Predicting of Ukrainian Horticulture Market Development

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Abstract – For determination of community needs in garden-stuffs and berries for period 2012-2015 it is suggested to carry out prediction of consumption level of horticulture products by the construction of neuron network on the basis of architecture "8-4-1" multilayered perceptron. Initial and predicted rows of consumption level of horticulture products with the purpose of possibility exposure of the predicted volumes of horticultural products consumption for period 2012-2015 and used for development of horticulture market strategy were compared in article. Information of State Statistic Service of Ukraine and authors' calculations is not confirmed by the prediction results of horticulture production in 2015, which are presented by The Ukrainian Branch Program of Horticulture Development till 2025.

Key words – horticulture production consumption, neural architecture, multilayered perceptron, market of horticulture products, government support.

I. Introduction

Providing in a necessary amount and assortment for population by high-quality fruit and baccate products and canneries – by raw material is acquired a most value in the conditions of insufficient securing of Ukrainian population by horticultural and berry products, and also further development of agro-industrial integration. The horticulture enterprises must provide the stable supply of fruit and baccate raw material in certain terms to processing enterprises.

Prediction is one of forms of the strategic planning, which allows optimum to connect the purpose of production and itself potential possibilities. Its aim is an assistance of producer's activity in achievement of the placed tasks taking into account the conditions of market and future course of events. Forecasting of horticulture industry development shows by itself the important element of the strategic planning of all national economy.

II. Data and Methods

Fundamental investigations were made by known Ukrainian scientists-economists which dedicated the question of economic efficiency of production in gardening of different legal enterprises' forms. There are O.Ermakov, V.Rul'ev, I.Cherven, O.Shestopal, O.Gutorova and others. Foreign scientists who dedicated investigations of neural architecture of multilayered perceptron were made in mathematical modeling and designing in a greater or lesser degree. There are Taner A.H., Brignell J.E., Dr. Simon Haykin from Canada, Hornik K., Stinchcombe M, White H. from USA.

And however much separate scientific aspects in relation to predicting of level consumption of horticulture and berries products remain debatable and need the proper researches. So, we made decision to apply mathematical models for predicting of horticulture developing in Ukraine till 2015 for first time whoever did it.

Market demand on the of horticulture products is represented by the base value of demand and market potential, where the first equals the actual consumption of fruit by population, and the second is determined as a sum of base level of sale and gross fund of products, which is needed for complete self-sufficiency of population in accordance with the recommended norms of consumption which characterizes the scale of market possibilities of industry on the whole. A market capacity calculates coming from the quantity of end-consumer and recommended norms of consumption of horticulture products for a population.

III. Results

Various factors influence on the fruit consumption level by Ukrainian people. A cross -correlation-regressive analysis gives an opportunity to define action direction of different indices on a resulting factor using the statistical data. Fair price influence on the horticulture products, hrn /t (x_1), household's part in total croppage,% (x_2), income level of Ukrainian population, hrn/a (x_3) on the fruit consumption output, kg on one person (y_{Xi}). The result of calculations is expressed by a cross-correlation-regressive model (equation 1).

$$y(x) = 47,0373 - 0,0117x_1 - 0,327x_2 + 0,0041x_3$$

$$R = 0,804 \qquad (1)$$

Calculations showed that the correlation coefficient had strong influence on the investigated index. The results a cross-correlation-regressive analysis resumed, that the income level increasing of population stimulates the consumption output growth, while a fruit market price and household's part in total gross collection restrain the rise of resulting factor.

Fruit consumption helps not only to lead a healthy life but also substitute expensive medical preparations. Certainly, that fruit are a not panacea for all woes, and inhibition only of fruit diet will not be able to cure a chronic patient. But they are a powerful preventive and carry out favorable influence on motion of certain illnesses. Thus, the reasonable consumption of natural gifts can prevent the diseases or decrease them.

The dynamics of human health indices in Ukraine convincingly testifies dependence morbidity level on the fruit consumption deficit. For the last 15 years the horticulture products consumption in a calculation on a one person increased on 29% equally 48% of fruit consumption rational norm (90 kg). General morbidity for investigated period diminished on 23,2 % (316,3 cases on thousand persons), including neoplasms — on 3,8% (0,6 cases on thousand persons), the amount of cases of circulatory system diseases increased on 50,4% (18,6 cases on thousand persons).

Investigation of rate of dependency human morbidity level on the fruit consumption deficit suggestive that increasing fruit consumption in dietary ration on 5 kg/a amount of general morbidity, neoplasms and circulatory system diseases (Table 1).

TABLE 1

DEPENDENCE MORBIDITY LEVEL ON THE FRUIT CONSUMPTION DEFICIT IN UKRAINE IN 1997-2012*

INDEXES	EQUATION OF POLYNOMINAL CURVE: $y(x) = a_0 + a_1 x + a_2 x^2$			APPROXIMATION VALIDITY R^2	QUANTITY DISEASES ADJUSTMENT OF INCREASING FRUIT CONSUMPTION ON 20 KG/A, THOUSAND PERSONS	
	a_0	$\grave{a}_1$	$\grave{a}_2$		nominal, cases	relative, %
Human general morbidity, cases on thousand persons	1278,2	-2,4646	-0,0397	0,2146	76,5	6,6
inter se: - neoplasms, cases on thousand persons	18,242	0,0562	-0,0032	0,5566	2,4	14,7
- circulatory system diseases, cases on thousand persons	30,778	2,9481	-0,062	0,1983	22,9	41,9

* Author calculations

TABLE 2

ACCORDANCE VERIFICATION OF ACTUAL AND PREDICTED OF CONSUMPTION LEVEL OF HORTICULTURE PRODUCTS, '000 TONS

INDEXES	YEARS								
	1996	2000	2006	2007	2008	2009	2010	20101	2012
Actual result	1980,6	1439,1	1749,6	1630,2	1958,0	2010,0	2100,7	2203,2	2405,0
Predicted result	1980,6	1439,1	2113,4	1630,2	1958,0	2010,0	2179,9	2203,2	2410,5
Deviation	0	0	363,8	0	0	0	79,2	0	10,5

TABLE 3

PREDICTION OF PROVIDING OF UKRAINE POPULATION BY THE DOMESTIC PRODUCTS OF HORTICULTURE

YEARS	MARKET CAPACITY, THOUSANDS OF TONS	ACTUAL CONSUMPTION, THOUSANDS	GROSS YIELD, THOUSANDS OF TONS			IMPORT, THOUSANDS OF TONS	PROVIDING BY DOMESTIC PRODUCTS WITHIN MARKET, %	PROVIDING BY DOMESTIC PRODUCTS WITHIN ACTUAL CONSUMPTION, %
			Householders	Ag enterprises	Sum			
2009	4152,9	2100,7	1403,3	214,8	1618,1	1139,0	23,2	45,8
2010	4109,0	2203,3	1459,7	286,8	1746,5	1130,0	26,1	48,7
2011	4083,1	2152,9	1592,8	296,9	1889,7	1118,6	25,3	48,0
2012	4057,3	2219,4	1724,1	321,5	2045,6	1104,4	27,5	50,2
2013	4031,4	2183,8	1881,8	333,6	2215,4	1090,8	27,1	50,1
2014	4005,6	2214,8	2051,9	346,6	2398,5	1073,8	28,5	51,5
2015	3979,7	2386,4	2235,3	361,5	2596,8	1054,7	33,5	55,8

* Authors' calculating

The major change on decreasing human morbidity level brings in increasing of horticulture products amount in daily food consumption on 20 kg/a. The calculations ascertain that quantity adjustment of increasing fruit consumption on 20 kg/a edges down the human general morbidity on 6,6% (76,5 thousand cases), including neoplasms — on 14,7 % (2,4 thousand cases), circulatory system diseases — on 41,9 % (22,9 thousand cases).

For determination of community needs in garden-stuffs and berries for period 2012-2015 it is suggested to carry out prediction of consumption level of horticulture products by the construction of neuron network on the basis of architecture "8-4-1" multilayered perceptron, which takes into account nine factors which makes influence on this index. There are factors which impact on the level of consumption of horticulture products by population of Ukraine: profits and charges of population, part of charges on food in general costs, amount of morbidity cases, part of population with profits below living wage, amount of households with children, volume of import, average selling price and part of production by households in the whole garden-stuffs for last fifteen years.

Equation of neuron regression has equation 2:

$$y = 7069,86 - 9,4 \cdot 10^{-4} \cdot x_1 + 2,03 \cdot 10^{-3} \cdot x_2 +$$
$$+142,84 \cdot x_3 - 145,7 \cdot x_4 - 0,23 \cdot x_5 - 19,94 \cdot x_6 +$$
$$+0,02 \cdot x_7 - 0,06 \cdot x_8. \tag{2}$$

y - level of consumption; x1 - population profits; x2 - population charges; x3 – charges for food; x4 – quantity of households with children; x5 – amount of morbidity cases; x6 – part of population with profits below living wage; x7 – volume of import; x8 – average selling prices.

The next stage of complex predicting of consumption level of horticulture products is determination statistically of meaningful indexes of neuron regression level. So far as only x3 , x4 , x5 , have observed level of meaning less then observed level of "a" (0,05), then these measures make considerable influence to investigated indicator.

Other indexes are not statistically meaningful. Consequently, level of horticulture and berries consumption mostly depend in a country from charges on food, amounts of households with children and amount of cases of morbidity.

We compared initial and predicted rows of consumption level of horticulture products with the purpose of possibility exposure of the predicted volumes of gardening products consumption for period 2012-2015 and used for development of horticulture market strategy (Table 2).

Using of neuron network by means of construction of architecture of multilayered perceptron gives possibility to make high-quality, close to the fact sheets prediction of horticulture products consumption by Ukrainian population in 2011-2015 with a further prediction purpose of market development of horticulture products.

Authors set, that in 2015 year, by comparison to 2010 year, the increasing of part of population charges will take place on food on 16% with diminishing of the combined charges. Positive is that diminishing of both part of population with a profit below living wage and gross incomes of population forecast became 35%. At the same time middle prices on the horticulture products in Ukraine

and volumes of import of garden-stuffs and berries will increase almost on 70%.

Prediction of providing of Ukrainian population by horticulture products till 2015was made, which testifies that on the nearest five years is expecting the increasing of gross volumes of harvesting, including in agricultural enterprises, on 26% (74,7 thousands of tons), and in the householders on 53% (775,6 thousands of tons).

Consequently the increase of actual consumption will proceed due to domestic producers, and the imported deliveries in 2015 year will reduce on 10% (75,3 thousands of tons), by comparison to 2010 year (Table 3).Users' profit increasing and, accordingly, themselves solvent demand will be instrumental in stimulation of horticulture production. The level of consumption in 2015 year will be 54 kg for one person per year if to take into account factors which are instrumental in growth of the horticulture consumption by population of Ukraine.

The prediction of horticulture products consumption proves that in 2010 year part of untapped possibilities was evened 29,6% from the gross capacity of market. Actually prediction is overcame only on a half from the general human requirement in fruits (including on 27,5% due to an import) and in 2015 to it will diminish to 8,2%, a considerable segment will belong to the domestic production (65,3%), and volumes of the imported products will be 26,5% (Figure 1).
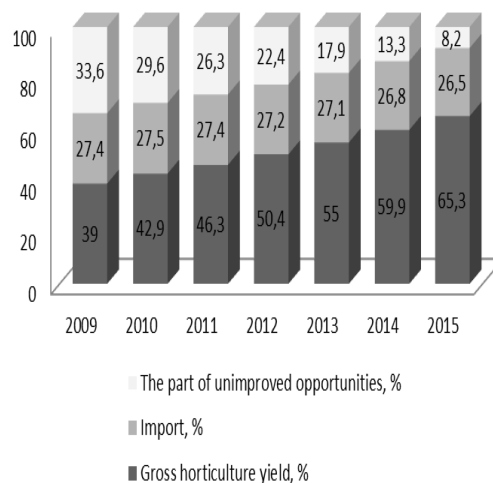

Fig. 1 Prediction of consumption horticulture market development in Ukraine

These calculations testify to Ukrainian market potential of horticultural products, which is not used fully at an existent situation. There is a chance to reduce dependence of horticultural market consumption on imported products if it will be used forward measures from the side of government for limitation of import and defence of domestic commodity producer, creation of the proper operating and orientation on the products competitiveness and brunch on the whole

A base for strategy forming is an analysis of internal and external environment, results of scientific researches, which are directed on a leading out the gardening industry from the crisis and contain prediction of horticulture market development. Unfortunately, information of State

Statistic Service of Ukraine and author calculations is not confirmed by the prediction results of horticulture production in 2015, which are presented by The Branch Program of Horticulture Development till 2025 (Table 4).

TABLE 4

THE PREDICTION RESULTS OF HORTICULTURE PRODUCTION TILL 2015

YEARS	AGRICULTURAL ENTERPRISES (THOUSANDS OF TONS)		IN TOTAL (THOUSANDS OF TONS)	
	Program of Horticulture Development	State Statistic Service	Program of Horticulture Development	State Statistic Service
2006	136,1	136,2	X	1114,3
2010	378,0	286,6	X	1746,5
2015	436,6	361,5	3200	2596,8

Table 4 dedicated that predicted volume of horticulture production by agricultural enterprises, which was proposed by Program of Horticulture Development, exceed actual data calculated by State Statistic Service in 2010. Information differs toward an increase from the author prediction of horticulture production and berries in total, agricultural enterprises in 2015 year too.

Program of Horticulture Development foresees the increasing of perennial plantings general area of agricultural enterprises from 326,42 thousand acres in 2010 year to 574,52 thousand acres in 2020 year, or on 24,71 thousand acres annually during 10 years.

It is necessary to reproduce perennial plantings in a volume 7% from a general area (or 15,6 thousands of tons) every year according to recommendations from. Therefore, due to recommendations of organization of systematic recreation of horticulture planting, the annual areas increasing of young gardens must make not less than 63,25 thousand acres (24,71 thousand acres — on expansion and 38,54 thousand acres — on an annual recreation).

It is necessary 2,3 thousands USD for uprooting old plantings, creation and care of one acre of the new plantings on the average. And for such positive increasing it is necessary to take into account 150 million of USD in the charges of the State budget of Ukraine for Ministry of Agrarian Policy and Food every year.

Financing of the government programs was foreseen by the budget of Ukraine on 2010 for a growing and caring after young orchards, vineyards and berry patches, and support of hop-growing development in size of development tax of viticulture, gardening and hop-growing (70 million of USD), and accordingly only 34% or 23,8 million of USD – for creation of the young planting, and it only 63,3% from the planned annual increasing volume of garden area.

Perennial plantings area reduced from 643,46 thousand acres to 556,72 thousand acres during 2009-2011 (data of State Statistic Service). The Program of Horticulture Development demonstrates a difference, which testifies to lower expected trajectory of growth by comparison to author calculations.

The overpriced plans were built in practice of menage which considerably differed from the real results in future. Unfortunately, it is inherent to our national programs in a certain measure: Cabinet resolution was responded for decision to lead the production of domestic horticulture products and berries to 4,5 million tons in 2005, and actually gross yield was 1,7 million tons; Program of Horticultural Development in 2015 year – 3,2 million tons, and actually in 2012 year – 1,9 million tons.

Budgetary financial resources are not enough for the revival of the domestic horticulture, for example 562,5 million of USD were allotted for agriculture in 2012 years, including 137,5 million of USD for horticulture, viticulture and hopgrowing. Therefore the role of the government is limited. Only the real budgetary recharge and attracting investment will enable to provide support.

Conclusion

Prediction results of consumption by Ukrainian population of horticultural products by the construction of neuron network which based on architecture of radial base function and the prediction information of gross yield and import, got by cross-correlation regressive analysis, are used for determination of market limits of horticulture and berries development in future.

Calculated prediction of market development of horticultural products in 2015 testifies to the general production increasing of horticulture and berries yields and insignificant reducing of imported products, and level of consumption will be 54 kg (119 pounds) per person.

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