ONE APPROACH TO THE DEVELOPMENT OF MODELS OF LOGISTICS OF TOURISTICS COASTAL REGIONS

Željko Ivanović*
Center for logistics and transportation *«Z-Logistics»* Bar, bubazel@t-com.me

Abstract: *The research presented in this paper is model of logistics of coastal tourist regions that presents special and unique tourist area with a number of smaller towns and tourist resorts. In order to eliminate all that is unnecessary in the process of implementation of logistic flows imposed the idea of enhancing the existing solutions of distribution system, so that at the end result was the development of a win - win situation of all parties in the logistics chain. Exploring the relationship: space → logistics centers and terminals → location problem → optimization of supply of tourist facilities is basis for the development of the model. The paper presents the possible variants of sustainable modes of regional travel.*

Keywords: *Logistics, tourist region, model of logistics.*

* Corresponding author

1. INTRODUCTION

Coastal tourist regions (CTR) in their evolutionary development path dominantly incorporated spatial and historical component, with all the characteristics in terms of: (i) the close association with the water surface, (ii) dense urban cores with a concentration of generators of logistics activities within them, (iii) narrow one-way streets weighted implementation of freight transport, (iv) the congestion on the approach roads at certain intervals, (c) the predominance of road transport mode of shipping goods, (vi) the desire to find an adequate model of supplying the city center and tourist resort and that it does not undermine the quality of tourist offer and environmental area. Because of pronounced regional metabolism of all processes and activities, especially those in the field of logistics, CTR require new solutions that can adapt to the newly developed situation.

In recent years, more and more the focus is on models of sustainable regional development, which promote integration of regional forms, incorporating the logistics into tourist offer, more decisive guidance on the use of combined mode of distribution and concept of environmental sustainability. This model essentially opposes road pro-freight transport strategy that has long been present and encouraged the increase in the number of delivery vehicles on the road especially per year, initiating the series of negative environmental influences.

2. THE ESSENCE OF THE TERM MODEL OF LOGISTICS

Term of model of logistics (MOL) presents the [4] form made on set of principles, first of all logistics (Figure 1.) for optimal connection of primary logistics elements and secondary logistics elements aiming at the development of new tenable system's and conceptual solution of regional logistics.

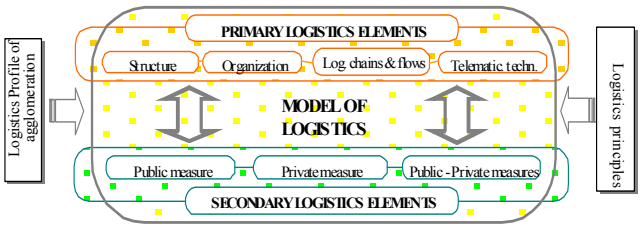

Figure 1. Graphical representation of the MOL [4]

Model of sustainability is closely connected to the total logistics integration (TLI) process in a geographic area. Founder of spatial economics Von Tienen (developed model of concentric zones in 1826.) made the first serious attempt to explain the differences in the heights of land rent and land use, binding to the factor of sites comparing to the city center. In accordance to Tinen's theory, we can conclude that the CTR factor of sites in relation to the water surface is the key element of the model. On this basis, the geographic area in CTR the closest to water surface, and presents the area with the highest density, the highest rents and the highest traffic intensity. As a rule, these spaces are reserved for the most expensive tourist facilities, while the

most distant geographical areas with the lowest rents are used for industrial or agricultural production, where transportation costs are lowest one, and the intensity of transport is considerably weaker.

How TLI creates sustainable, competitive, strategic advantage, it must be approached to the reaffirmation of the spatial aspect of the CTR in accordance to Tinen model. Descriptive approach to research of relationship: *geographic area and associated generators of logistical requirements → logistics centers and terminals → location problem → optimization of supply of tourist facilities presents the basis of research*.

Quality management of TLI system essentially should represent searching for the optimum between four processes [7]: (i) research and forecasting of customer needs and expectations, (ii) cooperation, coordination and consolidation of material, energy, transport, information flows, (iii) network and spatial planning, (iv) environmental planning.

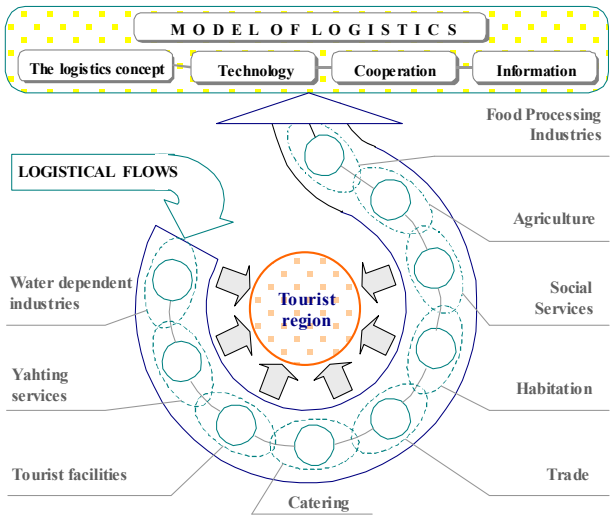

Figure 2. Tourism region and its integration (The author's creations)

Pronounced regional metabolism affect the existing logistics solutions, initiates higher costs and more complex problems related to the processes of physical distribution of goods. Applying complex approach aimed at minimizing transportation requirements and the development of cooperative models of physical distribution were never seriously considered. Therefore, the development of new methodological approaches to create sustainable solutions to regional logistics imposed itself as an inspiration and a necessity.

3. APPROACH THE DEVELOPMENT OF A MOL

CTR in its evaluation development (Figure 3) crossed the four developmental stages. Each of these stages of development depending on the degree of development of society had attended a logistics solution. The characteristic of the fourth stage of development, there is a process of regional metabolism that has its future development trend. In addition, there is a concentration of a number of regional function in a relatively small space, which intersect with each other creating a series of negative effects that harm the sustainable development of the region. Its economic prosperity experienced by only those regions that have a better logistics solution.

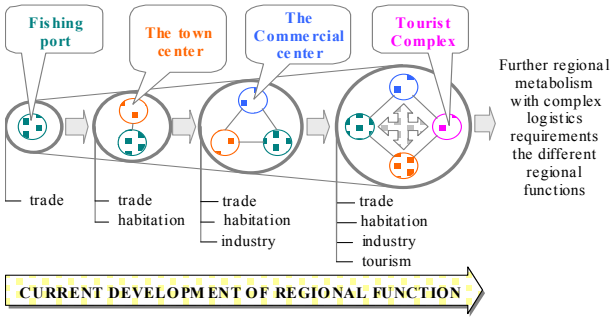

Figure 3. Evaluation of tourism regions (The author's creations)

Limited infrastructure capacity on the one hand and the increased frequency of vehicles on the other hand, create a number of obstacles to the realization of commodity flows. Regions that are in the initial stages were oriented to trade and housing, are now faced with an increasing number of tourists. The former of confrontation and refraction of commodity flows such as ports, harbors and squares in the city, have now become a major tourist and gastronomic places where there has been a change in the characteristics of commodity flows in terms of size, intensity and structure. The key problem is that there has been an increase in road transport products [10]: (i) elimination of holding stock in the facilities, (ii) the desire to deliver the goods by the JIT strategy, (iii) a sharp increase in B2C commerce, and (iv) to independently solve problems of transport of some subjects not taking into account the overall efficiency.

A common feature of all development phases of tourism in the region is the need for the supply and distribution of goods whose intensity changes over a period of years. What separates CTR are size, shape and physical characteristics of commodity flows. In addition, the difference is the way of distribution of goods. Once the goods was brought directly to the water, and later after the technological progress that was from the mainland, and more recently to look for adjustable solution that would take advantage of both modes of delivery and distribution.

3.1 Principles of development MOL

Because of its multidimensional influence on the business, development of MOL has to be based on the application of system's approach using the next relations: *preparation → analysis → synthesis → control*.

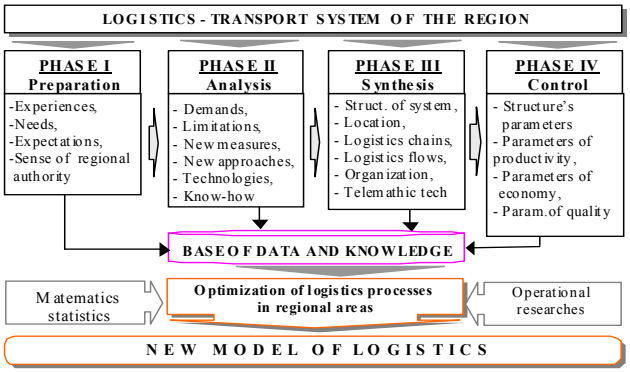

Figure 4. Course of development MOL [4]

The development of new system's solution also should be based on:

- output of multicriteria's analysis,
- output of model of optimization where time and cost are the main components,
- planning of activities on the process model,
- using top-down or bottom-up approach, as well as using both approaches during the decision making,
- application of logistics controlling as a concept that enables integrated assistance to decision making,
- application of some measures that will enable adjusting the gap between public and private sectors,
- application of integrated logistics service (ILS),
- development of the model for multicriteria's evaluation of possible solutions.

3.2. Conditions for the development of regional MOL

Conditions 1 The tendency for TLI in a CTR is basically related to the process of development of logistics centers (LC) organized (Figure 5) within or outside the seaport.

Their function [10] is to create the preconditions for: (i) concentration of all logistics activities on one space without the duplicating of capacities, (ii) coordination and cooperation between some links in the logistics chain, (iii) specialization of the work of logistics systems, (iv) marketing approach and market animation, (v) proposal of logistics services on one space, (vi) high quality of logistics service, (vii) application of environmental acceptable technologies of transport. LC imagined and organized on this way, present central elements and base structure – the hardware of the MOL.

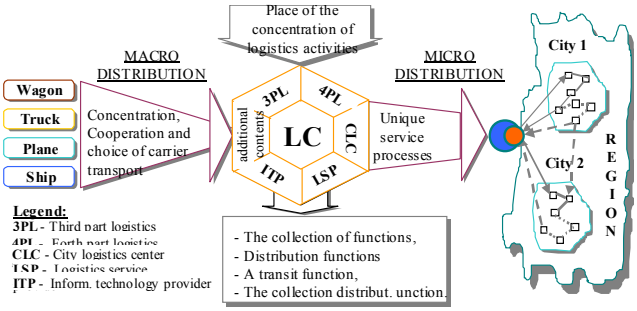

Figure 5. LC a place of concentration [4]

The decision model that incorporates a large naval port with LC and several smaller ports and harbors along the coast of a CTR, is a good basis for developing a network of cross docking terminals and transfer from macro to micro trade flows, which are implemented by the demands of tourism entities. Cross docking terminals in combination with small fast boats, which carry small containers delivery from the sea, ecological and commercial vehicles that distribute goods in containers or on pallets in the tightest of urban areas on the mainland side, are the key technological elements of the solution.

Condition 2. The use of new logistics strategies (LS). Their orientation is focused on time synchronization and the implementation of new types and forms of cooperation, integration and specialization in logistics. LS provide quality input for strategic decisions, requiring detailed analysis and research in order to find an adequate response including questions such as: (i) logistics activities and the scope of organized within the LC, which left logistic providers, (ii) the form of organizational forms applied between LC and 3PL and 4PL, (iii) what is the optimal degree of cooperation in terms of investment, cost, quality and delivery reliability, and (iv) the form of management applied.

Condition 3. Many obvious problems in the logistics processes, especially in transport process cause demands for the application of modern logistics measures, which (Figure 6.) should contribute to development of new tenable conceptual solutions.

Conditions 4. The existence of logistics professionals, capable to implement and maintain the MOL.

3.3. Possible solutions to the MOL of CTR

All so far developed MOL are trying to achieve satisfaction of set goals with the goals of efficiency, economy, quality of service and protection of the environment stand out as primary. Level organization

of logistics processes necessary to facilitate the implementation of a supply chain should be resolved by applying adjustable MOL, through a variety of his possible solutions (Figure 7).

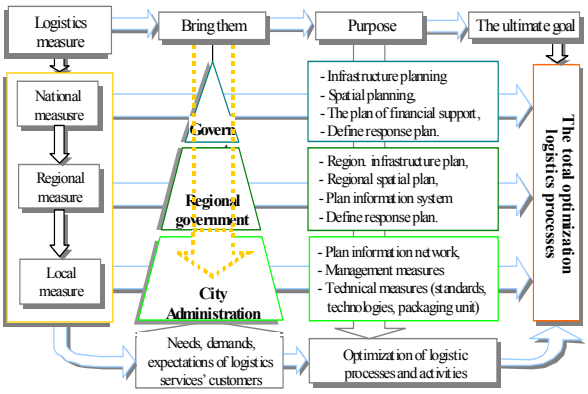

Figure 6. Representation of measures in the logistics [4]

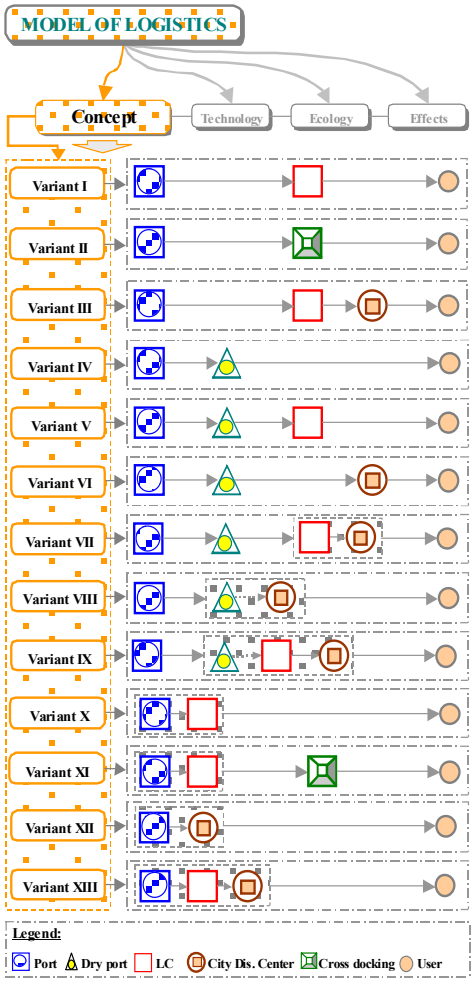

Figure 7. Variety of logistics solutions for model CTR (The author's creations)

4. MATHEMATICAL RESTRICTIONS IN MODEL

The key objective of the model is to minimize total facility and transportation costs. Further:

- Does not assume each site has the same fixed costs;
- Does not assume that sites are capacitated;
- Does not assume that there is a set number of facilities *p* that should be opened;

Determines optimal number and locations of facilities, as well as assignments of demand to a facility.

4.1 Clustering generator

Grouping of generators on the following principle is necessary to define the possibility of developing cross docking terminals: (i) select a distance measure, (ii) select a clustering algorithm, (iii) determine the number of clusters, (iv) validate the analysis

Defining distance: the Euclidean distance

$$D_{ij} = \sqrt{\sum_{\kappa=1}^{H} (x_{ki} - x_{kj})^2} \qquad (1)$$

Dij - distance between cases *i* and *j*
xki - value of variable *Xk* for case *j*

4.2 Defining the conditions and limitations

Including:

- Minimizes total facility and transportation costs;
- Does not assume each site has the same fixed costs;
- Does not assume that sites are capacitated;
- Does not assume that there is a set number of facilities *p* that should be opened;
- Determines optimal number and locations of facilities, as well as assignments of demand to a facility.

Notations:
nf_j = fixed cost of locating a facility at candidate site *j;*
nC_j = capacity of a facility at candidate site *j;*
nα = cost per unit demand per unit distance;
nd_{ij} = distance between demand node i and candidate site *j;*
nh_i = demand at node *i;*
ny_{ij} = 1 if demand node *i* is assigned to facility at node *j*, 0 otherwise.

$$Min \sum_{j \in J} f_j x_j + \alpha \sum_{iinI} \sum_{j \in J} h_i d_{ij} y_{ij} \qquad (2)$$

$$s.t. \sum_{j \in J} y_{ij} = 1 \quad \forall i \in I \qquad (3)$$

$$y_{ij} - x_j \le 0 \quad \forall i \in I, \forall j \in J \qquad (4)$$

4.3 Defining the number and spatial distribution of LC

In this case there are two possible scenarios: (i) the status quo scenario, and (ii) the appointment of new scenario for optimal locations. The current spatial distribution of key LC should be included in the MOL. The new terminal layout should be done using the method of multi-criteria optimization.

4.4 The simulation experiment and draw conclusions

Special attention in the MOL focuses on operating processes related to marketing logistics. Marketing logistics is related to the process of ordering and implementation of orders. The transport process as a subsystem of marketing logistics are studied in terms of six basic characteristics of transport requirements, as follows: (i) type of material, (ii) manifestation (iii) place of origin, (iv) law of origin, (c) place of realization, (vi) interval of patience.

The whole problem of simulation modeling is divided into two levels, according to the functions of individual commodity flows: (i) Level 1 refers to the implementation of the macro trends in delivery, (i) Level 2 is related to the process of physical distribution. However it is possible to observe the region one level, it is a matter of choice and present factors

5. ALGORYTHM FOR DEVELOPMENT OF MOL

Within the algorithm there are identified (Figure 8) the next key processes:

1) specify the size of the region,
2) clustering generators of logistical requirements,
3) defining the structure of the system,
4) validation of the solution of simulation modeling.

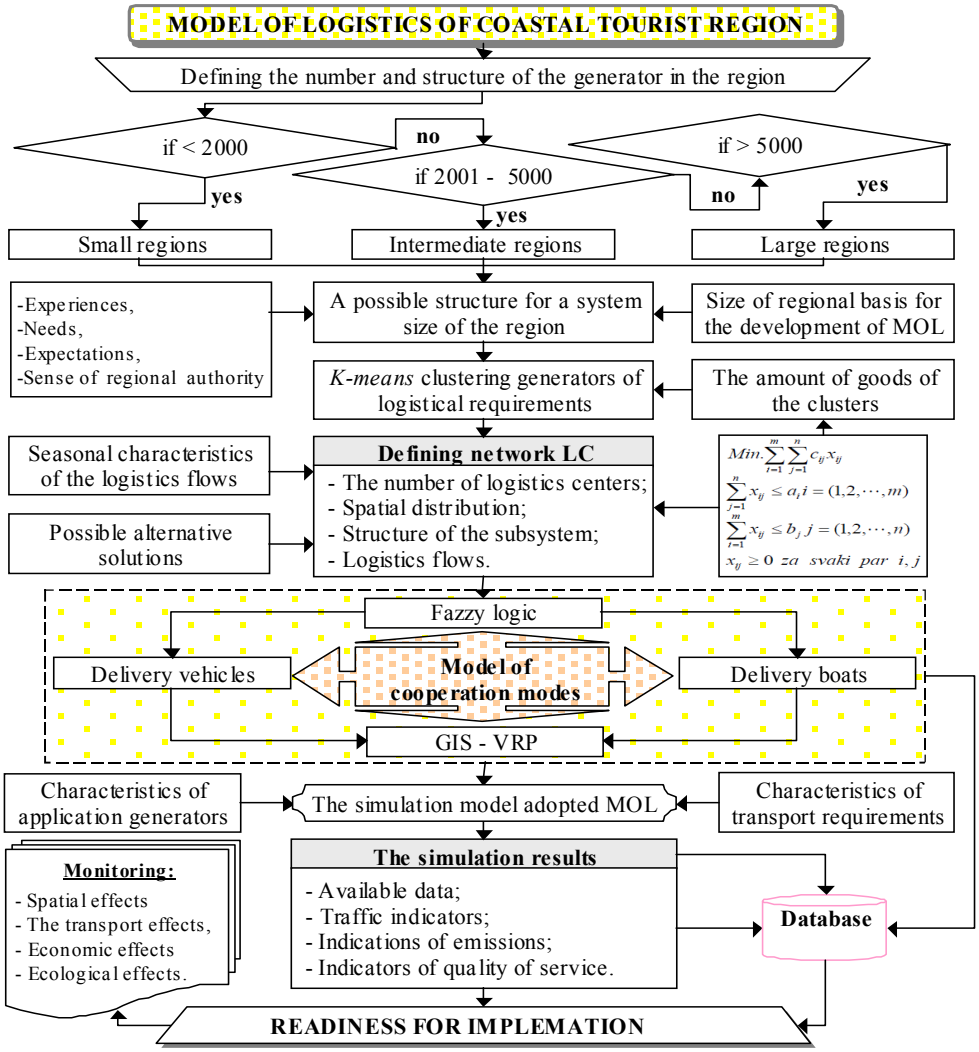

Figure 8. Algorithm for development of MOL (The author's creations)

6. CONCLUSION

Interdependence of regional metabolism of sustainable regional development and logistics model CTR gets all close examination viewpoint.

Space restrictions and increased demands for rational operations within specific areas, such as CTR, demand requirements for quality logistics services, including first and foremost, faster and reliable movement of material, transportation, financial and information flows across and within these areas. Although in the past twenty years there have been significant changes in the structure of the food chain, as reflected in the specialization and professionalization of certain LS by: (i) the formation of a network of LC, and the concentration of logistics activities in the same, (ii) reduction of stocks (iii) the application of IT and technology in all links of the chain, (iv) improving information systems and information management, (v) management and control procedures and activities in the logistics chain, etc., it must be said that the increasing fluctuation of tourists, and thus increased volume of trade in tourist regions, requires the development of new models of logistics, especially in the field of system and technology solutions with a focus on optimizing processes within them.

Development of a new MOL for the CTR, requires a multi - step approach to solving of problem. System approach is a good basis for the development of these models. Planning and execution of certain research activities that need to quantify and define the spatial, economic and technical - technological performance of the region in order to develop a form that will allow a total optimization of logistics flows and processes that take place in them is necessary to perform the first stage of development, or in period of system analysis. The development of individual solutions in the model are carried out in two steps, and it would essentially represent system synthesis. The last stage is simulation modeling as control and verification of the proposed solutions of the effects of the application of the new MOL.

REFERENCES

[1] Bentzen K., Hoffmann T., 2004. *NeLoC, Service Concept Report for Logistics Centres*, Association of Danish Transport Centres, Aalborg;

[2] Cranic T. G., Ricciardi N., Storchi G., 2001. *Advanced Freight Transportation Systems for Congested Urban Areas*, Université de Montréal and Universitá degli studi di Roma;

[3] Egger D., Ruesch M., 2002. *BESTUFS D 2.3. - Road princing and urban freight transport Urban freight platforms,* Best Practice Handbook;

[4] Ivanovic Z., 2006. *Modern approach to the development of sustainable logistics conceptual system`s solutions,* Symposium of Operation research SYM-OP-IS, Banja Koviljaca, Serbia*;*

[5] Köhler U., 1997. *New Ideas For The City Logistics Project In Kassel,* University Of Kassel, Kassel;

[6] Schaffeler U., 2001. *Inner Urban Freight Transport and City Logistics*, Summary of projects and results from topic;

[7] Tanaguchi E., Thompson R. G., Yamada T. and Van Duin R., 2001. *City Logistics - Network Modelling and Intelligent Transport Systems*, WIT pres London;

[8] Tanaguchi E., Tamagawa D., 2005. Evaluating Toll Measures of Urban Expressway Considering The Behaviour of Several Stakeholders Associated with Urban Freight Transport**,** The 4rd International Conference on City Logistics, Langkawi;

[9] Visser J., Binsbergen A., Nemoto T., 1999. *Urban freight transport policy and planning,* First International Symposium on City Logistics, Cairns, Australija;

[10] Zecevic S., Tadic S., 2006. *City logistics*, Faculty of Transport, Belgrade;

[11] Zecevic S., Radivojevic L., Kilibarda M., Tadic S., 2002. Snow White: *"City logistics concept",* Conference: "Planning and Implementation", Belgrade,