})$ will be the probability of formation of high demand and significant volumes of sales for fruit and vegetable produce for the same type of the services (Fig. 1).

We will denote J_i as the multitude for numbers of those logistical channels which correspond to *i* type of providing services on organization of sales.

As p_{ij} $(i = \overline{1,\ 4};\ j \in J_i)$ we will denote probability of receiving a high margin for sales of fruit and vegetable produce for *j* logistical channel and *i* type of providing services on organization of sales, and as v_{ij} $(i = \overline{1,\ 4};\ j \in J_i)$ we will denote the probability of forming a high demand and a large volume for selling of the fruit and vegetable produce for the same type of services.

The generalized weight-average probability of receiving a high margin per unit of all produce should be not less than a certain lower limit, for example, $p = \gamma_1$.

For describing this limitation the author's methodology has been suggested. Consequently we receive a formula:

$$\frac{\sum_{i=1}^{4}(p_i \sum_{j \in J}(p_{ij} x_j))}{\sum_{j \in J} x_j} \ge \gamma_1 . \quad (15)$$

Similarly the generalized weight-average probability of formation of a high demand and a big volume of the sold fruit and vegetable produce should be not less than a certain lower limit, for example, $p = \gamma_2$. As a result we obtain the formula:

$$\frac{\sum_{i=1}^{4}(v_i \sum_{j \in J}(v_{ij} x_j))}{\sum_{j \in J} x_j} \ge \gamma_2 . \quad (16)$$

If the predicted probability of receiving a high margin from sales of fruit and vegetable produce is known for *i* type of providing services on organization of sales, we will denote it $p_i^* \ (i = \overline{1,\ 4})$. Then for each type of providing services we can form the limitations based on which the generalized weight-average probability of receiving a high margin per unit of produce will be not less than the probability:

– with the complete cycle of post-harvest processing and logistical service

$$\frac{\sum_{j \in J_1} p_j x_j}{\sum_{j \in J_1} x_j} \ge p_1^* ; \quad (17)$$

– with the partial cycle of post-harvest processing and the complete logistical service

$$\frac{\sum_{j \in J_2} p_j x_j}{\sum_{j \in J_2} x_j} \ge p_2^* ; \quad (18)$$

– without post-harvest processing with the partial logistical service

$$\frac{\sum_{j \in J_3} p_j x_j}{\sum_{j \in J_3} x_j} \ge p_3^* ; \quad (19)$$

– in the frozen state with the complete cycle of post-harvest processing and logistical service

$$\frac{\sum_{j \in J_4} p_j x_j}{\sum_{j \in J_4} x_j} \ge p_4^* . \quad (20)$$

If the prognostic probability of forming a high demand and significant volume of sales of fruit and vegetable produce for *i* type of services on the organization of sales, we will denote it as $v_i^* \ (i = \overline{1,\ 4})$. Then for each type of providing services limitations can be formed, due to which the generalized weight-average probability of forming a high demand and significant volumes of sales per unit of the produce will be not less than this probability:

– with the complete cycle of post-harvest processing and logistical service

$$\frac{\sum_{j \in J_1} v_j x_j}{\sum_{j \in J_1} x_j} \ge v_1^* ; \quad (21)$$

– with the partia cycle of post-harvest processing and the complete logistical service

$$\frac{\sum_{j \in J_2} v_j x_j}{\sum_{j \in J_2} x_j} \ge v_2^* ; \quad (22)$$

– without post-harvest processing and with the partial logistical service

$$\frac{\sum_{j \in J_3} v_j x_j}{\sum_{j \in J_3} x_j} \ge v_3^* ; \quad (23)$$

– in the frozen state with the complete cycle of post-harvest processing and logistical service

$$\frac{\sum_{j \in J_4} v_j x_j}{\sum_{j \in J_4} x_j} \geq v_4^* . \qquad (24)$$

At facilities of the processing cooperative there is a possibility to store not frozen fruit and vegetable produce in the amount of F_1, frozen produce – in the amount of F_2. Taking into account the limited facilities for storing the produce, we obtain two more limitations:

– for not frozen fruit and vegetable produce

$$\sum_{j=1}^{2n+m+k} x_j \leq F_1 ; \qquad (25)$$

– for frozen fruit and vegetable produce

$$\sum_{j=2n+m+k+1}^{3n+m+k} x_j \leq F_2 . \qquad (26)$$

If the costs for labor per unit of produce in the system of logistical servicing (packing; freezing or defrosting; storing; distributing; shipping) are denoted as g_i $(i = \overline{1, N})$ for i logistical channel, and labor resources are denoted as G, the general labor costs for all the produce satisfy the following limitation:

$$\sum_{i=1}^{N} g_i x_i \leq G . \qquad (27)$$

For each type of services amounts of ordering services on organization of sales of the fruit and vegetable produce can be limited, the upper limit will be denoted as H_i $(i = \overline{1, 4})$ for i logistical chain. In this case we will have the limitation:

– with the complete cycle of post-harvest processing and logistical service

$$\sum_{j=1}^{n} x_j \leq H_1 ; \qquad (28)$$

– with the partial cycle of post-harvest processing and the complete logistical service

$$\sum_{j=n+1}^{2n} x_j \leq H_2 ; \qquad (29)$$

– maximal possible volume of ordering services on organization of sales of fruit and vegetable produce without post-harvest processing and with the partial logistical service

$$\sum_{j=2n+1}^{2n+m+k} x_j \leq H_3 ; \qquad (30)$$

– maximal possible volume of ordering services of sales of fruit and vegetable produce in the frozen state with the complete cycle of post-harvest processing and logistical service

$$\sum_{i=2n+m+k+1}^{3n+m+k} x_i \leq H_4 . \qquad (31)$$

We will denote L as the multitude of indices which are the numbers of those logistical chains for which long-term contracts have been concluded.

We will denote m_l and M_l correspondingly as maximal and minimal volumes of orders by contracts for l logistical channel $(l \in L)$.

Then the following two-sided inequalities form one more group of limitations:

$$m_l \leq x_l \leq M_l \ (l \in L) . \qquad (32)$$

If for example long-term contracts have been concluded with the first, fifth and tenth logistical channels then we have the following limitations:

$$x_1 \leq M_1; \qquad (33)$$

$$x_5 \leq M_5; \qquad (34)$$

$$m_{10} \leq x_{10} \leq M_{10}. \qquad (35)$$

The cost of service per unit in the servicing cooperative on organization of sales of fruit and vegetable produce for l logistical chain $(l = \overline{1, N})$ we will denote t_l $(l = \overline{1, N})$.

Then for each type of rendering services we will form the inequality which limits the generalized weight-average price of unit of service by a certain lower limit, for example t_l^* $(l = \overline{1, 4})$:

– with the complete cycle of post-harvest processing and logistical service

$$\frac{\sum_{j=1}^{n} (t_j x_j)}{\sum_{j=1}^{n} x_j} \leq t_1^* ; \qquad (36)$$

– with the partial cycle of post-harvest processing and the complete logistical service

$$\frac{\sum_{j=n+1}^{2n} (t_j x_j)}{\sum_{j=n+1}^{2n} x_j} \leq t_2^* ; \qquad (37)$$

– without post-harvest processing with the partial logistical service

$$\frac{\sum_{j=2n+1}^{2n+m+k} (t_1 x_j)}{\sum_{j=2n+1}^{2n+m+k} x_j} \leq t_3^* ; \qquad (38)$$

– in the frozen state with the complete cycle of post-harvest processing and logistical servicer

$$\frac{\sum_{j=2n+m+k+1}^{3n+m+k} (t_j x_j)}{\sum_{j=2n+m+k+1}^{3n+m+k} x_j} \leq t_4^*. \quad (39)$$

6. Formation of efficiency function

As the criterion of optimality we take the minimal value of expenses for services of the servicing cooperative.

We will denote as c_i general expenses for the unit of fruit-vegetable produce which will be sold using *i* logistical channel.

Efficiency function takes the form:

$$\sum_{j=1}^{3n+m+k} \tilde{n}_j \tilde{o}_j \to \min . \quad (40)$$

Coefficients of the efficiency function (include direct and indirect expenses) can be defined using a calculating-analytical method for each certain channel concerning different features (distance, terms of supply, volumes and so on) of a separate consumer.

Conclusions

Realization of the concept DRP in distributing logistics of the fruit and vegetable servicing cooperative is more efficient in combination with such methods of modeling as the decision tree method and linear modeling.

At that the process of building the decision tree for organization of sales of fruit and vegetable produce should consider differentiation of the services concerning the level of post-harvest processing and logistical service as well as probability estimations of the significant demand and volumes of sales and high margins per unit of sales for each member of the cooperative.

As variables of such an economical-mathematical task it is reasonable to consider volumes of organization of fruit and vegetable produce sales by members of the cooperative using different channels and different levels of processing and logistical service.

In the system of limitations it is essential to consider prognostic parameters concerning the expected demand, contractual obligations as well as the critical duration of the harvest supply after its picking to the consumer.

Efficiency function of the integrated model is reasonable to be focused on the main mission of the business activity of the servicing cooperative – minimization of service costs for its members. At that it is necessary to consider probable values of the decision tree which at the same time promote maximization of profits for members of the fruit and vegetable cooperation.

The results of the study are focused on deepening and widening existing conceptions about theory and methodology of the logistical organization of a cooperative fruit and vegetable business.

The proposed methodology of the integrated modeling can be used in the practice of planning and management of a fruit and vegetable providing cooperative while working for its members on the recommended package in diversification of cooperative orders and sales. This approach will enable companies touse more rationally the existing capacity of the fruit and vegetable cooperative and minimize (optimize) expenses on services for its members as well as contribute to the decrease of risks for agricultural commodity producers concerning unfavorable conjuncture of the market while selling the produce via the cooperative.

Further researches are worth being focused on the study of integrated use in the system of fruit and vegetable providing cooperation of modern logistical concepts and the method of imitating modeling.

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Oleksandr VELYCHKO. PhD in Economics, Associated Professor, in Dnipropetrovsk State Agrarian and Economic University, Head of Management and Law Department.