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THE USE OF ECONOMIC-MATHEMATICAL MODELING AND MODERN TECHNOLOGIES IN THE OPTIMIZATION OF ENTERPRISE'S MARKETING DISTRIBUTION POLICY

The basic approaches of distribution channels formation of enterprise are analyzed, the stages of sale channel strategy development are studied. The modern trends of sales channels development related to direct marketing are analysed. The processes of development, maintaining and usage of customers, suppliers and mediators databases are considered in order to establish and develop contacts with them, advantages and disadvantages of the databases usage are overviewed. The appropriateness of economic-mathematical modeling usage to optimize marketing distribution policies is justified.

Key words: marketing distribution policy, distribution channels, direct marketing, databases, economic-mathematical methods and models.

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ВИКОРИСТАННЯ ЕКОНОМІКО-МАТЕМАТИЧНОГО МОДЕЛЮВАННЯ ТА СУЧАСНИХ ТЕХНОЛОГІЙ В ОПТИМІЗАЦІЇ МАРКЕТИНГОВОЇ ПОЛІТИКИ РОЗПОДІЛУ ПРОДУКЦІЇ ПІДПРИЄМСТВА

Проаналізовано основні підходи до формування каналів розподілу продукції підприємства, досліджено етапи розроблення стратегії каналу збуту. Проаналізовано сучасні тенденції у розвитку каналів збуту, які пов'язані з прямим маркетингом. Розглянуто процеси розроблення, ведення та використання баз даних покупців, постачальників та посередників з метою встановлення та розвитку контактів з ними, недоліки та переваги використання баз даних. Обґрунтовано доцільність використання економіко-математичного моделювання для оптимізації маркетингової політики розподілу.

Ключові слова: маркетингова політика розподілу, канали розподілу, прямий маркетинг, бази даних, економіко-математичні методи і моделі.

Statement of the problem

The important task for the enterprise to make a product available for the customers is effective marketing distribution policy formation. It includes a choice of the product distribution channels and decisions of marketing (sale) logistics connected with warehousing and transporting of products.

However, many domestic enterprises do not pay much attention to the management issues of marketing policy, its analysis and modification.

The appearance of new technologies and other changes in the factors enterprise environment operating cause necessity of organizations' marketing distribution policy optimization. For this purpose it is appropriate to use the latest methods of economic-mathematical modeling that will allow to make better decisions and reduce the cost of sales, transportation and warehousing of products. It also requires

improving of the supply with information of enterprises in the area of marketing because it is often directed only at the internals and doesn't contain enough information about the state and dynamics of the environment.

Analysis of recent research and publications

The issues of product distribution channels formation is sufficiently covered in academic literature [1, 2, 3, 4]. Particularly it is found that the factors causing the choice of a product distribution channel include following: characteristics and preferences of consumer, product characteristics, financial costs and a measure of sales control. However, the directions of marketing distribution policies optimization using economic-mathematical modeling, creation and use of databases are often ignored in marketing scientific research.

The formulation of objectives

The purpose of this study is to analyze the stages of product distribution channels formation, identify the areas and key directions of economic-mathematical models and modern technologies usage on it.

Presentation of main materials

While making decision on the formation of distribution channels formation of products it is necessary to determine the following: the length of distribution channel; types of agents to be used, the number of resellers on each level of distribution channel.

The main decisions of the enterprise in the formation of the distribution channel are given in fig. 1.
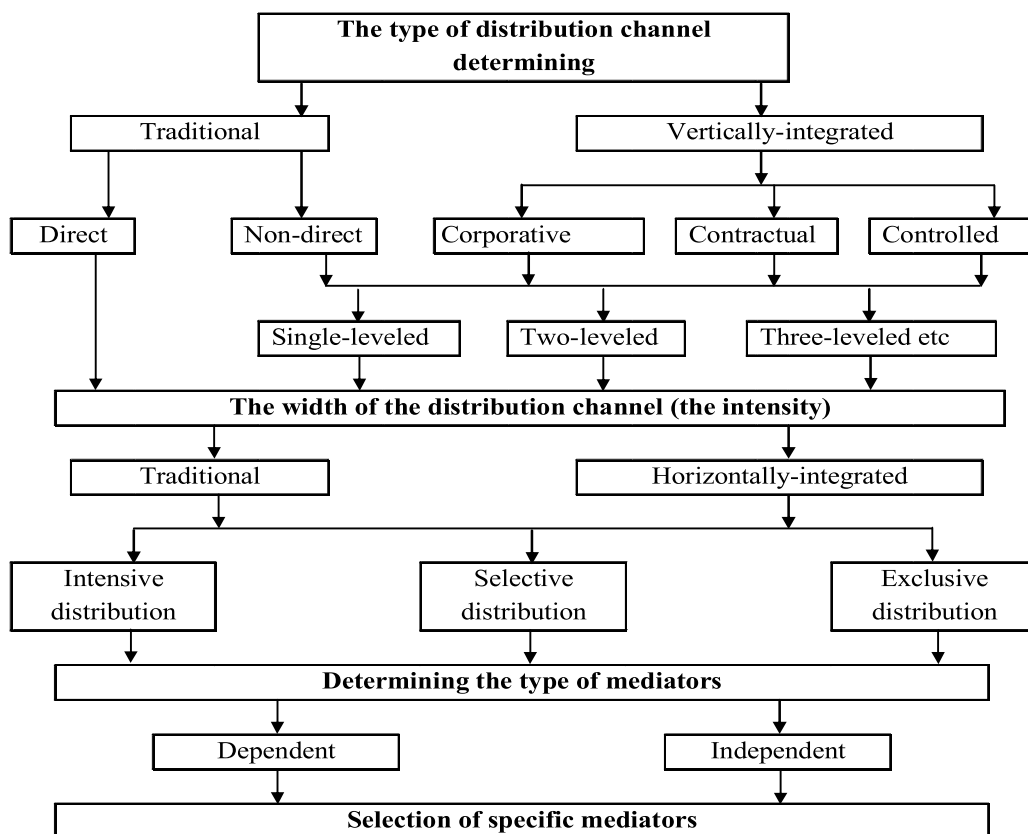

Fig. 1. Stages of strategy development for distribution channel
Source: on the basis [1, 3]

Having made the decision on the choice of indirect production distribution channels for the enterprise it is important to choose the specific mediators that would represent their products in the market.

To estimate mediators and their subsequent choice the multicriterial approach only can be suitable (fig. 2).
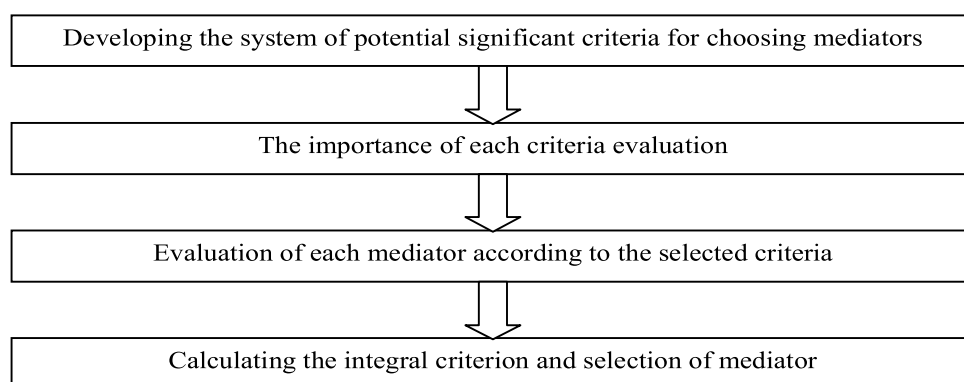
Fig. 2. Algorithm for mediators selection
Source: personal elaboration

To choose potential mediator by means of qualitative analysis it is necessary to form a system of possible criteria for evaluating each mediator (financial situation, market coverage in a particular region, etc.).

To estimate each mediator by selected criteria one can use the method of expert ranks which are given for the ten-point scale (e.g., a stable financial situation is ranked high, and a large number of products of different companies is ranked low).

Using direct marketing it is necessary to resolve the issue of its form (sales by phone, mail, catalog, online, personal selling). In the case of sales through trading staff it is determined whether it is their own staff or involved from other companies or taken under the contract.

Modern trends in the development of product distribution channels are connected with the increasing role of direct marketing using a variety of its forms.

Nowadays sales of products using phone, mail and Internet are actualized. As noted in [5, p. 88] in 2011 the sales with use of the phone were expected to increase in 1.5 times (in 2010 the increase was 40 %). Such selling form is most common in the consumer market. However, the wish to reduce the cost of customer acquisition in the shortest time contributes to its active use in the market of consumer organizations.

Recently the use of the Internet for purchases is growing up.

An analysis of survey conducted by InMind shows that in the second quarter of 2010, 66 % of Ukrainian Internet users carried purchasing of products using this form of direct marketing [6, p. 62]. Generally those are people between the ages of 21 and 30, a third of which has a high and above-average level of income. Main types of products saled over the Internet are given in table 1.

Table 1

Products purchased online, %

Kinds of products	2009	2010	Growth index
1. Books	22	33	150,00
2. Mobile phones	19	26	136,84
3. Gifts	22	26	118,18
4. PC components	28	26	92,86
5. Home appliance	17	25	147,06
6. Software	15	15	100
7. PC (laptops)	19	14	73,68
8. Games	9	12	133,33
9. Video CD, DVD	6	9	150,00
10. Cameras	9	7	77,78
11. Music CD, DVD	5	7	140,00
12. Tires and rims for cars	2	3	150,00

Source: on the basis of [6, c. 63].

According to the financial company Fintime, Internet commerce turnover of the domestic market in 2012 reached $ 1.6 billion. About 8 thousands online stores are operating in Ukraine these days, and the top 300 of them occupy 80 % of the market share. With the use of Internet the most actively sold products are household appliances, clothing and books: in the segment of home appliances and electronics every eighth purchase in Ukraine is virtual [7].

The size of the e-commerce market in 2012 increased by 45 %, and this is not the limit experts predict that in 2013 market size of Internet commerce will grow by 49 % up to $ 2.37 billion [8].

The main problems related to the limited usage of Internet sales is the lack in trust to the online merchants, misunderstanding of its benefits and lack of need in it, and also the inability to see a product before purchasing.

When planning personal selling enterprise should possess information about their actual and potential customers. This requires an enterprise to create a database of customers. It can be used to search for potential buyers, "adjustment" of products and services to the specific needs of target customers and to maintain long-term relationships with the latter. The database means a data bank that contains all the information about clients that apply to the enterprise. This data is systematically registered, compiled and constantly updated by electronic data processing [9].

Today such a term as "database marketing" is used. It refers to the process of development, maintenance and use of databases of buyers, suppliers and mediators to establish and develop contacts with them [3, p. 166].

The modern market is characterized by sustained competition for customers. The information about a consumer and history of his purchases, collected in the client database (DB), gives a huge advantage to the owner of such a database in the competition and allows him to create partnership with clients.

Client databases have a complex structure and contain a lot of information. For instance, Fingerhut, which sells through catalogs, uses a database containing about 1300 pieces of information regarding each of the 30 million families, and a database of financial company Ritz-Cartton contains more than 500 thousand pieces of information regarding preferences of individual consumers [10].

Creating and managing customer database is performed by using customer information and interaction history. It allows one to develop direct supply of products and services to customers within the implementation of direct marketing.

An important data for marketing is the following [9]:

– address information (addresses with the exact spelling, correct postal code, indicating the street and house number);

– features of contacts establishment (when, with whom and how contacted);

– likely data (how many people showed interest to proposals of enterprise).

– data on response and evaluation (who and how responded to the proposals and whether the reaction covered costs).

The facts and features are laid in the databases. Facts are defined values such as the attitude to a particular area, the amount of turnover, status (interested party or client). Features are quality criteria and attributes, such as, for example, solvency, lifestyle, use of free time, the potential of client. The combination of all those features defines customer profile [9].

The information in the database on the market of capital products and market of consumer products is somewhat different (table 2).

When constructing a database different levels of market aggregation can be used (table 3).

The database formation allows enterprises to do following things: to find potential customers in more efficient way; to adjust a supply to certain market segment demand; to form customer's loyality by means of gifts, discount cards, special offers, etc.; to use funds on marketing measures more effectively.

The database construction process first of all consists of construction aim determination depending on its user. Further it is necessary to gather such an information which can be either primary or secondary and also internal (from customers) and external.

The data in database can be viewed and modified in the optimization system framework with use of built-in table data. The possibilities of such programs can be applied to main database through file export or import between modeling system and table optimization package.

Table 2

The information in customer databases

On the market of capital products	On the market of consumer products
– what kind of products or services acquired specific client; – sales and prices in the past; – the main characteristics of clients (age, birthday, hobbies, favorite foods); – the data of competitor suppliers; – the status of ongoing contracts; – the consumers expected outgoings over the next few years; – the evaluation of the strengths and weaknesses of competitors on selling and servicing current accounts of the consumers	– the consumers demographic data (age, income, family composition, birthdays); – the psychographic data (occupation, interests, attitudes); – data on the purchasing habits (former purchase, consumer preferences); – place of residence; – sales volumes; – purchase of similar products from other manufacturers

Source: on the basis of [10].

Table 3

The features of market aggregation for database creation

Set of markets	Methods of aggregation
Consumer market	By place of residence, sex, age, family size, volume of orders, psychological characteristics, adherence to trade marks, motives of the acquisition, consumption intensity
Market of consumer organizations	By geographical, industry features, importance of consumer, ownership
Market of government institutions	By geographical, industry features, importance of consumer
Market of mediators	By the number of contacts in purchases

Source: [11, c. 170]

Marketing on basis of customers database can be used by experts that cooperate with customers companies and services enterprises (hotels, banks, airlines). On the other hand to this type of marketing are also increasingly turning companies selling packed consumer products and other retailers. As a typical user of marketing based on a database [9] can be:

– enterprises in the area of means of production (e.g., manufacturers of forklift trucks, organizational machinery, equipment, etc.);

– consumer goods producers (for example, companies producing cars, manufacturers of books);

– organizations in the financial services area (e.g. banks, insurance agencies, real estate consulting agency, etc.);

– crafters (e.g., painters, roofers, carpenters, etc.).

It will allow them to personalize their suggestions.

Enterprises and organizations can use their databases for different purposes (table 4).

But along with the benefits, the usage of databases is associated with the following disadvantages:

– its development and implementation requires significant funds for the purchase of computers, software, computer communications and staff training;

– it is necessary to retrain all the employees in the direction of their activities on customers orientation;

– not all the consumers agree with the fact that enterprises use private information about them;

– within the implementation of loyalty programs some buyers may demand form enterprises to provide them discounts in much larger quantities than others.

Table 4

Directions of databases usage in marketing

Directions of DB usage	Characteristics
Searching of perspective clients	In advertisement some form of feedback is usually provided, such as reverse card or phone number to which free calls are guaranteed. The database is formed on the basis of the responses of consumers. With help of this database enterprise is trying to identify the most perspective customers, and then contact to them by mail or phone (sometimes representatives of the company personally visit such a potential customer), trying to make them their actual customers.
The decision making about which consumers should receive an appropriate proposal	An enterprise describes an "ideal customer" profile for some suggestions. Then they seek in their databases for customers with features that most close to this ideal type. Analyzing thoroughly a the response of an individual, a company may eventually improve the accuracy of the "targets" election for their marketing efforts. If the customer purchased the product, the company can continue communicating with him, for example in a week it will send the customer a postcard with gratitude for purchase, in five weeks – a new proposal, in ten weeks (if the client did not respond) – call him and offer a special discount.
Enhancing customer loyalty	Enterprises can intentionally generate interest and enthusiasm of its clients, identifying their preferences by fixing them, and then send these customers relevant information, gifts, etc. As a result, the enterprise has made long-term relationship with each customer.
Re-activation of purchases	The database helps the enterprise to increase the attractiveness of proposals for the replacement of products, for improvement or issue of additional products at the very moment when consumers are likely to agree to purchase it.

Source: on the basis of [10]

However, these disadvantages do not diminish the value of databases creation. As based on the analysis of secondary marketing information, return on investment on databases creation with modern and up to date information is 400 % [3, p. 168]. Well organized database should provide such an increase in sales, which would fully cover the costs of its creation and operation [10].

The decision on the formation and modification of product distribution channels would be more justified using economic and mathematical modeling.

In table 5 the kinds of economic-mathematical models and its appropriate use conditions for optimizing marketing distribution policies are provided.

Conclusions

In an ever changing marketing environment factors, especially the needs of consumers, enterprises are looking for new approaches and methods for influencing them. An important issue in such environment is to develop new and improve existing products distribution channels. When making a decision on the distribution channels formation, enterprises should determine the length of the distribution channel, types of mediators to be used, number of trade intermediaries at each level of the distribution channel. The majority of the domestic enterprises use indirect distribution channels because it is important for them to choose the specific mediators that would represent its products in the market.

However, current trends of products distribution channels development are related to the increased role of direct marketing using a variety of its forms, including the use of telephone, mail and the Internet.

While planning a personal selling, the enterprise should possess information about their actual and potential customers. This requires creation of a customers database. Information about the consumer and history of his purchases, that is collected in the client database provides a huge advantage to the owner of such a database in competitive activity and allows to create partnership with clients. In addition, formation of databases effectively allows enterprises to find potential customers, adjust offers to the needs of specific market segments, create customer loyalty through presents, discount cards, special offers, etc.; to use funds for marketing activities in more efficient way.

Table 5

Economic–mathematical models in the distribution policy

Type of model	Essence	Typical tasks	Terms of appropriate expediency
1	2	3	4
Optimization models	Finding the best (optimal) from the perspective of some criterion (criteria) choice of the use of resources in marketing policy (finished products, funds, etc.). Such a problems are solved using optimization models methods of mathematical programing	Optimization model of consumers to providers attachment	It is advisable to use when determining the structure of the distribution channel
		The determination of the best route in order to bypass all defined points and return back either as soon as possible or at the lowest cost	It is used while planning delivery of routes a final product
		The task of storage allocation consists in minimization of the total transportation and warehousing costs	It is advisable to use when you need to minimize costs in the chain enterprise-consumer-warehouse
		The task of the best item selection from the total amount so that the total weight or size of selected items does not exceed the specified value, or the total benefits is maximal	It is used in planning the optimal load of cars, airplanes, ships, warehouses, etc.
Methods and models of inventory management	These methods are used for problems solving optimization in which the data on the goods supply, the demand for the product, the cost and storage of inventory, optimization criterion are known	A system with a fixed size of the order	The size of the order for replenishment is constant, and the next batch of products comes with reduced stocks to a certain critical level, so called point of order
		A system with a fixed frequency order	This system is effectively used when it is possible to vary the order, and the cost of any order processing is small
		A system with two fixed levels of inventory and fixed frequency order	A system involves setting upper and lower limits of acceptable inventory levels
		A system with two fixed levels of stocks without constant frequency order. This system is also called the "minimum-maximum" system	It eliminates the disadvantages of the previous system is its modification
		Self-regulatory system - a system with variable frequency and size of orders, taking into account stochastic (undetermined) terms	In practice, the constancy of the conditions is rare due to changes in demand for inventory, terms of delivery, etc.
Demand and consumption modeling in marketing	Buying demand functions - the functions that reflect the dependence of demand for certain products and services from the complex of facts that affect it. These features are used in analytical models of demand and consumption and are based on information about the structure of incomes, prices, family composition, and other factors	Uninvariate demand function of income $N_i = f_i(D)$, where D - is income; N_i — demand for the i-th product or service; f_i — type of the function	Is used in the analysis of consumer demand
		Tornquist function for essential commodities N_1 has following form: $N_1 = a_1 D / (D + C_1)$, where a_1 — upper limit of demand; C_1 — increase of income	Worthwhile to use for the analysis of the demand for essential commodities

Table 5 Continued

1	2	3	4
		Tornquist function for pre-selection products N_2 has following form: $$N_2 = a_2(D - b_2) / (D + C_2),$$ where $D \geq b_2$; a_2 — upper limit of demand; b_2 — certain level of income; C_2 — increase of income	It is used to analyze the demand for pre-selection products. Demand for this group of products appears after income reaches the value of b_2
		Tornquist function for luxury products N_3 has following form: $$N_3 = a_3 D(D - b_3) / (D + C_3),$$ where $D \geq b_3$; $a_3 > 1$; b_3 — certain level of income; C_3 — increase of income	It is used to analyze the demand for luxury products. Function N_3 has no limits, the demand for luxury goods occurs after the income D exceeds the level b_3
Prediction of consumer demand models	The structure and level of demand for any product depends on many economic and environmental factors	Demand is determined as a function of many factors $$N = f(F, D, P, S, t),$$ where F is a level of production (offers) of products and services; D is the level of income of certain population groups, P - level and the ratio of prices; S - size and composition of the family, t - time period	Should be used when it is necessary to consider the influence of each of the following factors
		Structural models are built on the assumption that each population group for statistical budget data can be calculated by its inherent economic structure of consumption: $$R = \sum_{i=1}^{n} r(D_i)\, W(D_i) \quad \text{or} \quad R = \sum_{i=1}^{n} r_i W_i \ ,$$ where n — number of groups of families referred to the same level of income; D_i — average income of family of i-th group; $r_i = r(D_i)$ — demand structure in i-th group; $W_i = W(D_i)$ — specific weight of i-th group in its total amount	The structural models are most used for predicting demand and consumption, they make impossible comparison of the structure of demand in certain groups, by region, to calculate the "market basket", etc.
		Analytical models of demand and consumption that are built in the form of equations describing the dependence of consumption of products and services on their quantity and prices with further considering a certain level of income	It is used for predicting demand and consumption for a particular group of consumers
Mass servising theory	Mass servising systems (MSS), in which, on the one hand, undetermined mass requests (demands) to perform any services occur, on the other - those request are satisfied according to certain laws	MSS includes following elements source of requirements input stream of requirements, queue, service unit (service channel), the output stream of requirements. The study of such systems is a subject of mass service systems theory	In the organization of trade those models allow to determine the optimal number of outlets of the profile, the number of sellers, the frequency of delivery of goods and other parameters

Source: on the basis of [12, 13, 14, 15]

To justify the decisions in marketing distribution policy it is appropriate to use economic-mathematical methods and models. They help to optimize the cost of transportation and storage of finished product, to predict demand for different market segments, to determine the optimal number of outlets, number of sellers, frequency of product delivery.

Prospects for future research

The perspective direction for detailed research is formation and adaptation of economic and mathematical models for particular enterprises with specific industries.

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