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HOLISTIC THINKING APROACH: CASE STUDY OF POST NETWORK IN SLOVENIA

ABSTRACT

Modern complexity of management is associated with important decision making, confronting a great number of useless information. Selection of information - the choice of only quality ones, i. e. essential ones, is a big problem in management decision-making. Implementation of systemic approach i. e. dialectical-network thinking (DNT) can help to deal with it. The paper presents a holistic thinking approach in a case study for the Slovenian parcel postal problem. The volume of parcel flows at the Post of Slovenia between Posts is increasing rapidly and it requires a new design of the postal network. This paper presents a reorganization of parcel services between Postal Logistics Centers and Posts by adding Regional Parcel Centers and Parcel Posts to the network. A case for the area covered by Ljubljana Postal Logistics Center is given, which takes into consideration the sorting out and the retaining of parcels in the Posts, Parcel Posts and Regional Parcel Centers within their individual areas.

KEY WORDS

systemic thinking, dialectical network thinking, management, logistics, postal services, postal delivery

1. INTRODUCTION

Logistic enterprises want to supply customers in such a way that the difference between the revenue of the service and the operating costs is the highest possible; however, they are often limited by obligatory standards or standards that the competitive companies guarantee.

Extensive human activities affect the world's permanent changing. The consequences are seen, among the others, in the continuous confrontation with different – always new *problem situations* and their solving; among the *basic features* of both are the *complexity* (intricacy under the influence of relationships) and the *dynamics*. Researching and managing such phenomenon can be supported by competence in usage of the *theory of systems.*

It is known that decision-making based only on intuition is insufficient, especially nowadays, at the time of global business. Therefore, managers have to operate with adequate *knowledge capital*. It is a synergetic composition of inborn talents, feelings, abilities as well as gained knowledge and experiences. DNT puts this capital knowledge into function of management decision-making, thus easier and holistic information management is needed for quality and efficient and successful problem solving. It enables managers to be creative, co-operative and interdisciplinary. It opens possibilities for combination of theory and practice in the decision-making processes, as presented in our contribution.

The sense of systemic thinking, as predicted by modern DNT is therefore the *most (sufficient)* holistic and realistic preparation and performance of human activities, when we deal with research, development, decision-making, informing or performing [9]. DNT is able to give enough support to holistic thinking, decision-making and acting when we have to solve complex management situations, because dialectical systemic approach supports recognition of interdependence of the participants in the problem-solving process (different but essential professions/occupations, cultures). On the basis of these findings, managers can form such a list of (needed and sufficient) potential solutions easier, to mitigate the decision-making process of problem solving. Holistic approach is an expression easy to use but difficult to define in detail/precisely. It contains all, all components and all

their relationships (links and relations); characterising the treated phenomenon, of course, it is impossible to include everything. Therefore, the holistic approach is not performable, not when we speak about work and thinking of people as individuals without (co-professional) co-operation; at the same time it may overburden us. Obviously, it has to be decided which level of holistic approach is satisfactory enough and needed at the same time for the actual case. It is important to use DNT in each aspect of the complex problem solving. The very moment we do not consider influence of the choice of the aspects, we can easily fall into virtual holism when we think, make decisions and act/perform – or carry out, for example, management decisions. Because of *one way/one-sided thinking*, which may be the consequence of extensive specialisation; we may have overlooked or neglected the essence when we made the choice or even aspect of treatment of some manager's decision. Global business conditions force us to *try to be holistic in our way of thinking, making decisions and acting, as much as it is possible and needed at the same time.*

2. PROCESS OF REQUISITE HOLISTIC DECISION-MAKING – PROBLEM OF MANAGEMENT DECISION-MAKING

Quality of management depends on creative, dynamic, qualified, development- and interdisciplinary cooperation-directed managers. However, nowadays, in the world of global economy they do not have at disposal/do not operate with sufficient quantity of information, needed for (more or less) complex problems solving and with them connected/linked *decision-making*. This is of great importance as the purpose of information is to decrease/cut down the risk, included into each decision-making, as we make decisions about the future [10]. It is not difficult to prepare a lot of data; but it is difficult, or almost impossible to provide proper information in time for those who make decisions. On the other side, waiting for information paralyzes decision-making and problem-solving related to it. Information quality influences the degree of risk, as decisions are divided into decisions made in certain situations, decisions in risky situations and decisions in uncertain situations.

Decision-making in management can be performed by using routine, analyses or intuition (direct comprehension, perception of the essence, independently of the sensible dissection, inspiration: to be dedicated, lead by intuition; create and work by intuition, with intuition; to be gifted with intuition; expressionistic work was a fruit of pure intuition, intuitivism: to have intuition; contribution is an evidence of author's great intuition) [11]. *Routine* decision-making is carried out normatively (according to the rules). *Analyzed* decision-making is carried out on the basis on the research (knowledge supported) of the phenomenon in the more complicated circumstances. *Intuitive* decision-making is used directly, or when there are no other possibilities, it origins in person's subconscious. In management, there is a great share of intuitive decision-making in top management and it has to be mastered by choice of personnel/staff (capable and talented managers). At the executive level the share of intuitive decision making is slight; the decision making is mastered by inspection and normative approach. The author says that top management decision-making is made of 80% intuition, 16% analyses and 4% routine; on the other extreme, at the executive management level there is 2% of intuitive, 35% analyses and 36% routine decision-making.

We assume that many persons, especially modern managers have to make decisions on the basis of intuition because of missing and partial information. It means they make *decision intuitively* (in the knowledge about management there is prevalent belief that managers have to make decisions on the basis of analyses (as far as 80%) and also supported by knowledge and scientific achievements), which is possible to improve by the intuition techniques and last but not least, although it has not been scientifically confirmed, also by recognition of the influence, to subconscious. In people and business management, special importance for decision-making lies in empathy, inspiration, experiences and knowledge [4].

In decision-making, managers use intuition and knowledge in different combinations: at the beginning, intuition has to be used more because of the poor knowledge; later it seems that the only right way is knowledge [3]. Researches say that usage of intuition is especially useful in decision-making if:

- there is a high level of uncertainty,
- there were few experiences, (precedent),
- there are no reliable facts,
- the time is very limited and pressure to choose the right solution great,
- when there are several acceptable solutions, which seem sensible and supported by "factual" arguments.

It has also been shown, that in crises, when fast solutions had to be made, the usage of empathy and inspiration were successfully applied, supported by already accumulated knowledge and experiences. Many times it is more sensible to solve small (simple) problems using intuition, because the costs and damages are lower than in case of coming up with solutions to big problems.

In the last decades, a lot of researches were carried out showing that in the field of management some

people have great intuition and make decisions successfully using it. These phenomena appear more often on the higher level of decision-making, where less structured decisions have to be made (less clear decisions). It has also been shown that team co-operation is developed parallel with this phenomenon.

Of course, intuition only is not sufficient for quality decision-making. Knowledge capitals, which are consequences of most different influences, the following are also needed: (inborn and developed) feelings, talents and abilities, education, environment, experience and sometimes also luck. All these are components which help managers to achieve requisite or sufficient holistic decisions, enabling them to take into account all the essential components and liaisons in the process of decision-making. Quality decisions are fruit of the systemic thinking, as is DNT and dedicated to the management complex problem solving. Quality decisions can be achieved by the system of aspects, which are:

- systemic (considering global characteristics, not being a part of each component) which are not part of each segment,
- systematic (considering the characteristics of the segments, details),
- dialectic (considering interdependence of the segments, which take them into liaison/and mutual influence and originating new characteristic, possessed by the whole and not by the segment),
- realistic/materialistic (as little simplification of the real picture as possible in comparison with the real characteristics / the least possible simplification of the reality).

2.1 Hierarchy and the process of the management decision-making

Everything in the nature, including humans, undergoes permanent changing, causing components interdependence. In the process of changing, one thing happens before another. The practice shows that the *preceding steps in the process are more influential than the later ones*. The examples can be found: in maths expressed by Markov's chain, in ecology by circulation, in organisations circulation, known from organisational cybernetics, etc. The same can be found when we speak about management decision-making, knowing hierarchy of superiority and inferiority of decisions. Higher levels define the goals of decisions, which are then realized by lower levels. Thus, actually the hierarchy of *sequences and inter-dependence* of (alternative) decisions and activities are important for their realization [8, 9]. According to the *laws on hierarchy of sequences and interdependence,* unfortunately not included in the methodology of network thinking (NT), in the working process and the related problem-solving the starting points are the most important. Human life practice and work process show that there are two (interdependent) subsystems of starting points processes. The first one proportionally does not depend on humans, therefore it is the objective part of the starting point, and the second is the subjective one, made of sensible and emotional parts – the personality's value priorities.

Managers, for example, do not have the task to enforce their will, but to act during the early phases of the process chain, e. g. to make decisions in case of many alternatives, too many data and messages (i. e. comprising clear data) and therefore, too little information (i. e. influential messages, satisfying information needs). Numerous interdependences should be taken into consideration, e. g. those between people on the same organizational-hierarchical level and those at different levels, and also those between the events, processes in the organization and its surroundings, otherwise we (maybe) have data, but we do not have (useful) information.

When there are several solutions or alternatives to the problem, it means that the same problem can be solved in different ways. The alternative is not only about that, that one decision can solve the problem, and the other not, but rather about different solutions which can, more or less successfully, solve the problem or prevent its origin.

3. CASE STUDY HOLISTIC THINKING APPROACH

The Post of Slovenia has a leading position in providing parcel services in Slovenia. In the last few years the Post of Slovenia has developed such parcel services that provide customers quick parcel delivery, sometimes even on the same day.

Because e-commerce is developing rapidly, the flow of parcels is increasing. This is the reason why Central European countries are reconstructing their postal services. The Post of Slovenia would also like to follow these efforts. This paper presents an approach to the reorganization of postal services, particularly as applicable to the Post of Slovenia.

In Slovenia two Postal Logistics Centers - PLCs have been opened in the last nine years. An evaluation of logistic costs has been made, considering two instead of only one PLC, based on the methodology of 0 - 1 programming of Bruns, Klose and Stahly [1]. We have to evaluate whether the two existing Postal Logistics Centers allocated in Slovenia already have optimal macro–locations of the required capacity and where to locate Regional hubs on the lower level among the nodes which pres-

ent Regional Parcel Centers. On the lower level new Parcel Posts (with short time depots) have to be established.

This problem is only a part of the logistic problems of the Slovenian postal network when trying to set up an optimal allocation of modern Postal Logistics Centers in the given 4-level hierarchical structure of regional central places in Slovenia. A verified model of spatial optimization by Bruns [1], developed for the Post of Switzerland, has been previously partly applied and extended to evaluate Slovenia's second Postal Logistics Center in Maribor [5]. Here the results of Bruns [1]: Restructuring of Swiss Parcel Delivery Services that are based on the 0 - 1 programming have been used.

As in Switzerland, the problem of postal hub location has been studied also in some other Central European countries. Transportation network for parcel delivery service in Austria is described in the paper of Wasner and Zapfel [13], where an integrated multi--depot hub-location vehicle routing model for network planning of parcel service in Austria is described in detail.

Ebery et al. [2] described the capacitated multiple allocation for the hub location problem. We are upgrading his approach to evaluate the flows between PLCs and Regional Parcel Centers - RPC patronizing the given set of Parcel Posts - PP. In our approach the number of chosen PPs and RPCs has its upper limit and is chosen among the existing Posts. It depends on the volume of the parcel flow coming from or going to a certain RPC per day. The economy of scale achieved by the 4-level structuring of hubs in central places of different levels as nodes is analyzed for the case of the Post of Slovenia delivery service with the extension of the results of Ebery et al. [2].

In Slovenia there are 557 Posts. The flows of parcels are directed from a Post to a Post until the truck is fully loaded and then sent to the PLC Ljubljana or the PLC Maribor and back.

As a rule each postal mail is transported at least twice; once from the Post office of receipt to the PLC and the second time from the PLC to the addressee's Post.

There are different ways of transporting parcels as shown in Figure 1:

- Transport of parcels from the Post office to the PLC;
- From the PLC (Ljubljana or Maribor) to another PLC (Maribor or Ljubljana);
- From the PLC to the Post office;
- From one Post office to another;
- From Slovenia to foreign countries and back (Austria, Italia and Croatia).

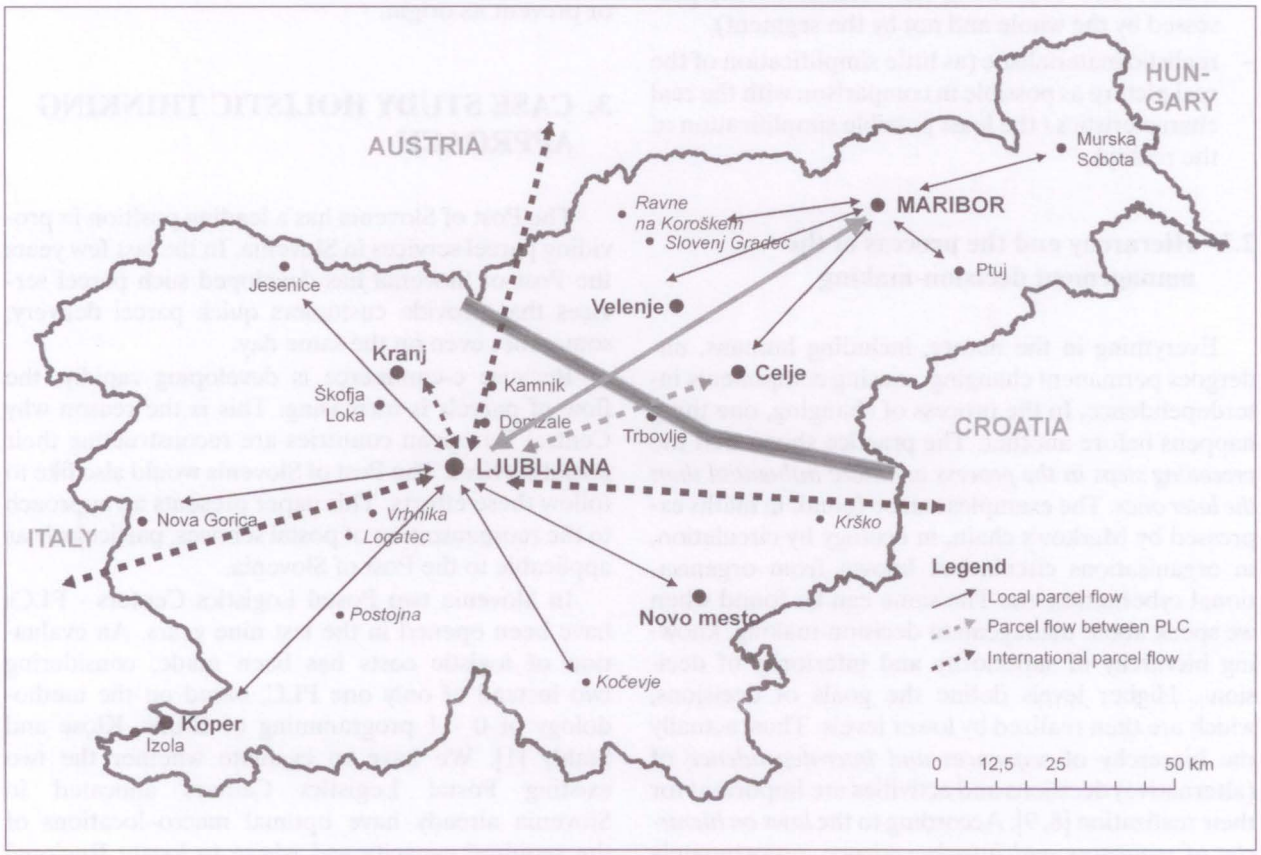

Figure 1 - The parcel flows in Slovenia

4. REGIONAL PARCEL CENTERS AND PARCEL POSTS

E-commerce influences the increase of parcel services and in the number of parcels all over the world. How can this demand be addressed properly? New technologies and a modern organization of postal services could improve the design of postal systems and especially the logistics of these systems. By using basic approaches of the graph theory we can improve the solutions concerning the hub location problem by using the model called Multi hierarchical hub location model combined with the vehicle routing problem on a special way.

A postal hub is a special type of central facility, which can act as a transshipment point in postal transportation systems with many origins and destinations.

Given a collection of Posts and the cost of traveling between them, the Traveling Salesman Problem is to find the cheapest way of visiting all the activity nodes and returning to the starting point.

The basic problems are [6]:

1. to determine the optimal number of Posts as hubs patronizing separate areas (Regional Parcel Centers), and to determine the location and the size of hubs;
2. to determine the optimal fixed locations of Postal Logistics Centers, patronizing Regional Parcel Centers, location of Regional Parcel Centers, patronizing Parcel Posts and Parcel Posts patronizing area of inhabitants.

In all Posts we need to achieve:

- an effective collection and sorting of parcels;
- a reliable delivery;
- an effective transport.

The total sum of logistic costs of parcel services should be minimal, often under certain capacity constraints.

A short mathematical formalization of the problem is as follows:

$$\min \sum_i \sum_j \sum_l \sum_m \sum_k w_{ij} c_{ijlmk} x_{ijlmk} + \sum_l f_l z_l + \sum_m f_m u_m + \sum_k f_k y_k \quad (1)$$

Subject to:

1. There being only one-way from v_i to v_j:

$$\sum_l \sum_m \sum_k x_{ijlmk} = 1 \quad (2)$$

2. The intensity of the flow from v_i to v_j through the node does not exceed the capacity of nodes:

$$\sum_i \sum_j w_{ij} \sum_l x_{ijl} \le \gamma_l y_l \quad (3)$$

$$\sum_i \sum_j w_{ij} \sum_m x_{ijm} \le \gamma_m y_m \quad (4)$$

$$\sum_i \sum_j w_{ij} \sum_k x_{ijk} \le \gamma_k y_k \quad (5)$$

When the value of the variable x_{ijlmk} is between 0 and 1, x_{ijlmk} denotes the fraction of the daily flow of parcels that travel from Post v_i to Post v_j. c_{ijlmk} is the cost of sending one unit of traffic flow.

Decision variables are as follows:

w_{ij} – the volume of the associated traffic stream of parcels;

f_k – the daily fixed cost associated with the operation of Postal Logistics Center at a node v_k;

f_m – the daily fixed cost associated with the operation of Regional Parcel Center at a node v_m;

f_l – the daily fixed cost associated with the operation of Parcel Post at a node v_l;

γ_k – the capacity of Postal Logistics Center at a node v_k;

γ_m – the capacity of Regional Parcel Center at a node v_m;

γ_l – the capacity of Parcel Post at a node v_l.

Variable z_l is defined by:

$$z_l = \begin{cases} 1, \text{ if node } l \text{ is a Parcel Post} \\ 0, \text{ otherwise} \end{cases} \quad (6)$$

Variable u_m is defined by:

$$u_m = \begin{cases} 1, \text{ if node } m \text{ is a Regional Parcel Center} \\ 0, \text{ otherwise} \end{cases} \quad (7)$$

Variable y_k is defined by:

$$y_k = \begin{cases} 1, \text{ if node } k \text{ is a Postal Logistics Center} \\ 0, \text{ otherwise} \end{cases} \quad (8)$$

The Posts on the level of local communities, patronizing a certain area, have to be assigned to the proper Parcel Post. The results by Wolfler Calvo [14] on the lower level (from Parcel Post to Posts) are being used.

A transport network has to be built which connects Posts, Parcel Posts, Regional Parcel Centers and Postal Logistics Centers, where the costs of daily transshipment of parcels would be minimal.

We used the data of parcel volume from March 2005 from the Post of Slovenia as presented in Table 1 and optimized the hierarchical structure for picking, processing and delivery of parcels from a Post to a Post.

In our study the decision variables are limited (as follows) and the hierarchy could be the following:

- one or two Postal Logistics Centers;
- eight or fewer Regional Parcel Centers, each of them consisting of three to twelve Parcel Posts;
- the Parcel Posts should cover twenty or fewer Posts.

This heuristic reduces the problem of dimension.

Table 1 - The average number of delivered parcels between regions (table of using data)

Region	Ljubljana	Maribor	Celje	Kranj	Nova Gorica	Koper	Novo mesto	Murska Sobota	Total
Ljubljana	1,732	1,777	1,047	813	504	627	800	423	7,723
Maribor	2,277			857	535	449	708		4,825
Celje	320			151	92	88	150		801
Kranj	378	324	164	155	149	112	178	64	1,524
Nova Gorica	304	192	150	127	96	120	110	47	1,147
Koper	312	185	137	104	66	101	95	53	1,052
Novo mesto	269	210	139	111	68	78	118	50	1,042
Murska Sobota	73			28	15	21	40		177
Total	5,665	2,686	1,636	2,347	1,526	1,597	2,198	636	18,291

The optimal structure of Regional Parcel Centers in the area covered by the Postal Logistics Center Ljubljana is as follows:

- **1002 Ljubljana** and the Parcel Posts: 1380 Cerknica, 1230 Domžale, 1290 Grosuplje, 1241 Kamnik, 1330 Kočevje, 1270 Litija, 1370 Logatec, 1215 Medvode, 1310 Ribnica, 1420 Trbovlje, 1360 Vrhnika, 1410 Zagorje ob Savi;
- **4101 Kranj** and the Parcel Posts: 4270 Jesenice, 4240 Radovljica, 4220 Škofja Loka, 4290 Tržič;
- **5102 Nova Gorica** and the Parcel Posts: 5270 Ajdovščina, 5280 Idrija, 5220 Tolmin;
- **6104 Koper** and Parcel Posts: 6251 Ilirska Bistrica, 6320 Portorož, 6230 Postojna, 6210 Sežana and
- **8101 Novo mesto** and the Parcel Posts: 8250 Brežice, 8340 Črnomelj 8270 Krško, 8290 Sevnica and 8210 Trebnje.

Figure 2 presents the optimal transport structure of combinatorial programming for the area covered by the Ljubljana PLC by using different vehicles (carrying from 75 parcels to 1200 parcels). With a new trans-

Figure 2 - Regional Parcel Centres in Slovenia and Parcel Posts in the territory of Postal Logistics Centre Ljubljana

portation structure of sorting out and the retaining of parcels in the Posts, Parcel Posts and Regional Parcel Centers within their individual areas we can reduce the transportation costs by more than 20 per cent.

5. CONCLUSION

In today's business environment there is constant need for technical, technological and organizational adaptations in order to increase the system efficiency. Planning includes among other things the adaptation of the existing processes and organizational solutions of postal operators, optimization of postal systems, traffic systems, and the transport technology included in the overall logistics system. Determining of the location relies on a variety of qualitative and quantitative factors, as well as expert knowledge from specialists in this area. The creators, i. e. bearers of the development strategy have to be ready to take over the responsibility for the consequences of the made decisions. Quality, holistic management decision-making, creates competitive advantages and can be proved by a practical example (Post of Slovenia) of decision-making. Great importance of high-quality, timely and sufficient holistic information, is presented through the case study of distribution of parcel delivery for the area covered by the Postal Logistics Centre Ljubljana.

Based on the gathered data on the intensity of parcel items, a simulation has been carried out and a solution has been suggested for the reorganization of the structure of delivery centres. The obtained results of optimal network structure indicate the reduction of the total transportation distances by 32 per cent. When considering the total logistics costs, the reduction amounts to more than 20 per cent with the new transportation structure of sorting out and the retaining of parcels using Regional Parcel Centres and Parcel Posts.

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POVZETEK

CELOVITOST RAZMIŠLJANJA: PRIMER APLIKACIJE POŠTNE MREŽE V SLOVENIJI

Sodobna kompleksnost menedžmenta je povezana s sprejemanjem (bolj ali manj) pomembnih odločitev. Te so posledica velikega, mnogokrat (žal) neuporabnega števila informacij. Njihovo selekcioniranje – izbor samo tistih kakovostnih, bistvenih za konkretno problematiko menedžerskega odločanja – je velik problem. Pri tem lahko pomaga sistemski pristop oziroma dialektično-sistemsko razmišljanje (DNT). Članek predstavlja celovitost razmišljanja v primeru aplikacije poštne mreže paketnih pošiljk v Sloveniji. Število paketnih pošiljk na Pošti Slovenije skokovito narašča, zato je potrebna reorganizacija poštne mreže. Članek prestavlja reorganizacijo paketnih storitev med poštnimi logističnimi centri in poštami z uvedbo regijskih paketnih centrov in paketnih pošt. Podan je primer za območje pokrivanja Poštnega logističnega centra Ljubljana, ki vključuje ločevanje in izločanje pošiljk na poštah, paketnih poštah in regijskih paketnih centrih za lastna območja.

KLJUČNE BESEDE

sistemsko razmišljanje, dialektično omrežno razmišljanje, menedžment, logistika, poštne storitve, poštna dostava

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