Annals of the Academy of Romanian Scientists
Series on Agriculture, Silviculture and Veterinary Medicine Sciences
ISSN 2344 – 2085 Volume 7, Number 1/2018

FISH RESOURCES AND CONSUMPTION IN ROMANIA. ECONOMIC AND SOCIAL IMPORTANCE

RESURSELE ȘI CONSUMUL DE PEȘTE ÎN ROMÂNIA. IMPORTANȚĂ ECONOMICĂ ȘI SOCIALĂ

NECULA Raluca[1], CONSTANTIN Marian[2], DRĂGHICI Manea[3]

Rezumat. *Prezenta lucrare urmărește cunoașterea nivelului resurselor și consumului pentru produsul pește din România. Analiza este efectuată printr-o structură specifică comportamentului consumatorului prin care se caută a fi încadrate și aspectele economico-sociale. Din confruntarea elementelor de producție/consum existente la nivel național, ce este interpretativ redată prin indicatori valorici și procentuali, reiese situația cunoașterii proveniență și consumului producției de pește. Se constată o predominanță a importurilor, alături de tendința de creștere a consumului populației. Nivelurile valorilor prognozate au fost redate conform ecuațiilor de regresie și respectiv rezultatele variațiilor (±x cu referire la consumul de pește pe locuitor). Analiza efectuată a scos în evidență: consumul de pește în România care va continua să crească odată cu creșterea producției interne, dar concomitent tendința de diminuare a acestui consum odată cu scăderea acestei producții; importul producției de pește care determină o formă diferențiată a comportamentului consumatorului român (amplificarea cantităților importate determină numai până la o anumită limită o creștere a consumului). Se poate concluziona că tendința de creștere a consumului va depinde de comportamentul consumatorului român care va fi într-o foarte strânsă legătură cu alți factori socio-economici.*

Abstract. *The paper's aim is to determine the level of the resources and consumption for the fish product in Romania. The analysis is carried out through a structure specific to the consumer's behaviour, which also seeks to frame economic and social aspects. From the confrontation of the production / consumption elements existing at national level, which are interpreted by value and percentage indicators, results the knowledge of the origin and consumption situation of the fish production. There is a predominance of imports, along with the ascetic trend of the population's consumption. The predicted values were reported according to the regression equations and the variation results (± x with reference to fish consumption per capita). The analysis highlights: the consumption of fish in Romania, which will continue to grow along with the increase in domestic production, but also the tendency to diminish this consumption with the decrease in production; the import of fish*

[1]Lecturer, PhD, University of Agronomic Sciences and Veterinary Medicine from Bucharest, Faculty of Management, Economic Engineering and Rural Development, raluca_nec@yahoo.com.
[2]Prof., PhD, University of Agronomic Sciences and Veterinary Medicine from Bucharest, Faculty of Management, Economic Engineering and Rural Development, marianconstantin2014@yahoo.com, corresponding professor of Academy.
[3]Prof., PhD, University of Agronomic Sciences and Veterinary Medicine from Bucharest, Faculty of Management, Economic Engineering and Rural Development, dmprofesor@yahoo.com.

production determines a differentiated form of the Romanian consumer's behaviour (the increase in imported quantities only determines an increase in consumption up to a certain limit). It can be concluded that the trend of increasing consumption will depend on the behaviour of the Romanian consumer, which will be very closely related to other socio-economic factors.

Keywords: actual/predicted consumption, fish resources/consumption, degree of self-supply, equation/regression function, variable of influence.

1. Introduction

Considered a basic food, fish consumption in Romania is focused on the provenance sources, which are the domestic production and importations [5]. Given the still low level of consumption at national level, the present paper raises the question of knowing the causes of this decrease, together with the prospective variational possibilities based on the influential factors.

In this context, this paper discusses on the one hand the consumption of fish through the oscillations of domestic production, import and export by presenting it for the period 2005-2016, together with the possible scenarios given by the presumptive levels that resulted from the structural analysis of the influence of the factors (domestic production, import, export).

2. Materials and Methods

The methodological criteria followed in this paper refer, on the one hand, to the interpretative form of the system of technical and economic indicators frequently used in the economy, together with the results of the presumptive forms presented by the regression functions [1, 2].

At the same time, the national data from the dynamics of the period 2005-2016 focused on production, import/export and consumption (given in terms of quantities of fresh fish). Further, the percentages processed were replicated in appropriate comparative forms.

The baseline for the whole reference period was the total production provenance with reference to the baseline year 2005, alongside the structure of provenance/consumption of the fish product. The indicator of self-supply is intended to explain the interpretation of the way the domestic production covers domestic consumption requirements during the reference period analysed.

To ensure that this study is not only a historical analysis, along with the comparator indicators commonly used in the economy, we also sought to determine the presumptive knowledge of the influence of resources on national consumption for the fish product.

On the variance of the influence factors (with reference to the variables ± x) the consumption levels (*y*) were determined using equations / regression functions ($Y = a + bx$). The level of 2016 has formed the basis of comparison of the variational scenarios (±10 %.....±50 %) resulting the factors influence on consumption. This influence was carried out in the partial structure of the influence factors ($x_1 \rightarrow$ internal production, $x_2 \rightarrow$ import, $x_3 \rightarrow$ export), but also on the aggregate of the three factors (x_1, x_2, $x_3 \rightarrow$ the cumulative influence of the set of factors) [3, 4].

The correlation report (*r*) and the determinant coefficient (R^2) by the values obtained from the calculations indicated the link between the connection variables and consumption and the adequacy of the correlation forms [2].

It should be mentioned that in the use of this methodological type could not be included the multitude of influence factors, elements which might be defined in other fields (for example the socioeconomic ones).

3. **Results and Discussions**

The issue of resources and consumption of fish and fishery products has always been a topical one. The paper aims to present the problems regarding the fish resources and consumption in the current stage, and on the other hand the knowledge of the prospective consumption levels due to the variations of the influence factors in Romania.

Appropriate indicators capture all these issues by highlighting the most important aspects in a specific structural form.

The problem of fish resources and consumption in Romania was presented in a staggered way through an appropriate methodology that initially followed the structure of resources and consumption destinations, and subsequently the expected levels of fish consumption resulting from the influence of the main factors of influence.

3.1. The evolution of the origin of fish quantities in Romania.

The resources are related to the forms of use of fish productions that were given for the period 2005-2016. The provenance of the total production is made of domestic production and import, for which the presentations of the analysis were carried out successively.

Under this form the evolutionary levels were monitored by the values shown in Table 1, of which for the mentioned period can be highlighted the following:

Table 1. The structure of the fish production origin in Romania for the years 2005-2016

Year	***Total***			Internal production			Import			Degree of self-supply
	thousands of tons	% versus 2016	% compared to 2005	thousands of tons	% of total	% compared to 2005	thousands of tons	% of total	% compared to 2005	%
2005	99,112	69.80	100	17,358	17.51	100	81,754	82.48	100	17.3
2006	99,268	69.91	100.15	16,349	16.46	94.18	82,919	83.53	101.42	16.3
2007	81,694	57.53	82.42	15,106	18.49	87.02	66,588	81.50	81.44	18.5
2008	90,299	63.59	91.10	16,250	17.99	93.61	74,049	82.00	90.57	18.8
2009	102,408	72.12	103.32	15,202	14.84	87.57	87,206	85.15	106.66	14.7
2010	102,664	72.30	103.58	15,184	14.78	87.47	87,480	85.21	107.00	15.2
2011	82,337	57.98	83.07	11,593	14.07	66.78	70,744	85.92	86.53	14.1
2012	88,869	62.58	89.66	13,443	15.12	77.44	75,426	84.87	92.25	15.5
2013	90,861	63.99	91.67	14,861	16.35	85.61	76,000	83,64	92.96	17.4
2014	102,492	72.18	103.41	15,319	14.94	88.25	87,173	85.05	106.62	15.3
2015	114,284	80.48	115.30	19,601	17.15	112.92	94,683	82.84	115.81	18.5
2016	141,992	100	143.26	23,180	16.32	133.54	118,812	83.67	145.32	15.5

**Source: [6, 7, 8]*

- The total fish provenance in Romania for the period 2005-2016 shows a growth trend (the quantities which are at only 99,112 thousand tons in 2005 reaching 141,992t thousand tons in 2016). As such, there is an increase of +43.26%, but at which the pace of 2011-2013 recorded a decrease. Analyzed by the same form of comparison but to 2016, the same trend of increase can be traced;
- The domestic production of fish in Romania in the evolution of the period 2005-2016 recorded a favourable growth rate (from 17.38 thousand tons in 2005 to 23,180 thousand tons in 2016). Let's mention the 2006-2010 period when a decrease was registered in domestic production, after which the increase can be considered ascending (with reference to the succession of the years 2011-2016).
But low production levels can be seen in terms of total production of these domestic outputs (these ratios are between 14.28% and 18.49%);
- The quantities of imported fish have a special role at national level, ascertained by their high level. If in 2005 were imported 81,754 thousand tons, in 2016 a quantity of 118,812 thousand tons was imported. As such, this increase reaches in 2016 an increase of 45.32% compared to 2005. The comparable analysis to the total quantity highlights the fact that the import of fish records shares annually between 81.50% and 88.67%;

- The degree of fish supply for the Romanian population has very oscillatory levels (between 14.1% and 18.8%). This indicates precisely the situation given by the fairly modest annual quantities of domestic production that is intended to meet domestic consumption requirements. From all of this we can infer the trend of increased production of fish that is based on both the increase in domestic production and the import that is a priority (i.e. over 4/5 of the total).

3.2. The evolution of the export and consumption of fish in Romania.

Considered a form of balance, export and human consumption are the priority forms of knowledge of structures also in this field. For the same period 2005-2016 the analysis is based on the absolute and relative figures shown in Table 2 where the following can be highlighted:

Table 2. The structure of total export and consumption for fish products in Romania

Year	Total			Export			Human consumption		
	Thousand tons	% vs. 2016	% vs. 2005	Thousand tons	% vs. total	% vs. 2005	Thousand tons	% vs. total	% vs. 2005
2005	99,112	69.80	100	0,437	0.44	100	98,675	99.55	100
2006	99,268	69.91	100.15	0,728	0.73	166.59	98,540	99.26	99.86
2007	81,694	57.53	82.42	0,988	1.20	226.08	80,706	98.79	81.78
2008	90,299	63.59	91.10	0,950	1.05	217.39	89,349	98.94	90.54
2009	102,408	72.12	103.32	3,434	3.35	785.81	98,974	96.64	100.30
2010	102,664	72.30	103.58	3,048	2.96	697.48	99,616	97.03	100.95
2011	82,337	57.98	83.07	5,066	6.15	1159.26	77,271	93.84	78.30
2012	88,869	62.58	89.66	4,437	4.99	1015.33	84,432	95.00	85.56
2013	90,861	63.99	91.67	4,861	5.34	1112.35	86,000	94.65	87.15
2014	102,492	72.18	103.41	4,015	3.91	918.76	98,477	96.08	99.79
2015	114,284	80.48	115.30	4,088	3.57	935.46	110,196	96.42	111.67
2016	141,992	100	143.26	2,651	1,85	364.14	115,482	81.32	117.03

**Source: [7, 8]*

- The fish export although with a growth trend is represented by a very low share compared to the annual total. If in 2005 this export share was only of 0.44%, in 2016 this level reaches 1.85%. Originally this trend is of increase, in 2013, followed by decreases (with reference to the following years). Compared to 2005 there is a clear increase in the quantities of fish to be exported;

- The human consumption of fish records the highest annual levels compared to the total. On the other hand, these increases have very significant variations. With reference to the annual absolute figures these values are between 80,706 thousand tons and 115,482 thousand tons, which levels in relative figures also include oscillations (between 81.32% and 99.55%).

Table 3. The evolution of annual fish consumption per capita in Romania for the years 2005-2016

Year	Annual consumption per capita Kg / year / cap.	Comparison with annual consumption per capita		Comparison with consumption on main nutritional elements	
		% vs. 2016	% vs. 2005	% compared to total calorie consumption	% compared to total protein consumption
2005	4. 5	76.27	100	0.25	0.98
2006	4.6	77.96	102.22	0.19	0.98
2007	3.8	64.40	84.44	0.22	0.83
2008	4.0	67.79	88.88	0.23	0.88
2009	4. 8	81.35	106.66	0.28	1.08
2010	4. 9	83.05	108.88	0.28	1.09
2011	3. 9	66.10	86.66	0.21	0.86
2012	4. 2	71.18	93.33	0.23	0.93
2013	4. 3	72.88	95.55	0.24	1.01
2014	4. 9	83.05	108.88	0.28	1.11
2015	5. 5	93.22	122.22	0.30	1.20
2016	5. 9	100	131.11	0.32	1.29

** Source: [7]*

Regarding the consumption of fish per capita, the analysis is deepened by following the knowledge of the annual consumption per capita quantities that was considered the qualitative aspect of this investigation. The data presented in **Table 3** are edifying for this issue, focusing on the elements of actual consumption per capita, and on the other hand, presenting comparisons to the total annual consumption, as well as on the main nutrients (calories and proteins). All these elements of analysis are reproduced by the following:

- The annual consumption levels of the fish product in Romania have a growing trend (between 3.8 and 5.9 kg/cap./Year). From the comparison with the year 2005, it is shown the existence of the 2007-2008 and 2011-2013 periods, whose consumption level is below the level of the comparison year. Compared to the year 2016, we are witnessing a tendency to approach the annual consumption versus the consumption level of this last year of analysis;
- The comparisons with the main nutritional elements (represented by the total nutrients and proteins) are found to be edifying for the consumer's behaviour regarding the fish product. Comparing the calories from fish to the total calories consumption there are annual variations (expressed in relative figures between 0.19% and 0.32%), but in the evolution of the analyzed period (2005-2016) there is a growing trend. The comparison with the total protein consumption shows the existence of similar variations along with the same growth trend.

To sum up, from all these results a dimensional aspect of the problem with reference to the quantitative tendency expressed by the annual increasing consumption level of the fish product, together with the qualitative side represented by the orientation of the consumer's behaviour to increase this consumption in the food feed quantity being the comparison of total calories and protein).

3.3. The projected levels of fish consumption in Romania due to the influence of the main factors / influence variables.

All the previously expressed elements (presented in absolute and relative figures) refer to the current knowledge of the production situation and the level of utilization of fish production in Romania.

Towards this historical character, it is the question of knowing the levels of consumption for the situation in which variations in the factors of influence will occur. But to delimit the actual values on the level of fish consumption, of course within certain tolerance limits, the results of the regression function ($Y = a + bx$) were interpreted.

Table 4. The predicted fish consumption values (Y) due to influence of variables levels ($\pm x$).

Regression function		Amplification/simplification (with reference to variables le $\pm x$)	Predicted consumption values resulted from amplification/ simplification (±) of the regression function (in kg/cap./year)				
Presentation of the regression function ($y \rightarrow$consumption)	The interpretive variable (x_1, x_2, x_3)		10%	15%	20%	25%	50%
$Y(x_1) = 2.7984 + 0.0651x_1 + 0.00302x^2_1$ (R^2=0.813; r=0.66)	$x_1 \rightarrow$ internal production	+	6.42	6.68	6.95	7.22	8.72
		-	4.16	4.08	4.01	3.93	3.55
$Y(x_2) = -3.3337 + 0.1407x_2 - 0.000527x^2_2$ (R^2=0.979; r=0.96)	$x_2 \rightarrow$ import	+	6.07	6.07	6.03	5.96	5.02
		-	11.7	10.9	10.1	9.2	5.0
$Y(x_3) = 5.417 + 0.0683x_3 + 0.00627x^2_3$ (R^2=0.968; r=0.94)	$x_3 \rightarrow$ export	+	6.88	7.42	8.01	8.64	12.4
		-	5.1	4.76	4.47	4.21	3.57
$Y(x_1. x_2. x_3) = 8.67 + 1.016\,x_1 - 0.0316x^2_1 + 0.1309x_2 - 0.0003739x^2_2 + 0.427\,x_3 + 0.002226x^2_3$ (R^2=0.994; r=0.98)	$x_1, x_2, x_3 \rightarrow$ the set of cumulative factors	+	6.52	6.85	7.22	7.63	10.22
		-	5.57	5.42	5.31	5.24	5.45

The projected values have been structured in the given scenario system as a perceived knowledge of the consumption in kg/cap./year, alongside the total national consumption of the fish product.

Variations $\pm x$ (10% ... 50%) give the absolute and percentage levels for these indicators, the basis of calculation being the level of 2016 (the last year of analysis) [4].

a) - The scenario indicating predicted consumption based on regression functions resulted from the oscillation of the influence factors (x_1, x_2, x_3).

These are delimited by the values shown in Table 4, which can be completed with the following interpretations:

- According to the interpretive variable x1 → internal production, included in the regression equation [$Y(x_1) = 2.7984 + 0.0651x_1 + 0.00302x^2_1$] the following trends are observed: an increase in fish consumption with the increase of this domestic production are between 6.42 and 8.72 kg/cap./year); while the decrease in domestic production of fish causes a decrease in consumption (the levels are decreasing from 4.16 to 3.55 kg/cap./year);
- The variable x_2 → the import, by the values resulting from the regression function regression [$Y(x_2) = -3.3337 + 0.1407x_2 - 0.000527x^2_2$] defines oscillating values that are also expressed in the following form: the increase in the quantities imported of the fish product has a different influence on consumption, respectively up to an imported amount of 15% (from 6.03 to 6.07), followed by a decrease of 5.02 kg/cap/year; the situation of diminishing imports entails a decrease in consumption (from 11.7 to 5.0 kg/cap./year);
- The export of fish production, the interpretative formula given by x_3 → export, along with the regression equation [$Y(x_3) = 5.\ 417 + 0.0683x_3 + 0.00627x_{23}$], through the resulting levels, the following can be deduced: an increase of export causes an increase in consumption (from 6.88 to 12.4 kg/cap./ year); the decrease in exports also leads to a decrease in consumption (from 5.1 to 3.57 kg/cap./ year).
- the concomitant action of the three variables (x_1, x_2, x_3 → total cumulative factors), according to the regression equation [$Y(x_1, x_2, x_3) = 8.67 + 1.016\ x_1 - 0.0316x_{21} + 0.1309x_2 - 0.0003739x_{22} + 0.427x_3 + 0.002226x_{23}$] shows predicted consumption levels as follows: the increase of all variables determines a successive increase for all steps of amplifying the variables (where projected consumption values are between 6.52 and 10.22 kg /cap./year); the decrease of the variables levels causes a decrease in consumption (its oscillations being between 5.57 and 5.45 kg/cap./year);
- from the analysis of the correlation coefficient values for the four situations we can deduce the following: the correlation ratio measures the action of all the factors (x_1, x_2, x_3) at which there is an influence on the resultant variable (y). At the same time, there are permanent forms of the existence of a very close connection between the influence variables and consumption (the correlation ratio being between 0.94 and 0.98 in the case of the influence of import, export and cumulated influence of the three factors), the domestic production factor correlates with the consumption with only 0.66. As the share of this dispersion within the overall dispersion will be higher, the link between the two variables will be stronger;

- The determination coefficient can be considered as the most used criterion to interpret the significance of the correlation coefficient. In the analysis, the levels are between 0.813 and 0.994, indicating the existence of a covariance value reported to the total volume of the variation. This criterion does not always have special significance/ importance due to the important influence of the lot size in determining the correlation coefficient. Thus, the correlation ratio confirms the permanent existence of a very close link between the influence variables and consumption. Synthetically, the interpretation of the significance of the determination coefficient reveals that the level of the results of the correlation form is sufficiently strong (according to the value of R2 between 0.813 and 0.994).

Table 5.

The predicted percentages of consumption for fish product ($Y \rightarrow +10\% ... + 50\%$) following the influence of variables ($\pm x$). Regression function		Amplification (with reference to variable x)	Predicted values of fish quantities/consumption resulting from amplification (+) of regression function (in kg/cap./year)				
Presentation of the regression function (y = consumption)	Different factors (x_1, x_2, x_3)		10%	15%	20%	25%	50%
$Y(x_1) = 2.7984 + 0.0651x_1 + 0.00302x^2_1$ ($R^2 = 0.813$; $r = 0.66$)	$x_1 \rightarrow$ internal production	Variational evolution of domestic production level (thousand tons)	25,498	26,657	27,816	28,975	34,770
		Percentage variation in consumption levels (%)	8.29	12.64	17.13	21.75	46.93
$Y(x_2) = -3.3337 + 0.1407x_2 - 0.000527x^2_2$ ($R^2 = 0.979$, $r = 0.96$)	$x_2 \rightarrow$ import	Variation evolution of import level (thousand tons)	130,693	136,633	142,574	148,515	178,218
		Percentage variation in consumption levels (%)	1.86	1.85	1.22	-0.04	-15.29
$Y(x_3) = 5.417 + 0.0683x_3 + 0.00627x^2_3$ ($R^2 = 0.968$, $r = 0.94$)	$x_3 \rightarrow$ export	Variation evolution of export level (thousand tons)	127,030	132,804	138,578	144,352	173,223
		Percentage evolution in consumption levels (%)	16.42	25.70	35.68	46.38	110.49
$Y(x_1, x_2, x_3) = 8.67 + 1.016x_1 - 0.0316x^2_1 + 0.1309x_2 - 0.0003739x^2_2 + 0.427x_3 + 0.002226x^2_3$ ($R^2 = 0.994$, $r = 0.98$)	$x_1, x_2, x_3 \rightarrow$ the set of cumulative variables	The cumulative level of quantities given by the variable factors (thousand tons)	283,221	296,095	308,968	321,843	386,211
		Percentage evolution in consumption levels (%)	9.25	14.82	21,01	27.83	71.31

b)- The scenario that frames the knowledge of total fish consumptions (Y) follows by the regression equations, the variational evolution of the influence of the successive level of the influence factors (x_1 , x_2 , x_3). The results are presented in **Table 5**, which represents the projected values of the total consumption (in thousand tons) and percentage (the basis of comparison being the quantitative level of 2016). The following can be deduced from the interpretations of the forecasted values:

- The variation in the level of total domestic fish production (+10% ... + 50%) also leads to a percentage increase in consumption (successively these increases being between 8.29% and 46.93%);
- On the increase of the import there is a variation increase (between 113.06 and 178.2 thousand tons), where the percentage oscillations of the consumption levels represent an increase for the sequences up to 20% followed by a decrease;
- The variation evolution of the export level is represented by a successive increase (between 127.0 and 173.2 thousand tons), which at the same time determines a percentage increase of the consumption levels (according to the size steps the level of growth starts from 16.42% and reaches 110.49%);
- The concomitant overall influence of the three factors (x_1, x_2, x_3) determines that the cumulative level of sequential amplifications will cause a total consumption between 283.2 and 386.2 thousand tons, the growth percentage being between 9.25% and 71.31%.

Conclusions

The structural shapes presented in the two scenarios particularly target the consumption of fish in Romania. According to the values derived from the data processing carried out in the 2005-2016 dynamics, the following conclusions can be drawn:

Conclusion (1). The existence of a trend of provenance for the fish product accompanied by variations, which can be made in the following references: the domestic production is recorded as a growth trend considered as an increase in the period 2005-2010, together with a decrease in the last period (2011-2013); the import of fish is a priority (represents over 4/5 of the total) with very high annual shares (between 81.50% and 88.67% of the total); the level of self-supply is at modest and very variable levels, which only partially cover internal consumption requirements (these levels being between 14.1% and 18.8%).

Conclusion (2). Fish exports are represented by very low shares compared to the total annual, the trend being initially of increasing (until 2013), followed by decreases.

Conclusion (3). Human consumption embraces differentiations as follows: the total consumption of fish is increasing, but an oscillation was noticed whose variations are significant (between 81.32% and 99.55%); the annual growth rate of annual consumption per capita (compared to 2005, there are the 2007-2008 and 2011-2013 periods when the consumption level is below the year of comparison. Compared to 2016 there is a tendency to approach the annual consumption of this last year of analysis); comparisons of the main nutritional elements represented by the nutritive and protein elements significantly show the consumer's behaviour by the quantitative trend through the increasing annual consumption level along with the qualitative side represented by the consumer behaviour orientation with reference to the tendency to increase this consumption in feed food quantum (given the comparison of total calories and protein).

Conclusion (4). The levels of the predicted values according to the regression equations and the results of the variations ± *x* (10% ..... 50%), referring to the consumption per capita, were as follows: a trend of increase in consumption with the increase in domestic production and, at the same time, a decrease in this consumption as the production decreases; the import of fish production determines a differentiated form of behaviour of the Romanian consumer: with the increase of imported quantities we have an increase of consumption up to a certain limit (up to a share of the imported quantities of 25%, is increased from 6.03 to 6.07 kg/year/cap.), after which the increase in imports leads to a decrease in consumption (from 6.07 to 5.02 kg/cap./year); at the same time, the decrease in imports leads to a decrease in the consumption per capita below half (from 11.7 to 5.0 kg/year/cap.); on export it is found that an increase also leads to an increase in consumption (from 6.88 to 12.4 kg/year/cap.), and the decrease also leads to a decrease in consumption (from 5.1 to 3.57 kg/cap./year); the presumed level of consumption through the concurrent action of the three variables (domestic production, import, export) determines a successive increase (from 6.52 to 10.22 kg/cap./year), respectively a decrease from 5.57 to 5.45 kg/year/cap.

Conclusion (5). The forecasted values of the total consumption by the singular and overall influence of the three variables highlight the same trends. With particular reference to the imported quantities where the percentage change in consumption levels shows an increase for sequences up to 20% followed by a decrease.

Conclusion (6). The correlation report confirms the permanent existence of a very close link between the influence variables and consumption and the interpretation of the significance of the determinant coefficient shows that the results of the correlation form are sufficiently strong (R^2 values are between 0.813 and 0.994).

Fish consumption in Romania will continue to grow, which will depend on the behaviour of the Romanian consumer but in a very close correlation with other socio-economic factors.

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Annals of the Academy of Romanian Scientists
Series on Agriculture, Silviculture and Veterinary Medicine Sciences
ISSN 2344 – 2085 Volume 7, Number 1/2018

LAND RECLAMATION IN ROMANIA. HISTORICAL RETROSPECTION AND PERSPECTIVE

Aurel LUP, Liliana MIRON, Indira Deniz ALIM

Abstract. *In Romania from about 15 million hectares of agricultural land and 9.7 million hectares of arable land, 5.3 million hectares are affected by soil erosion, 5.5 million hectares are affected by excess humidity and 5.5 million hectares are affected by drought. Prior to 1990, 3.1 million hectares were equipped for irrigation, 3.1 million hectares for works to check excess humidity and only 2.2 million hectares for soil erosion control. After 1990, several rehabilitation projects were carried out, but most of them dealt with irrigation. The latest National Program of 2016 provides for an area of 2 million hectares for irrigation, especially in the Danube Floodplain. There are no rehabilitation programs for soil erosion control or excess humidity, other than the ones partly included in the irrigation systems.*

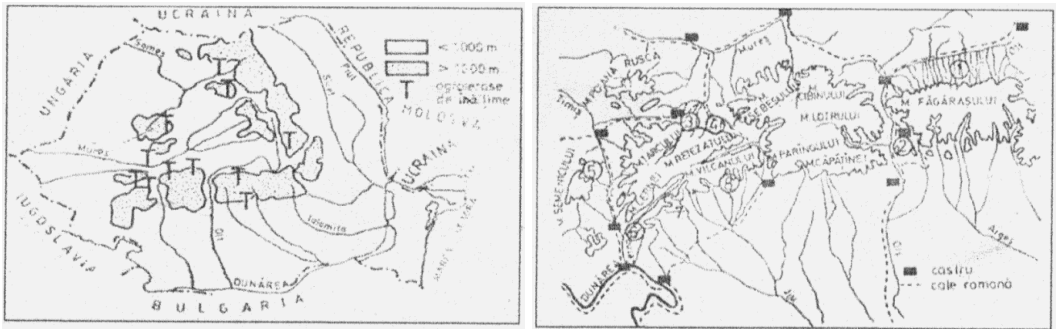
Keywords: land reclamation, retrospection, history.

1. Introduction

Expert studies have shown that on more than half of Romania's agricultural land three natural calamities produce significant harvest losses. These are drought, excess humidity and soil erosion. For farmers the most visible is drought, which almost every year causes damage in one region or another during one of the vegetation seasons. In order to combat the drought, as early as the end of the 19th century some proposals for large-scale irrigation equipment were made but were not implemented (Lup, 1997). As far as excess humidity is concerned, since the 18th century, more than one million hectares have been drained but the problem has not been solved throughout the country (Lup, 2014). While in the western and south-western parts of the country drainage and regularization of watercourses works are made, throughout the rest of the country, ponds and fisheries are set up, and small vegetable areas are equipped for irrigation, while the works against soil erosion are almost unknown. At the beginning of the 20th century, studies were developed for large-scale irrigation equipment but were not finalized. Among these we mention the work titled *Irrigation Studies in Romania* by engineer V. Roşu, 1907, for an area of 150,000 ha and engineer Al. Davidescu's *For the Irrigation of 1,773 Thousand ha* (Lup, 1997). However, the two world wars prevented works on large areas. Only after the seizure of political power by the communist-totalitarian regime in 1945, and then after the nationalization of all the country's wealth, elaborated works to combat drought, excess humidity and soil erosion became possible.

2. Material and Method

The material used is predominantly bibliographic and comes largely from the research done in this field by the first author. This is the historical part of this article. In addition, the current land reclamation programs, that include both works that are undergone at this time and short-term 2020 and mid-term 2030 future programs, are overlapping. The authors also mention legislative acts (laws, decrees) that approve these programs as they entail big investments. The method used is specific to this type of research: material collection and selection, processing, comparisons, conclusions and recommendations of the authors in relation to the past and the future of this type of study. From a historical point of view, the material is structured as follows: a) the old, medieval and modern period until the end of the 19th century; b) the first half of the 20th century; c) the planned economy period until 1989; d) the market economy period. Rehabilitation of the works made during the planned economy period and the perspective of 2020-2030.



3. Results and Discussions

3.1. The old, medieval and modern period until the end of the 19th century.

For the human species, as for any other living organism, survival means food, and when fruit and wildlife could no longer provide it, man had to cultivate the land. Thus, agriculture was born at first in the hollows of the forest and then it was developed on deforested areas.

The need for food growing with the demographic evolution, the method of increasing the productivity of the land was undertaken: irrigation, drainage, cultivation of sloping land, trough terraces to prevent erosion.

Thus, land reclamation was born, and this happened similarly in the territories inhabited by Romanians (Fig.1.2).

Traces of irrigated areas were identified not in dry areas, but where water was available without much expense. In Figure 1 irrigations continue in history until the Latène period (5th century BC – 1st century AD.) and are located in the Southern Carpathians from Cerna valley to Dâmboviţa valley comprising the piemonts. Irrigated through overflow were meadows, vegetables in the garden system. Also for the increase of cultivated areas, terraces were built, climbing up to 1,200-1,400 m of altitude (Fig. 2).

During the Middle Ages, land reclamations were represented by a large number of triple-role ponds: water mills activation, fish production and irrigation of vegetable gardens. For Transylvania we have written testimonies about ponds in the 12th century Crişana, 13th century fisheries on the Someş, Crişuri and Mureş rivers, 15th century ponds in Braşov and Sibiu. In 17th century Moldavia, the historical sources mention the existence of over 1,500 ponds, with a total area of about 200,000 ha (Davidescu D., 1994).

In the period between the second half of the 18th century and the first half of the 19th century, both in Wallachia and in Moldavia several irrigation works were performed, among which we can mention:

- Canalul Iazul Morilor-Târgovişte (Mill Pond -Târgovişte Canal), about 7 km in length, built in 1748, initially used for mills functioning and then for irrigation;
- Canalul Leaotul-Iazul Morilor-Prahova (Leaotul-Mills Pond-Prahova Canal), 26 km in length (1890);
- Canalul Sturza de la Focşani (Sturza Canal at Focşani), on the Putna river;
- Canalul Morilor şi Canalul Mărăcineni (Mills Canal and Mărăcineni Canal on the Buzău river).

In the field of excess humidity elimination and works for flood control, the first studies date back to Dacian times. Later on – the 17th-18th centuries - there is evidence of flood control and drainage of swamps works in various areas of Wallachia, such as Rădăuţi in Moldavia or the Dâmboviţa Basin in Wallachia.

A special case is that of Banat and the Western Plain, where the former Habsburg Empire began from the second decade of the 18th century extensive drainage works, regularization of watercourses, water supply, on an area of over one million hectares.

At the end of the 19th century, in Romania, there was a special interest in irrigation and the first studies on irrigation of field crops appeared. The Italian engineer Gioia proposed a sub-Carpathian canal, and engineer Chirul published the study: *Canals on Rivers and Irrigation.*

3.2. The first half of the 20th century.

The studies continue, from which we mention: *Studies on Irrigation in Romania 1907*, author Eng. V. Roșu. An area of 150,000 ha in Oltenia, Wallachia and Moldavia was considered, having as source of water the inland rivers, *The Study of Irrigation of the Danube Plain and the Inland Rivers*, author Eng. Davidescu. The study was taken up as a standard estimating 212 lei/ha. On this project there had been talks among Romanian and foreign specialists for 20 years until the author's death.

In 1929, a commission studied the possibility of embankment of the Danube and introducing irrigation on large areas. There were intermittent talks up to the Second World War without taking a concrete measure in the field, and even less during the war.

However, research was carried out in vegetation pots on the contribution of irrigation to the yield increase by: N. Chirițescu-Ava 1923, Amilcar Vasilescu 1932, Gh. Ionescu-Șișești and I. Valuță 1934, insufficient for the elaboration of irrigated technologies for the plants in the fields. The technology of rice was improved and the area cultivated with rice grew from 560 ha in 1940 to 3,250 ha in 1944.

In the area of excess humidity, the specialists' attention focused on the Danube Floodplain. After A. Saligny's death in 1924, Gr. Antipa's concept gained ground, namely the submersible embankment (Botzan et al., 1991).

The issue of soil erosion remains in the research phase without a statistic of the old terraces, vineyard plantations, and soil-setting plantations (Davidescu, 1994).

3.3. The planned economy period 1945-1989.

The new political power established on March 6, 1945 found a war-damaged agriculture, and land reclamation as described above. The catastrophic drought in 1945-1946 would follow, a situation in which the increase of agricultural yields was a priority, and the solution - irrigation. In 1950, the land reclamation situation was the following: irrigation - 42,000 ha, embankments - 622.2 thousand ha, drainage - 358.0 thousand ha and only 2,000 ha of anti-soil erosion works.

In 1950, the new political power was determined to put an end to this situation, and even if the complicated process of collectivization had begun only one year before, actually after the 1945 agrarian reform, and especially after the 1948 nationalization, the economy of the new socialist state was strong enough to allow large investments, especially since, besides the confiscation of the economy, it also had the power to make decisions.

The electrification plan. This was the name of the first program of land reclamation works, named after the Soviet model, as it was considering the construction of the Bicaz hydroelectric plant, and from its reservoir intending to provide water for the irrigation of an area of 300,000 ha.

In the same 10-year plan (1950-1960) 2.7 million hectares would be equipped for irrigation in the driest areas, of which, in the beginning, 1.2 million hectares would use the Danube River as the source of water for 500 thousand hectares, lake reservoirs for another 500 thousand hectares, and for 200 thousand ha inland rivers: Jiu, Argeş, Olt, Ialomiţa, Siret. In this first decade, 158,000 ha were equipped for irrigation (but no hectare from the Bicaz reservoir), 185,000 ha of embankments, 138,000 ha of drainage and 98,000 ha of anti-soil erosion equipment/facilities. During the first years of this period, the irrigated areas were extended for the supply of vegetables to the capital city and other working-class townss, for cereal crops, for the cultivation of cotton on furrows in the Modelu, Rosetti, Zimnicea areas.

In 1962, by HCM (Decision of the Council of Ministers) 1050/1962 the embankment and drainage of 300,000 hectares in the Danube Floodplain was approved in order to increase the arable area of the state's households. At organizational and research level, in 1966 *The Land Reclamation Department of the Superior Council of Agriculture* was established, and in 1969, after a series of reorganizations, *The Institute for Studies and Research for Land Reclamation* was established (1971), which would become in 1978 *The Institute for Research and Technological Engineering for Irrigation and Drainage* (ICITID Băneasa-Giurgiu).

The National program for extending land reclamation works in 1966-1970. Under this program, irrigation systems were built in Jegălia on 23,000 ha; Gălăţui-Călăraşi 82,000 ha; Carasu 200,000 ha (partially). In July 1970, *The National program on water resource management, the extension of irrigation works, embankments, drainage and soil erosion control in RSR (Socialist Republic of Romania) in 1971-1975 and general and prospective provisions until 1985* was launched.

Table 1. Area programmed to be equipped until the end of 1989 - thousand ha -

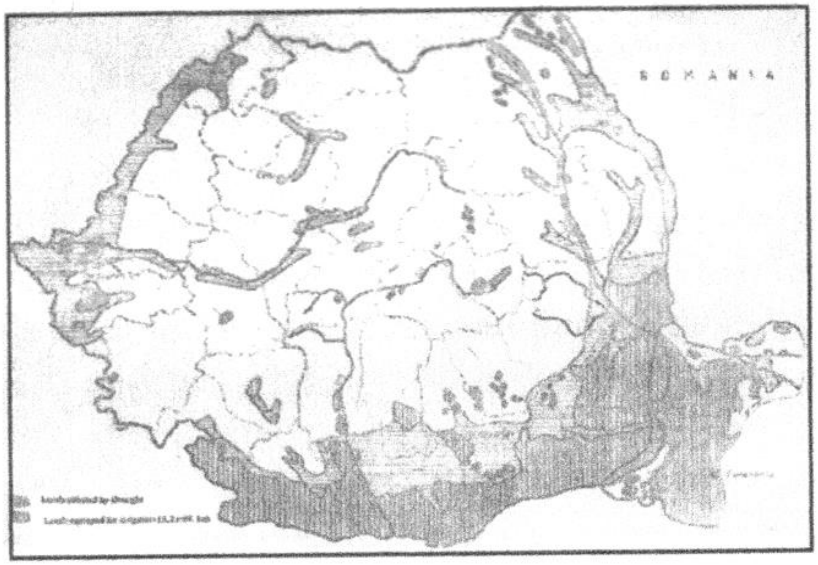
Action	Equipped area (potential)	Equipped area on 31 dec.1982	Remaining area to be equipped	Equipped in 1989
1. Equipment for irrigation	5,500	2,380	3,120	3,109
2.Drainage	5,530	2,576	2,954	3,085
3. Soil erosion control	5,300	1,718	3,582	2,222

Source: National Program 1983

1983 - The national program for ensuring secure and stable agricultural yields by increasing the productive potential of the land, better organization and unitary use of agricultural lands, the entire area of the country, the performance of irrigations on about 55-60% of arable land, of drainage and soil erosion control works. In figures, this program looks like this (Tab.1). At the end of 1989, of this last program only 56% of the irrigation program was implemented, somewhat less (55.8%) of the drainage program, and only 42% of the area planned for soil erosion control. Even these figures given as *official* by designers and builders (DGEIFCA) can be questioned in view of the era's tradition of reporting fictitious figures (obviously higher in achievements and lower than the actual ones, concerning the unresolved negative phenomena, for example excess water, salinization, swamping, etc.).

In fact, the same DGEIFCA published in 1998 data on the equipped areas, which were much larger than the official ones, presented in the following year, i.e. 1989. For example, according to the above-mentioned institution, the area equipped for irrigation at the end of 1988 was by more than 480 thousand ha larger than the one presented officially at the end of the following year, i.e. 1989.

The same happened in drainage, i.e. the area was by over 400 thousand ha larger than the official one (presented in the next year), and in soil erosion control works, i.e. the area was by more than 270 thousands ha larger (in 1988), compared to the final figures published in the following year, i.e. 1989 (6).



Source: DGEIFCA

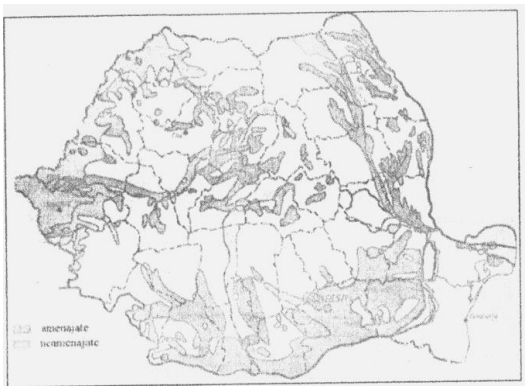
Fig. 3. Areas affected by drought in Romania.

In all land reclamation programs irrigation was given priority as the most efficient and quickest way to increase yields per ha.

As far as location was concerned, the frequency and duration of droughts were taken into account. The largest areas were equipped in the south and east of the country using the Danube River as water source (for about 85% of the equipped areas). Figure 3 shows the areas equipped at the end of 1989 compared to the last program (1983).

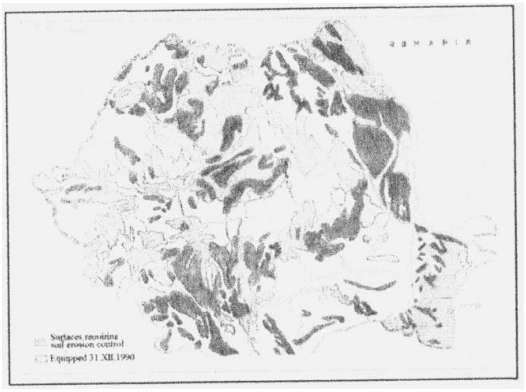
In this period, the most important factor was the degree of aridity of the area and less the economic suitability. For example, Nicolae Ceausescu himself recommended that by the end of 1985, Brăila County and the entire Dobrogea should be equipped for irrigation without taking into account the water pumping and relief height.

Figures 4 and 5 show the areas where work was carried out to fight excess humidity and soil-erosion, respectively, compared to the areas scheduled in 1989.



Source: DGEIFCA

Fig. 4. Excess humidity areas in Romania.



Source: DGEIFCA

Figure 5. Areas affected by soil-erosion in Romania and the level of works in 1990.

3.4. The market economy period.

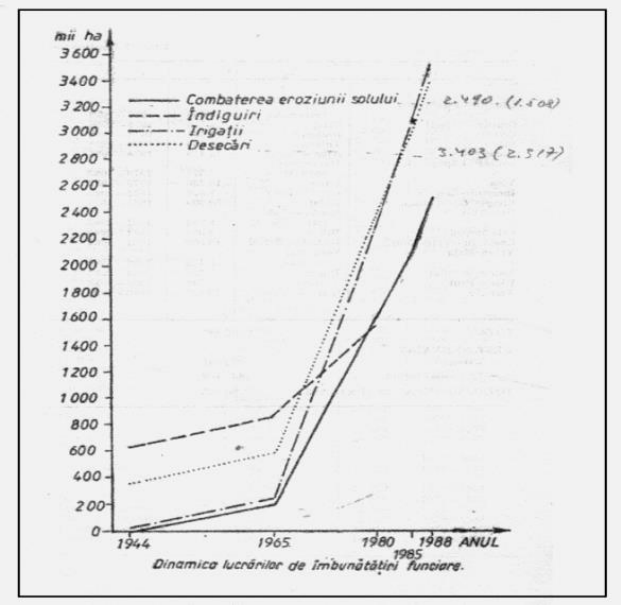
Compared to the national program in 1983, at the end of 1989 there were still 2.740 thousand ha to be equipped for irrigation; 2,445 thousand ha of drainage works and nearly 3,100 thousand ha of soil erosion control works had been carried out in over 700 sites and were in different execution phases.

In this situation, the new government stops the funding of the works and demands explanations from the over 85,000 specialists trained in the research, design and construction of the works. By order of the Prime Minister, a commission is appointed to analyze the situation and to propose measures.

The commission's first conclusion was:

Since 1966 the works have been carried out at an unrealistic pace (see Fig. 6)*; in the last 15 years the expansion of areas was given most of the attention, while in some cases the technical requirements have been abandoned in the conception and execution stage, as well as the requirements for environmental protection. About 40% of the irrigation canals are non-enclosed, water losses reaching 30-60%, the pumping aggregate yield is below the catalogue values, watering equipments have low reliability, and others are technically outdated.* Regarding the fate of the objectives in progress, the commission proposed:

- Completion of 212 objectives;
- Conservation of 139 objectives;
- To continue the work on 230 objectives.



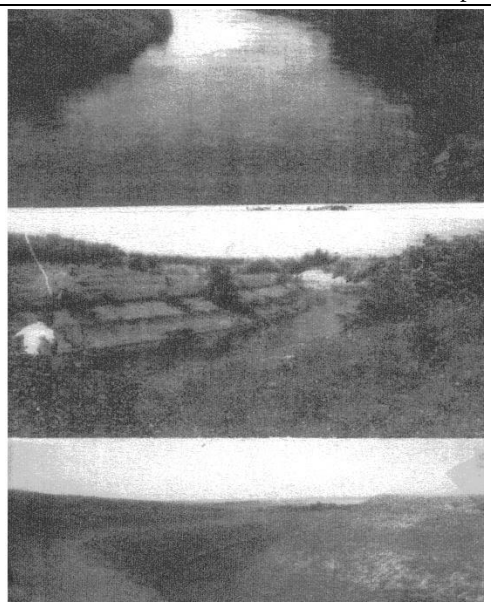
Source: DGEIFCA

Fig. 6. The dynamics of land reclamation works.

For the proposals made, the commission requested the sum of 4 billion lei, while investments worth 25 billion lei are in progress.

To this amount, the cost of the rehabilitation of the irrigation systems is added, given that some of them functioned for a longer or shorter period under the conditions established by the commission.

The Carasu irrigation system in Constanta County, for example, operated for 20 years with non-waterproofed or imperfectly waterproofed canals and inadequate watering equipment (Fig.7-8).



Source: Rehabilitation study. Diagnostic Carasu and Vederoasa, Constanța County

Fig. 7. Partially non-waterproofed channels in the irrigation systems Carasu and Vederoasa.

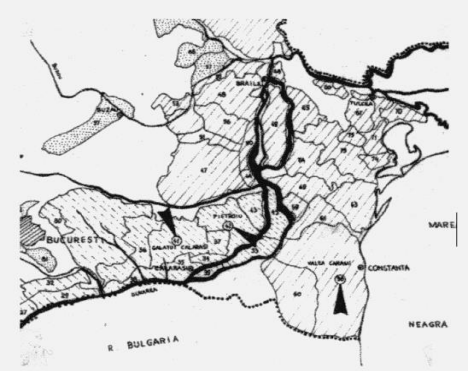
Source: Photo archive A.Lup

Fig. 8. Suspended gutters imperfectly assembled and deteriorated watering equipment

Due to this situation, a period of rehabilitation of the irrigation systems began as early as 1990, taking into account not so much the wear and tear but the fact that they actually functioned without being completely equipped. The working pace (in some years, more than 200 thousands ha were equipped and put into use), and certainly the lack of financial resources have led the builders to give up some components such as waterproofing of canals, water measuring equipment, automation and for the indispensable components (pumping stations, watering equipment) to resort to the cheapest and least efficient solutions.

The assessments of the rhythm of the works, their quality and degree of reliability were acknowledged by the members of the commission and by the builders, but only in 1990 when the works carried out for the national irrigation system were already “history". The images in Figures 7 and 8 are eloquent in this respect.

The first irrigation systems for which rehabilitation studies have been initiated since 1990 were Carasu in Constanta County with an area of 200,000 ha, Gălățui Călăraşi County with an area of 85,000 ha and Pietroiu-Ștefan cel Mare Calarasi and Ialomiţa Counties with an area of 55,000 ha, the total area studied being of 345,000 ha (7). The study was conducted from the autumn of 1990 to the summer of 1992, in collaboration with the French company. The average investment for the three systems was estimated at approx. 3000 USD/ha. The location of the three irrigation systems is shown in Fig. 9.



Source: Rehabilitation study

Fig. 9. Location of irrigation systems Carasu, Gălățui and Pietroiu.

Source: Study of Irrigation and Drainage in Romania

Fig. **10.** Location of hydro-ameliorative systems in Romania.

The findings of the diagnostic-study include:

- large water losses on non-waterproofed or partially waterproofed canals (Fig. 7);
- defective watering equipment, used improperly;
- incomplete and inefficient drainage especially in Gălăţui and Pietroiu systems built on drained areas.

The exploitation of the three irrigation systems was more or less complete before 1990 with all the above-mentioned failures. Under these conditions, the technical and economic parameters were not achieved, irrigations of this period producing significant losses to the State which, during the entire period of exploitation, subsidized the water by up to 80% of the costs, and to the agricultural units by not achieving the planned yields. The authors of the study signalled the phenomenon of salinization especially in the systems in Călărași County, the drainage system being incomplete and inefficient. Regarding the actual rehabilitation, the process is delayed although the rehabilitation programs are renewed with each change of the government or minister. There are no data on the achievement of the works on the area of 5500 thousands ha foreseen in the program of 1983, not even on the rehabilitation of the area of 3000 thousands ha, which had already been equipped in 1989.

The Study on Irrigation and Drainage in Romania (8). It was conducted by the UK firms BINNIE-PARTNER and HUNTING TECHNICAL SERVICES LTD between 1992 and 1994. A number of 104 irrigation systems from Moldavia, Dobrogea and the Danube Floodplain (Fig.10) were studied. Generally, the study found the same deficiencies, but unlike the previous one, it also analyzed the

problem of drainage, especially in the systems in the Danube Floodplain, mostly on drained lands.

As the study covered virtually Romania's entire territory, among its conclusions there are important recommendations:

- In technical and economic terms, in Romania, it is possible to irrigate efficiently 1400-1600 thousands ha;

- At a pumping height of over 70 m, water costs outweigh the extra income and, in conclusion, irrigation becomes economically inefficient.

The Romanian Irrigation Equipment Study (9). It was carried out by MORRISON KNUDSEN CORPORATION USA in the irrigation systems Giurgiu-Răzmireşti, Ialomiţa-Călmăţui Giurgiu County and Bărăgan Constanţa County. Carried out in 1992/1993, it was interested in the capacity of the irrigation systems of Romania to introduce high-performance central pivotal irrigation equipment, movable ramps, etc.

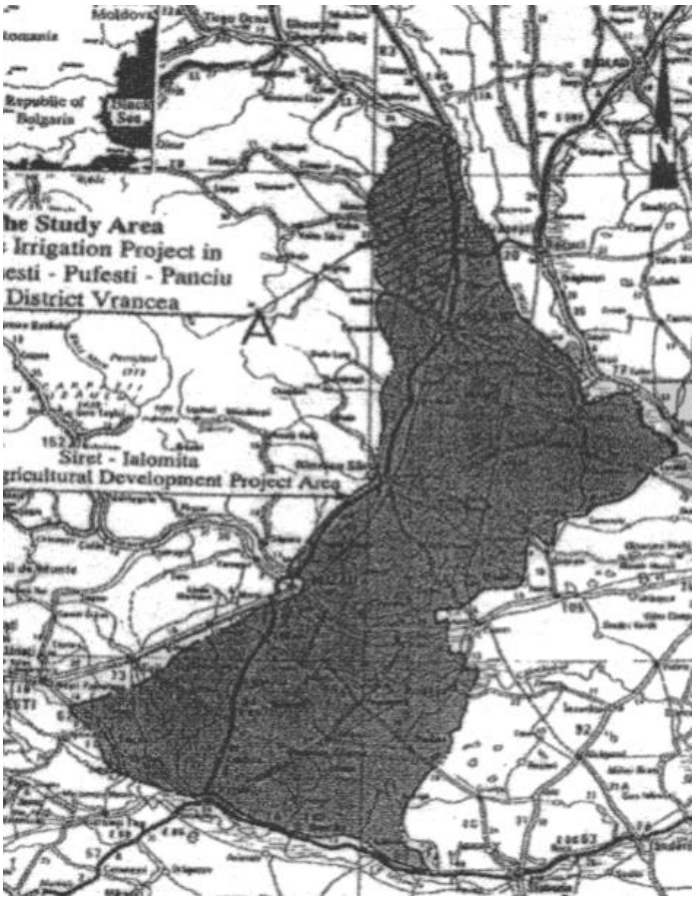


Fig. 11. The location of the JICA study (highlighted area) within the *Siret-Bărăgan Canal* project.

Feasibility study of the irrigation project in the Rugineşti-Pufeşti-Panciu Area (10) Vrancea County, conducted by the Japanese company JAPAN INTERNATIONAL COOPERATION AGENCY-JICA in 1994-1995, part of the *Siret-Bărăgan Canal* Project, which envisioned the irrigation of an area between 500-700 thousands ha. The study was located in the northern end of the project on an area of 22360 ha (Fig. 11, highlighted area). The study is important because, unlike the irrigation systems in the Wallachian Plain with pumping heights of up to 200 m, here the pumping height would have been only of a few meters and the area could be irrigated by surface leakage, therefore with low energy consumption.

The PRRSI Project - Rehabilitation and Reform of the Irrigation Sector (5).
The study aimed at adapting the irrigation systems built before 1990 to the new agrarian structures and the requirements of the market economy. It was to be implemented by the competent ministry in the period 2004-2011. An irrigation system started in Sadova-Corabia Dolj County 40000 ha of a total area of 100,000 ha. It is partially rehabilitated.

The Irrigation Sector Investing Strategy Study (11).
It consists of an economic analysis of the irrigation sector carried out in 2007-2008 by a consortium of the Dutch DHV system (Fidman Merk). The entire irrigation-equipped area before 1990 was surveyed, that is 3000 thousands ha. All the irrigation systems in the ANIF administration were analyzed according to the viable/non-viable criterion. It concluded that about half of the area equipped before 1990-1992 is viable, including systems or parts of systems that can become viable through rehabilitation. However, rehabilitation is considered a long-lasting problem, so there is a priority selection of 836 thousands ha viable at the time, but obviously after rehabilitation, which in principle means removing the deficiencies present since its putting into use. Interestingly, the practical Dutch classified the priority order according to efficiency criteria (seed culture), organization (OUAI), usability in recent years rather than the aridity-drought index (5^{th} place). The study also mentioned that irrigation should not be the subject of slogans and political choices.

The National Program for the Rehabilitation of the Main Irrigation Infrastructure in Romania 2016 (12).
It is the latest program developed by MADR/Ministry of Agriculture and Rural Development and aims at rehabilitating an area of 2,006,941 ha by 2020, divided into three phases and in 86 works, for which the amount of € 1015 billion is provided.

The program is motivated by annual harvest losses worth $ 2874 million due to drought.

Conclusions

In Romania, each of the three categories of calamities, i.e. drought, excess humidity and soil erosion, affect about half of the agricultural area of the country, which corresponds to the last program in 1983. Only about 60% of this program was achieved for drought and excess humidity and 40% for soil erosion control, although about 1,500 million tons of unrecoverable soil are lost annually.

• After 1989, the works did not continue according to the program, instead rehabilitation studies of the areas equipped until 1989 began.

• Periodically, rehabilitation programs are developed but only for the irrigation systems; currently the last number being of approx. 2 million hectares, respectively 1/3 of the 1983 program.

• The Danube Floodplain systems through the State-owned land ceded to domestic and foreign companies are a priority for rehabilitation.

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Annals of the Academy of Romanian Scientists
Series on Agriculture, Silviculture and Veterinary Medicine Sciences
ISSN 2344 – 2085 Volume 7, Number 1/2018

THE CAPACITY OF THE APICULTURAL PRODUCTION AND THE MARKET PULSE

Marian CONSTANTIN[1], Raluca NECULA[2],
Mihai FRUMUȘELU[2], Mihai-Alexandru COSTESCU[3]

Abstract. *The present study investigates the relation between production and market, at national level which is currently described as being marked by a growing number of bee families but also by an annual variation. The honey product also knows a growing trend, but at a considerably lower rate than the number of bee families. The adjustment of the functions and of the comparisons with the year 2014 reveals a favourable direct relation. The analysis of the influence of the number of bee families upon the honey product reveals that the growth in the number of bee families leads to an increase of the honey production, but at a considerably lower rate. On the other hand, a decline in the number of bee families leads to a decrease in the honey production (which is below the level of the year 2014, but in different ways). The level and the interpretation of the residual margin and of the correlation quotient revealed situations when the purchase price, honey purchasing and honey consumption are strongly correlated to the number of bee families. Such cases are regarded as frequent phenomena belonging to the pulses of the honey product market.*

Abstract. *Prezenta lucrare umărește o cunoaștere a necesității corelației producție piață, pentru care la nivel național este semnalată tendința de creștere a numărului familiilor de albine, dar și o variație anuală. La produsul miere se constată un ritm de creștere mult mai scăzut față cel al numărului familiilor de albine, iar ca rezultat al ajustărilor funcțiilor și comparațiilor față de anul 2014, este semnalată existența unei relații favorabile directe. Din analiza influenței numărului de familii de albine asupra producției de miere, s-a putut constata pe de o parte că amplificarea numărului de familii de albine determină o creștere a producției de miere, dar cu un ritm mult mai lent, iar pe de altă parte diminuările numărului familiilor de albine provoacă o scădere a producției de miere (care se situează sub nivelul anului 2014, dar sub forme diferențiate).*
Nivelul și interpretare a valorilor abaterii reziduale și coeficientului de corelație a evidențiat situații prin care prețul de achiziție, cumpărarea și consumul de miere sunt foarte strâns corelate cu numărul familiilor de albine acestea fiind considerate fenomene frecvente ale impulsurilor pieței produsului mierii.

Keywords: family of bees, *apiculture*, *bee-keeping*, purchase price (of honey), honey purchase/consumption, regression equation, adjusted value, market factor.

[1]Prof., PhD, Faculty of Management, Economic Engineering in Agriculture and Rural Development, Bucharest, Romania.
[2]Lecturer, PhD, Faculty of Management, Economic Engineering in Agriculture and Rural Development, Bucharest, Romania.
[3]Assist., PhD, Faculty of Economics and Business Administration, Craiova, Romania.

Introduction

Honey is one of the main products of the bee-keeping branch and one of the main components of the human consumption of food. At various stages of the economic development, honey was appreciated under its tri-dimensional form of food, natural cure and products obtained by processing it. The present study aims at highlighting the influence of the factors that influence both the production and the consumption of honey, pointing out the main stages of the market chain. The methodology used enabled a level of quantification suitable for understanding the variation of all indices by comparisons within the dynamics of the analysed interval of time. The results were structured in form of scenarios and aimed at knowing the presumptive possible levels of the factorial variations occurring on the market (price and demand) which influence the resulting element of the apicultural production (the capacity of production). The levels of the results of two statistical indexes — the residual margin and the correlation quotient — completed and, moreover, strengthen, by means of appropriate interpretation, the interactions which appear on the market of the honey product.

Materials and Methods

Using a suitable methodology, the study aimed at identifying the main aspects of the relationship between the bee-keeping production capacity and the influence of the factorial elements and explaining this relationship. The statistical results refer to the interval 2003-2014, with the indexes expressed as both absolute and relative values, which enabled a suitable interpretation. The structure of the indexes covered levels represented by number of bees, production and market prices, and, respectively, the factors that influence the potential of apicultural production. In order to give an accurate account of the occurrence of annual variations, the calculation methodology started from identifying the comparative levels of the year of reference, i.e. 2003, using the regression square functions $y=f(x)$. These functions were used to an accurate approximation of the analysed phenomenon, by means of appropriate scenarios. The next step was the evaluation of the values adjusted for the resulting variable (y) which resulted from the oscillations of the influence factors (x). The variations of the influence factors were structured by means of scenarios and represented by simulations rendered by amplification/simplification forms in relation to the adjusted calculation reference of the year 2014. All this enabled the evaluation of the level of the results of the resulting variable (the theoretical variable *Yi*). The variation results were expressed both as absolute and as relative values, in order to find out the variation levels and to interpret them. The residual margin (which is a synthetic indicator representing the difference between what is empirical and real, choosing the function with the smallest value) and the correlation quotient are the foundation for the results obtained from the relations x/y.

I have constantly aimed at using the calculation methodology to get beyond the historical frame of knowing the approached problems, by means of scenarios meant to evaluate to presumptive levels (*y*) by calculating the oscillating forms of the factorial variables (*x*).

Results and Discussions

The present study focuses on the problems related to the apicultural products and is centred on the quantitative dimension of the capacity of production, which, at national level, is represented by the number of bee families that determine the honey production. But these aspects, analysed in relation to quantity and value, are connected to the trivalence present on the market: consumption, price and purchase. The study analyses the annual evolution of the bee families and of the amount of honey produced by them, as well as the influence of the market factors on these primary quantitative factors.

1. - The evolution of the number of bee families and the honey production in Romania.

The evolution of the number of bee families and honey production analysed at national level has various annual levels. The parameters are displayed in both absolute and relative forms in Table 1 and in graphical form in Figure 1, highlighting the following aspects:

- The number of bee families has a clear rising trend, but also annual variations. It is worth mentioning that the level reached in 2014 is +60.83% higher than the one of the year 2003;

- Similar annual variations also occur for the honey production, which has a maximum value in 2013 and a minimum one in 2007 (the productions being of 26,678 and 16,767 tons, respectively). The analysis compared to the reference year 2003 reveals a rising trend with significant annual variations.

Table 1.- The evolution of the number of bee families and of the honey production in Romania during the interval 2003-2014

Specifi-cation	UM	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
Number of bee families	thousand families	840	888	888	891	982	998	1057	1257	1250	1254	1354	1351
	% compared to the year 2003	100	105.71	105.71	106.07	116.90	118.80	125.83	149.64	148.80	149.28	161.19	160.83
Honey pro-duction	tons (annual total)	17409	19150	17704	18195	16767	20037	**19937**	19924	24127	23062	26678	18040
	% compared to the year 2003	100	110.00	101.69	104.51	96.31	115.09	114.52	114.44	138.58	132.47	153.24	103.62

Source: Co-ordinates of the standard of living in Romania. Population incomes and consumption, INS, 2015.

The analysis of the variation of the number of bee families and of the honey production reveals annual variations, but at a different rate every year. Concerning the number of bee families, the growth is constant with relatively small variations every year, whereas the honey production has significant annual variations. One may even regard these variations as related to the season of the year.

2. - The variation of the bee product output capacity (of the number of bee families) depending on the market.

This variation was rendered by means of scenarios and aimed at knowing the factors that determine it. These factors play and important part on the market nowadays. The use of regression functions revealed the levels of these resulting variables (y), by modifying the influence factors (*x*). The adjusted values are shown in Table 2 and illustrated in Figure 2. These values render the variation levels of the number of bee families/of the honey production according to the evaluations made using the regression functions. These were expressed both in absolute figures and as percentage in relation to the value of the year 2014, which led to the following conclusions:

Table 2. The evaluation of the level of the number of bee families (*y*) influenced by the variations of the market factors (*x*), using the regression function

			The level of the results of the resulting variable Y results according to the variations of the influence factor x (5% ..... 50%) (UF /% versus 2014)							
			X5%	X10%			X15%		X50%	
The description of the relations and of the variables (*y* resulting; *x* factorial)	Function (regression equation) and the calculus reference level, the year 2014 [*y*(*x*)] Variations of the *x* factor [amplifying (+), diminution (-)]	UM	UF	%	UF	%	UF	%	UF	%
1.- The influence of the purchase price of the honey product (x) on the number of bee families (y)	(+)*Y* *y*(*x*) = 1.424 mil. bee families (value adjusted, the year 2014)	mil. bee families	1,4481	101.69	01.01.95	104.59	01.01.93	108.09	1,8340	128.79
	(-)	mil. bee families	1,3664	95.95	01.01.60	93.11	01.01.61	90.31	1,0166	71.39
2.- The influence of honey purchase (x) on the number of bee families (y million families)	(+) *y*(*x*) = 1.363 bee families (value adjusted, the year 2014)	mil. bee families	1,446	106.08	1,536	122.69	1,632	119.73	2,481	182.02
	(-)	mil. bee families	1,287	94.42	1216	89.21	1,152	84.51	0,883	64.78
3.- The influence of the honey consumption (x) on the number of bee families (y million bee families)	(+) y(x) = 1.255 (value adjusted, the year 2014)	mil. bee families	1,723	137.29	1882	149.96	2,051	163.42	3,538	281.91
	(-)	mil. bee families	1,438	114.58	1311	104.46	1,195	95.21	0,684	54.50
4.- The influence of the number of bee families (x million families) on the honey production (y tens of thousand tons)	(+) *y*(*x*) = 2,277 tens of thousand tons (value adjusted, the year 2014)	tens of thousand tons	2,334	102.50	2388	104.87	2,438	107.07	2,704	118.75
	(-)	tens of thousand tons	2,217	67.36	2153	94.55	2,087	91.65	1,533	67.32

y(*x*) is the values adjusted on years. The calculus base is the year 2014.

- ***The influence of the purchase price of the honey product (x) on the number of bee families (y),*** which is an effect of adjusting the function (*Y*), was rendered by results showing an amplification/diminution. The amplification of the purchase price (+*x*) led to different effects on the number of bee families, as follows: rising the price with up to 10% leads to an increase of the number of bee families (+28% compared to the year 2014); lowering the purchase price leads to a decrease in the number of bee families, which reached the level of 71.39% compared to the year 2014. This makes the producer want to raise the production capacity when the purchase price rises, but the effect is just the opposite: the number of bee families goes down.

- ***The influence of honey purchase (x) on the number of bee families (y)*** reveals different effects, which, according to the regression equation () and comparing the results to the reference represented by the year 2014, may be described as follows: an increase of the consumption with +10% ... +50%, which leads to a successive growth of the number of bee families, which reaches a maximum of 182.2%; a decrease in honey consumption leads to a decrease in the number of bee families, which reaches a level of only 64.7% compared to the year 2014. This clearly influences the relation between the demand (honey purchase) and offer (as a result of the production capacity) on the honey product market.

- ***The influence of the honey consumption (x) on the number of bee families (y million bee families)*** as a form of the relation consumer/producer is rendered by the results of the variations of the regression function (). The conclusions are as follows: a growth in honey consumption (*x*) the production potential, expressed by the number of bee families, has a significant growth (for its last evaluation stage of *x* at +50%, the growth of y reaches 281.91% compared to the year 2014); when the honey consumption goes down (-*x*%), there are different rates of reduction: those between -5% and -10% lead to a level which is still above that of the year 2014, whereas those between -15% and -50% lead to a level that is lower than that of the year 2014, with a decline that reaches 54.50%. The overall conclusion is that the market demand represented by the variation of the honey amounts (*x*) is in a direct relationship with the offer, represented by the number of bees.

- ***The influence of the number of bee families (x million families) on the honey production (y tens of thousand tons)*** reveals a continuation of the correlative forms rendered in the previous paragraphs, where the regression function () is used to identify the influence of the potential of the apicultural producer upon the honey production. The variations of the number of bee families occur with different rates, which can be expressed by comparing them to the adjusted value of the year 2014. This information can be described as follows:

a growth of the number of families in a succession of +5% ... +50% leads to a growth of the honey production, but at a rate given by the growth of the +*x* value, at a slower pace (the growth ranges between +2.5% and +18.75%; the decline of the number of bee families, expressed by the factorial variable x leads to a decline of the honey production *y*, which is below the level of the year 2014, but under a differentiated form (a decrease of -5% and -50% for the variable *x* results in a production decrease to levels of 67.36% and 67.32% respectively, whereas a decrease of -10% and -15% reduces the production to 94.55% and 91.65%, respectively). This suggests that the correlation between the production potential (number of bee families) and offer (honey production) appears to be connected to some forms of correlation production ↔ market, which lead to differences in the offer, some of them seeming to be described as production seasonality.

3 – The residual margin and the correlation quotient. These two parameters are forms of interpreting the dynamics of the factorial variables on the resulting ones. The level of the data that were rendered previously and structured according to the correlating functions is based on the values of the residual margin and of the correlation quotient. All this, which is also displayed in Table 3, points out the following:

Table 3. The level of the residual margin and of the correlation quotient (*x/y*) concerning the honey production capacity and the intensity of the market factors.

Crt. no.	Structure of the correlative functions (*x/y*)	Residual margin	Correlation quotient (ratio)
	1.-The influence of the purchase price of the honey product (x) on the number of bee families (y)	0.092	0.938
	2.- The influence of honey purchase (x) on the number of bee families (y million families)	0.060	0.975
	3.- The influence of the honey consumption (x) on the number of bee families (y million bee families)	0.064	0.971
	4.- The influence of the number of bee families (x million families) on the honey production (y tens of thousand tons)	0.215	0.320

- the purchase price is very strictly correlated with the number of bee families, in that an increase in the honey purchase/acquisition price makes the apiarist more co-interested (as suggested by the increase in the capacity/potential of honey production and of the number of bee families);

- a correlation that ranges between the same dimensional limits for the residual margin/correlation quotient also occurs for the influence of honey purchase upon the number of bee families (because selling honey directly to the consumer is a frequent phenomenon on the apicultural market);

- honey consumption and the number of bee families are in the same direct correlation and represent a ratio expressed both by the residual margin and by the correlation quotient. This happens because the honey production potential, expressed by the number of bee families, and the honey consumption may be regarded as extreme elements of the honey chain (made of the main stages of the apicultural market);

- the relationship between the number of bee families and production is considered to require a detailed account of the direct correlative factors of the apicultural production (seen as primary factors) and the following factor types: climatic (e.g. the favourability of the season when the pollen is picked up by the bees); economic (e.g. internal/external honey trade); political (the new coordinates of the EU-market concerning the apicultural production and the honey chain, etc.); social (e.g. how beekeeping is learned and performed by the population belonging to different age groups, etc.). All these factors eventually represent the result of the activities on the apicultural market. This is a good reason why one mustn't correlate honey production with the number of bee families only, something which would represent insufficient knowledge, where the correlation quotient is 0.320 only and the residual margin is 0.215.

Conclusions

The analysis of the capacity of producing apicultural products requires appropriate knowledge, which consists of knowing the overall influence of market factors. Concerning Romania, the following conclusions emerge:

1 The potential of the apicultural production potential, expressed by the number of bee families is on the rise, but also has annual variations. The yearly production of honey occurs at a considerably lower rate compared to the increase rate of the number of bee families. The latter varies mainly in relation to the annual seasonality of the honey product.

2 The fact that the number of bee families is correlated with the purchase price, as well as with the degree of purchasing and consuming honey, resulted by adjusting the functions and the comparisons to the year 2014, suggests the existence of a favourable direct relation.

3 *The influence of the number of bee families (x) on the honey production (y)* occurs at different growth rates compared to the value adjusted of the year 2014. To be exact, an increase in the number of bee families in a succession of +5% ... +50% leads to a growth of the honey production, but at a considerably lower rate. A decrease in the number of bee families leads to a decrease of the honey production below the corresponding value of the year 2014, but under

differentiated forms: a decline of -5% and of -50% leads to a decrease in the production to 94.55% and 91.65%, respectively, whereas a decline of -10% and -15% reduces the value of the production to 94.55% and 91.65 %, respectively. This suggests the necessity of knowing the correlation production ↔ market, and to account for differences in the offer one should take into account the seasonality of honey production.

4 The correlative functions enabled the conclusion that the values of the residual margin and of the correlation quotient reveal the following situations: the purchase price, the process of purchasing and consuming honey are very strongly correlated with the number of bee families. These are frequent phenomena on the honey market and are main stages in the honey chain.

5 The relation between the number of bee families and the honey production requires to know not only the directly correlating factors of the apicultural production but also the factors pertaining to climate, economy, politics, which can all be subsumed to the forms of the apicultural market. However, this last conclusion is not a very strong one, as long as the correlation quotient has a value of 0.320 only and the residual margin is of 0.215.

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Annals of the Academy of Romanian Scientists
Series on Agriculture, Silviculture and Veterinary Medicine Sciences
ISSN 2344 – 2085 Volume 7, Number 1/2018

ROMANIA, A BACK UP SOLUTION CONCERNING FOOD AND WATER IN 21st CENTURY EUROPE

Romulus GRUIA[1]

Abstract. *At present a major preoccupation at European level is to solve the alimentary problem on average and long term, in the context of demographic evolution, of natural resource exhaustion and climate changes. In principle, societies look for models of agro-alimentary regeneration, of adaptation of production systems, of conservation (where possible) or agro-eco-system reconversion, but also of application of circular economy principles to reuse secondary production, residues and wastes, as well as to achieve synthetic proteins. The aim of the paper is to emphasize Romania's role and place it in the situation when Europe's standard agriculture seems to have reached its limits, water as aliment becomes a problem, i.e. to show a series of solutions through which the Romanian agro-zoo technical and natural area practically becomes a reserve at continental level. The paper synthesizes the transition towards predictive agro-alimentary systems by emphasizing the main solving stages, so that Romania, through this profile, may become extremely useful in European integration, being able to decisively contribute to alimentary balance.*

Keywords: predictive agriculture, agro-zoo technical area, food, fresh water, agro-alimentary systems.

1. Introduction

It seems that standard agriculture has reached its limits in certain parts of the globe. At European level for example, and especially in the western part, the super saturation of land with chemical fertilizers paradoxically leads at present to the stagnation of agricultural production yield and quality, with effect upon animal breeding. From here worries arise as to a big alimentary crisis that might appear in EU around the year 2030. It is not surprising that the financing of agri-food scientific research is generous at present, but it seems that for the 2021-2027 period it will be too (there is information from different EU documents).

The idea we are suggesting is that Romania, having a particular specificity (geo-climatic, technical and human) can play a role in solving possible alimentary and water crises, of course by approaching certain beneficial and well financed strategies.

[1]Transilvania University of Brașov, Academy of Romanian Scientists.

It must be specified that for our country there are in fact two opposed scenarios: either nothing constructive is done and we will become food and water dependent, or we will find and apply solutions for this warning.

We mean to avoid critical points in stipulated changes for the 21st century, with effect in fighting drought and demographic and natural environment "desertification" on the salvation from exhaustion of water table from aquifer strata (the first saturated with water horizon met under earth surface, with variation of influence level by climate conditions).

The approached theme is complicated and vast. That is why we concentrate the **objectives** of the study on three directions: - to be aware of avoiding the *"Big disaster"* (in the future to look for water and food outside Romania, which aims at an *"alertness");* to achieve a synthesis on technico-organising principles for the Romanian phyto-zoo-alimentary and natural area to become a national resource with potential of reserve and element to attract "food and water" in the future decades (which aims at a "*clear* v*ision and professionalism"*);

- to find theoretic and practical production solutions concerning *"The big chances"* (to imagine basic conditions necessary to produce and sell Romanian food and drinking water, including for exportation, in order to contribute at EU level with food and water for the worrying future (which means the capitalization of a serious "*opportunity"*).

2. Methodology and Work Hypotheses

The processing of cumulated data methodologically pursued the following systemic logics, in several steps:

- ***Step I*** - Reparation of the standard system of agricultural production;
- ***Step II*** - Production orientation towards European "oasis", such as Romania, to capitalize the existing **biodiversity**;
- ***Step III*** - Imposing **bio-economic** principles and practice of circular economy (recovery and capitalization of secondary products, wastes, residues, etc.);
- ***Step IV*** - Passing towards new food resources, namely towards **synthetic proteins** (reserve of food in "casualty" conditions from the 21st century);
- ***Step V*** - Technical and psychological change of the **feeding manner**: *new alimentary directions* and a new *culinary paradigm* by applying vanguard ideas: bio complexity, personalized and predictive gastronomy and others.

3. Results and Discussions

Going through the 5 mentioned steps attempts to solve the proposed objectives, so that to sustain the idea of active player, i.e. Romania to be a "donor" in the European food security in the decades to come.

In order to achieve this desideratum, from the very beginning we consider that an intelligent strategy becomes imperiously necessary for a balanced development of Romania's agriculture in relation to *nature – food & water – human resource.*

In these conditions there are necessary elements that show **premises** from which there may start disposals of this problem, respectively concerning food and avoiding alimentary problems in the 21st century. We distinguish two basic components, namely a series of premises at European level or at the Romanian space (Bogdan, A.T., 2012; Gruia, R., 2016; Abrudan, I., 2018)**.** Food and drinking water must be a basic concern for our country, so that Romanian premises refer to *natural and social environment specificity and dynamics* (Tab.1).

Table 1. Avoiding alimentary crises by taking into consideration basic premises

No.	Basic ideas	NATURAL AND SOCIAL DIAGNOSIS	TECHNICAL AND MANAGERIAL DYNAMICS
1	**EUROPEAN PREMISES**	- Agro-eco-systemic exhaustion - Climate changes - Demographic increase	- agro-food technologic limitations (signs of ***stagnation*** of the production level and technical saturation through modern methods)
2	**ROMANIAN PREMISES**	- Climate changes - Demographic decline - Population aging	- adaptation of the bio economic model, demographic, managerial and legislative solution in the Romanian zoo technical sector; - genetic amelioration: creation of new sorts of fodder plants and adaptation of species and animal races resistant at high temperatures and drought; - avoiding pathologic losses and water conservation when drought.

In this context, Romania may keep and consolidate its biodiversity through intelligent policies, so that the natural and food patrimony may be developed, based on the process of diversification and introduction in the agro-zoo technical circuit of new species with economic potential, required for the necessary protein

equilibrium (especially the animal one) in the future decades and to avoid potential crises of alimentary nature.

As for assuring drinking water, a series of actions become obligatory:

- regularization of water streams;
- unclogging of water streams and reservoirs;
- spring maintenance; - antipollution measures (National Report, 2004).

Concomitantly it is absolutely obligatory to totally solve the irrigation system in Romania.

Based on what has been said, we will analyze the solving steps that may represent the necessary support to elaborate a national strategy meant to ensure good enough agro-alimentary productions, including the contribution of drinking water capitalization too.

3.1. Methodological priorities to remediate and develop the Romanian agri-food system

A first step is to methodologically sustain Romania's priorities with regard to food security and safety.

The potential we have entitles us to analyze the possibility to become a real European solution concerning food and drinking water. Without pretending problem exhaustion, we mention among the necessary elements for such a strategy:

- *conservation* of natural patrimony through the demarche of an applied ecology (to avoid the destruction of agricultural potential, in many concerns there are unwanted aspects of the present!);
- application of methods and principles of *engineering and management* concept in sustainable development of the agro-alimentary system.

3.2. Diagnosis regarding natural and cultural potential to sustain the Romanian agri-food system

The second step is important in order to exactly understand the present situation, i.e. to collect data by inventorying the natural and cultural-scientific patrimony that sustains the Romanian agro-alimentary system.

Given the conditions when climate changes already affect the capacity to produce food, the new conceptual approaches undoubtedly lead to finding scientific and technical solutions. The idea to capitalize *biodiversity* and local *geo climatic and cultural diversity* seems to be essential.

Concerning **biodiversity,** it is known that in the Romanian space live numerous species of plants and animals that disappeared a long time ago in other parts of Europe, or are still existing, but in very reduced numbers (Cristea, M.D., 2007; 2012; Maruşca, T., 2017).

As arguments we remind: ***Catalogue of plant variety*** (sorts) that are cultivated on Romania's territory, identifying a number of 2118 sorts of plants and ***Catalogue of domestic mammals*** which includes 79 races (out of which 26 are still active, 19 in potential danger and 34 disappeared). However it must be mentioned that many local races (Ţurcană, Ţigaie, Capra Carpatină, etc.) have a reproduction system in local communities (reproductive isolation on a certain area, without genealogic register and production official control, the selection being made in agreement with the owner's preference).

As for **geo climate and cultural diversities,** the diagnose referring to food and drinking water may be grouped in the following typological aspects: - diversity of biodiversity geo resources (flora, fauna); - diversity of agro touristic geo resources (tourist villages / agro-alimentary products and cultural elements of the local community) and – diversity of drinking water geo resources (water as an "aliment"). Table 2 mentions synthetically (Cristea, M.D., 2012; Gruia, R., 2017), a series of information that demonstrate the existence of a real potential that may guarantee the work basis for a real food reserve in the future.

Table 2. Geo resources from Romania's biodiversity

Romania's flora	Romania's fauna
On Romania's territory have been identified 3700 species of plants from which up to now 23 have been declared nature monuments, 74 have disappeared and 1253 are considered rare. The three large vegetation zones in Romania are the alpine zone, the forest zone and the steppe zone. Vegetation is tiered, in concordance with soil and climate characteristics, but also depending on altitude, as follows: oak, lime, ash (in steppe and low hill zones); beech, holm-oak (between 500 and 1200 meters); spruce, fir, pine (between 1200 and 1800 meters); juniper, savin and dwarf trees (between 1800 and 2000 meters); alpine lawns formed of petty herbs (above 2000 meters). Off large valleys, due to persistent humidity, there appears meadow specific vegetation, with cane, rush, carex and often with bunches of willows, poplars and alders. In the Danube Delta swamp vegetation is predominant.	It is one of the richest and varied ones in Europe, containing rare or even unique species on the continent. In Romania there live 732 vertebrate species and subspecies and numerous (several thousands) non-vertebrate species. Vertebrates are represented in Romania's fauna by: cyclostomes (4 species), fish (184 species and subspecies), amphibians (20 species and subspecies), reptiles (31 species and subspecies), birds (382 species and subspecies) and mammals (110 species and subspecies). Among the mentioned groups, in the Romanian space almost 4000 butterfly species (from which approx. 25% on the Tâmpa Mountain/ Braşov). Among mammals, one is in imminent extinction danger (sea cow), one in danger (mink), 13 vulnerable and 4 threatened.

Table 3. Genetic resources from the traditional or recently diversified Romanian space, with economic potential in alimentation

Genetic resources with phyto-alimentary potential	**Genetic resources with zoo-alimentary & clothing potential**
FOREST FRUIT GROUP FROM ROMANIA	FARM MAMMAL GENETIC RESOURCES
Wild strawberries *(Fragaria vesca)*	Domestic pig (*Sus scrofa domesticus* or *Sus domesticus*)
Huckleberries *(Vaccinium myrtillus L)*	Ruminantia suborder cow (ruminants), Bovidae family.
Raspberry *(Rubus idaeus)*	Horse (*Equus caballus*)
Culture huckleberries *(Vaccinium corymbosum)*	Domestic sheep (*Ovis aries*)
Sea buckthorn *(Hippophaë rhamnoides L.)*	Domestic goat (*Capra aegagrus hircus*)
Blackberry *(Rubus fruticosus L.)*	FARM POULTRY GENEITC RESOURCES
Eglantine *(Rosa canina)*	Hens (Gallus gallus domesticus)
Cowberry *(Vaccinium vitis idaea - L.)*	Turkey hens *(Meleagris gallopavo)*
Elder *(Sambucus L.)*	Domestic geese (*Anser cygnoides)*
Currant *(Ribes rubrum)*	Ducks *(subfamily Anatinae)*
Gooseberry *(Ribes grossularia)*	Quails *(Coturnix coturnix)*
Strawberries *(Fragaria viridis)*	Pigeons *(Columba livia)*
Filbert *(Corylus avellana)*	Pheasants *(Phasianus colchicus)*
Nut *(Juglans regia L.)*	Peacocks *(Pavo sp.)*
GROUP OF MEDICINAL AND MELIFEROUS PLANTS FROM ROMANIA	GENETIC RESOURCES OF SMALL FARM ANIMALS
Blues *(Centaurea cyanus)*	Rabbits *(family Leporidae)*
Potato *(family Solanaceae / Solanum tuberosum)*	Chinchilla *(family Chinchillidae)*
Esculent chestnuts (*Castanea sativa*)	Nutria *(Myocastor coypus)*
Artichoke (*Cynara scolymus*)	Muskrat *(Ondatra zibethicus)*
Cucumber *(Cucumis sativus)*	Guinea Pig *(subfamily Caviinae)*
Hot pepper (*Capsicum annuum*)	Ferret *(Mustela putorius)*
Sea buckthorn (*Hippophaë rhamnoides* L.)	Mink *(Mustela vison)*
Onion (*Allium cepa*)	Polar fox *(Vulpes lagopus)*
Chicory *(Cichorium intybus*)	NON TRADITIONAL ANIMAL GENETIC RESOURCES
Fir tree *(Abies alba)*	
Thyme *(Thymus serpyllum)*	
Basil *(Ocimum basilicum)*	Molluscs *(branch Mollusca)* - invertebrates s (shells, snails, sepias, octopi and others) Crustacee (*branch Arthropoda*) - aquatic arthropods (crabs, shrimps, lobsters, krills, crayfish, crawfish and others) - terrestrial arthropodes – insects are eatable (ants, bee and wasp larvae, grasshopper, bugs, butterflies and moths and others)
Cherry *(Cesarus vulgaris)*	
Apricot *(Familia Rosaceae)*	
Primrose *(Primula veris)*	
Strawberry *(Family Rosaceae)*	
Algae – aquatic plants able to photosynthesise (sea non toxic agaes are eatable, as for ex.: spirulina, kelp, chorella and others)	
Mushrooms - *regnum Fungi / separated from regnum Plantae and Animalia* (eatable mushrooms - of *Ascomycota* type as well as *Basidiomycota* /that have top and foot)	

Diagnosis will have in view, besides plants from big culture and horticulture, or from traditional zootechnics, also other genetic resources, with economic phyto-zoo-alimentary potential.

Romania is one of the few European countries where *agro systems* represent significant reservoirs from the point of view of genetic diversity both for phytoculture and for zoo culture, that have been conserved at the formation and development place (*in situ*) (Drăgănescu, C., 1984; Gruia, R., 2016).

Table 3 enumerates the species that belong to agro-biodiversity specificity, aiming to have an image of the present production and of the potential of diversification through new species with economic potential and new food sorts.

Geo resources of drinking water are a support for the optimistic idea of Romania's future alimentation, because, after a series of predictions, drinking water may become more precious than oil in the 21st century.

In Romania we consider that it becomes more than opportune to approach a **strategy** with a clear basic financing, so that present quantities of fresh water may be mentioned, regenerated, as well as capacities of drinking water capitalization may be developed.

All these are important, especially that it must not be forgotten that Romania owns 60 % from Europe's mineral water reserve (mediafax.ro/).

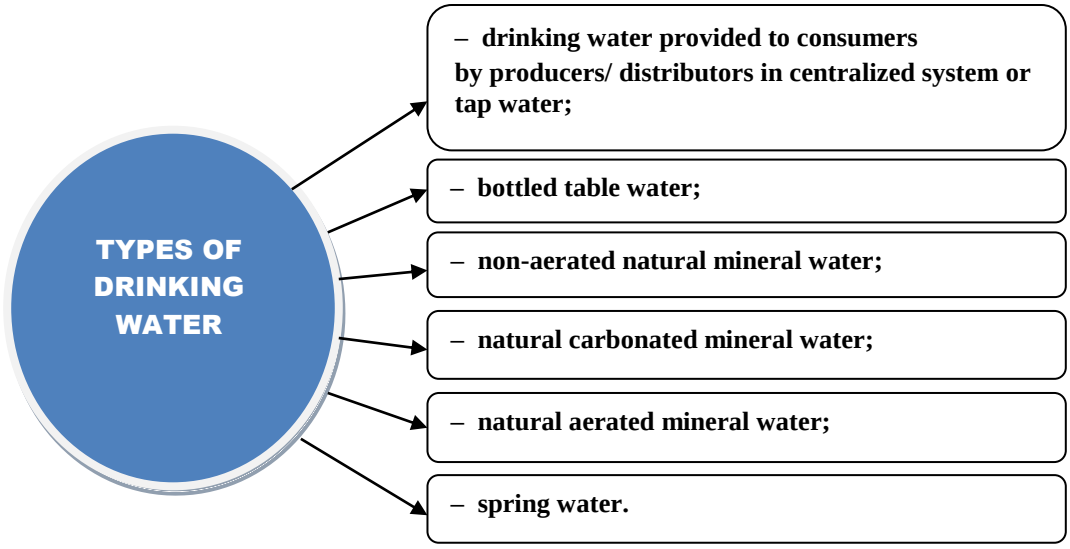

Fig. 1. Geo resources of drinking water from Romania.

Consequently, within the principles of the mentioned strategy, we should NOT sell the ownership right of this resource (as well as neither of other resources and raw materials), but to capitalize only the obtained and diversified productions (Fig. 1.).

3.3. Application of bio economy principles for the sustainable development of phyto-zoo-alimentary system

Analyzing the third step, as it is known, **bio-economy** indicates an economic theory that inevitably leads towards a sustainable development from the ecologic and social perspective.

Methodologically, it is taken into consideration matter/substance (S) and energy (E) that enter economic processes with relatively low entropy and come out with another entropy degree, which imposes to take into consideration thermodynamics principles in the context of the ever more precarious offer of natural resources (Georgescu-Roegen, N., 1979).

After the year 2012, the European economy is focused towards a more important and sustainable utilization of renewable resources. In other words, taking into consideration that the paradox between demographic increase and finite natural resources dramatically accentuates, Europe needs secure and healthy renewable biologic resources for food and fodder for animals, as well as materials, energy and other corresponding products. That is why we should have in mind to pass from standard agriculture to modular and precision agriculture (Gruia, R., 2010).

Green economy, based on bio-economy green power (implicitly sustainable), is part of the integration in green revolution, with ecologic management, green energy and corresponding "green" affairs: solar energy, wind energy, bio fuel, hydro energy, thermal energy and last but not least, agro alimentary system green power (Bogdan A.T. and Comșa, Dana, 2011). The natural consequence is the decisive step in professional formation. We mean "eco-bio-economic engineering", but also "eco-bio-economic management" (Gruia, R., 2013).

Practically, nowadays and at the present technical level, nobody may allow a vast extending of green economy, so that there appeared development models based on the principles of this type of economy, but with new dimensions. The question is about considerable enlarging the systemic coverage towards *social aspects* (taking into consideration that there is higher unemployment, situations of loss of national capital, lack of chances for youth and others), enlarging towards innovation and technology rethought, especially on *circular model*, these ones finally leading to *"blue economy" model* (Pauli, 2010).

Blue economy is firstly based on scientific analyses that identify the best innovations. These lead to the creation of a social capital that, in its turn, will allow to have *cheaper* and the best products, the healthiest products and will stimulate *entrepreneurship*. Solutions are stipulated to re-project manufacture processes in environmental friendly and cheap systems.

This economic model offers private entrepreneurs instruments capable to sustain the creation of jobs, men's well-being, but also environment health (being aimed in fact the *eco-health generation*, especially the getting food direction).

Passing from green economy to blue economy may lead to **Romanian economy security** in the decades to come, and in the agriculture field the change of managerial paradigm supposes, among others, the following elements too: - agro-eco-system reconversion (application of technologies friendly with natural environment);

- circular economy (with reuse of secondary agri-food production, wastes and residues);

- reorientation of human resource formation in the field (new educational approaches on bioeconomic and sustainable development direction) (Pillet, G., 1993, Gruia, R.,1998, Pauli, G., 2010).

3.4. Finding new food resources in order to counteract potential alimentary crisis

In a fourth step of analyses there may be observed the historic evolution of the feeding manner and food production. Thus, mankind needed almost 10.000 years of agriculture to develop the cultures and animal livestock we are now consuming. There were necessary only some centuries to develop agricultural tools that culminated with large scale and efficient mechanized agriculture and with nowadays biotechnology equipment.

There were necessary only decades to harmonize science with food, to connect food with health, allowing us to directly manipulate the genetic constructions of the food we eat. In the future, as almost 75% of the world population is affected by the lack of different types of aliments, the next frontier is our ability to produce aliments from molecular components and to replace thus the need of practices that develop the food which consumes resources, almost non ethical ones, with personalized, health generating systems, etc.

A possibility agro-alimentary research develops in the present refers to **synthetic foods,** that are created by combination of alimentary substances (in fact they are natural raw materials) and submitting these substances to different modern processes in order to get the desired food product.

Although these are artificial food products, they contain complete proteins that have been derived from natural foods. It must be mentioned that there is a very little quantity of food that contains complete proteins (all the amino acids that are not produced by the organism).

3.5. Alimentary education as resource for the understanding of another feeding pragmatic level

We cannot solve any alimentary crisis unless we put, in the fifth step, the problem of men's permanent education in the more and more accelerated conditions of science and technique development, including from the perspective of population information and formation for the understanding of new paradigms linked to the feeding manner.

The feeding manner is aimed when food is accumulated both by energo-nutritive contribution and by the health generating and psycho-sensorial ones. These are well underlined aspects in obtaining food supplements (based on certain ingredients), functional food (with innovative fortifying components), nutraceuticals and others.

As for culinary production, among the new paradigms we may remind ***predictive alimentation*** (it refers to the passing from empiric or mystical predictions to algorithms and predictive modelling) and ***personalized gastronomy*** (it is based on the idea that men differently respond concerning alimentary habits and behaviours, because of certain environment factors and due to the influence of genetic variants concerning absorption, metabolism and utilization of nutritive components from food).

Conclusions

(1) In the situation when Europe agriculture seems to stagnate and water (as an aliment) becomes a problem in the context of climate changes, the solution is to consolidate new concepts (having as a basis the capitalization of local *biodiversity* and of *geo-climatic and cultural diversity*, bio-economy and bio-technology principles etc.), that lead to a **change of paradigm** concerning the regeneration of the alimentary act by which it is possible to pass from standard agriculture towards modular and precision agriculture, to predictive/preventive and personalized alimentation, but also to synthetic food.

(2) Having a significant geo resource potential, in conformity with the presented diagnose, the production of food in the future decades has to ensure good and secure agri-food productions for Romania, also including the contribution of drinking water capitalization, through a **national strategy** on the axes of harmonizing the relation *Nature –Food & water –Human resource*, equation in which, in order to understand and apply the strategy and the new paradigm linked to the feeding manner, the priority if human resource information and formation and corresponding financing of the research in the field.

(3) The next frontier is our ability to produce foods from molecular components and replace the need of practices to develop aliments that consume resources, often non ethical ones, through personalized and health generating systems, including (although we are not yet prepared) the development of practices to obtain synthetic foods.

(4) Romania is one of the few European countries where *agro systems* represent significant reservoirs from the point of view of genetic diversity both for phyto culture and for zoo culture, that have been conserved at the place of formation and development (*in situ*) and that have in their structure geo resources of drinking water of six types, so that, based on a *smart strategy*, to be able to benefit from the **opportunity** that Romania may represent a reserve and a contributor of food and water in Europe, in the future decades.

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