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THE IMPROVEMENT OF INTERNATIONAL TOURISTIC BUSINESS BASED ON THE MODEL OF INFORMATIONAL PRODUCTS DISTRIBUTION

DOSKONALENIE MIĘDZYNARODOWEGO BIZNESU TURYSTYCZNEGO W OPARCIU O MODEL DYSTRYBUCJI PRODUKTÓW INFORMACYJNYCH

Olga Sazonets, Marianna Hankina ✉

Ukraine, National University of Water and Environmental Engineering,
Academic and Research Institute of Economics and Management

Abstract. In the paper statistical data of Information technology development during 2008-2017 and a further forecast till 2019 are presented. They were found to increase by 115 billion dollars. The authors present references on the basis of using methods of dynamic programming in economic processes. Being based on the algorithm of building the model of dynamic programming the problem of the optimal distribution of information products among tourist enterprises functioning in the city of Dnipro (Ukraine) is solved. The purposeful function and restrictions concerning the problem of optimizing the usage of programming products are presented. As a result of calculations of the optimal distribution of information products among tourist enterprises the purposeful function is received, that shows the maximum additional income which constitutes 349000 thousand UAH. Information products are distributed as follows: the capacity of tourist operators is 6000 UAH, the capacity of tourist agencies is 5250 UAH, the capacity of aviation ticket offices is 750 UAH, the capacity of excursion bureaus is 3000, the capacity of enterprises of sports tourism is 2250 UAH, the capacity of enterprises of entrance/departure tourism is 2250 UAH It was revealed that the needs of tourist enterprises of the city of Dnipro in information products are fully provided.
Keywords: information, information technologies, programming products, information products, tourist enterprise

Streszczenie. W artykule przedstawiono dane statystyczne na temat rozwoju technologii informacyjnych w latach 2008-2017 oraz przewidywany trend do 2019 r. Stwierdzono wzrost o 115 mld dolarów. Autorzy odnoszą się do stosowania podstawowych metod programowania dynamicznego w procesach gospodarczych. W oparciu o algorytm do konstruowania modelu programowania dynamicznego rozwiązano problem optymalnej dystrybucji produktów informacyjnych wśród przedsiębiorstw turystycznych działających w mieście Dniepr (Ukraina). Przedstawiono funkcję celu i ograniczenia dotyczące problemu optymalizacji wykorzystania produktów programistycznych. W wyniku obliczeń optymalnej dystrybucji produktów informacyjnych wśród przedsiębiorstw turystycznych uzyskano funkcję celu, która pokazuje maksymalny dodatkowy dochód w wysokości 349 000 tys. hrn. Produkty informacyjne są rozmieszczone następująco: pojemność operatorów turystycznych wynosi 6000 hrn., pojemność biur podróży - 5250 hrn., pojemność lotniczych kas biletowych - 750 hrn., pojemność biur turystycznych - 3000 hrn., pojemność przedsiębiorstw turystyki sportowej 2250 hrn., pojemność przedsiębiorstw turystyki przyjazdowej / wyjazdowej - 2250 hrn. Stwierdzono, że potrzeby przedsiębiorstw turystycznych miasta Dniepr w zakresie produktów informacyjnych są w pełni zaspokojone.
Słowa kluczowe: informacja, technologie informacyjne, produkty programistyczne, produkty informacyjne, przedsiębiorswo turystyczne

Introduction

At present, in the first half of the 21st century, the role of information in human life is decisive - the more skills and knowledge one has, the higher one is valued as an expert and co-worker, the more respect one has in society. During the last decades it is insistently said about the transfer from “industrial society” to “information society”. The change is carried out by means of production, of the people’s

✉ e-mail: o.m.sazonets@nuwm.edu.ua; gankina.ms@gmail.com

world outlook, of their way of living. Information technologies change in a cardinal way the everyday life of millions of people.

The research of this article is based on the following methodical approaches:

- information has become one of the most important strategic, managerial resources, along with resources – human, financial, material ones;
- its production and use constitute the necessary basis of the efficient functioning and development of various spheres of society life, and, first of all, of economics;
- not only each human being has access to the sources of information in any part of our planet, and also the new information generated by it becomes the possession of the whole of mankind.
- under present conditions the right for information and the access to it are of vital value for all members of society.
- the wide use of information processes in international tourism is needed.

The distribution of information resources is of practical value in economics. The underestimation of its importance under market conditions leads to economic losses. The distribution of information resources is carried out with the help of a set of various managerial decisions. Here, the enterprise determines tasks for its future and methods for their implementation. In this paper it is necessary to solve the problem of the optimal distribution of information resources among tourist enterprises for their rational use. The necessity is the condition in correspondence with which the resources quantity is limited and the income growth for tourist enterprises here must be maximum.

Material and methods

The methodological basis of presented scientific research is built on theories, concepts and methods of social development and information society.

The substantiation of results is provided for by the handling of a great volume of statistical information using scientifically grounded methods of economic research (analysis and synthesis – in determining factors of impact of the development of tourist enterprises, in studying the provision for the use of the potential of tourist enterprises in the sphere of communication, a graphic method – in handling theoretical and statistical material, economic mathematical modelling, namely the method of dynamic programming – in compiling the model of securing by information resources tourist enterprises in the city of Dnipro).

Results and discussion

At present the world enters a new era – the information one, a century of electronic economic activity, of network communities and organizations without borders. The arrival of new time will change radically the economic and social aspects of society life. Similar changes in a very direct way concern the place of man in the information world. A human being changes in correspondence with the vector of information-technical characteristics of society. However, this is not altogether the passive adoption of new conditions of production and consumption. A human being performs as a subject of information reality, that passes far above information-technical characteristics. The informatization of everyday life and the appearance of a new information field of human existence does not occur without traces for the real world of a human being. In the electronic space behavioural standards and value orientations of the personality are changed.

Tomash Dychkovs'kyy, Dzhoanna Dychkovs'ka showed how information technology affects the functions of the management system in Polish enterprises (T. Dychkovs'kyy, D. Dychkovs'ka, 2014). Rafał Krzykawski stressed the importance of information technology in Polish enterprises. (Rafał Krzykawski, 2007). In particular, he highlighted висвітлив IT use in Poland and Europe. He also introduced perspectives for the development of IT use.

The statistic depicts (Figure 1) spending on global IT services from 2008 to 2019. In 2018, spending on IT services is expected to amount to around 1003 billion U.S. dollars worldwide. The IT services market encompasses a range of services that assist individuals and enterprises in implementing, managing, and operating the wide variety of processes, systems, software, equipment, and peripherals that are used in the modern IT environment.

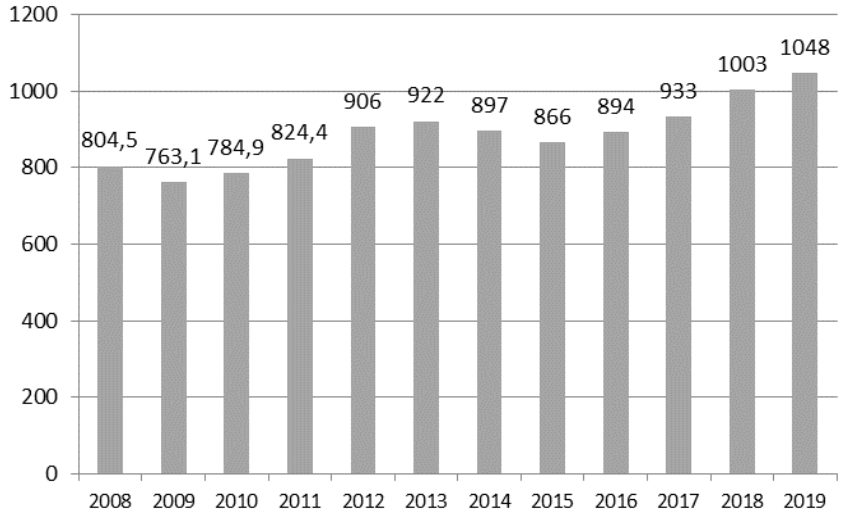

Figure 1. Information technology (IT) services spending forecast worldwide from 2008 to 2019 (in billion U.S. dollars)
Source: compiled by authors on the basis of reports about volumes of tourist enterprises activity.

Thus, the informatization with each year all the more embraces almost all spheres of mankind's activity in the world. A problem appears with the efficient disribution of information resources in enterprises.

Technologies of resources distribution in the project among executors were studied in the paper by Hrynchenko. M.A. *Tekhnolohiya* (2013). In this work there had been presented a programme mechanism of implementing the algorithm of resources distribution. V.V. Tsyganok suggested the method of solving the problem of resources distribution using systems of supporting the adoption of solutions (Tsyhanok V.V., 2010). He used a modified genetic algorithm for solving a discreet problem. Kirik O.YE considered the process of distributing flows of restricted resources in energy systems in (Kirik O.YE, 2013) The paper analyzed the problem of the optimal loading of the product suppliers. The problem of the optimal resources distribution was also studied by foreign scientists Barkalov Y.V., Burkova A.V., Hlaholev V.N. Kolpachev (Barkalov Y.V., 2002). The optimal resources distribution in conditions of indistinct interval uncertainty was investigated by N.O. Brynza, V.A. Zatkhey, O.V. Vil'khivs'ka (2016)]. In paper (Cbitnyev A.I., 2011) the use of tied resources was studied. A.I. Sbitnev and V.V.Kozlov found the algorithm of distributing interrelated information resources (V.V. Kozlov, 2011).

Principles of using methods of dynamic programming in economic processes are contained in works by A.P. Vlasyuk (1997), O.YU. Tymeychuk, (2009), S.I. Nakonechny, S.S. Savina (2004) and other scholars. The mathematical modelling of the process of distributing resources was carried out by Dokuchayev A.V. (2011).

Being based on the algorithm of building a model of dynamic programming, let us solve the problem of the optimal distribution of information products among tourist enterprises functioning in the city of Dnipro (Ukraine).

Let us write the mathematical statement of a problem. In the general form the problem of optimizing the use of programme products lies in choosing such a method of distributing between various enterprises of a tourist branch which will provide for the largest economic effect, or efficiency criterion. At the level of the enterprise or the branch the economic effect is determined as profit increment. In this way for our case the efficiency criterion is presented as the profit increment from the realization of information products. With its help the coverage of permanent expenditures of the enterprise and the obtaining of total profit are supported.

Then the limitations of the problem determining the domain of its solution will be the following:

1. The volume of information products implemented by enterprises of information sphere is not to exceed volumes of all manufactured information products.
2. The volume of information products realized to a particular enterprise is not to exceed its need for it.
3. The volume of presenting tourist services is not to exceed the capacities of tourist enterprises.

4. The enterprise-consumer of information products may manufacture only one kind of tourist service.
5. The profit from realizing information products does not depend on their redistribution among tourist enterprises.
6. The total profit equals the sum of income obtained from the realization of information products to each tourist enterprise.

Let us present the problem of the dynamic programming for distributing information products among enterprises of some sample from tourist a branch.

i – number of the enterprise manufacturing the information product for tourist enterprise where $\overline{i = 1,I}$, *I* – total quantity of enterprises manufacturing the information product for tourism;

A_i – enterprises engaged in manufacturing information product;

j – enterprises, which use information product; $\overline{j = 1,J}$, where *J* – number of tourist enterprises which are in need of information products of information enterprises of this sample;

B_j – number of tourist enterprises which are in need of information products of information enterprises of this sample; of *b*- kind;

b – ordinal number of the kind of tourist product manufactured using the information product of *m*- kind;, $b = \overline{1,B}$, $m = \overline{1,M}$, where *B* – number of kinds of tourist product, *M* – number of kinds of information products used by tourist enterprises;

k – number of process steps;

S_0^m – total needs of B_j tourist enterprises in the information product of *m*- kind;

x_j^m – total volume of information products of *m*-kind, distributed among B_j - tourist enterprises;

$g_j(x)$ – additional profit from realizing information product, $\overline{j = 1,J}$, $0 \le x \le S_0$.

The purposeful function of this problem is the maximum total additional profit under the optimum distribution of information products among different tourist enterprises:

$$Z = \sum_{j=1}^{J} g_j(x_j^m) \to max \qquad (1)$$

Limitations for this problem will be the following:

$$x_j^m \ge 0,\ j = \overline{1,J} \qquad (2)$$

$$\sum_{j=1}^{J} x_j^m \le S_0^m \qquad (3)$$

Let us consider the main stages of implementing this model. To develop the model statistical data concerning the development of information products were handled by enterprises of the city of Dnipro: native and foreign literature, records of enterprises operating on the market of information produce, information of periodicals, information resources of Internet network. The model is calculated for 2016.

Manufactures of information products in Ukraine conduct for tourist enterprises:

- maintenance of tourist firm site;
- filling-in pages of content in facebook, etc;
- purchase of traffics;
- prices arbitration;
- discount systems;
- sms- dispatch.

Consumers of information products are such types of tourist enterprises:

- tourist operator;
- tourist agency;
- aviation booking office;
- excursion bureaus;
- enterprises in sport tourism;
- enterprises of entrance/departure tourism.

To preserve the confidential information about the economic activity of private enterprises and because of the impossibility of getting the official data enterprises are assigned in correspondence with directions of activity conditional names for capacities:

B_1 – tourist operator;

B_2 – tourist agency;

B_3 – aviation ticket office;

B_4 – excursion bureau;

B_5 – enterprises of sport tourism;

B_6 – enterprises of entrance/departure tourism..

Data about demands for information products are measured in UAH and are placed in Table 1.

Table 1. Demands of tourist enterprises in c. Dnipro for information products (UAH)

Name of assortment	Consumers and their demand						Total
	Tourist operator	Tourist agency	Aviation ticket office	Excursion bureau	Enterprises of sport tourism	Enterprises of entrance/ leparture tourism	
	B_1	B_2	B_3	B_4	B_5	B_6	
Balances	6000	5000	500	4000	2000	2000	9500

Source: compiled by authors on the basis of reports about volumes of tourist enterprises activity.

Initial data about volumes of manufacturing information products and demands of tourist enterprises for them are approached to real demands for each of them.

This model has certain limitations and assumptions for application.

1. Calculations presented in accordance with the model permit to partially carry out the distribution of information resources because here are not considered the demands of enterprises of other kinds of economic activity for information products, apart from tourist enterprises of c. Dnipro.
2. The model is a local one because only enterprises of the tourist branch in c. Dnipro are analyzed and the demands of tourist enterprises and proposals of enterprises of information sphere of other regions and towns of Ukraine are not considered.
3. Some initial data, are approximate ones, because of the confidential information about tourist and information activity of enterprises.

Limitations and assumptions were used due to the partial absence of information about demands of tourist enterprises from other towns for information resources. But under the condition of the information availability the model will take into account all these aspects.

Let us realize the model in practice and analyze obtained results. Information enterprises of some sample A_i manufactured information products for the sum of 19500 UAH, which are to be distributed between tourist enterprises with such capacities B_1 = 6000 UAH, B_2= 5000 UAH, B_3 = 500 UAH, B_4 = 4000 UAH, $B_5 = 2000$ UAH, $B_6 = 2000$ UAH. Issuing from this, demands of tourist enterprises for information products constitute $B_1 + B_2 + B_3 + B_4 + B_5 + B_6$=19500 UAH. Hence, problem specification meets limitation (2) is presented in a tabular form (Table 2). It is necessary to distribute information products among tourist enterprises in such a way as to receive maximum profit.

Let us present the economic-mathematical model of problem solution. Let us write down the purposeful function - the maximum additional profit from realization on the basis of formula (1) in the form:

$$Z = \sum_{j=1}^{6} g_j(x_j^m) \to max \qquad (4)$$

Let us write down limitations to this problem:

$$x_j^m \geq 0, \overline{j = 1,6} \qquad (5)$$

$$\sum_{j=1}^{6} x_j^m \leq 19500 \qquad (6)$$

It is necessary to find variables x_j^m, which satisfy limitations (5), (6) and maximize function (4). The purposeful function $Z_k^* = (S_{k-1}^m)$ will signify conditionally optimal profit, obtained from *j* , (*j*+1),… 6-th enterprise if among them resources were distributed in an optimum way S_{k-1}^m $(0 \leq S_{k-1}^m \leq 19500)$. Allowable solution at *k*-th step meet the condition $0 \leq x_j^m \leq S_{k-1}^m$. This means that for the *j*-th enterprise nothing will be allocated, or there will be allocated not more than kept at *k*- th step.

Let us use initial data (Table 1), table 2 and methods of dynamic programming for calculating the optimum distribution of balances among tourist enterprises. Calculations will be done with the help of information system MS Excel. The algorithm of calculation is automated with the help of this programme. Calculation results are given in Table 3.

Results of maximizing profit increment using the method of passing in reverse order are singled out in table 3. As a result of calculations done of the optimum distribution of information products among tourist enterprises we received the purposeful function which shows the maximum additional profit from realizing information products and amounts to 3490000 thousand UAH if information products are distributed in such a way: $B_1 = 6000, B_2 = 5250, B_3 = 750, B_4 = 3000, B_5 = 2250, B_6 = 2250$.

Table 2. Profit increment of tourist enterprises from realizing information products, UAH

Cost of information products	B_1	B_2	B_3	B_4	B_5	B_6
	$g_1(x)$	$g_2(x)$	$g_3(x)$	$g_4(x)$	$g_5(x)$	$g_6(x)$
0	0	0	0	0	0	0
750	30000	30000	75000	18000	22000	21000
1500	40000	40000	74000	19000	23000	24000
2250	60000	45000	72000	21000	25000	25000
3000	75000	55000	70000	23000	24000	23000
3750	85000	60000	67000	24000	22000	22000
4500	95000	70000	65000	25000	21000	20000
5250	110000	75000	63000	23000	19000	19000
6000	125000	72000	61000	22000	17000	17000
6750	115000	71000	60000	19000	16000	14000
7500	110000	71000	57000	17000	15000	11000
8250	100000	70000	54000	15000	13000	10000
9000	90000	68000	53000	14000	12000	9500
9750	85000	66000	52000	12000	10000	8500
10500	75000	63000	51000	10000	9000	8000
11250	60000	60000	48000	9000	8000	7500
12000	55000	57000	45000	8500	6000	7000
12750	45000	54000	44000	8000	5500	6000
13500	40000	51000	40000	7500	5000	5500
14250	35000	48000	42000	7000	4000	5000
15000	30000	44000	38000	6200	3500	4500
15750	25000	40000	36000	6000	3100	4000
16500	20000	36000	32000	5800	2900	3500
17250	20000	32000	30000	5500	2700	3000
1800	15000	30000	2500	3400	2500	2500
18750	10000	28000	2200	5300	2400	2000
19500	5000	25000	2000	5000	2100	1900

Source: compiled by authors on the basis of reports about volumes of tourist enterprises activity.

Table 3. Calculation of optimum distribution of balances among enterprises of the tourist sphere in c. Dnipro
Source: compiled by authors on the basis of reports about volumes of tourist enterprises activity.

S_0=19500	*k*=6			*k*=5			*k*=4			*k*=3			*k*=2			*k*=1		
Demand for information product	$g_6(x_6)$	$Z_6^*(S_5)$	$x_6^*(S_5)$	$g_5(x_5)$	$Z_5^*(S_4)$	$x_5^*(S_4)$	$g_4(x_4)$	$Z_4^*(S_3)$	$x_4^*(S_3)$	$g_3(x_3)$	$Z_3^*(S_2)$	$x_3^*(S_2)$	$g_2(x_2)$	$Z_2^*(S_1)$	$x_2^*(S_1)$	$g_1(x_1)$	$Z_1^*(S_0)$	$x_1^*(S_0)$
750	21000	21000	750	22000	22000	750	19000	22000	0	75000	75000	750	30000	75000	0	30000	75000	0
1500	24000	24000	1500	23000	43000	750	21000	43000	0	74000	97000	750	40000	105000	750	40000	105000	0
2250	25000	25000	2250	25000	46000	750	23000	62000	750	72000	118000	750	45000	127000	750	60000	135000	750
3000	23000	25000	2250	24000	47000	750	24000	65000	750	70000	137000	750	55000	148000	750	75000	157000	750
3750	22000	25000	2250	22000	49000	2250	25000	67000	1500	67000	140000	750	60000	167000	750	85000	178000	750
4500	20000	25000	2250	21000	50000	2250	23000	69000	2250	65000	142000	750	70000	177000	1500	95000	197000	750
5250	19000	25000	2250	19000	50000	2250	22000	70000	1500	63000	144000	750	75000	182000	2250	110000	208000	2250
6000	17000	25000	2250	17000	50000	2250	19000	72000	2250	61000	145000	750	72000	192000	3000	125000	227000	2250
6750	14000	25000	2250	16000	50000	2250	17000	73000	2250	60000	147000	750	71000	197000	3750	115000	242000	3000
7500	11000	25000	2250	15000	50000	2250	15000	74000	3000	57000	148000	750	71000	207000	4500	110000	252000	3000
8250	10000	25000	2250	13000	50000	2250	14000	75000	3750	54000	149000	750	70000	212000	5250	100000	262000	3750
9000	9500	25000	2250	12000	50000	2250	12000	75000	3750	53000	150000	750	68000	215000	5250	90000	277000	5250
9750	8500	25000	2250	10000	50000	2250	10000	75000	3750	52000	150000	750	66000	217000	5250	85000	292000	6000
10500	8000	25000	2250	9000	50000	2250	9000	75000	3750	51000	150000	750	63000	219000	5250	75000	302000	6000
11250	7500	25000	2250	8000	50000	2250	8500	75000	3750	48000	150000	750	60000	220000	5250	60000	307000	6000
12000	7000	25000	2250	6000	50000	2250	8000	75000	3750	45000	150000	750	57000	222000	5250	55000	317000	6000
12750	6000	25000	2250	5500	50000	2250	7500	75000	3750	44000	150000	750	54000	223000	5250	45000	322000	6000
13500	5500	25000	2250	5000	50000	2250	7000	75000	3750	40000	150000	750	51000	224000	5250	40000	332000	6000
14250	5000	25000	2250	4000	50000	2250	6200	75000	3750	42000	150000	750	48000	225000	5250	35000	337000	6000
15000	4500	25000	2250	3500	50000	2250	6000	75000	3750	38000	150000	750	44000	225000	5250	30000	340000	6000
15750	4000	25000	2250	3100	50000	2250	5800	75000	3750	36000	150000	750	40000	225000	5250	25000	342000	6000
16500	3500	25000	2250	2900	50000	2250	5500	75000	3750	32000	150000	750	36000	225000	5250	20000	344000	6000
17250	3000	25000	2250	2700	50000	2250	3400	75000	3750	30000	150000	750	32000	225000	5250	20000	345000	6000
1800	2500	25000	2250	2500	50000	2250	5300	75000	3750	2500	150000	750	30000	225000	5250	15000	347000	6000
18750	2000	25000	2250	2400	50000	2250	5000	75000	3750	2200	150000	750	28000	225000	5250	10000	348000	6000
19500	1900	25000	2250	2100	50000	2250	3050	75000	3750	2000	150000	750	25000	225000	5250	5000	349000	6000

Conclusions

The paper disclosed basic information products which are used by tourist enterprises. The problem is solved in accordance with which it is necessary to distribute information products among tourist enterprises in such a way for the income increment of tourist enterprises to be maximum. As a result of the used economic-mathematical model of dynamic programming the optimum distribution was received of information products among enterprises of the tourist branch. It is revealed that demands of tourist enterprises in c. Dnipro for information products are completely provided for.

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