# TRACK AND TRACE METHODS APPLIED BY LOGISTICS SERVICE PROVIDERS IN ZALA COUNTY

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***Abstract***

Material flow is a key element of logistics processes. During the flow of materials, the position of raw materials, parts, semi-finished products and products are changed. It travels different lengths of time during the movement of goods over a variable period of time. During production, it is very important to have the right elements at the right place at the right time and to be immediately informed of any changes at that location.

Similarly, it is a basic requirement today that during long distance transportation, especially when the goods stop in one place, because of waiting for the right vehicle, the user will be informed about the status of his goods.

The previous technical possibilities provided only limited possibilities for tracking the goods, but in today's conditions it is possible to tell exactly where the goods are.

In Zala County, companies and related logistics providers have developed methods for tracking goods according to local needs.

In this article we introduce logistics services and investigate the tracking methods used by service companies and by contacting service companies in Zala County and using the available databases.

**Keywords**: ICT, logistics service providers, Track and Trace, Zala County

### *Összefoglalás*

Az anyagáramlás a logisztikai folyamatok kulcseleme. A folyamat során megváltozik az alapanyagok, alkatrészek, félkész-termékek és végtermékek helyzete. Az anyagáramlás során az áru különböző időtartamokon mozog, valamint változó ideig. A gyártás során nagyon fontos, hogy a megfelelő elemek a megfelelő helyen, a megfelelő időben legyenek, és hogy azonnal értesüljünk a helyszínen bekövetkező változásokról. Ehhez hasonlóan ma már alapvető követelmény, hogy a távolsági szállítás során a felhasználó információt kapjon az áru állapotáról.

A korábbi műszaki megoldások csak korlátozott lehetőségeket jelentettek az áruk nyomon követésére, de a mai körülmények között pontosan meg lehet mondani, hol tartanak a félkész-, késztermékek az anyagáramban.

Zala megyében a vállalatok és a velük kapcsolatban álló logisztikai szolgáltatók számos módszert dolgoztak ki, amelyek az áruk helyi igények szerinti nyomon követését teszik lehetővé.

Ennek megfelelően a cikkben bemutatjuk a logisztikai szolgáltatásokat, valamint megvizsgáljuk a logisztikai szolgáltató cégek és kapcsolt vállalkozások által alkalmazott nyomkövetési módszereket a rendelkezésre álló adatbázisokon keresztül.

**Kulcsszavak**: ICT, logisztikai szolgáltatók, Track and Trace, Zala megye

## *Introduction*

Since the middle of the decade, the intensifying competition has been constantly pushing business organizations to stand the test in the most efficient, quick and innovative way. Compared to the past, the goal is not only to maintain certain market positions, but to reach and expand them.

Today's production environment is characterized by low serial numbers, unique products, and great variety. That requires a special production environment. Sales orders change stochastically not only in terms of order quantities, but often also in terms of timing and composition. The direct consequence of it is that the programmability of production becomes more difficult, and the uncertainties of supply increases in this environment, while the value of in-process stocks, as well as raw materials or finished goods, remains high, even if quantity indicators do not change. Only creative, innovation-oriented behaviour can play a key role in this situation as observed by Kerepeszki et al. (2010).

The competitiveness of a company is basically determined by four factors of equal value: the quality, the price, and the turnaround time related to availability, as well as the customer service quality. Logistics, which assists companies with a high level of organization of physical flow processes and their ancillary and ancillary functions to ensure competitiveness, has now become a major concept in international business and, with some delay in scientific research, has been the focus of interest for the last one and a half or two decades. Despite this, most companies still tend to look at specific areas of operation, the resources required for their activities separately, in a traditional approach. To this end, such companies tend to formulate partial goals, particularly with regard to factors such as capacity utilization, inventory management, or productivity. The problem is that this approach does not treat the company as a single structure, but as the sum of its parts, without considering the interactions between the individual functional elements as observed by Halászné (1998).

To become effective performers in today's business world, business organizations need to use the tools and approaches of system theory to knowledge and understand their operating environment. In this way, in a broader sense, even the most complex phenomena for traditional analytical thinking are easier to interpret, modelling the system (company) you want to know can be done, which makes corporate processes transparent and integrates the operation of the company as a whole into its environment.

The complexity of problems generally requires a system-based approach, also in the sense that logistics processes occur between and within systems.

The first step in enforcing this requirement is the adoption of a process-oriented approach in the company, by abandoning the principles of prior static thinking and action, assuming the logical interplay of individual functional process elements, thus serving a complete process system to achieve the objectives.

In this approach, the influence (increase or decrease) of partial performance and costs is realized only to the extent that the result of the intervention approaches the optimum of the whole process.

It is a basic requirement for a company that operates in the business of logistics to have the materials, tools, resources and relevant information at the right cost, time, place, quantity and quality at the right time.

To ensure this, it is necessary that:

• process-oriented, i.e. customer-oriented management philosophy,

• process optimization, i.e. complex system development and implementation of processes based on a system approach, and

• Process Management as a Comprehensive Management Technique to Transform Company Operations and Logistics Services Companies.

Nowadays, most of the logistics services are provided by these logistics providers, as companies outsource their logistics tasks to logistics providers. Their job is to provide quality and cost-effective (possibly optimal) service.

With all this in mind, and seeing the professional requirements of the time, the continuing evolution of supply chains, new tasks and activities are emerging, these expectations must be met by logistics providers.

Zala County has to face similar challenges. However, due to its location, the county has many special external circumstances. To meet these needs, many factors need to be examined and analyzed.

Compared to Győr - Moson - Sopron and Vas counties in the Western Transdanubian region, Zala county - typically - is much more restrained in investment activities, which clearly affects the activities of logistics providers. The central role of Győr is being counterbalanced by a Szombathely, Zalaegerszeg, and Nagykanizsa axis. This may lead to additional logistical needs, resulting in additional services or service providers.

In addition to economic factors, it is important to mention that Zala County is particularly well-qualified in the field of vocational training in logistics, since secondary education and master's degree programs are available in various institutions, and continuous supply of professionals should not be a problem for businesses.

The current research focuses on Zala County, but in the future it would be worthwhile to do similar research for the neighbouring counties and related regions of the neighbouring countries. This is all the more important because Croatia's accession to the EU has brought about changes in the services market. As a result, Croatian ports (in particular Rijeka) will be appreciated on the one hand, and rail access to the Slovenian Koper rail will be made easier as a result.

An important consideration is how the region can benefit from this, including the organization of directional trains and the operation of a container terminal, i.e. how to achieve the goal of stopping transit goods in the area. All of these justify Zala County's emphasis on logistics for regional functions, for which the construction of the M7 motorway has provided a good basis (although local expectations have not been justified), while the construction of the M9 expressway is a north- You can create a southbound traffic connection, avoiding Budapest.

## *Materials and Methods*

In case of the logistic services the theoretical model of the research is based on the definition of logistics what consists of flow of material and information. The research was methodologically cross sectional, but in two topic it also has longitudinal elements. It defined the questions of the research too. The research focused on the companies what provide logistics services in Zala county, we treated Zala County as the subject region of our investigation. The empirical analysis was appropriate to define the measure of the services and to the relation between them the correlation- and the variance analysis. To examine the common occurrence

of the services we carried out a cluster analysis. During the survey big part of the questionnaires were answered in electronic form using the Lime survey program. In few cases the questionnaires were answered on paper, according to the request of the companies. Beside the questionnaires we also made interviews, from them case studies were made to introduce the different forms of logistics services. For the statistical evaluation we used the PASW Statistics 18 and Microsoft Office Excel programs. During the research we contacted 121 enterprises, and we collected 64 totally answered questionnaires, and 53 of them was usable for this research.

## *Results and Discussion*

We completed a regional research oriented to the logistics service provider companies what offer services in Zala County. On the basis of the questionnaires, we had several markable and useful results which contributed to the learning of the topic.

### *Logistic services*

We have used the term logistics service several times before. Indeed, logistics services have now become a commonplace concept. However, it is important to clarify and interpret this concept a little. First question, what do we mean by service?

Hereinafter, logistics services are services that are directly or indirectly related to the implementation of logistics processes. There are two main options for developing commercial logistics services:

1. Logistics solutions implemented at any stage of the product chain in its own development.

2. Recruitment of logistics service providers. In this case, many operations that were previously part of the production, sales, processing are removed from the company. Both solutions have their advantages and dangers. (Tátrai, 2010).

Today, shipments flow through a network of services operated by logistics providers. (Ishfaq, 2012). Cooperation between manufacturers and external logistics providers has become an essential part of day-to-day work in industry and commerce. This cooperation can be

traditionally narrow or extensive, targeting complex logistics services. The services used can be divided into two groups in terms of complexity:

• Simple,

• Complex.

Simple, low-level logistics services include: A to B shipping, customized storage to resolve bottlenecks, or simple external packaging. These services have long been used.

Complex, high-level services focus on integrated activities. High-level logistics services consist of various types of logistics activities, including the coordination and management of these services. These include, for example, third party distribution, where the external partner performs transportation, warehousing, packaging, material handling, inventory management, and distribution resource planning. Logistics service centres are operated primarily by external service organizations (Kovács, 2004).

Services, even those that serve a large number of people, are always tailored to the individual needs of the user.

Serving each partner is unique and different. Service and consumer interact. (Kovács, 2001).

Successful deployment of Logistics Service Providers (LSPs) is based on building long-term relationships with customers. The way relationships between such companies are designed affects the success of logistics providers (Grawe et al., 2012). It is expected that the more intensive the cooperation between the partners, the greater the potential for strengthening in terms of savings and efficiency gains (Leitner et al., 2011).

Logistics services across national borders are particularly complex, not only due to increased distances and cost constraints, but also due to cultural and organizational circumstances that affect the usability of specific services offered to customers (Mentzer et al., 2004).

The logistics service industry worldwide will be affected by future developments. Therefore, the formulation of future scenarios is an important basis for developing long-term strategies. (von der Gracht and Darkow, 2011).

*The track and trace (TR)*

The track and trace can be interpreted in many ways. In this paper, we will use in the following way and we are going to define the concept in the line with the producing companies of Zala County.

Under track and trace, we mean the identification of the exact location of materials, parts, products involved in the material flow, from entering the process to leaving it. Through tracking, the spatial and temporal position of the material involved will be known during the whole process.

There are two types of tracking within the closed chain:

- Forward tracking
- Backwards tracking

The forward tracking usually follows the product's life which leads to the user; while the backward tracking is dealing with that the waste prodcuts when and where were made. The track and trace – of course – includes a type of identifiability. We discussed this in detail in a previous paper (Szabó et al., 2019).

In order to achieve the aims of the track and trace, it is necessary to define those data that is stored about products (summary name of raw material, auxiliary material, component, semi-finished product, finished product) involved in the material flow. These data must be connected to the products. Tracking requires the assignment of important parameters related to the flowing material. For example, for internal tracking, a product might have the following information:

- what materials and components were used in the product
- the date of production
- on what machine the product was made
- in which shift (s)
- by which tool (s) were made
- which people worked on it
- date and result of quality controlling
- storage information

- shipping information

On the ground of these information, both directions of tracking can be implemented. If a finished production order is subsequently found to have quality problems, then tracking provides itemized information about that, from the given order in which warehouse and where are still items, and where they have been already shipped. The other way is that, when quality problems are found at the point of use. In this case, we can trace back all manufacturing details of a given product, in order to find all similar (faulty) product packages.

*Analysis of track and trace methods in Zala County*

The scope of our analysis was the tracking methods applied in Zala County.

Almost the 70% (67.92%) of the surveyed companies applies tracking solutions in the field of logistics in some way, while more than 30% of the asked companies do not, which companies usually have a small customer base. From the 53 questionnaires completed, 43 provided meaningful answers arrived regarding the vehicle and product tracking. Respondents could select either product tracking or vehicle tracking, or both at the same time. At the 75 % of respondents, tracking included vehicle follow-up, while at the remaining 25% this meant product-track-and-trace.

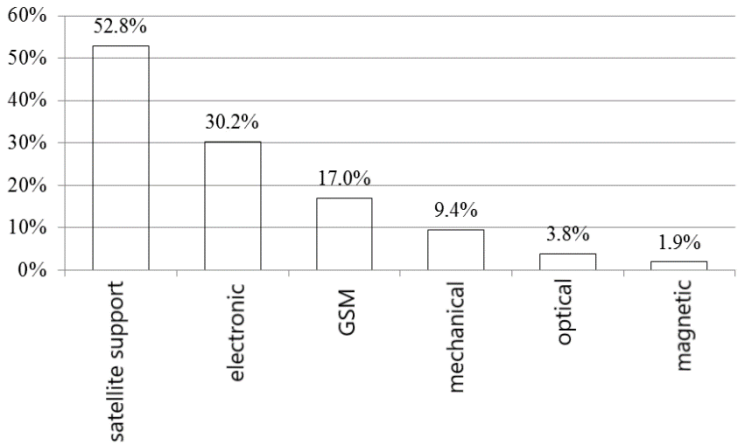


*Figure 1. Percentage distribution of the tracking principle (own editing)*

Taking into account the results of the 2004 research, it can be stated that the role of identification has increased, which is also visible from the number of solutions used. Over the last 10 years, satellite-based identification has become the most widespread solution, in which the decreasing price of the technology played a main role, but at the same time the 10 years ago used technologies also remained. In the following figure the percentage distribution of applied numbers in tracking technologies are visible, showed by the current research.

The remarks of the graph are the following:

0. Satellite supported
1. Electronic
2. GSM
3. Mechanical
4. Optical
5. Magnetic

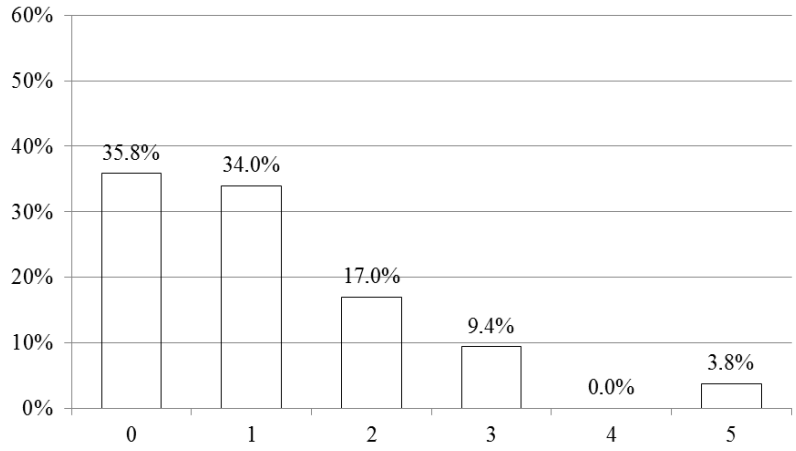


*Figure 2. Percentage distribution of applied tracking technologies (own editing)*

Almost the third of the surveyed businesses do not use any form of electronic identification, which is mainly due to the size of the small businesses in the sample. The other reason can be that the customer requirements do not make it obligatory everywhere. On the other hand, more than two thirds of respondents use one or more technology options. The increase in the number

of identifications may be related to the service structure provided. One respondent may have mentioned several technologies.

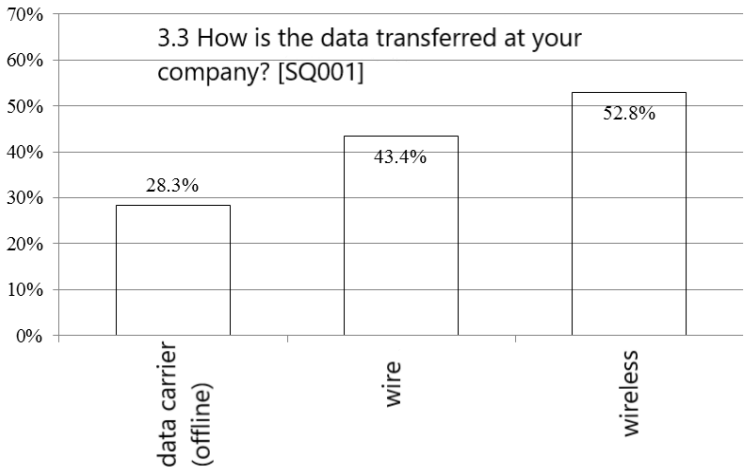


*Figure 3. Data transmission methods (own editing)*

The transmission of data at the surveyed companies is mostly via wireless (52.8%). It's clearly visible RF technology has already overtaken wired data transmission in this area.

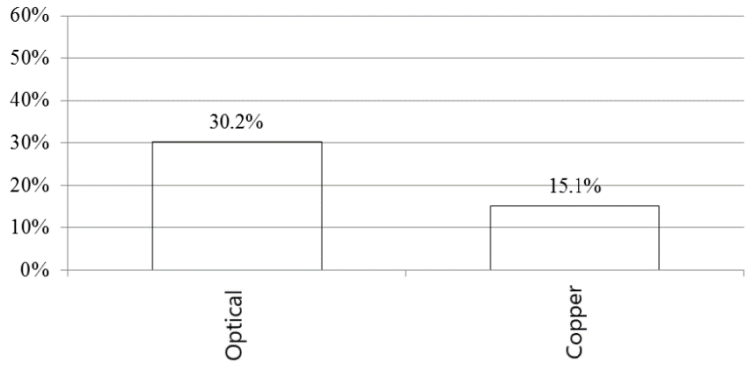


*Figure 4. Wire transmission methods (own editing)*

In both cases, optical transmission is the significant. The percentages of the bottom figure refer to the whole sample.

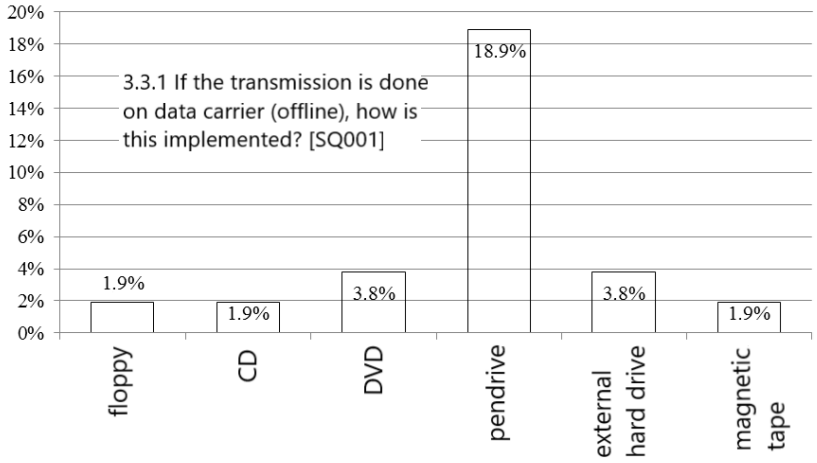


*Figure 5. The method of transmission on data media (offline) (own editing)*

As you can see, the most common way to transfer data offline is the USB stick. Floppy drive is completely getting out of reach, just like CDs and DVDs, many devices today only have USB connectivity and do not have an optical drive.

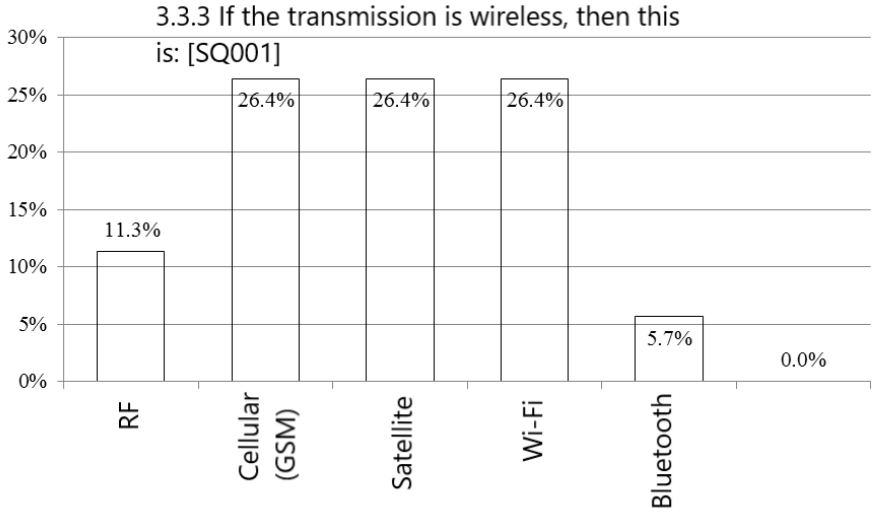


*Figure 6. Wireless transmission methods (own editing)*

For wireless transmission, cellular (GSM), satellite, WI-FI systems showed the same distribution in the sample.

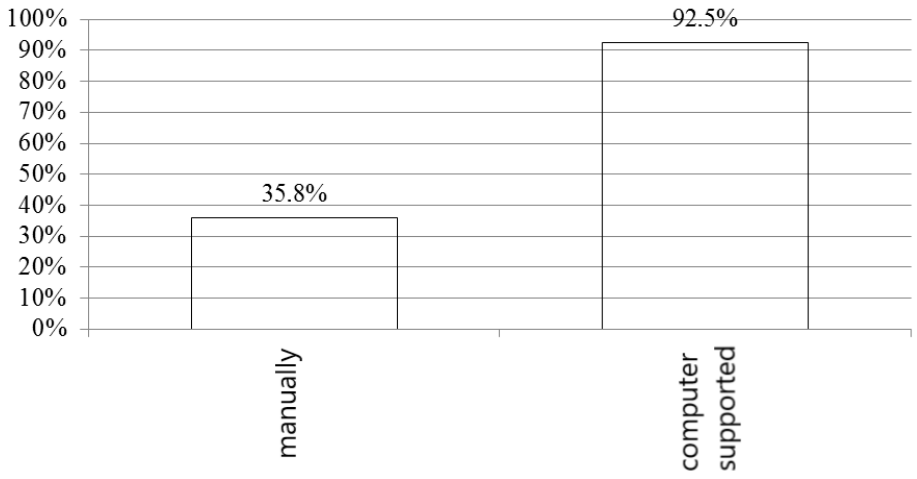


*Figure 7. Logistics data processing methods (own editing)*

We can see at the logistics data processing that in many cases paper-based processing takes place besides the electronic processing, which can be either the printing of a document at the end of the process after electronic processing or in a parallel time with the electronic process also.

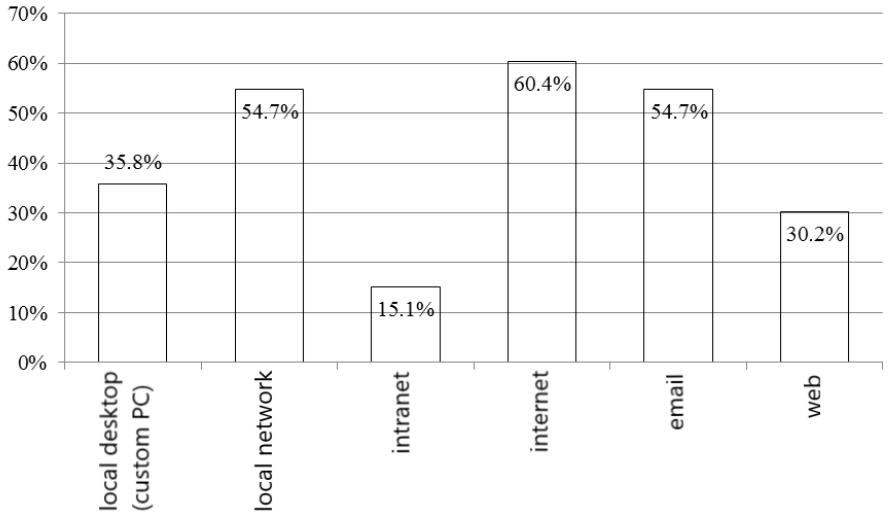


*Figure 8. Access to data methods (own editing)*

In terms of access to data, on one hand is visible that the role of the local network has also strengthened, while on the other hand we can see that the role of the Internet and email, along with web applications, has either increased significantly. Most part of companies applies multiple types of data access at the same time, which can be related to the "this kind of needs" of the business customers.

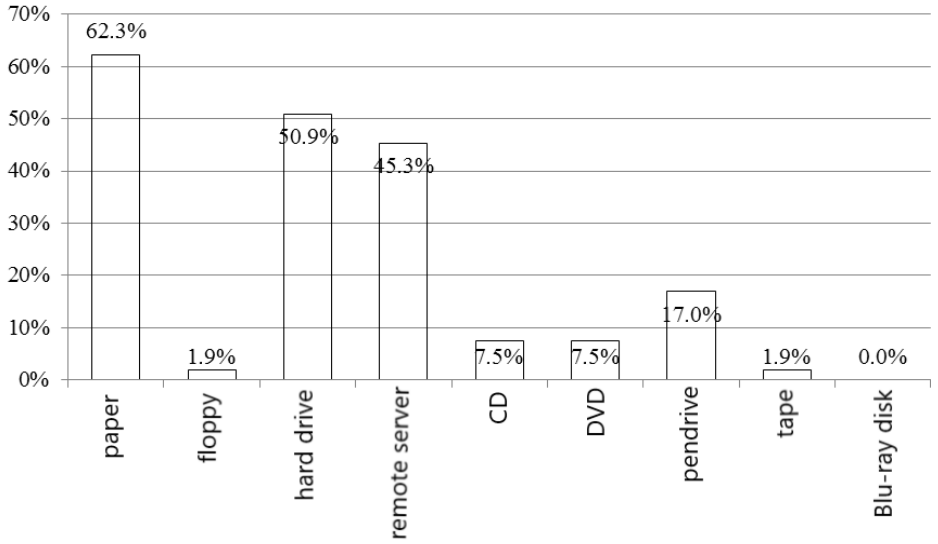


*Figure 9. Logistics data storing methods (own editing)*

At the logistics data storing, the rate of paper based storing is surprisingly high, due to the compulsion to complete the requirements of quality management systems used, companies consider traditional paper-based storage to be more reliable than electronic backup. It's visible on the graph that some technologies are disappearing e.g. floppy disks.

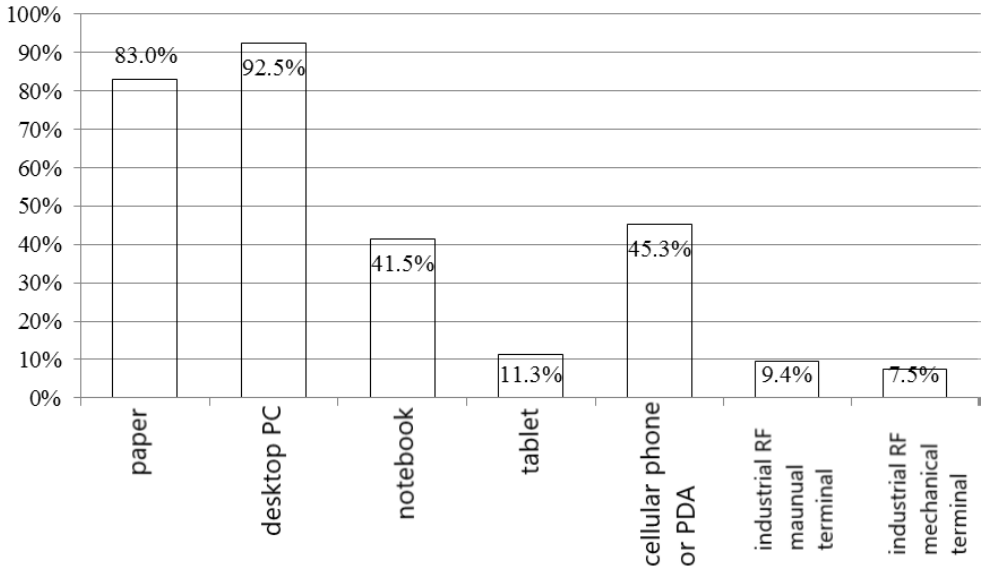


*Figure 10. Logistics data display methods (own editing)*

The projector was mentioned several times at the open question during the logistic display. New tools have become more widespread in this area as well, and it is noticeable in the chart that workers usually use more and more methods in this field.

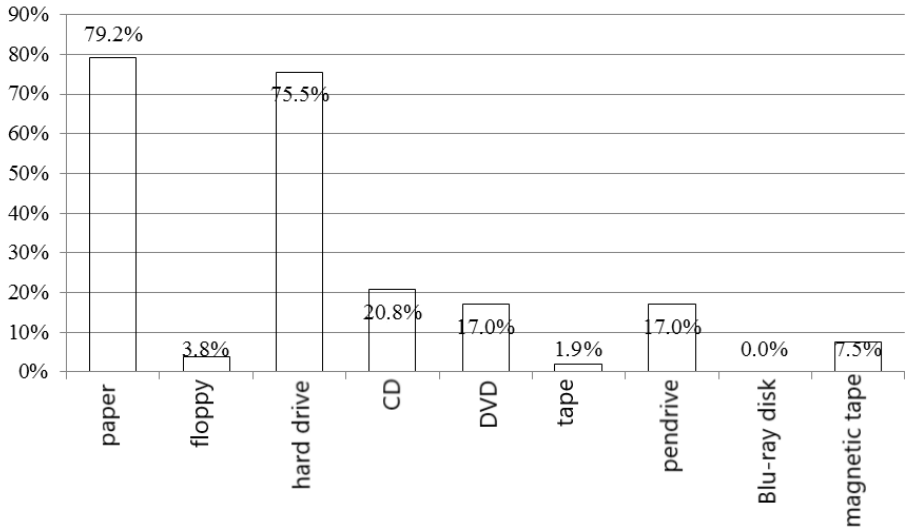


*Figure 11. Which way is logistics data archived? (own editing)*

At the data archiving, we have a similar situation than at the data storage.

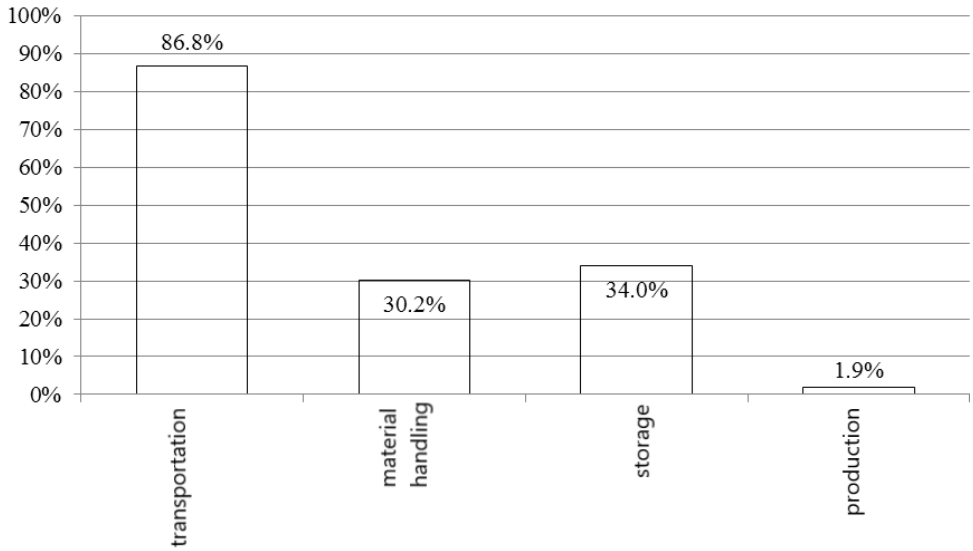


*Figure 12. In what logistics area are telematics solutions applied? (own editing)*

It can be seen that because of the new demands in the field of transport / transportation, the telematics applications increased in this territory the most. Usage of the EDI (Electronic Data Interchange) has fallen dramatically in the past 10 years, thanks to the appearance of new technologies that make it easier and in many cases faster to access.

During the 2004 research it was still around 45% (44.64%), while in the case of the current paper it's only 25% (24. 52%). 10 years ago, EDI was used by the supplier and the buyer side in 50-50% distribution, in the current research can't be seen any significant difference in this field. (There were only 1 more reply to supplier side) In this way, we can say that use-rate of EDI on the buyer and supplier side has not really changed.

We also made a variance-analysis at the ICT territory, where we were able to examine the data of two populations. At the analysis, the significance level of homogeneity is 0.281 and the significance level of variance-analysis is 0.273.

Table 1 shows a decline in the ICT attributes, which reason from one side is the incomplete overlap of the sample, the other might be that the businesses have become more cautious about IT investments.

*Table 1. Descriptive analysis for ICT attributes (own editing)*

**Descriptives**

ICT_features

| | N | Mean | Std. Deviation | Std. Error | 95% Confidence Interval for Mean | | Minimum | Maximum |
|---|---|---|---|---|---|---|---|---|
| | | | | | Lower Bound | Upper Bound | | |
| Past | 67 | 20.1791 | 16.07739 | 1.96417 | 16.2575 | 24.1007 | .00 | 65.00 |
| Present | 67 | 17.3433 | 13.65101 | 1.66774 | 14.0135 | 20.6730 | .00 | 49.00 |
| Total | 134 | 18.7612 | 14.92547 | 1.28936 | 16.2109 | 21.3115 | .00 | 65.00 |

*Table 2. Homogeneity of variance analysis for ICT attributes (own editing)*

**Test of Homogeneity of Variances**

ICT_features

| Levene Statistic | df1 | df2 | Sig. |
|---|---|---|---|
| 1.173 | 1 | 132 | .281 |

*Table 3. Variance-analysis (ANOVA) ICT attributes (own editing)*

| ANOVA | | | | | |
|---|---|---|---|---|---|
| ICT_features | | | | | |
| | Sum of Squares | df | Mean Square | F | Sig. |
| Between Groups | 269.403 | 1 | 269.403 | 1.211 | .273 |
| Within Groups | 29358.955 | 132 | 222.416 | | |
| Total | 29628.358 | 133 | | | |

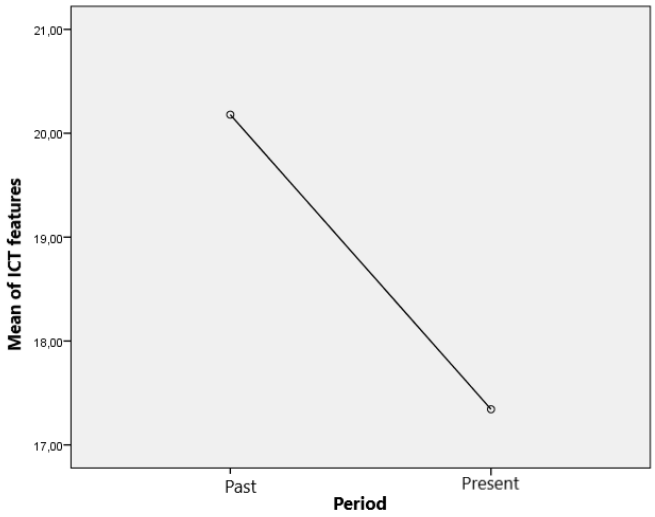


*Figure 13. Periodic distribution of ICT attributes (own editing)*

It can be stated that although it has been buried before, the barcode still remains. Experts do not yet see the end of the barcode era. In fact only one technology, the flexible disk, is considered to be gone. Its function has been taken over by several devices. To save the day's work, the flash drives, and for a longer period of work time, the hard drives took over the storage function.

However, in the field of ICT, it is especially true that the confusion of need, demand and necessity is a common mistake. In many case, the developers of new technologies believes in the in the obvious benefits of new product and in its rapid adoption but at the same time, the difficulties and pitfalls of creating a market pull shouldn’t be underestimated. (Pataki, 2014).

## *Conclusion*

Telematics applications are playing an increasingly important role in logistics, including tracking. This development is based primarily on consumer expectations. Supply chain actors want real-time and as accurate as possible information about the product, the service, and the services combined with the product. Actually, the driving force behind innovation in telematics lies in preserving the market competitiveness. ICT costs are only one question at the collaboration between mid-sized and high-turnover companies. The administrative burden of managing collaborative transactions can be too big to handle over phone and fax, but cannot justify investing in an Electronic Data Interchange (EDI) system or a sophisticated web-based exchange system, because only the cooperation doesn't make it economic (Cruijssen et al. 2007). The surveyed companies not only have recognized the benefits and importance of telematics, but without these solutions, it is difficult for them to remain even competitive. While 10 years ago, when they were only "trying" the possibility of telematics in logistics, now, they are an integral part of the day-to-day routine of the surveyed companies. In the field of logistics telematics, mobile applications have become a daily routine as well, and instead of isolated solutions, usage at the whole-enterprise level got typical. Here, we need to consider the transition from EAN European standards to RFID-EPC standards, which will have to be implemented on the ground of the following process by 2018 in connection with the consumer goods (load unit):

- marketing management,
- product range handling (controlling),
- inventory stock management (tracking) (Georgjević, 2011).

At the beginning of the research in 2013, the cloud based computing solutions were not included in the questionnaire, but since then, we can say that the use of this solutions are growing significantly in the logistics and transportation services sector. The main reason behind this progress is that the cloud based solutions provides such possibilities to logistics service providers, with which they can efficiently organize and execute the basic product handling, transportation, freight forwarding and customs clearance, warehousing, distribution and other value-added services (Subramanian et al., 2014). The integration of cloud based computing solutions not only makes possible to develop the logistics services through optimized

utilization, reduced idle time, improved throughput, reduced operating costs, but also provides important benefits for logistics providers such as integrated promotion and customer relationship management (Subramanian et al., 2014). In the future, this can be a new research direction.

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