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Territorial examination of the logistics processes of enterprises

Abstract

The position of small and medium-sized enterprises in Zala County develops peculiar to the situation in Hungary. The location of the county is not bad because there are five capitals within a radius of 250 kilometres. This central position and the small distances is much appreciated in logistics, especially in the case of local companies. The above fact also has a significant impact on the logistics processes of SMEs, many of which are closely linked to these companies, either as suppliers or as service providers. The county administration is aware of these favourable qualities, and in recent years significant developments have begun in the county council. Our entire research is related to micro-, small- and medium-sized enterprises in Zala County, especially service providers. Our research explores and models the logistics processes connected to the service providers. The analysis is performed with a generalised simulation model. In the framework of our study, we attempt to find the bottleneck to make the previously mentioned processes more efficient. The article also includes a literature review of the modelling of the problem and the logistics processes related to service provider companies. We are also going to present the results of the database-processing related to the topic. In conclusion, we wish to show how service companies have evolved in the local context and how the management of their logistics operations has changed.

Keywords: logistics processes, simulation, SMEs, provider of logistics, Zala county

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Introduction

The situation of small and medium-sized enterprises in Zala County has been developing uniquely compared to the average Hungarian circumstances. The county's conditions are not adverse at all, as there are five capitals within a radius of 250 kilometres. This central position and the short distance from the capitals help local companies to develop their logistic role. This fact also has a significant impact on the logistics processes of SMEs, many of which are closely linked to these companies, either as suppliers or service providers. The county leadership has also recognised these advantages, and in recent years major developments have begun in the county.

The logistics processes related to small and medium-sized enterprises in the county have developed in a particular way – based on the previously mentioned trends –, which led to the idea that these processes should be analysed and critical points should be uncovered. Our entire research focuses on small and medium-sized enterprises in Zala County, with special attention given to service providers. In the framework of our research, we attempt to identify and model the logistic processes connected to service providers, in a simulation model analysis. As part of the research, we plan to identify bottlenecks to make processes more efficient.

As preliminary steps, we reviewed the literature required for modelling the problem and also the literature on the logistics processes related to service companies. We also considered methodological possibilities related to the research. In this paper, we would like to present our findings and methodological options for the modelling.

We included in our research manufacturing companies and service providers, among them small and medium-sized enterprises. The analysis and development of logistics processes are the common task of logistics experts, and thanks to the discipline, they play an important role in supply chains and business competition. We have mainly equipment manufacturers in our region where most of the production processes are previously defined so they can rarely be changed or modified on site. The requirements of logistics service processes are more complicated than production processes, so their analysis is also more complex (Bednar et al. 2015; Estók 2007; Kot–Dima 2013; Kovács–Kot 2016; Macal–North 2006). However, the structure of these processes can be customised locally, specifically for businesses, so there are more possibilities for optimisation.

In the world's largest economies, the dominance of the service sector is growing, according to statistics provided by OECD and World Bank databases. The service sector is responsible for more than 63% of the world's GDP and is even higher in countries with higher GDP (over 75%) (Kása et al. 2014). So, the concept of reorganising inoperable business processes is still with us in this century, but generally, more sophisticated tools and methods are needed (Kása et al. 2014).

Zala County, as the target-location of the research and its macroeconomic environment

A brief introduction to Zala County: It is located in the southwestern part of Transdanubia. Veszprém County borders it from the east, Somogy from the south, Vas from the north and Croatia and Slovenia from the west. Besides Győr-Moson-Sopron and Vas County, Zala is the third county in the Western-Transdanubian Region. The changes in population are shown in *Table 1*. The population, which has been decreasing above the national average, was 277,290 according to 2015 data.

Table 1: *The population of Zala County* (KSH)

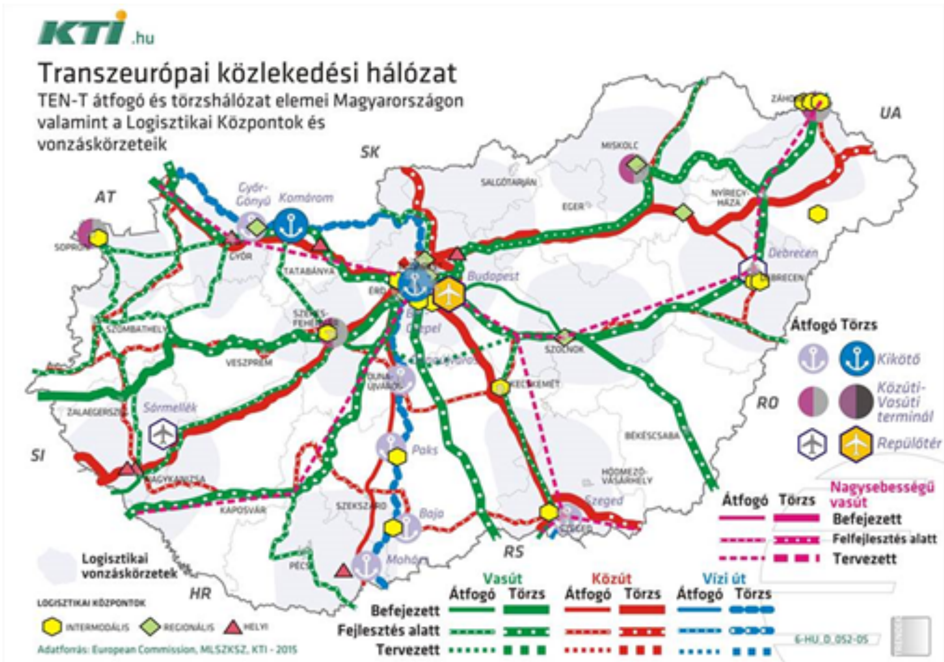
Year	Population
1980	317 298
1990	306 398
2001	297 404
2011	282 179
2015	277 290

The late 1980s and early 1990s brought a change in the economic life of the county, which stabilised in the early 2000s. Still, the economic crisis that began in 2008 led to a significant reduction in the capacity of several more substantial companies.

However, characteristic features of the county are favourable. Croatia and Slovenia directly border it, and Austria is also close by. Five capitals are within a radius of 250 kilometres.

The road section of the TEN-T network, V corridor, passes west to east through Hungary; the V corridor is an integral part of the M7 and the M70 motorways passing through the county (*Charts 1* and *2*). There are several ports with international traffic nearby, such as Fiume (Rijeka), Koper, or Trieste, from which North Sea ports can be reached. (The medium-term plan is M9.) There are several lines of the national railway network running through the county (Budapest, Pécs, Szombathely).

Figure 1: *Elements of the Trans-European Transport Network in Hungary*



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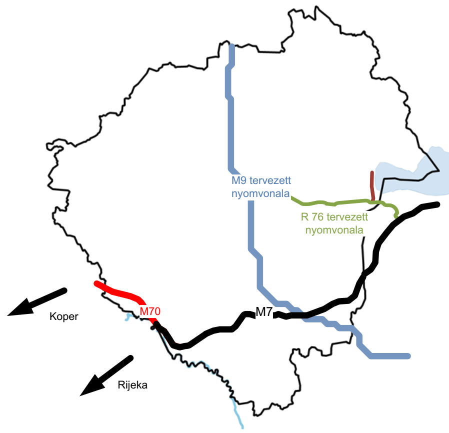
The 2013 Territorial Development Concept of Zala County emphasised – based on previous research – that Zala County is not easily accessible. However, as a result of the M7 motorway and the Hungarian-Croatian-Slovenian expressway network development, a logistic zone can be established along the Hungarian-Croatian-Slovenian borders (e. g. the logistics base of the Müller supply chain), where premises in the Letenye and Nagykanizsa regions could compete with the neighbour countries.

It is noteworthy that logistics weighs significantly in the economy of Zalaegerszeg, even though its geographic location and transport connections do not seem to be ideal for it. Combined freight transport is not significant. In Nagykanizsa, these conditions have been established, but current market circumstances do not require such services.

Developments in the county will strengthen the logistic role of both Zalaegerszeg and its surrounding areas, and, likely, these investments will significantly develop the region's role in the supply chain.

Figure 2: *Major international roads in Zala County*



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The passing through of a large part of the east-west transit traffic of Europe can result in a significant economic advantage. The European Union places the micro-regions of individual countries into a unified economic community and a joint region. There are many development opportunities in the field of additional services, which would provide economic and financial benefits. As regards commodity traffic, Zala County can be a vital road link between seaports and Central Europe. The Sármellék airport offers an opportunity for air cargo transportation, which in today's world, where lead times are an increasingly important factor, can be of central importance (Szabó 2017).

Table 2: *Companies providing logistics services in Zala County*

TEAOR number	Number of the companies
52 Warehousing and ancillary activities	80
521 Warehousing and storage	8
5210 Warehousing and storage	8
522 Supplementary transport activity	72
5221 Land transport service	14
5222 Water transport service	1
5223 Air transport service	2
5224 Cargo Handling	10
5229 Other supplementary service of transport	45

31/12/2012, KSH

We consider the geographical position a factor in competitiveness, but we must emphasise that this can only be exploited if there are high added value logistics services.

Table 2 lists the logistics service providers.

Literature review

For the analysis of the local companies' logistics processes and the identification of the bottleneck, we have to model current processes. For effective modelling, we have reviewed the literature to apply the best solutions in the research. The every-day logistics processes of businesses – as the main processes in the supply chain – create highly complex multi-factor systems (Velychko 2015).

If we research the production processes within the manufacturing business, we find that analysing and developing them is the joint responsibility of logistics and production professionals. Thanks to this, logistics is now a common task and plays a vital role in both supply chains and business competition. In the case of service logistics processes, we can witness the same thing; the only difference is that these processes are even more complex, so their analysis is also more complicated (Bednar 2015; Kot–Dima 2013; Macal–North 2006).

The authors, Kása and Gubán reviewed the relevant literature extensively in 2015. This literature review suggests that many techniques and methods are available to improve the logistics and business processes of businesses. All of them are based on the BPR (Business Process Re-engineering) concept. With the help of BPR, a process structure plan can be created. Subsequently, significant changes take place for better performance and a more harmonious process structure. BPA (Business Process Alleviation) on the other hand, describes the logistic structure of the process.

The research method

Complex systems can be analysed by using models. We can get much more information about the characteristics, operation and behaviour of an existing system and the connecting processes if analysed and studied using an appropriate model. It also has the added advantages that it is cheaper than testing a real system, and it is safer because the system can work in parallel with the model.

These systems are typically influenced by the technology, the availability of the infrastructure, the traffic, but also by the weather and other ad hoc factors. Although the problem is multi-factorial, and we often talk about systems that are difficult to predict, it is worth focusing on their simulation. One of the main reasons for this is that, based on the experience of the last decades, a significant competitive advantage can be achieved by increasing the efficiency of logistics processes.

For process analysis, we need a modelling tool which provides a system that accurately describes the processes, and it is operating in real-time. It should also be cheap and provide precise results. Previous studies proved that these processes should only be examined at the model level without interfering in the real system. Many of the previously studied modelling solutions are useful, and in our research, we wish to follow in the footsteps of these examples (Gubán 2015; Gubán–Kovács 2017).

Based on the examples available in the literature, we chose mathematical modelling to map and describe the problem. The reason for this is simple: this tool can easily describe logical relationships, it can clearly distinguish the recorded and unknown data, while the mathematical toolbox and the descriptive tool are also evident. Furthermore, it is easier to build a computing model for a mathematical model, which can support later research.

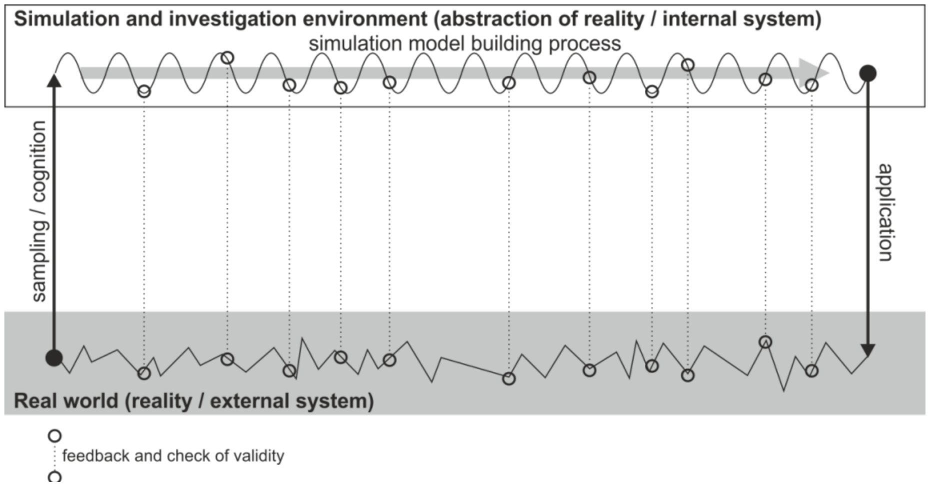
Mathematical modelling is, by all means, not easy. The model has to be sufficiently detailed, but not too detailed because it could easily impair the transparency and the possibilities of analysis. It automatically follows from this that the decomposing of the activities into elementary activities is – one might say – arbitrary. In any case, it requires meticulous economic consideration (Gubán 2015).

Successful models can be found in the following studies: (Dolezal et al. 2015; Kása et al. 2014; Kása–Gubán 2015; Pawlewski–Greenwood 2014).

Understanding the characteristics, operation, and behaviour of the systems and processes we are analysing is not easy due to their complexity. Without optimal process structures, the economy can no longer function efficiently, and to find the right solutions is mainly the process designers' responsibility (Sterman 2000). The aim is to increase the efficiency of production and service, which can be achieved by changing the values of the parameters and analysing the results obtained. There are many tools for the planning, analysing and development of logistics processes (Bednar–Modrak 2015).

Service providers and companies determine the characteristics and requirements of each area, following an overall analysis. Then the general facts, axioms and mathematic formulas are defined.

3. Figure: *The model and reality*



Gubán–Hua (2014)

The model and the task connected to the model are twofold. The model describes a "world" and the task, and its solution are used to answer questions related to the "world" through conclusions and calculations. The literature suggests various methods to solve the task related to the model. For our model, the best solution was simulation analysis, because there are many connected elements which are not deterministic in this case. The simulation model "analyses" the complex system by simulating its behaviour. Due to the structure of the model, it only considers the essential elements of the complex system, so it is much simpler than a real system (Law–Kelton 2000).

Simulation studies of logistics processes are presented in several publications with their successful applications (Grabara et al. 2013; Gubán et al. 2017; Grigoryev 2016; Kovács–Kot 2016; Pawlewski–Greenwood 2014; Kovács–Tamás 2015; Merkuryev et al. 2009).

Simulation is an analytical tool associated with a simulation model by representing existing or non-existing systems. Today it is one of the most widespread decision-making tools (Tecnomatix documentation 2010).

Based on VDI (Verein Deutscher Ingenieure, German Engineers Accossiation) guideline 3633, simulation is an emulation of a system and its dynamic processes in a model on which we can experiment. It aims to achieve results that can be transferred to real systems. In addition, within a simulation model, simulation determines the preparation, execution, and evaluation of carefully managed experiments (Tecnomatix documentation 2010).

The typical application fields of simulation are the following (Arató et al. 2016):

- planning and analysis of production or service processes,
- optimisation of supply chains,
- planning and analysis of transport systems, etc.

The most common application field of simulation software is the analysis of manufacturing and service processes because of the following trends:

- production and service activities are very complex stochastic processes,
- customer needs change very quickly, which results in the followings;
  - a shift in production/service volume,
  - changing the version of the product/service, or
  - modifying the production/service processes
  - the pressure for continuous cost reduction and efficiency improvement requires the optimisation and development of production/service activities (see (Ślusarczyk 2014).

Simulation analysis of manufacturing and service processes is required in the case of:

- deterministic process of complex and large systems and processes;
- the stochastic process of systems and processes in which events are randomly influenced. These random events can be the following:
- machine/equipment operation problems,
- demolition of material flow machines,
- lack of equipment or human resources,
- lack of component supply (supplier or transport problems),
- faults in regulatory systems, etc.

The aim of the simulation analysis of production/service or logistics processes:

- elimination of errors in the implementation of new complex production systems or material flow systems,
- comparison of system versions
- analysis of deterministic and stochastic processes,
- ensuring the possibility for bottleneck analysis,

- optimisation of machine, process, and system parameters to increase efficiency,
- comparison of operational strategies,
- elimination of abnormal systems,
- analysis of system parameters and influence of parameters, etc.

Conclusion

In this present paper, we described the first phase of the research concerning the logistics processes of enterprises in Zala County.

From the characteristics of the county, it seems justified to map out the logistics processes of local businesses and point out their critical elements. First, we studied the literature and previous research within the field. The next step is going to be data acquisition because individual local data should be collected from multiple local databases. Therefore, we have focused primarily on methodological issues in this article. After the data acquisition, we plan to create a model that describes local processes on a high level. Mathematical modelling is common in logistics systems, and there are many good examples in this field. We have also chosen this method because the review of the literature proved it to be an effective tool. Software analysis and simulation are standard in the study of logistics systems. We will use this solution in our research too.

We have not set a simple research task for ourselves, but if we can answer the main questions, we will be able to suggest solutions.

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