

**Transformational processes
the development of economic
systems in conditions of
globalization: scientific bases,
mechanisms, prospects**

**Collective monograph edited by
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ISMA University
Riga (Latvia) 2018

**Ekonomisko sistēmu attīstības
transformācijas procesi
globalizācijas apstākļos:
zinātniskie pamati,
mehānismi, perspektīvas**

**Kolektīva monogrāfija
M. Bezpartochnyi zinātniskajā redakcijā**

Informācijas sistēmu menedžmenta augstskola
Rīga (Latvija) 2018

economic and financial mechanisms of state regulation of the development of tourism and resorts.

This will increase the amount of capital investment in the tourism and resorts of Ukraine and become one of the main sources of revenues to the state budget.

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**DEVELOPMENT
OF QUALITY
MANAGEMENT
SYSTEMS IN
THE HOTEL-
RESTAURANT
BUSINESS**

Introduction. One of the important problems of the hotel-restaurant economy of Ukraine for today is development and implementation of a

quality management system (QMS) (Azgaldov et al, 2011, 2015; Topol'nik, Ratushnyj, 2008) [1-3]. Availability of QMS remains an important tool in competitive struggle on the market of the hotel-restaurant services (HRS) (Topol'nik, Ratushnyj, 2008) [3].

The complexity of the assessment of HRS is largely caused by difficulties of formalization, generalization and analysis of evaluation criteria, and definition of methods of their measurement. Therefore qualimetric methods are most often used for setting quality service parameters (Topol'nik, Ratushnyj, 2008; Kuzmin et al, 2017, 2018; Niemirich et al, 2018; Dietrich et al, 2017) [3-7].

A qualitative index of a product is a quantitative characteristic of one or several properties of a product, which characterize its quality, and is considered in terms of certain conditions of its creation, exploitation or consuming (Azgaldov et al, 2011, 2015; Topol'nik, Ratushnyj, 2008) [1-3].

According to the amount of characterized properties the indexes are divided into simple and complex (Topol'nik, Ratushnyj, 2008) [3]. Simple qualitative index identifies one of its properties (Sébédio, 2017; Kuzmin et al, 2014-2017) [4, 8-11]. Complex index identifies several properties of a product (Azgaldov et al, 2011; Topol'nik, Ratushnyj, 2008) [1, 3].

A product quantitative estimation is a set of operations, which includes: qualitative indexes' nomenclature selection of a product, value determination of these indexes and their comparison with basic indexes (Niemirich et al, 2018; Kuzmin et al, 2018; Dietrich et al, 2017) [5-7].

Complex method of a product quantitative estimation is based on expressing of the estimation rate by one number, which is a result of grouping of selected simple indexes to one complex index (Azgaldov et al, 2011, 2015; Topol'nik, Ratushnyj, 2008) [1-3].

Complex method of a product quantitative estimation is prevailing (Wang et al, 2016; Rodgers, 2017; Perng, Oken, 2017) [12-14]. But, a complex estimation of food products is not exclusive of differential estimation, because in some cases high value of complex qualitative index can disguise the low level of product's quality according to some simple indexes.

Each qualitative index, being a quantitative characteristic (extent) of one of object's quality model (fact) should reflect (to greater or lesser extent) the ability (property) of the object (fact), meet public demands (interests, values) in certain conditions. Therefore, in order to form a qualitative index we should take into account following qualitative

components: public demand, certain conditions, object and extent of its meeting. Qualitative index should provide an answer to the question: to what extent is this object (fact) able to meet public demand (interest, value) (Topol'nik, Ratushnyj, 2008) [3].

Materials and methods. The daily ration of human nutrition (breakfast, lunch, dinner) and the norms of the physiological needs of the average person – to determine the complex quantitative assessment of the quality of diets. An additive mathematical model as most widespread in a qualimetry is used for joining the quality rating into the generalized (complex) index. Methods – qualimetric (Azgaldov et al, 2011, 2015; Topol'nik, Ratushnyj, 2008) [1-3].

Method of a diet complex quantitative estimation (Topol'nik, Ratushnyj, 2008; Kuzmin O. et al. 2017) [3-4]:

1. Index values for set diets are determined from the formula:

$$P_{ij} = \frac{M_{ij}}{\sum M_{ij}}, \quad (5.1)$$

M_{ij} – content of nutrient materials in group j in nutrition products included in the diet.

2. Analogously, due to recommended norm, basic indexes are determined:

$$P_{ij}^{basic} = \frac{M_{ij}^{basic}}{\sum M_{ij}^{basic}}, \quad (5.2)$$

M_{ij}^{basic} – regulatory i nutrient material in group j of daily ration material.

3. Simple indexes' estimation of proteins, fats, carbohydrates is calculated by the formula:

$$K_{ij} = \left(\frac{P_{ij}}{P_{ij}^{basic}} \right)^z, \quad (5.3)$$

- P_{ij} – index of a nutrient material in daily ration;
 P_{ij}^{basic} – basic (balanced) value of index of a nutrient material in daily ration (according to norms of physiological needs);
 z – index, that considers the influence of changing index value on qualitative rate of an object, that is equal to plus 1 in proteins and carbohydrates content estimating and minus 1 in fats content estimating.

4. Weight coefficient value of nutrient materials m_{ij} is calculated by the formula:

$$m_{ij} = \frac{\sum M_{ij}^{basic}}{M_{ij}^{basic}} \cdot \frac{1}{\sum \left(\frac{\sum M_{ij}^{basic}}{M_{ij}^{basic}} \right)}. \quad (5.4)$$

Complex qualitative index of meal due to nutrient materials equation for two-level structure is determined from the adaptive model:

$$K_o = \sum_{i=1}^t M_j \cdot \sum_{j=1}^{n_i} m_{ij} \cdot K_{ij}, \quad (5.5)$$

M_j – weight coefficient value of nutrients.

Results and discussions. According to norms of physiological needs of a common person at the age from 18 to 59 we have developed complex qualitative index of meal: total amount of nutrient materials – 617 g (proteins – 88 g; fats – 107 g; carbohydrates – 422 g); total amount of mineral matters – 11150 mg (Na – 5000 mg; K – 3750 mg; Ca – 800 mg; Mg – 400 mg; P – 1200 mg); total amount of vitamins – 90,3 mg (B_1 – 1,6 mg; B_2 – 1,8 mg; B_6 – 1,9 mg; C – 85,0 mg).

1. Complex quality rating of breakfast. Due to norms of macronutrients, mineral matters and vitamins content, included in breakfast dishes, the calculation of nutrient materials found in menu (Table 5.3).

According to the recommended norms of physiological needs basic values have been determined from the formula (5.2). Basic qualitative

indexes of macronutrients, mineral matters and vitamins are the following: for proteins – $P_p^{basic}=0,15$; fats – $P_f^{basic}=0,17$; carbohydrates – $P_c^{basic}=0,68$; sodium – $P_{Na}^{basic}=0,45$; potassium – $P_K^{basic}=0,34$; calcium – $P_{Ca}^{basic}=0,07$; magnesium – $P_{Mg}^{basic}=0,03$; phosphorus – $P_P^{basic}=0,11$; thiamine – $P_{B1}^{basic}=0,02$; ribofflavinum – $P_{B2}^{basic}=0,02$; perydoxine – $P_{B6}^{basic}=0,02$; cevitamic acid – $P_c^{basic}=0,94$.

Weight coefficient value of nutrient materials m_{ij} has been calculated due to the recommended norms of physiological needs by the formula (5.4). Weight coefficients are the following: proteins – $m_p=0,50$; fats – $m_f=0,40$; carbohydrates – $m_c=0,10$; sodium – $m_{Na}=0,03$; potassium – $m_K=0,05$; calcium – $m_{Ca}=0,25$; magnesium – $m_{Mg}=0,50$; phosphorus – $m_P=0,17$; thiamine – $m_{B1}=0,36$; ribofflavinum – $m_{B2}=0,32$; perydoxine – $m_{B6}=0,31$; cevitamic acid – $m_c=0,01$.

Table 5.3

Calculation of macronutrients, mineral matters and vitamins content included in breakfast dishes

Nutrient materials	Name of the dish						
	Diary butter	Aubergine caviar with green onions	Beef stewed	Pasta cooked	Bread of wheat flour of grade 1	Cocoa with milk	Total
Weight, g	10	150	125	150	150	200	785,0
Macronutrients, g:							
proteins	0,06	1,20	17,90	15,60	11,40	3,80	49,96
fats	8,25	4,22	6,60	1,35	1,35	3,90	25,67
carbohydrates	0,09	12,90	7,00	112,80	74,55	24,80	232,14
Mineral matters, mg:							
Na	7,40	915,00	775,00	15,00	732,00	50,00	2494,40
K	2,30	457,50	266,00	186,00	190,50	242,00	1344,30
Ca	2,20	47,10	22,00	27,00	39,00	122,00	259,30
Mg	0,30	29,40	25,00	24,00	52,50	18,00	149,20
P	1,90	84,00	178,00	130,50	124,50	120,00	638,90
Vitamins, mg:							
B ₁	0,00	0,11	0,07	0,26	0,24	0,00	0,67
B ₂	0,01	0,11	0,17	0,12	0,12	0,00	0,53
B ₆	0,00	0,32	0,67	0,09	0,09	0,00	1,17
C	0,00	30,00	1,10	0,00	0,00	0,00	31,10

Absolute values of qualitative indexes of macronutrients, mineral matters and vitamins calculated by the formula (5.1) are the following: for proteins – $P_p=0,160$; fats – $P_f=0,080$; carbohydrates – $P_c=0,750$; sodium – $P_{Na}=0,510$; potassium – $P_K=0,270$; calcium – $P_{Ca}=0,050$; magnesium – $P_{Mg}=0,030$; phosphorus – $P_P=0,130$; thiamine – $P_{B1}=0,020$; ribofflavinum – $P_{B2}=0,015$; perydoxine – $P_{B6}=0,034$; cevitamic acid – $P_c=0,920$. Obtained results are brought in the Table 5.4.

Table 5.4

Calculation of absolute values and simple qualitative indexes

Absolute values					Simple qualitative indexes				
	breakfast	dinner	supper	daily ration		breakfast	dinner	supper	daily ration
Macronutrients									
P_p	0,160	0,160	0,18	0,16	K_p	1,138	1,145	1,31	1,06
P_f	0,080	0,100	0,14	0,14	K_f	2,079	1,710	1,19	1,21
P_c	0,750	0,740	0,66	0,70	K_c	1,075	1,075	0,97	1,03
Mineral matters									
P_{Na}	0,510	0,390	0,38	0,47	K_{Na}	1,130	0,880	0,84	1,04
P_K	0,270	0,310	0,15	0,25	K_K	0,810	0,940	0,45	0,74
P_{Ca}	0,050	0,050	0,09	0,07	K_{Ca}	0,730	0,680	1,29	1,00
P_{Mg}	0,030	0,052	0,04	0,04	K_{Mg}	0,850	1,460	1,07	1,00
P_P	0,130	0,188	0,34	0,17	K_P	1,210	1,740	3,15	1,53
Vitamins									
P_{B1}	0,020	0,046	0,07	0,04	K_{B1}	1,130	2,610	4,18	2,00
P_{B2}	0,015	0,030	0,15	0,06	K_{B2}	0,780	1,480	7,91	3,00
P_{B6}	0,034	0,370	0,07	0,11	K_{B6}	1,650	1,770	3,39	0,18
P_c	0,920	0,880	0,69	0,79	K_c	0,980	0,940	0,74	0,85
Complex quality rating of daily rations									
K_0						1,27	1,69	3,38	2,11

Simple indexes' quality rating of proteins, fats, carbohydrates has been calculated by the formula (5.3) using data from Table 5.4. Simple indexes' estimation is the following (Figure 5.7): from proteins – $K_p=1,138$; fats – $K_f=2,079$; carbohydrates – $K_c=1,075$; sodium – $K_{Na}=1,130$; potassium – $K_K=0,810$; calcium – $K_{Ca}=0,730$; magnesium – $K_{Mg}=0,850$; phosphorus – $K_P=1,210$; thiamine – $K_{B1}=1,130$; ribofflavinum – $K_{B2}=0,780$; perydoxine – $K_{B6}=1,650$; cevitamic acid – $K_c=0,980$.

Complex qualitative index of meal due to nutrient materials equation for two-level structure has been determined from formula (5.5), in which weight coefficient values (M) are for macronutrients – 0,35; vitamins – 0,55; mineral matters – 0,1. Due to the calculation results breakfast has complex quality rate $K_o=1,27$.

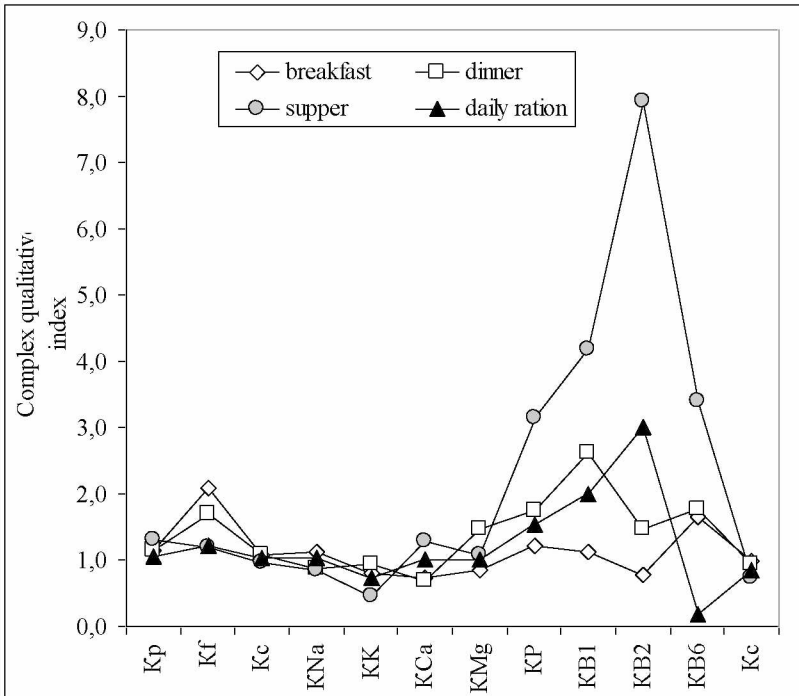


Figure 5.7 Single indexes of the quality of the diet

2. Complex quality rating of dinner. Due to norms of macronutrients, mineral matters and vitamins content, included in dinner dishes, the calculation of nutrient materials found in canteen menu is provided (Table 5.5).

Absolute values of qualitative indexes of macronutrients, mineral matters and vitamins calculated by the formula (5.1) are the following: for proteins – $P_p=0,160$; fats – $P_f=0,100$; carbohydrates – $P_c=0,740$; sodium $P_{Na}=0,390$; potassium – $P_K=0,310$; calcium – $P_{Ca}=0,050$; magnesium – $P_{Mg}=0,052$; phosphorus – $P_P=0,188$; thiamine – $P_{B1}=0,046$; ribofflavinum – $P_{B2}=0,030$; perydoxine – $P_{B6}=0,370$; cevitamic acid – $P_c=0,880$ (Table 5.4).

Table 5.5

**Calculation of macronutrients, mineral matters and vitamins
content included in dinner dishes**

Nutrient materials	Name of the dish							Total
	Beetroot boiled with green onions	Vegetable soup and beans	Fried fish fried	Buckwheat porridge	Rye bread	Sugar cookies	Tea with sugar	
Weight, g	150	500	100	150	100	50	200	1250,00
Macronutrients, g:								
proteins	2,88	12,80	15,07	14,81	7,60	7,5	0,2	60,85
fats	3,37	10,90	6,67	3,90	1,10	11,8	0,0	37,74
carbo- hydrates	16,99	43,20	6,67	76,35	40,70	74,0	16,0	273,91
Mineral matters, mg:								
<i>Na</i>	164,40	129,20	1089,33	988,50	538,00	36,0	0,0	2990,43
<i>K</i>	549,60	1073,0	213,33	256,50	206,00	90,0	6,0	2394,43
<i>Ca</i>	70,80	93,00	70,27	81,00	38,00	20,0	1,0	374,07
<i>Mg</i>	81,60	75,00	84,27	94,50	49,00	13,0	1,0	398,37
<i>P</i>	81,60	279,00	484,27	351,00	156,00	69,0	0,0	1420,87
Vitamins, mg:								
<i>B₁</i>	0,04	0,48	0,56	0,36	0,18	0,08	0,0	1,70
<i>B₂</i>	0,07	0,17	0,45	0,20	0,11	0,08	0,0	1,08
<i>B₆</i>	0,05	0,30	0,61	0,29	0,06	0,06	0,0	1,37
<i>C</i>	19,08	12,40	0,93	0,00	0,00	0,00	0,0	32,41

Quality rating of simple indexes for a group of nutrient materials has been determined from the formula (5.3), as a result the values are the following: for proteins – $K_p=1,145$; fats – $K_f=1,710$; carbohydrates – $K_c=1,075$; sodium – $K_{Na}=0,880$; potassium – $K_K=0,940$; calcium – $K_{Ca}=0,680$; magnesium – $K_{Mg}=1,460$; phosphorus – $K_P=1,740$; thiamine – $K_{B_1}=2,610$; ribofflavinum – $K_{B_2}=1,480$; perydoxine – $K_{B_6}=1,770$; cevitamic acid – $K_c=0,940$ (Table 5.4).

Complex qualitative index of meal due to nutrient materials equation for two-level structure has been determined from formula (5.5). Due to the calculation results breakfast has complex quality rate – $K_o=1,690$.

3. Complex quality rating of supper. Due to norms of macronutrients, mineral matters and vitamins content, included in supper, the calculation of nutrient materials found in canteen menu is provided (Table 5.6).

Table 5.6

Calculation of macronutrients, mineral matters and vitamins content included in supper

Nutrient materials	Name of the dish			
	Cheese pudding (baked with carrots)	Bullet rifled	Tea with sugar	Total
Weight, g	250	100	200	550
Macronutrients, g:				
proteins	25,28	7,40	0,20	3,88
fats	22,65	2,90	0,00	25,55
carbohydrates	49,65	51,40	16,00	117,05
Mineral matters, mg:				
<i>Na</i>	1140,00	402,00	0,00	1542,00
<i>K</i>	487,50	125,00	6,00	618,50
<i>Ca</i>	352,00	25,00	1,00	378,00
<i>Mg</i>	152,50	3,00	1,00	156,50
<i>P</i>	511,00	872,00	0,00	1383,00
Vitamins, mg:				
<i>B₁</i>	0,28	0,15	0,00	0,43
<i>B₂</i>	0,83	0,08	0,00	0,91
<i>B₆</i>	0,35	0,06	0,00	0,41
<i>C</i>	4,00	0,00	0,00	4,00

Absolute values of qualitative indexes of nutrient materials calculated by the formula (5.1) are the following: for proteins – $P_p=0,18$; fats – $P_f=0,14$; carbohydrates – $P_c=0,66$; sodium – $P_{Na}=0,38$; potassium – $P_K=0,15$; calcium – $P_{Ca}=0,09$; magnesium – $P_{Mg}=0,04$; phosphorus – $P_P=0,34$; thiamine – $P_{B1}=0,07$; ribofflavinum – $P_{B2}=0,15$; perydioxine – $P_{B6}=0,07$; cevitamic acid – $P_c=0,69$ (Table 5.4).

Quality rating of simple indexes of nutrient materials has been determined from the formula (5.3), as a result the values are the following: for proteins – $K_p=1,31$; fats – $K_f=1,19$; carbohydrates – $K_c=0,97$; sodium – $K_{Na}=0,84$; potassium – $K_K=0,45$; calcium –

$K_{Ca}=1,29$; magnesium– $K_{Mg}=1,07$; phosphorus – $K_p=3,15$; thiamine – $K_{B1}=4,18$; ribofflavinum – $K_{B2}=7,91$; perydoxine – $K_{B6}=3,39$; cevitamic acid – $K_c=0,74$ (Table 5.4).

Complex qualitative index of meal due to nutrient materials equation for two-level structure has been determined from formula (5.5). Due to the calculation results supper has complex quality rate – $K_o=3,38$.

4. Complex quality rating of daily ration. According to the canteen menu original data is calculated for determination of daily ration (Table 5.7).

Table 5.7

Calculation of macronutrients, mineral matters and vitamins content for daily ration

Nutrient materials	Name of the dish			
	Breakfast	Dinner	Supper	Total
Weight, g	785,0	1250,0	550	2585,0
Macronutrients, g:				
proteins	49,96	60,85	32,88	143,69
fats	25,67	37,74	25,55	88,96
carbohydrates	232,14	273,91	117,05	623,1
Mineral matters, mg:				
<i>Na</i>	2494,40	2990,43	1542,00	7026,83
<i>K</i>	1344,30	2394,43	618,50	4357,23
<i>Ca</i>	259,30	374,07	378,00	1011,37
<i>Mg</i>	149,20	398,37	156,50	704,07
<i>P</i>	638,90	1420,87	1383,00	3442,77
Vitamins, mg:				
<i>B₁</i>	0,67	1,70	0,43	2,8
<i>B₂</i>	0,53	1,08	0,91	2,52
<i>B₆</i>	1,17	1,37	0,41	2,95
<i>C</i>	31,10	32,41	4,00	67,51

Absolute values of qualitative indexes of nutrient materials are the following: for proteins – $P_p=0,16$; fats – $P_f=0,14$; carbohydrates – $P_c=0,70$; sodium – $P_{Na}=0,47$; potassium – $P_k=0,25$; calcium – $P_{Ca}=0,07$; magnesium– $P_{Mg}=0,04$; phosphorus– $P_p=0,17$; thiamine – $P_{B1}=0,04$; ribofflavinum – $P_{B2}=0,06$; perydoxine – $P_{B6}=0,11$; cevitamic acid – $P_c=0,79$. The results are brought in Table 5.4.

Quality rating of simple indexes of nutrient materials has been determined by the formula (5.3), as a result the values are the following: for proteins – $K_p=1,06$; fats – $K_f=1,21$; carbohydrates – $K_c=1,03$; sodium

– $K_{Na}=1,04$; potassium – $K_K=0,74$; calcium – $K_{Ca}=1,00$; magnesium – $K_{Mg}=1,00$; phosphorus – $K_P=1,53$; thiamine – $K_{B1}=2,00$; riboflavinum – $K_{B2}=3,00$; perydoxine – $K_{B6}=0,18$; cevitamic acid – $K_c=0,85$.

Complex qualitative index of meal due to nutrient materials equation for two-level structure has been determined from formula (5.5). Due to the calculation results daily ration has complex quality rate $K_o=2,11$.

Obtained values of complex qualitative index of breakfast, dinner, supper and daily ration are brought in Table 5.4.

Due to the data, we can draw a conclusion that the biggest value of the complex index $K_{o_{max}}=3,38$ is obtained in supper, the lowest value is typical for breakfast $K_{o_{min}}=1,27$. Whereas, breakfast is considered to be the most balanced meal with value $K_o=1,27$, which is close to the optimal value of complex quantitative rating $K_o=1,00$. Quality rating of daily rations in hotels and restaurants provides an opportunity to determine diet balance due to the norms of physiological need for daily ration.

Conclusions. Method of quality rating of daily rations in hotels and restaurants is considered. The structure of qualitative indexes and results of experimental research of complex diet quantitative rating are represented. Taking into account the norms of physiological need of a common person, complex qualitative rate of one meal and daily ration in a canteen is calculated. For this daily ration, complex qualitative indexes for group of macronutrients, mineral matters and vitamins are identified. The most balanced values of the complex qualitative index are determined which are common to breakfast with rate $K_o=1,27$.

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