Empirical Approaches About the Input-Output Model for the Local Economic Development: Case Study in Braila Municipality

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I. Introduction

At a territorial level, the economic development presupposes the reinforcement and increasing of the regional or local economic capacity and the formulation of an answer to the economic, technological, social etc. changes. We should also mention that "the local economic development is a long term process, also supported by activities designed for a short, medium or long term. The foundation for the local economic development […] is represented by the endogenous resources, the initiative and the entrepreneurial activity at local level"[1].

The local economic development was designed and understood by numerous authors as a part of regional development; "different local development methods" were identified and practiced, "based on three conceptions":

- The development oriented towards the factors of production, based on capitalizing the abundance and low cost of some basic economic resources;
- The Keynesean approach, centered on the joint effects of demand stimulation and public investments;
- The development of the local productive system by the efficient organization of the local resources around the industrial and rural districts or a combination of the two"[2].

When we refer to the development oriented towards factors of production, we hint at two major components. The first component is concerned with the issue of assigning the factors of production and their migration, at a local level; the analysis is based both on the framework offered by the unisectoral neoclassic model and on the bisectoral one. The second component, however, is concerned with the relation between the factors of production and the technological changes.

The Keynesean local development model is based on: subsidizing the least competitive sectors, which ensures an optimal volume of revenues and expenses; direct productive investments; local authorities' participation in the shared capital of some private companies and, not least of all, public investments in the infrastructure, with the aim of attracting potential investments.

II. The input – output model for the local economic development

The basic idea of all local development models is "the internal feed-back achieved by the input-output connections between the economic agents, such as the companies and the households"[3].

More exactly, at the level of the local communities, the economic agents are companies or enterprises, public service suppliers whose connections with the households, materialized through exchanges of public goods and services and workforce, respectively, are established both within the community and outside it. In this context, a model which is extensively used, not only in the local or regional development analysis, is the *input-output model* (I - O)[4].

II.1. Generalities

The I – O model considers a simple structure of production expressed through a linear relation and with constant coefficients, containing several economic activities and processes, each producing one output. To produce a unit of a certain output, for instance the j^{th} output, requires a quantity a_{ij} of input i. Therefore, in the linearity conditions shown above, producing the output quantity x_j requires an input i quantity $a_{ij}\ x_j$, represented as x_{ij}. Essential for this model is the fact that "at least partly, inputs are themselves current outputs for the other processes of the system"[5]. This short description corresponds to the I – O model, which, associated to a complex economic system, is known under the name of *Leontief model*[6]. The a_{ij} coefficients are the input coefficients, and the matrix:

$$A = (a_{ij})_{\substack{1 \le i \le n \\ 1 \le j \le n}} \qquad (1)$$

is *the input matrix.*

Leontief models can be closed or open, depending on whether the mass of inputs is identical with the mass of outputs or not. Subsequent developments, including the related models, can be found in an extensive field literature. Essentially, unlike other models which approach "economy as a whole"[7] and only grasp the final transactions, the I – O model describes a functional model of economy, incorporating the connections between the flows of intermediary goods.

II.2. An adaptation of the I – O model for the local economic development

If, at a macro level, the flows of goods can be considered between the different economic sectors, at the level of the local communities we can consider the intermediary transfer of goods and services between companies and, of course, households. Characteristic for the I – O model of local economic development is an open Leontief model, which presupposes the existence of an input (work), considered as not being the output of any production process, and a demand for the achieved goods which exceeds their simple use as inputs.

As a consequence, if we try to formalize what was stated above, the production of economic goods and services contained in output i can be classified into two parts: intermediary (x_{ij}, j = 1, n) and final (x_i), where:

$$x_i = \sum_{j=1}^{n} x_{ij} + F_i , \quad i = \overline{1, n} \qquad (2)$$

F_i, having the significance of a final demand and representing the i output quantity consumed by households. In terms of the local economy development, these numbers can also have the significance of investments of the business sector, governmental purchases or third party purchases having as their object the i output. Also, in F_i one can also include the net exports obtained by the subtraction from the general exports of the competitive imports.

Using (1) and taking into account its significance in the I – O model, we obtain:

$$a_{ij} = x_{ij} / x_j , \; i = 1,n , \; j = 1, n \qquad (3)$$

the relation in which there is a strong technical hypothesis, according to which „a_{ij} is considered a stable coefficient, not necessarily fixed, but predictable, if it modifies"[8].

In a manner which has become traditional and upon which we no longer insist, we shall obtain the I – O Leontief system:

$$X\left(I - A\right)^{-1} F \qquad (4)$$

where $X = (x_1, x_2 ...., x_n)^t$, the vector of the local gross outputs, A the coefficient matrix of the intermediary gross flows, and $F = (F_1, F_2, ..., F_n)^t$ is the vector of the final demands whose possible significance we described above.

The equations contained in system (4) also entail a different interpretation, transforming the final demand F in the output X.

A few consequences, due to some simplifying assumptions accepted for the Leontief model used, are worth emphasizing, even if, by doing this, we move away from the reality.

We refer to the following: the existence of a constant relation between any intermediary input and any output resulting from the relation (3):

$$x_j = (1/a_{ij})x_{ij}, \quad i \neq j \qquad (5)$$

as well as of a constant ratio between any two intermediary inputs:

$$x_{kj}/x_{ij} = a_{kj}/a_{ij} \quad , \quad i \neq j, h \neq j \qquad (6)$$

A very extensively used convention[9], which does not alter the results of the analysis, is the one in which, in equation (4), the outputs can also be considered as net figures, which implies the fact that $a_{ii} = 0$. In the absence of this convention, matrix A can be completed with a new line meant to describe the added value y_j, obtained from the gross outputs x_j out of which the intermediary goods x_{ij} were subtracted, i.e.:

$$y_j = x_j - \sum_{i=1}^{n} x_{ij} \quad , j = \overline{1, n} \qquad (7)$$

Using the technical coefficients, we obtain:

$X = B\ Y$ where:

$Y = (y_1, y_2....., y_n)^t$ and (8)

$$B = \begin{pmatrix} \frac{1}{1-\sum_{i=1}^{n} a_{i1}} & 0 & \dots & 0 \\ 0 & \frac{1}{1-\sum_{i=1}^{n} a_{i2}} & \dots & 0 \\ \cdot & & & \\ \cdot & & & \\ \cdot & & & \\ 0 & 0 & \dots & \frac{1}{1-\sum_{i=1}^{n} a_{in}} \end{pmatrix} \qquad (9)$$

Relations (8) and (9), obtained from the input matrix, transform the added value into gross outputs and vice-versa.

We should also notice that:

$$\sum_{j=1}^{n} y_j = \sum_{i=1}^{n} F_i = PLB \qquad (10)$$

and these figures represent the value, at a national scale, of the GDP, and at the level of a community, of the gross product (GLP) resulted from the local development.

III. The qualitative analysis and the multiplying effects in the local development

Matrix $(I - A)^{-1}$, also named the Leontief matrix, will constitute the support of the qualitative analysis of local development. Following a methodology described by McNicoll and Baird (1980), the qualitative analysis, meant to offer the synthetic indicators of local development, will focus on: the analysis of the multipliers, the impact studies and the forecast.[11]

III.1. The local development multipliers

If we represent by a^*_{ij} The element on position *(i,j)* in the Leontief matrix, then, for each activity j, specific to local development, the multiplier will be defined by:

$$k_j = \sum_{i=1}^{n} a^*_{ij} \ , \ \ j = \overline{1, n} \qquad (11)$$

The significance of this multiplier refers to the total modification of the local output, resulted from a modification, with a unit, of the production corresponding to activity j in the final demand. In other words, multipliers have the role of estimating the level of local development owing to some unitary modifications of the final demand.

Field studies emphasize the fact that these multipliers are supra-unitary because, except for the direct effects, emphasized through the modification of the output, the local production will also be affected through:

- *the indirect effects* determined by the increase of the intermediary local operation expenses for producing a unit in the final demand j;
- *the induced effects,* determined by the local consumption of the households involved in expanding the production specific to activity j.

An overview on the variation of the total output can be achieved by introducing an *output aggregate multiplier* which expresses, through a weighted mean, the overall influence of the different activity on local development.

Such an expression can be given by:

$$k = \frac{\sum_{i=1}^{n} k_i \left(\sum_{j=1}^{n} a_{ij} + F_i \right)}{\sum_{i=1}^{n} \left(\sum_{j=1}^{n} a_{ij} + F_i \right)} \qquad (12)$$

As a consequence, we witness a process of indirect and induced expansion in the local development, the multiplier measuring the totality of these effects. Technically, as shown in McNicoll and Baird's study (1980), multipliers which also include the induced effects are known as Type II multipliers, unlike Type I multipliers, which only include the indirect effects.

III.2. The impact studies

By impact studies, the analyses regarding the local development aim at determining the effects of the emergence or expansion of new activities in the economic process specific to the local development. More exactly, as shown McNicoll and Baird (1980), with reference to the regional development, we are talking about the assessment of the "impact of a new industry on the regional gross production"[12].

Within this framework, the following is accepted as a relation for determining the impact:

$$\Delta X = \left[1 - \overline{A}\right]^{-1} \Delta F \quad (13)$$

where:

ΔX = the modification in the local outputs derived from the operations specific to the new local activity/industry. ΔX will be a column vector with n+1 elements; $\overline{A}$ = the extended Leontief matrix of the coefficients of the intermediary flows, which includes a line and a column corresponding to the new local activity/industry; ; ΔF = the modifications in the final demand determined by the emergence of the new local activity/industry.

In the circumstances of the determining, from equation (13), of the outputs corresponding to the n+1 local activities/industries, as well as of knowing the coefficients of the necessary number of employees for each output unit, e_i, $i = \overline{1,n+1}$, we can establish the impact of the new local activities/industries on the necessary workforce.

$$\Delta E_i = e_i \ \Delta X_i, \ i = \overline{1, n+1} \quad (14)$$

where, ΔE_i measures the modifications in employment in activity i, and ΔX_i is the ith element of the column vector X.

III.3. Forecast

Theoretically, a complete forecast of the evolution in the local development can be described by:

$$X_t = [I - A_t]^{-1} F_t \quad (15)$$

where:

X_t = the vector of the gross outputs in the year t;

A_t = the matrix of the inputs corresponding to the year t;

F_t = the vector of the final demands in the year t.

The use of relations (15) will lead us to a forecast closer to the reality, but presupposes considerable efforts to estimate the evolution of the constitutive elements imposed by the above mentioned relations.

McNicoll and Baird (1980) propose a “hybrid” forecast model, distinct from the complete model, expressed through (15), based on a few simplifying hypotheses, which can be summarized as follows: carrying out forecasts for short or medium term horizon defined by an interval of whole numbers, signifying years or months, [t_0, t_1]; the structure of the local activities/industries in the period [t_0, t_1] is the same, the Leontief being maintained during the whole analyzed period. As a consequence, instead of equation (15), we shall use:

$$X_{t_1} = [I - A_{t_0}]^{-1} F_{t_1} \qquad (15')$$

out of which, in the circumstances of estimating the final demand at the moment t_1, we shall be able to forecast the outputs at the same moment t_1 using the Leontief matrix at the moment t_0 in the circumstances of certain inter-temporal constant value presuppositions.

IV. The development of the public utility services in Brăila Municipality

The case study which we hereby present uses data and information supplied by the authorities of Brăila Municipality, as well as by a number of companies. The analysis focused on the development of the public services, considered as having an important role to play both in ensuring the community social comfort, but also as a standard of local development.

Therefore, at the level of Brăila Municipality, the main elements of the Leontief matrix were represented as a part of the public utility services, under the direct coordination of the Local Municipality Council: the processing and supply of thermal energy, sanitation, local public transportation and water supply and sewerage system.

The analysis refers to the year 2005, and the data were extracted from the book keeping of the public utility services managed by:

- S.C. CET-S.A. – for the thermal energy production and supply service;
- S.C. BRAI CATA-S.R.L. Brăila, S.C.ECO-S.A Brăila and S.C. RWE ECOLOGIC SERVICE for the sanitation service;
- S.C. BRAICAR-S.A. for the local public passenger transportation service;
- R.A. APA Brăila, for the water and sewerage system supply service.

The input-output (I – O) table of the public utility services at the level of Brăila Municipality was drawn up with the data supplied by the economic agents listed above.

Table 1 –I–O table of the public utility services at the level of Brăila Municipality:

	INPUTS PURCHASED BY:				FINAL DEMAND	TOTAL OUTPUT
	THERMAL ENERGY	SANITATION	LOCAL TRANSP.	WATER - SEWERAGE		
OUTPUT PRODUCED BY:						
Thermal energy	0.00	29,210.00	705,107.00	1,102,693.00	141,875,748.00	143,712,758.00
Sanitation	0.00	0.00	25,831.00	15,099.00	35,866,330.00	35,907,260.00
Local transport	72,402.00	23,114.00	0.00	96,390.00	62,513,370.00	62,705,276.00
Water sewerage	1,094,613.83	55,649.92	265,779.49	1,882,920.75	94,451,803.82	97,750,767.81
a.v.	142,545,742.17	35,799,286.08	61,708,558.51	94,653,665.06	*	*
TOTAL INPUTS	143,712,758.00	35,907,260.00	62,705,276.00	97,750,767.81	*	340,076,061

Analyzing the above table, we observe that the total output of each service is equal to the total input of that service, as a consequence of the fact that the matrix of the flows is built according to the principle of the double accounts. Thus, the I – O table presents, with accuracy, the input origin, as well as the output destination, reflecting the interdependent nature of the economic activities.

The table is structured on lines and columns, so that the columns stand for the services consumed (the consumption sectors), and the lines stand for the production of public utility services.

The content of a cell of the matrix in the I – O table (Table 1), placed at the intersection of line i and column j, stands for the absolute value which a public utility service supplies to another service, or, in other words, the absolute value which a local interest public utility service receives from a different service of the same nature, within the same administrative space.

The final demand, as we can observe in the table, is outside the area of the intermediary flow matrix and includes the household purchases in general.

The added value (a.v.) represents the difference between the total production value (the total output) and the service value.

The main purpose of the I – O analysis for the development of the Brăila Municipality public utility services is the description of the input – output flow and the quantification, on this basis, of the interactions between services in order to further estimate the effects of any change in the final demand on the whole system of public utility services at the level of Brăila Municipality.

IV. 1. The I-O empirical model

Using the elements in Table 1, as well as the descriptions and significances in (II.1), the input matrix (1) becomes:

$$A = 10^{-3} \times \begin{pmatrix} 0 & 0.2032526 & 4.9063633 & 7.6722896 \\ 0 & 0 & 0.7193810 & 0.4204999 \\ 1.1546397 & 0.3686133 & 0 & 1.5371912 \\ 11.1980075 & 0.5693042 & 2.7189504 & 19.2624651 \end{pmatrix} \qquad (16)$$

out of which the Leontief matrix results:

$$(I-A)^{-1} = \begin{pmatrix} 1.000093 & 2.095467 \times 10^{-4} & 4.928266 \times 10^{-3} & 7.831524 \times 10^{-3} \\ 5.646397 \times 10^{-6} & 1.0000005 & 7.205780 \times 10^{-4} & 4.299327 \times 10^{-4} \\ 1.172308 \times 10^{-3} & 3.697530 \times 10^{-4} & 1.000010 & 1.576728 \times 10^{-3} \\ 1.142226 \times 10^{-2} & 5.839038 \times 10^{-4} & 2.829070 \times 10^{-3} & 1.019735 \end{pmatrix} \qquad (17)$$

A first reading resulting from the Leontief matrix (17) and the data in Table 1 provides us with the GLP level resulted from the public utility services and two expressions of it with respect to the added value and the gross outputs connected to each other by the matrix:

$$B = \begin{pmatrix} 1.012507 & 0 & 0 & 0 \\ 0 & 1.001142 & 0 & 0 \\ 0 & 0 & 1.008415 & 0 \\ 0 & 0 & 0 & 1.029752 \end{pmatrix} \qquad (9')$$

out of which, using (10), we obtain:

$$PLB = 334689251.82\ lei \quad (10')$$

If additional statistical data had been available, at least for two distinct moments in time, the above analysis could have come up with an average annual GLP growth ratio, resulted from the mentioned public utility services, with respect to the number of inhabitants and, from a broader perspective, a comparison of these data with other local or regional communities or with the situation at national level.

IV.2 The empirical analysis of the multipliers

Multipliers actually emphasize the fact that an exogenous increase of the demand for local public products or services will influence the demand for other local products and services. The I – O analysis offers the instruments for measuring these effects, such as the variation regarding the different activities specific to the local development.

The field literature operates with a classification into three groups of the effects of the multipliers – output, income and employment – which measure "the effect of a modification in the final demand in a sector, the total local industry output and the number of workplaces lost/gained, respectively"[13].

As we have shown, for the output multipliers, the effects are considered on at least three levels, firstly, the *direct* effect of certain modifications on the respective local activity/industry output; secondly, the *indirect* effect on the other activities, which are suppliers of the former, and, thirdly, the *induced* effect which stems from the fact that the modification of the output in the local activity/industry will trigger the modification of the level of personal income in the local community, out of which, at least part of it, will be used at a local level.

The savings and the input in the local productions which will have to be imported will represent the most important leaks in this circular system.

Coming back to the situation of the public utility services in Brăila, multipliers can be classified according to their size, as follows from the use of (11) and (17) in Table 2.

Table 2: Output multipliers for the public utility services in Brăila Municipality

The public utility service	Multiplier 2005 (k_i, $i = \overline{1,4}$)
Water, sewerage	k_4 =1.029573
Thermal energy	k_1 = 1.012693
Local transport	k_3 =1.008488
Sanitation	k_2 =1.001164

In the circumstances described in Table 1, using (12), we shall obtain the aggregate output multiplier:

$$k = 1.015552 \qquad (12')$$

A few observations depicted from the field literature need to be reminded in this context. The first one refers to the following interpretation: the higher the multiplier, the higher the quantity of purchases made by the local service to achieve a certain output quantity. The second observation regards the evolution of the multipliers. Starting from data supplied by different case studies, we can accept the continuity condition, so, a certain degree of inter-temporal stability in the estimates of the multipliers in question. As a consequence, a prognosis or planning activity for a local development policy may consider this continuous behaviour of the output multipliers.

For this purpose other evaluations are also needed, as for example those of the income and employment multipliers. The income multipliers result directly from the described I – O model, by means of the Leontief matrix, (17). According to McNicoll and Baird (1980), the income multiplier "is here defined as the ratio between the total income modification and the direct income modification"[14].

In other words, with the previous representations, the λ_i, multiplier corresponding to the local activity/industry i, will be:

$$\lambda_i = \frac{\sum_{i=1}^{n} a_{ij}^* F_j}{a_{jj}^* F_j}, \quad i = \overline{1, n} \qquad (18)$$

In these circumstances, we'll have, in Table 3, the income multipliers, arranged according to their size.

Table 3. The income multipliers for the public utility services in Brăila Municipality

The public utility service	Multiplier 2005 (λ_i, $i = \overline{1, 4}$)	Indirect and induced variations (lei) 2005 (δ_i, $i = \overline{1,4}$)
Water sewerage	λ_4 = 1.018879	δ_4 =1.845437
Thermal energy	λ_1 = 1.007438	δ_1 =1.068.935
Local transport	λ_2 = 1.005255	δ_3 = 329.516
Sanitation	λ_3 = 1.002411	δ_2 = 86.572

If we define an aggregate income multiplier, λ, in a manner similar to (12) in Table 1 and Table 3, we obtain:

$$\lambda = 1.009793 \tag{18'}$$

From Table 3 it results that the direct effects are predominant, which is explainable for the analysis carried out on the public utility services.

The determining of the employment multipliers is, in general, more complex, as there isn't a relation between the I – O model and evolution of the number of positions. The problems which arise become even more complex if we consider the extra hours, the vacant positions, the reduced work programs as well as labour productivity.

The field studies indicate the method based on representative samples as the most adequate.

McNicoll and Baird (1980) use the employment multiplier of a local activity/industry as being the total variation of the number of employees, as a result of a unitary increase in the final demand for the respective local activity/industry.

Presupposing the existence of a proportional relation, similar to (14), between the income variation and the evolution of the number of positions as a result of an increase in the final demand, in the circumstances of an increase by 10% of the final demand we shall obtain:

Table 4: The variation of the number of employees as a result of the increase by 10% of the final demand

The public utility service	Direct increases(%)	Indirect and induced increase(%)
Sanitation	9.97	0.02
Local transport	9.95	0.05
Thermal energy	9.92	0.07
Water sewerage	9.81	0.18

The specificity of the analysis carried out, determined by the relatively low ratio of the intermediary exchanges in relation to the final demand leads to Type II effects, indirect, and induced, almost insignificant. We can still notice that a variation, within the limit of 10%, of the final demand, entails both direct variations and indirect and induced variations.

IV.3 The impact of the pre-accession structural funds

When we refer to the impact of the expansion of certain local development activities, a significant example for Brăila Municipality is the accessing of European non-reimbursable funds in order to support the local development process.

Considering the Financing Memorandum[15]agreed by the Romanian Government and the European Commission regarding the financial non-reimbursable assistance granted through the Instrument for Pre-accession Structural Policies for the program of "Rehabilitation and extension of the sewerage system and building of a used water filter station in Brăila Municipality", worth of 59,877,400 Euro, participates in the development of the public utility services at the level of Brăila Municipality and, indirectly, in the local development of the Municipality of Brăila.

The program is made of three components:

- finishing the execution works at the new sewer;
- expanding the sewerage system;
- building a water used water treating station in Brăila Municipality.

The first component was prioritized and completed on the 31st of December 2004, because of its importance in the economic and social life of the municipality.

A priority for the very near future is constituted by the "Expanding the sewerage system in Brăila Municipality" component, which is provided for in the Memorandum, amounting to 18,112,000 Euro.

This component was bid for and purchased by S.C.ATHENA-S.A. Greece, amounting to 17,750,000 Euro, 62,480,000 respectively (1 Euro = 3.52 lei).

The determining of the impact of this capital injection will not follow the methodology described in subchapter III.2 regarding the impact studies, because of the absence of statistical data, as well as of new relevant activities for the described model.

Therefore, if we adapt (13), while maintaining the Leontief matrix, (16), we can consider a variation of the final demand, expressed through value, determined by the local development needs:

$$\Delta F = (0, 0, 0, 62.480.000)^t \quad (19)$$

In these circumstances, out of (12) will result:

$$\Delta X = (489314,\ 26862,\ 98514,\ 63713043)^t \quad (20)$$

As it was natural, the capital injection into one of the specific local development activities also entailed, through direct or indirect and induced effects, variations of the outputs of all public utility services.

We can also notice that the impact on the total output, evaluated according to (2) as amounting to 64,327,733 lei can also be determined by using the output multiplier for the "water – sewerage" public utility service described in Table 2. Expanding this idea to the income multiplier, described in Table 3, we obtain an impact on the above mentioned service of 63,659,560 lei.

IV. 4 Predictions regarding the development of the public utility services

The exercise we hereby suggest concerns, on the one hand, the simplifying presuppositions in subchapter III.3, adapted by McNicoll and Baird (1980), and, on the other hand, the empirical data collected and used in this study.

Therefore, a medium term (more exactly, five years) forecast could use the following relation:

$$X_{2010} = [I - A_{2005}]^{-1} F_{2010} \quad (15")$$

The expression (15”) integrates the results obtained so far, regarding the multipliers of the public utility, as well as impact, services.

Therefore, in the circumstances of the forecasting, at the level of the year 2010, of the percentage increase of the final demand for the services mentioned as p_1, p_2, p_3, p_4 respectively, the relation (15”) becomes:

$$X_{2010} = [P(I - A_{2005})]^{-1} F_{2005} \qquad (21)$$

where:

$$P = (p_{ij})_{\substack{1 \le i \le n \\ 1 \le j \le n}}$$

is a diagonal matrix, with $p_{ii} = 1/(1+p_i)$, $i = \overline{1,n}$

Using the numerical data presented in this study we shall obtain:

$$X_{2010} = X_{2005} + \begin{pmatrix} 141888942 \\ 801 \\ 166322 \\ 1620542 \end{pmatrix} p_1 + \begin{pmatrix} 7516 \\ 35866348 \\ 13262 \\ 20943 \end{pmatrix} p_2 + \begin{pmatrix} 308083 \\ 45046 \\ 62513995 \\ 176855 \end{pmatrix} p_3 + \begin{pmatrix} 739702 \\ 40608 \\ 148925 \\ 96315809 \end{pmatrix} p_4 \qquad (22)$$

V. Conclusions

The present study approached the problem of local development using, within the general framework of the input-output analysis, as vectors of development, the public utility services. Certainly, the analysis is not complete, but it can constitute a research direction in the circumstances in which the problem of the public services represents a priority of the public administration reform in the context of the Romanian integration into the European Union.

The empirical application carried out in the Brăila Municipality can only confirm the actuality and the evolution, after a few decades, of the model developed by Leontief.

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[1] Matei, L., (2005), „Dezvoltarea economică locală”, Editura Economică, Bucureşti, p. 119.

[2] Idem, p. 153 – 154.

[3] Constantin, D., L., (2000), „Introducere în teoria şi practica dezvoltării regionale”, Editura Economică, Bucureşti, p. 24.

[4] The I – O model appeared as a model of empirical land applied approach and has known a vast development in the field literature. The most relevant and clear approaches belong to Leontief and their origin goes back in the year 1936, when the above mentioned author formulated the first model. The actual development was marked by the publishing, in 1941, at Harvard University Press, of a complete study „The Structure of the American Economy, 1919 – 1929”.

[5] Lancaster, K., (1973), „Analiza economică matematică”, Editura Ştiinţifică, Bucureşti, p. 103.

[6] A comprehensive description of this model belongs to Leontief himself and can be found in: Leontief, W., W., (1966), „Input-Output Economics”, Oxford University Press, UK or in: Leontief, W. (1970), „Analiza Input-Output. Teoria interdependenţei ramurilor economice; Editura Ştiinţifică, Bucureşti.

[7] Klein, R., L., Welfe, A., Welfe, W., (2003), „Principiile modelării macroeconometrice”, Editura Economică, Bucureşti, chap. 1, p. 13 – 70.

[8] Idem, p. 42

[9] Lancaster, K., (1973), Op. cit., p. 104

[10] Klein, L.R., Welfe, A., Welfe, W., (2003), Op. cit., p. 43

[11] McNicoll, I.H., Baird, R.G., (1980), „Empirical Applications of Regional Input-Output Analysis: A Case Study of Shetland” in „The Journal of the Operational Research Society”, vol. 31, no. 11, p. 984

[12] Idem, p. 985

[13] Idem, p. 988

[14] Idem, p. 989

[15] The Financing Memorandum constitutes the object of Ordinance nr. 17/26.07.2001, published in the Official Gazette nr. 478/20.08.2001