

RATKO ZELENIKA, D. Sc.
e-mail: zelenika@oliver.efri.hr
DRAGO PUPAVAC, M. Sc.
Sveučilište u Rijeci, Ekonomski fakultet Rijeka
Vukovarska 58, HR- 51000 Rijeka, Republika Hrvatska
e-mail: dpupavac@ri.tel.hr

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INTELLECTUAL CAPITAL – DEVELOPMENTAL RESOURCE OF LOGISTIC COMPANIES FOR 21st CENTURY

ABSTRACT

On the basis of relevant scientific research this paper systematically and concisely elaborates the interaction between intellectual capital and logistic services production. Full attention is given to intellectual capital as a factor in effective creation of the logistic processes or in other words, to prove the statement that the first place for achieving competitive advantages in the global and/or regional market of logistic services belongs to knowledge used to produce or improve the existent logistic systems and to create new ones.

Further, the paper deals with the tasks of creative logistic managers as open, dynamic and stochastic systems based on knowledge or the creation of universal logistic model determined by the fact that intellectual capital and technological paradigm create the way to new logistic paradigm.

Special attention is paid to building and presenting a mathematical model for measuring the intellectual capital as well as the success of its use in different logistic companies.

KEY WORDS

intellectual capital, resource, knowledge, logistic companies, logistic model, mathematical model

1. INTRODUCTION

Modern age, the age of the so-called global economy, is marked by intellectual capital as the most important factor of production in all sectors of economy, because it is a driving force of all other factors of production. Logistic companies' attention is focused more and more on creativity of operative staff and logistic managers, their enterprising spirit, readiness to use and accept new ideas, their flexibility and open-mindedness. Creativity, level of knowledge and experience are fundamental prerequisites for the growth of efficiency and effectiveness on the logistic services market. Creative work has become an omnipresent slogan which highlights that, regardless of technologically highly developed logistic business system, preconditions for its long-term growth and development

should be found in intellectual capital and the readiness of logistic companies to invest in human resources.

Out of such problem area we also determine the *subject of our research*: to study and determine the effects of intellectual capital on advancement of logistic company business.

According to that, the following hypothesis is also established: *with the help of quantitative and qualitative elements of intellectual capital paradigm it is possible to enlarge efficiency and effectiveness of working out logistic processes, and to find over and over again new ways of adding value to logistic services, lowering the total costs and offering the users of logistic services continuous support at the same time.*

2. CHARACTERISTICS OF INTELLECTUAL CAPITAL AS DEVELOPMENT RESOURCE FOR THIRD MILLENNIUM

Owing to the fact that raw materials, capacities of production, capital (...), can be purchased on the world market without restrictions, and also to the fact that labour force, or intellectual capital, is less moveable than other factors of production, in highly developed economies, and economies of more developed countries in transition, intellectual capital is increasingly becoming a restricting factor of economic growth. By investing in human resources the inhabitants of a certain country become capable of creating high productivity of work, and of moving the limit of working possibilities by their knowledge and learned skills. With educated population, or certain quantity of intellectual capital, the economic growth is inevitable. This is the reason why undeveloped countries cannot escape the vicious circle if they do not speed up the growth of economic sectors intensified by quality labour force.

Intellectual capital is in the majority of transition countries and undeveloped economies considered as something mysterious and hard to capture, something more like talent or a flash of ingenuity. But, regardless of this, human potential or intellectual capital is one of the most wanted “merchandises”, and is becoming more and more expensive as it is such a rare resource. What we have to define is: What is intellectual capital? Respecting other definitions and opinions, we could say that *intellectual capital consists of people with their knowledge, capabilities, creativity, skills, experiences, culture, motivation (...), it also consists of information network by which knowledge, information, software, databases, licenses, corporate culture, copyrights, information about customers and quality of relations with the market are transferred.*

3. INTELLECTUAL CAPITAL AS FACTOR OF LOGISTIC SERVICES PRODUCTION

Throughout the last ten years the superior influence of intellectual capital has been highlighted, as it is the fundamental factor of optimisation of services and goods production, while other classical factors as land, work, capital, organisation are secondary and static. Intellectual capital determines logistic companies businesses because logistic cannot be automated easily - information technologies can only assure that operations are done faster, in more precise mode, so that this is the reason why new logistic managers can be compared to modern Leonardos, possessing the knowledge about the knowledge.

Logistic systems of all kinds and all levels (micro, macro, global, mega) could not function without the existence and use of quality phenomenon of intellectual capital, even in cases when such systems are equipped by modern transport suprastructure, goods and passenger's circulation, and huge demand for logistic services. Only creative and inventive managers are able to make quick and efficient decisions, and to mix human and financial resources in optimal way, putting all logistic company resources at disposal to possibilities on logistic services market.

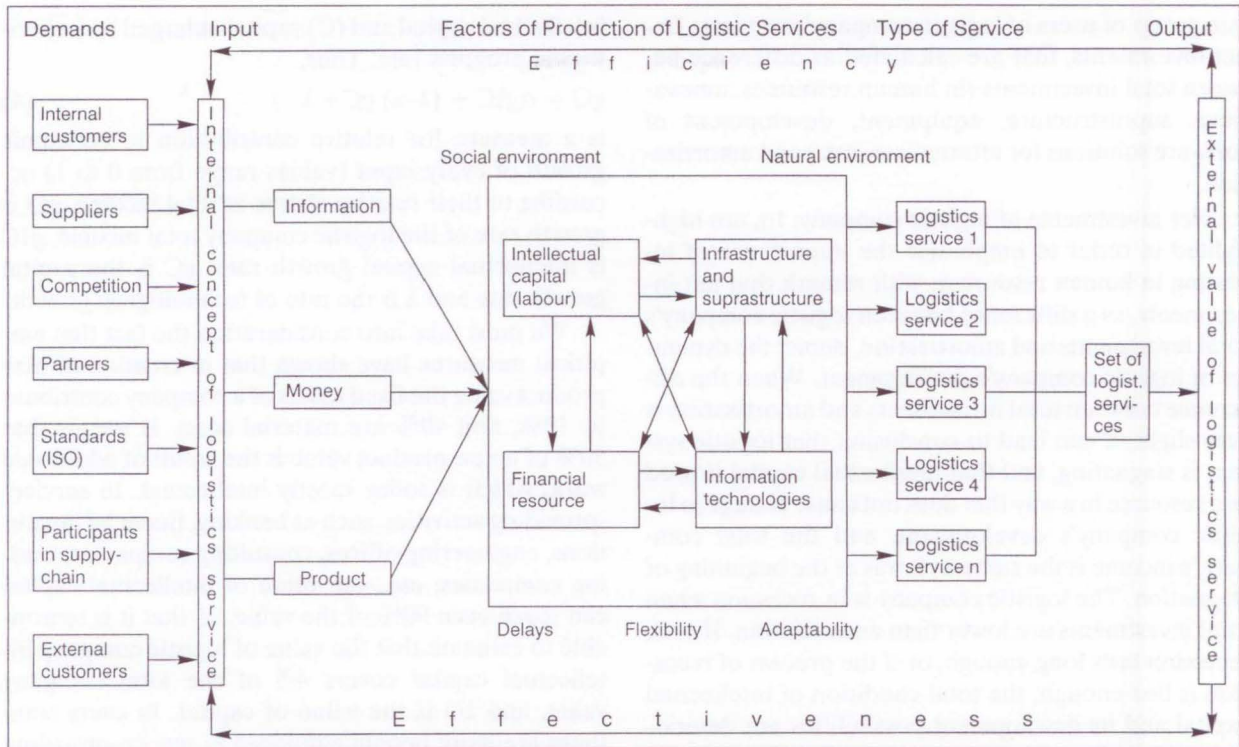
Human resources are the foundation to new and non-conventional way of thinking and decision-making by which strategic goal of logistic company can be achieved by increasing the level of logistic services and by lowering costs at the same time. These rules, supported by financial resources of the company, are the most important pre-conditions for logistic operators' success on the logistic services market. Human resources must be satisfying from quantitative and qualitative aspect, and they should be efficiently focused on production of competitive advantages.

4. INTELLECTUAL CAPITAL – CREATOR AND BASIC ELEMENT OF LOGISTIC MODEL

Logistic systems (macro and micro stochastic models) give many possibilities to create competitive advantage, and to achieve higher level of efficiency in managing inter- and intra-logistic activities of logistic and other business systems by quantitative analysis. The main goal of constructing the logistic model is to enable better understanding, faster realisation, to increase real logistic flow security, quality and control. Among the great number of factors and interrelations that determine inter- and intra-logistic activities, it is very important to define factors whose functioning is fundamental for efficient functioning of logistic and other business enterprises.

Logistic model (Scheme 1) depicts factors that determine the efficiency and effectiveness of inter- and intra-logistic activities, especially the factors of logistic services production: intellectual capital (labour force), information technologies (specific form of intellectual capital), logistic company financial resources, existing infrastructure and suprastructure. Those factors, especially intellectual capital and information technologies, synergically determine logistic services production efficacy and effectiveness, because it increases the ability of logistic system to efficiently connect numerous logistic “factories in the field”, which means certain functions of business system when we talk about intralogistic flows. According to this, it cannot be denied that the fundamental factor of logistic system profitability growth is investing in human resources, investing in information technology that helps the personnel who contacts the users of logistic services, and in information technology that helps the realisation of operative tasks, and also investing in infrastructure and suprastructure contents. Infrastructure in logistic model, apart from traffic and economic infrastructure also considers company's infrastructure (organization structure, quality control system, financial system, etc.). *Natural environment*, that consists of space, time and climate, and *social environment* that consists of the government, legal system, tradition, culture, customs, habits, philosophy, education, health care system, sport, religion (...) represent very important factors of logistic services production and logistic model development.

The presented logistic model development is based on internal and external environment requests that determine internal concept of a logistic service, and, according to that, suitable competitive attitude, or response of the logistic company to demands of external and internal environment. Every change in concept affects the users of logistic services. Inputs of the shown logistic model are products, information, and



Scheme 1 – Logistic model

money. Goals of a logistic company are achieved by engaging factors of production, and transformation of money in space and time. In this way the users of logistic services increase their benefit by getting certain logistic services (transport, storage), or the entire package of primary and secondary logistic services. The intellectual capital as creator and basic factor of the logistic model is most responsible for removing and neutralising of possible standstills in logistic system and its achieving a certain level of flexibility and adaptability, to increase the positive difference between external value of a logistic service and internal concept of its value. As the flexibility and adaptability of logistic company can be estimated by company's ability to adjust to internal and external environment, it means that flexibility and adaptability represent competitive advantages of logistic companies produced by intellectual capital. Flexibility and adaptability help creating certain external value of logistic services, equally from the logistic company's and its clients' points of view.

5. MATHEMATICAL MODEL AS FUNCTION IN MEASURING LOGISTIC COMPANY INTELLECTUAL CAPITAL

Skandia Group, a Swedish company that offers financial services and is worth 18 billion dollars, is often praised for its invention of a concept of measuring intellectual capital. In the beginning of the nineties Skandia required measuring of intellectual capital by

distinguishing the book value from the market value. The difference between those two values represents the value of invisible assets, which means intellectual capital. Since many companies today have become aware of the meaning and quantity of their own intellectual capital, they are more worried about preserving it than measuring it.

Mathematical model used for measuring the intellectual capital of logistic companies needs to sublime at least 5 categories of invisible assets: database of loyal customers, image and appeal of primary and auxiliary services of a logistic company, loyal labour force, the culture of offering services inside the logistic company, and the strength of logistic company's management. According to that, invisible assets can be presented as sum of different forms of intellectual capital:

$$IC = (Ww, +Lw, +Sw, +It, +Vm) + In, \quad (1)$$

where IC represents total intellectual capital of a company, Sw workers' wages, Lw workers' loyalty which is measured as a difference in wage between the number of workers that have left the company and new workers; Sw is satisfaction of company workers estimated as increase/decrease of income as consequence of increase/decrease of productivity; It - information technologies, that are the most valuable assets of logistic companies and include company's information system, business methods which are executed by applying suitable information technologies, and know-how; Vm is the vital minority of users of logistic company's services, that is expressed through analytic bills of cer-

tain group of users of logistic company's services; In - net investments, that are calculated as difference between total investments (in human resources, innovations, suprastructure, equipment, development of software solutions for internal use, etc.) and amortization.

Net investments of logistic company, I_n , are highlighted in order to emphasise the importance of investing in human resources, with remark that net investments, as a difference between logistic company's total investments and amortization, depict the dynamics of logistic company's development. When the difference between total investments and amortization is very slight, it can lead to conclusion that logistic system is stagnating, and that intellectual capital is used as a resource in a way that does not cause change in logistic company's development, and the total company's income is the same as it was at the beginning of stagnation. The logistic company is in recession when total investments are lower than amortization. If such recession lasts long enough, or if the process of recession is fast enough, the total condition of intellectual capital and its development possibilities are deteriorating, and the logistic company is getting closer to bankruptcy. When total investments are higher than amortization, a base is created for the increase of total income, quantity and quality of intellectual capital of a logistic company, which means increased possibility to put the intellectual capital in function of production and offering the package of logistic services that is superior compared to competitive logistic companies.

How successful a company is when using intellectual capital and its different forms, can be measured by putting those forms in connection to business gain of a certain period of time, so that the total coefficient of success of intellectual capital is calculated in this way:

$$C_{ics} = BG/IC \quad (2)$$

C_{ics} – coefficient of intellectual capital success

BG – business gain

The importance of intellectual capital as a key resource of logistic companies in 21st century must also be observed from the aspect of production, especially because many economists in their works present factors that affect the quantity of production. Those factors are: number of labour force, quantity of natural resources that can be used, quantity of capital and the level of development of technical progress. It means that the quantity of production output is nothing else but a function of factors of production named above. If we consider the function of production,

$$Q = F(IC, C) \quad (3)$$

where Q is the total income of a logistic company, IC is intellectual capital and C is the capital, we will get a rate that is equal to weight sum of growth rate of IC -

intellectual capital and (C) capital enlarged by technological progress rate. Thus,

$$gQ = \alpha gIC + (1-\alpha) gC + \lambda \quad (4)$$

is a measure for relative contribution to economic growth of every input (values range from 0 to 1) according to their relative shares in total income, gQ is growth rate of the logistic company total income, gIC is intellectual capital growth rate, gC is the capital growth rate and λ is the rate of technological growth.

We must take into consideration the fact that empirical measures have shown that in creation of new product value the fixed assets of a company contribute by 10%, and 40% are material costs. It means that 50% of a new product value is the result of additional work, which is today mostly intellectual. In service-providing activities, such as banking, financial institutions, engineering offices, consulting companies, trading companies, etc., the value of intellectual capital can reach even 90% of the value, so that it is reasonable to estimate that the value of logistic company intellectual capital covers 4/5 of the total company value, and 1/5 is the value of capital. In every state there are more people employed in service-providing activities than those activities contribute to national product, which is a sign that average productivity of work in service-providing activities is lower than in other activities. The estimated increase of productivity in service-providing activities is 0.5 % yearly, while increase in production is 3.3 %.

The growth of total yearly income of a logistic company can be expressed in the following way:

$$\% Q = 4/5 (\%IC \text{ growth}) + 1/5 (\%C \text{ growth}) + \lambda \quad (5)$$

As λ , the technological progress cannot be measured, it is necessary to present it as the rest, after all other components of output and input have been calculated

$$\lambda = \% Q \text{ growth} - 4/5 (\% IC \text{ growth}) - 1/5 (\%C \text{ growth}) \quad (6)$$

This enables a critical overlook on factors of growth in big service-providing systems. The average size of service-providing companies is mostly small, so that logistics as a science and logistics as an activity provides many possibilities concerning logistic operations and tight connection between numerous logistic "factories in the field".

6. CONCLUSION

Logistic services represent a group of sophisticated measures (activities) of intellectual capital owned by mega logistic operators that are helped by infrastructural and suprastructural contents which can, and do not have to be owned by mega logistic operators, modern information technologies which give hard value to

logistic services. Consequently, the analysis and estimation of logistic company resources related to the necessary resources is suitable, not only to achieve certain goals of logistic company, but also to find definite answers to questions such as, which logistic services to provide, who will work on the production, where and when. Such analysis contributes to formulation of quantitative and qualitative needs in the field of human potential and enables comparative analysis of the existing and needed human resources. As there always is a gap, efficient human resource management requires a few factors: human resources recruiting and selecting, education and improvement of human resources, realignment and surplus of human potential.

The presented mathematical model in function of measuring the intellectual capital of logistic companies takes in consideration the important categories of invisible assets of a logistic company, and is therefore suitable for representing the value of intellectual capital of a logistic company. The total intellectual capital of a logistic company is a sum of different forms of intellectual capital: salary of workers, their loyalty, satisfaction, plus information technologies, vital minority of users of logistic services and net investments.

RATKO ZELENICA, D. Sc.
e-mail: zelenika@oliver.efri.hr

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Sveučilište u Rijeci, Ekonomski fakultet Rijeka
Vukovarska 58, HR- 51000 Rijeka, Republika Hrvatska
e-mail: dpupavac@ri.tel.hr

SAŽETAK

INTELEKTUALNI KAPITAL - RAZVOJNI RESURS LOGISTIČKIH KOMPANIJA ZA 21. STOLJEĆE

U ovoj se raspravi temeljem relevantnih znanstvenih spoznaja sustavno i koncizno elaborira interaktivnost veza intelektualnoga kapitala i proizvodnje logističkih usluga. Najviše se pozornosti posvećuje intelektualnom kapitalu kao čimbeniku

efikasnoga osmišljavanja logističkih procesa, odnosno dokazivanju tvrdnje da djelotvorno uporabljenom znanju u funkciji proizvodnje i unapređenja postojećih, te kreiranja novih logističkih usluga, pripada primarno mjesto u stjecanju konkurentskih prednosti na globalnom i/ili regionalnim tržištima logističkih usluga.

U nastavku se promišljaju zadaće kreativnih logističkih menadžera u funkciji izgradnje logističkih kompanija kao otvorenih, dinamičkih i stohastičkih sustava utemeljenih na znanju, odnosno kreiranju univerzalnoga logističkoga modela determiniranoga činjenicom da intelektualni kapital i tehnološka paradigma kreiraju put novoj logističkoj paradigmi.

Posebna se pozornost u ovoj raspravi posvećuje izgradnji i prezentiranju matematičkoga modela u funkciji mjerenja veličine intelektualnoga kapitala i uspješnosti njegova korištenja u različitim logističkim kompanijama.

KLUČNE RIJEČI

intelektualni kapital, resurs, znanje, logističke kompanije, efikasnost, logistički model, matematički model

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