The influence of information technology in determining the model for sustainability of freight forwarding

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Abstract **- Freight forwarding as a factor for growth of the economy, industry and in particular the trade of the Republic of Macedonia and abroad, requires adapting to new conditions resulting from the global economic crisis. The fact that freight forwarding is an integral part of logistics need: To improve performance and to adjust to new conditions (legislation, international agreements and implementation of information technologies). This scientific paper gives a model of sustainable development of freight forwarding where the main accent is placed on the input of information technologies as one of the elements that affect it. From the given data we has analyze and forecast the influence of IT elements of the development on freight forwarding for the period from 2005 to 2015.**

Keywords - Freight Forwarding, Information Technologies, Inputs, Sustainable Development, Elements of Matrix.

I. INTRODUCTION

In the world as we know it which has to be competitive, freight forwarding corporations go into deeper partner-ship putting mere importance on the responsibility and the risk of work and tasks performance. Seeking ways to enlarge the profit, many corporations would many times peer into the necessity of dealing with freight forwarding activities as a certain and straight forward way of establishing enough profit, and also saving on freight forwarding costs, or said in other words effectively dealing with customers. These corporations on the other hand more and more are going into so called "sore competencies" and in this sense a growth is being established in terms of the mere importance of these specialized corporations being imposed that deal with freight forwarding business. Freight forwarding conciliators in Macedonia but also elsewhere throughout the world act in a restricted way, simply because they lay back on the organization of transport as well as freight forwarding business, whereas other freight forwarding services fall behind

the schedule or lack in total. Classical freight forwarding is growing to become a myth now days and freight forwarding agents spread out their services on the basis of the following: storing supplies, distribution of merchandise, and financial work out having to do with supplying goods, doing internal logistics and catering obligations throughout corporations and so on. Altogether with the process of globalization these things combined have to be one of the prior reasons answering the question why many large freight forwarding operators have laid their basis of foundation throughout Macedonia and such other countries of similar development. On the basis of the following we discuss courier corporations such as DHL, UPS, FedEx and some others that have been established and seen as important factors of influence on the market in Macedonia and other states in transition.

II. USE DETERMINING THE ELEMENTS OF THE MODEL OF SUSTAINABLE DEVELOPMENT OF FREIGHT FORWARDING

Doing the model of sustainable development of freight forwarding we need to determine the basic elements and by evaluating them, we can successfully come up with the desired results on the model. As such listed global elements of development necessary for evaluation of the freight forwarding agent's capacity we can distinguish between:

1) Globalization
2) Freight forwarding Infrastructure
3) Intellectual capital
4) Ecology prominence in the transportation system
5) Freight forwarding Outsourcing
6) Information technology
7) Inter and Intra freight forwarding
8) Freight forwarding controlling
9) Transportation infrastructure
10) Modern transport technologies
11) Financial potential
12) Outsourcing

13) Freight forwarding inf. system
14) Costs of freight forwarding
15) Freight forwarding regulations
16) Other elements of development

Other known elements of development are some international transportation documents, international affiliations or joint forces of transport operators, FIATA etc.

The model is dynamic which means that the allegiance of the defined elements will be contemplated - asserted throughout three phases of succession. The first phase or the current phase of the model, represents the initial value of the separate components of sustainable progress of freight forwarding. The second phase stands over the period up to 2012 when we expect progress over the implementation of the project of economic progress as well as sustaining transitional reforms. Talking about the transport domain this would signify that the current situation would become renewed and stabilized especially by conducting these, and finalizing the reforms themselves. The third phase refers on the period from 2012 up to 2015. At the same time this would mean that all sectors would become reconstructed especially those that have to do with the developing progress of the freight forwarding counterparts.

III. FORMULATING THE MODEL SUGGESTION OF SUSTAINABLE DEVELOPMENT OF FREIGHT FORWARDING

Making allowance between the correlation or interception of the elements of the model suggestion of sustainable development of freight forwarding we evince the allowance itself or the correlation of those elements in an matrix of growth figure, or in other words the figure of the matrix's direct and indirect growth rates. The matrix of growth suggestion coinciding alongside with the model suggestion and the very need of it derives from variety of reasons. As top or prior reason is the reason that we cannot display the correlation of the element growth factor between elements laying foundations on the direct growth rate only. Taking into consideration the direct rate of growth over the "i" and the "j" element, "r" and "r" we are prohibited in this sense to always precisely come up with a proof which one of the elements listed is in a better developing or progress stage of advancement in both total and relative sense, under the condition that we keep in mind their different starting values.

This is how we come to the need of necessity of introducing on the whole and large besides the direct also the indirect rates of growth throughout which we can than successfully deal with, or differ between these complex and constrictive correlations among elements and in this sense to come up with the possibility of precisely determining total and relative speed of growth and the ties among It is supposed that the sustainable development of freight forwarding consists of ''n'' intercepted in between each other dependant elements. With y_{it} and y we will pin point the value of the element of sustainable development of freight forwarding (input, figure) of the "i" element of sustainable development of freight forwarding (i=1,2…, n) in the period "t" and "t-1".

The growth of the value of the input on the "i" element is:
$$\Delta y_{it} - y_{it} - \Delta y_{it-1} \qquad (1)$$

The indirect rate growth of the "i" element of sustainable development of freight forwarding in comparison to the "j" element is being defined as cohesion − bearing of growth on the input in the "i" element, and in the value of the "j" element in time "t" or:

$$r_{ijt} = \frac{y_{it}}{y_{jt}} \qquad i,j = 1,....,n. \qquad Y_{jt} \neq 0 \qquad (2)$$

The indirect growth rate can be shaped in a form of a growth matrix of elements over the model of sustainable growth of freight forwarding.

$$R_t = \begin{bmatrix} r_{11} & r_{12} & r_{13} \\ r_{21} & r_{22} & r_{23} \\ ..... & ..... & ..... \\ r_{31} & r_{32} & r_{33} \end{bmatrix} \qquad t = 1,.....,T, \qquad (3)$$

The elements on the main diagonal stand for the direct (i=j), and the remaining (i≠j) stand for the indirect growth rates. The elements on the ''i'' line signify the growth over the input in the ''I'' element compared to the values of all the remaining elements in terms of their values. The elements in the ''i'' column symbolize – or quote the growth in the value of the inputs of all the elements on the model compared in correlation to the input of the "i" element in "t" time. From what we have stated so far we can come up with the assertion that each element in the matrix of growth is represented in a single row and a single column combining the elements of direct and indirect growth rates. So in the first row we have determined the growth over the input on the first element of sustainable development of freight forwarding compared to the remaining elements, as for the first column we have represented the growth of the remaining elements compared to the input over the first element. The remaining rows and columns match the remaining elements of the sustainable development of freight forwarding. The indirect rate of growth can be defined in correlation to the value of the "j" element of the model in the period t-1 or:

$$r' = \frac{\Delta y_{it}}{\Delta y_{j,t-1}} \qquad i,j = 1,.....,n. \qquad (4)$$

The interception between the direct and the indirect growth rate (2) and (4) can be represented throughout the following correlation:

$$r_{ijt} = \frac{r'_{ijt}}{1 + r'_{jjt}} \quad \text{and} \quad r_{ijt} = \frac{r'_{ijt}}{1 - r'_{jjt}} \qquad i,j = 1,.....,n. \qquad (5)$$

The growth matrix can be determined throughout inside vector of the elements on the model. This way of determining is useful for practical dislocation of the growth matrix. The growth vector over the elements of sustainable development of freight forwarding is:

$$\Delta y_{it} = \Delta y_{lt},.....,\Delta y_{mt} \qquad (6)$$

The vector of the reciprocal values of the elements on the model of sustainable development of freight forwarding is:

$$\frac{1}{y_t} = \left(\frac{1}{y_{lt}},...,\frac{1}{y_{nt}} \right) \qquad y_{it} \neq 0, \quad i,j = 1,.....,n. \qquad (7)$$

The outer vector of growth quotient on the elements of sustainable development of freight forwarding and the vectors of reciprocal values define the matrix of growth on the model of sustainable development of freight forwarding [2].

$$R_{pt} = \Delta y_t' \left(\frac{1}{y_t} \right) = \begin{bmatrix} \Delta y_{1t} \\ .... \\ \Delta y_{mt} \end{bmatrix} \left(\frac{1}{y_{1t}}, ..., \frac{1}{\Delta y_{nt}} \right) \quad (8)$$

$$R_{pt} = \begin{bmatrix} \dfrac{\Delta y_{1t}}{y_{1t}} & ... & \dfrac{\Delta y_{1t}}{y_{nt}} \\ ... & ... & ... \\ \dfrac{\Delta y_{mt}}{y_{1t}} & ... & \dfrac{\Delta y_{mt}}{y_{nt}} \end{bmatrix} = \begin{bmatrix} r_{1t} & ... & r_{nt} \\ .... & .... & .... \\ r_{m1t} & ... & r_{mnt} \end{bmatrix} \quad (9)$$

When we observe only the direct rates of growth than the growth of one of the elements is conveyed independently from the growth of the remaining part of the elements. But if you have a case of defining the indirect growth rates –or the growth of the "i" element compared to the "j" element (i,j=1,..n) than it could be possible to determine the structure of the growth of elements and represent all these correlations going through the matrix itself in growth on the system as a whole. The intensity of growth and the changes that have to do with are possible to be followed by parallel research in the direct and the indirect growth percentage.

IV. EMBEDMENT ON THE ELEMENTS OF THE MODEL SUGGESTION FOR SUSTAINABLE DEVELOPMENT OF FREIGHT FORWARDING

The year considered of great deal of importance up to which year all analyses have been fully conducted or notched up is the year 2005. As a basic structure of the model are considered those elements embedded and treated as prior in terms of quantifying elements of transport in the year 2005, as well as the values taken by appraisal and also the results taken up to the year 2015. The values of the elements for the year 2005 are result of deep research and on the other hand the values for the year 2012 and 2015 are apprised on the basis of the reforms taken on in the whole coinciding with the system of the state and also over the allegations of all the relevant factors within the country and foreign representatives of the European Union that reflect monitoring over the reforms in republic of Macedonia.

The difference among the values from 2015 and 2005 of all elements comprises the vector of incline $\Delta y'_{2015}$. The product from the incline vector $\Delta y'_{2015}$ and the vector of reciprocity $1/\Delta y_{2015}$ determines the matrix of incline in terms of the running - current values. When we calculate these values and covey them into percentage or figures than we get the direct (all elements in correlation to themselves) and the indirect growth (all elements established in correlation to other elements and vice versa) rate, which actually stand for the outer volumes of the model represented.

6) Information technologies (IT) are not only a tool, but also a means or a way to shape and realize the strategy and the achievement of the goals that need to be reached upon. In our country as well as in some other countries in the process of transition EDIFACT is not yet incorporated, thus this

technology on information is taken as a developing element of the freight forwarding agent's potential and so stays on a very low level, and in addition also the low level of incorporation of information technology on transport issues considered irrelevant in terms of usage makes up for the appraisal value of information technology in input 15 for the year 2005 and input 30 for the year 2012 . Tightening up the gab one step closer with the European Union, the country of Republic of Macedonia will result in a piecemeal of freight forwarding activities by the EDIFACT doctrines and thus embedding information technology as a developing element of the potential of the forwarder will be estimated or valued in input 60 for the year 2015 [1].

TABLE 1: IT ELEMENT OF THE MODEL OF SUSTAINABLE FREIGHT FORWARDING DEVELOPMENT, VALUES

Elements of Development	Input Y			Growth
	2005	*2012*	*2015*	Δy_{it}
6. Information Technologies	15	30	60	45

On the basis of hypothetical values of quotient – constant over elements of sustainable development of freight forwarding can lead to the constitution of the factor of these elements in the sustainable development of freight forwarding. In this model we have represented all the values which are important in the process of determination of the elements of sustainable development over freight forwarding in the year 2005, 2012 as well as 2015.

V. POSSIBILITY FOR USAGE OF THE SUSTAINABLE MODEL OF DEVELOPMENT

In the following discourse we have provided the growth development freight forwarding matrix according to the elements in the model correlating to the running and future values during the period from 2005 up to 2015. The vector of the reciprocal values of the elements of sustainable development of freight forwarding is:

$$\frac{1}{y_{2015}} = \left[\frac{1}{70}, \frac{1}{75}, \frac{1}{70}, \frac{1}{65}, \frac{1}{70}, \frac{1}{65}, \frac{1}{55}, \frac{1}{50}, \frac{1}{65}, \frac{1}{80}, \frac{1}{60}, \frac{1}{60}, \frac{1}{50}, \frac{1}{30}, \frac{1}{60}, \frac{1}{55} \right] \quad (10)$$

The vector of the growth of sustainable development of freight forwarding is:

$$\Delta y'_{2015} = \begin{vmatrix} 45 \\ 40 \\ 40 \\ 45 \\ 45 \\ 30 \\ 30 \\ 40 \\ 55 \\ 40 \\ 55 \\ 40 \\ 45 \\ 20 \\ 35 \\ 25 \\ 30 \\ 20 \end{vmatrix} \quad (11)$$

45/70	45/75	45/70	45/65	45/70	45/65	45/55	45/50	45/65	45/80	45/60	45/60	45/50	45/30	45/60	45/55
40/70	40/75	40/70	40/65	40/70	40/65	40/55	40/50	40/65	40/80	40/60	40/60	40/50	40/30	40/60	40/55
40/70	40/75	40/70	40/65	40/70	40/65	40/55	40/50	40/65	40/80	40/60	40/60	40/50	40/30	40/60	40/55
45/70	45/75	45/70	45/65	45/70	45/65	45/55	45/50	45/65	45/80	45/60	45/60	45/50	45/30	45/60	45/55
45/70	45/75	45/70	45/65	45/70	45/65	45/55	45/50	45/65	45/80	45/60	45/60	45/50	45/30	45/60	45/55
30/70	30/75	30/70	30/65	30/70	30/65	30/55	30/50	30/65	30/80	30/60	30/60	30/50	30/30	30/60	30/55
30/70	30/75	30/70	30/65	30/70	30/65	30/55	30/50	30/65	30/80	30/60	30/60	30/50	30/30	30/60	30/55
40/70	40/75	40/70	40/65	40/70	40/65	40/55	40/50	40/65	40/80	40/60	40/60	40/50	40/30	40/60	40/55
55/70	55/75	55/70	55/65	55/70	55/65	55/55	55/50	55/65	55/80	55/60	55/60	55/50	55/30	55/60	55/55
40/70	40/75	40/70	40/65	40/70	40/65	40/55	40/50	40/65	40/80	40/60	40/60	40/50	40/30	40/60	40/55
55/70	55/75	55/70	55/65	55/70	55/65	55/55	55/50	55/65	55/80	55/60	55/60	55/50	55/30	55/60	55/55
40/70	40/75	40/70	40/65	40/70	40/65	40/55	40/50	40/65	40/80	40/60	40/60	40/50	40/30	40/60	40/55
45/70	45/75	45/70	45/65	45/70	45/65	45/55	45/50	45/65	45/80	45/60	45/60	45/50	45/30	45/60	45/55
20/70	20/75	20/70	20/65	20/70	20/65	20/55	20/50	20/65	20/80	20/60	20/60	20/50	20/30	20/60	20/55
35/70	35/75	35/70	35/65	35/70	35/65	35/55	35/50	35/65	35/80	35/60	35/60	35/50	35/30	35/60	35/55
25/70	25/75	25/70	25/65	25/70	25/65	25/55	25/50	25/65	25/80	25/60	25/60	25/50	25/30	25/60	25/55

If you multiply the outer vector $\Delta y'_{2015}$ and $1/\Delta y_{2015}$, than you can determine the matrix of the sustainable development of freight forwarding correlating to the current or running values:

Throughout the research on the elements of the sustainable development of freight forwarding, we have come up with the direct rates of growth and the following results derived [3]. The direct rates of growth show that the influence of globalization as an element of sustainable development of freight forwarding for the period from 2005 to 2015 promotes a rate of growth of 64.29%. The huge importance of the globalization on the developing potential of freight forwarding in Macedonia and other transitional countries is a repercussion of their needs having the necessity to join towards the European Union and in this way to be more exposed on the process of globalization. Information technologies are more and more substituting capital and work, and in this way are more and more becoming some of the main causes of effective work that the freight forwarding agent does. The prices of this technology are constantly decreasing. The meaning of information technologies as an element of the sustainable potential of freight forwarding confirms a necessity in the growth of the rates over the period from 2005 up to 2015, a growth rate of 45%. It is especially necessary to increase the usage of the analytical informative technology in the occupation of the freight forwarding agent. Figure 1 shows the direct rates of growth per element on the model of sustainable development of freight forwarding in Macedonia. In the following text we make comparisons on the information technologies to other elements of the developing potential of freight forwarding. The comparison to the rest of the elements is lacking due to rationality. The comparison of information technologies to other elements that influence on the running development of freight forwarding in Macedonia and other countries in the process of transition for the period from 2005 up to 2015 points in a growth rate of 150% compared to freight forwarding law and regulations as well as compared to inter and intra freight forwarding and of about 75% compared to the freight forwarding controlling part "Fig. 1". This immense growth in the information technologies compared to

the listed elements refers to the fact that those elements of the developing potential of freight forwarding are under influence of information technologies [4].
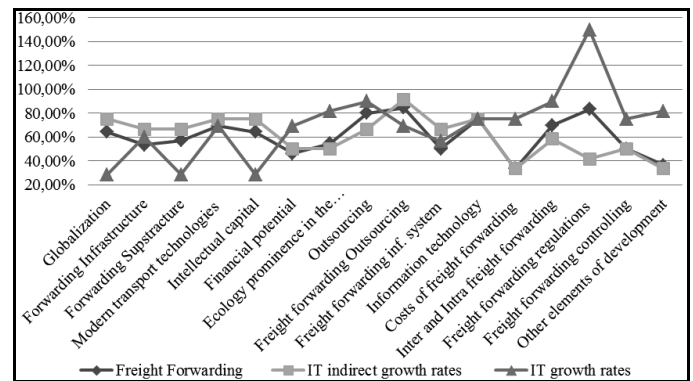

Figure 1: Graphic of direct development rates of freight forwarding, growth rates of the remaining part of elements in progress correlated to information technologies & indirect growth rates over information technologies associated to the remaining elements of freight forwarding development (2005 - 2015).

The growth of the information technologies in the freight forwarding sense or routine in Macedonia and other transitional countries are looking for a new law of regulation in accordance to the achieved criteria between the one who orders the certain freight forwarding activities and the contractor of those and in this way this newly founded law of regulation would grow to become stiff foundation or bedrock for successfully establishing information technologies. If you compare the indirect growth rate to all the other elements associated to information technologies "Fig. 1" than it could be claimed that a certain level of globalization would be achieved in the domain of the modern transport technologies and this achievement would configure for in about 69.23%. Information technologies also influence on the growth of the freight forwarding controlling so that a more sharpened focus of managing over the key factors could be established. These information technologies are as well on the other hand very important in the sense doing quality measurements over the deliverance of the certain freight forwarding services on both operational and tactical level. This further on would lead towards a continuous enhancement of freight forwarding activities which are implemented throughout the process of utilization of information technologies. When you compare the indirect growth rate of the remaining part of the elements to information technologies "Fig. 1" than a person can become observant over the fact that the biggest growth rate in correlation to information technologies will achieve a certain level of globalization on the model transport technologies [5], and thus the following this progress will be attained in 69,23%. Afterwards what follows is a freight forwarding infrastructure, outsourcing, and the freight forwarding information system of growth rate up to 56,25% which means that the meaning of the growth rate of these elements in its most contributes to the meaning and the importance on the growth rate of information technologies as an element of developing potential of freight forwarding in Macedonia and other transitional countries.

VI. Conclusion

By conducting the specific scientific analyses applied as well as the characteristics of international transport and freight forwarding we have come to the assumption that the development of the freight forwarding infrastructure information technologies and frame as well as getting the right insight over national and international inter-state law and regulations we have come to some level of increase in terms of the sustainable development of freight forwarding. The performance of the growth matrix plays a double role: it generalizes the term growth in its essence using the helping hand of all the direct and indirect growth rates and in this way enables laying foundation of dynamic systems which prove to be very useful in determining future freight forwarding development. Whereas for the indirect growth rates that appear in the model based on sustainable development of freight forwarding, they develop or determine the structure of the elements growth (information technologies etc.) and also display or exhibit all the interceptive relations on the total freight forwarding system. By applying these direct and indirect growth rates simultaneously we get the separate and the sin-energetic effects on the suggestion model of sustainable development of freight forwarding, or in other words we get the changes of the intensity in the element growth of the relatively low values on the element input in freight forwarding, which come to be direct consequence of the running or current transitional situation in Republic of Macedonia. Bearing in mind the fact that we want to increase the values of the elements on the suggestion model for sustainable development of freight forwarding, we have conducted analysis of the current situation during the year 2005, and only than it is that we have made deep analyses and research over the values derived in-from the year 2012 as well as the ending values of all the elements in the year 2015. The information technologies asserted indirect growth values suggest that globalization, modern transport technologies, intellectual capital and freight forwarding Outsourcing will contribute in their most over achieving a high direct growth rate depending on the usage of information technologies.

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