VÉDELEM TUDOMÁNY
KATASZTRÓFAVÉDELMI ONLINE TUDOMÁNYOS FOLYÓIRAT

Kiss Ádám István

POSSIBILITIES OF DEVELOPMENT OF ASSET REGISTER OF PROFESSIONAL DISASTER MANAGEMENT DEVICE

Abstract

The professional disaster management body is obliged to inventory its supplies and assets in accordance with the provisions of the Act on Accounting. The current inventory process is time-consuming, the people taking inventory spend several days with it in addition to performing their basic tasks. In the present publication, the author describes the Radio Frequency IDentification [RFID] technology and shows that if it is used, the process can be made more economical, and the relatively high initial investment costs are repaid.

Keywords: asset register, RFID, logisztics, stock-taking, disaster management

A HIVATÁSOS KATASZTRÓFAVÉDELMI SZERV ESZKÖZNYILVÁNTARTÁSÁNAK FEJLESZTÉSI LEHETŐSÉGEI

Absztrakt

A hivatásos katsztrófavédelmi szerv a számvitelről szóló törvény előírásainak megfelelően köteles leltározni a készleteit és eszközeit. A jelenlegi leltározási folyamat időigényes, a leltározó személyek alapfeladataik ellátása mellett több napot töltenek el vele. A szerző a publikációban ismerteti az RFID technológiát és bemutatja, hogy alkalmazása esetén a folyamat gazdaságosabbá tehető, a kezdeti viszonylag magas beruházási költségek megtérülnek.

Kulcsszavak: eszköznyilvántartás, RFID, logisztika, leltár, katasztrófavédelem

1. INTRODUCTION

Today's Hungarian disaster management is facing new challenges, its task system and importance are increasing, its basic goal is to ensure the basic constitutional rights, public order, public safety and the protection of the population in Hungary [1]. Disaster management is a national matter, its pillars are the Hungarian state, its citizens and the disaster management organization. It is especially true in the field of disaster management that theory and practice must be in harmony. [2]

Defense and elimination of the consequences must be ensured by coordinating the operation of the bodies created for this purpose and the various defense systems, and by involving and contributing those involved in disaster management. [3] In order to perform the disaster management tasks effectively, the starting sets and tools necessary for the performance of the basic task are acquired and stockpiled during the normal periodical activity.

The professional disaster management agency and its organizational units are considered to be economic operators covered by Act C of 2000 on accounting (hereinafter referred to as: Act). In accordance with the basic principles of accounting, it is obliged to keep continuous quantitative records of its assets and resources, and it is obliged to carry out a complete, quantitative recording at least every three years. The inventory process is carried out by reading the barcodes for the unique identification of the devices placed in the storage areas.

In close connection with the dynamic development of IT tools, new product identification systems are constantly being developed. Thanks to the development of technological solutions, more compact, cheaper and more efficient options and solutions appear on the market for users.

Before preparing the publication, I assumed that product identification based on Radio Frequency IDentification [RFID] technology is preferable to optical identification systems in terms of a longer time cycle. The main goal of the research formulation is to prove the advantages of the introduction of RFID-based technology in the light of the principle of efficiency and economy. To this end, I will describe the main data collection systems and their development. which I would like to present and prove my hypothesis through a practical example.

In order to verify the hypothesis and fulfill the objective, I analyzed the information found in the literature and drew conclusions from it.

2. DATA COLLECTING SYSTEMS AND THEIR DEVELOPMENT

Processes made faster by the continuous development of trade and IT made it necessary for product identification to be automated, thus becoming more cost-effective. In order to realize this need, bar codes first appeared in practice. The first patent was filed by Norman Joseph Woodland and Bernard Silver in 1949. The patent was registered in 1952 and featured a circular barcode type. Its data content was generated by the contours of different thicknesses and the pauses between them, the operating principle of which is very similar to the operation of MORSE code. [4]

Barcodes practically store data on a binary basis. The code with a combination of white and black colors can be translated into 0 and 1 characters, thereby recovering the data stored in them. The pattern drawn by the data stored on the printed barcode can be recoded with the help of a reading device, and the data set interpreted in this way is displayed as a character string through a processing device, displaying its exact content.

The barcode has gone through many changes since its patenting. The indicators of its development are closely related to the development of computing devices necessary for printing and reading. The sensitivity, error tolerance, resolution and physical dimensions of the devices had a significant impact on the amount of data that could be encoded. The technology soon reached its limits, as one-dimensional barcodes - due to their structure - are only suitable for storing a finite amount of data. thus, the appearance of two-dimensional barcodes corresponding to the expansion of user needs became necessary.

The strength of barcode-based registration is that, due to its operating principle, it requires little hardware and infrastructure. A simple barcode does not require any special equipment, it can be produced with any commercially available printer and stuck to the device to be identified using a simple self-adhesive label. The handling of the reading equipment does not require special expertise, the code can be scanned automatically by directing it to the bar code.

Low-cost technology due to its simple operating principle. Printers specifically used for printing barcodes are also commercially available at an affordable price, and the price of reading equipment is also low. Modern reading equipment can scan a very large number of barcodes in a short time, and code printing does not take much time either. Barcodes can be read accurately with a minimal percentage of errors. For many types, a built-in error detection mechanism is coded into the barcode, so wrong scanning is rare thanks to self-checking.

The disadvantage of barcode-based registration is that it is absolutely necessary that the code be in a visible place in its entirety. It can make the device difficult to identify in an office environment, or the code placed in a visible place can cause aesthetic problems. Code must be "in sight" and therefore exposed to environmental influences. To identify the code, the reader must see it in its entirety, however, if it is damaged or worn, the process becomes impossible. Due to the optical line of sight, a low reading distance is required. The information content of the codes used today has also become scarce. The amount of information that can be stored in a given bar code mostly only contains the unique identifier of the given product, all other information requires several linked databases of a different kind. The person operating the data collection device must locate and scan the code, which can be a time-consuming process. As a result, more time or more people are needed to complete a specific work process than in the case of RFID systems.

The history of RFID dates back to II. It can be traced back to World War II. The use of the then-known radar technology in this field was used to measure and track aircraft, as well as to identify friends and enemies. In the approximately 80 years that have passed since then, thanks to the development of technology, RFID identifiers have developed a lot in their structure and thus their field of application has expanded significantly. Today, we can find this technology in a wide variety of fields, it helps representatives of many industries with the help of precise positioning and wireless information transmission. A technical solution that is increasingly widely used in asset management, storage, inventory preparation, and trade.

The radio frequency-based identification system also consists of several elements. RFID tag The most important element of the system is the "tag" itself, which is nothing more than a transponder chip. These members contain important information for the reading device, during scanning, the previously programmed data stored here are read out via radio frequency. The

data is processed at the RFID middleware point. The equipment located between the scanning unit and the enterprise system. Its purpose is to filter and interpret the incoming data and then forward it to the necessary systems. The chips are provided with data content using RFID reading and writing equipment. The RFID reader antenna is responsible for sending and receiving the radio signal, communication takes place through this transceiver. The data is stored and further processed in a company information system.

The operating principle of the RFID system is simple. The RFID tag receives a signal within the range of the reader antenna, which causes it to send the pre-entered, programmed data stored on the chip. The reader antenna receives the incoming data and forwards it to the processing middleware. The processed and filtered data from here are transferred to the information system, where they can be processed.

Since their usability is extremely broad, similar to optical identification-based devices, RFID devices can also be grouped in several ways. The main difference between the devices can be observed in terms of the operating principle of the chips. We distinguish between passive and active RFID chips.

Passive members essentially do not have their own energy source, so they do not emit a continuous signal. They are activated only during reading, using the energy emitted by the reading device, and thus the data content stored in them becomes readable. Due to the lack of resources and memory, the production cost of members with a passive chip is significantly lower than that of their active counterparts, which is why they are used much more widely. Thanks to the constantly expanding range of uses and the resulting increasing mass production, a further decrease in the price of chips is expected in the future. Due to the area of the available storage spaces and the number of devices in them, this RFID type may be the most optimal way to modernize the device registration and inventory process of the professional disaster protection agency.

Active RFID members have their own built-in energy source, so they can emit a continuous signal. Thanks to the stronger signal, their reading distance is significantly greater than that of passive technology. However, the extra parts also mean that these systems are significantly more expensive. Their industrial use is widespread, and they are mostly used to identify containers, wagons and unit loads during transport.

Apart from the energy supply, chips can be categorized in several ways. According to their usage, according to their memory management, based on their physical appearance or operating frequency. However, the last two categories are important from the point of view of triggering the work processes I carry out.

The operating frequency of RFID chips affects the readability distance, the reading speed, and consequently the amount of data that can be stored. Another important factor is that members using a lower frequency are better read in an environment where there are materials interfering with the radio signal, thus enabling the technology to be reliably used in environments surrounded by liquid or metallic. Members can be divided into four main groups.

Low Frequency (LF), i.e. chips that use low frequencies. They operate in the 125 KHz - 134 KHz range, have a slow reading speed and a small data content. Their reading distance is approximately 20 to 40 centimeters. These passive members are mainly used in the following areas: entrance systems; chips implanted in animals; immobilizer systems built into cars; NFC data transmission technology with the help of an active member.

High Frequency (HF), i.e. high frequency devices. They operate at 13.53 MHz. This enables faster data transfer and the reading distance is also higher, 1 - 1.5 meters. In this category, too, we can mainly talk about passive chips, however, in terms of their use, they are more closely related to asset registration, logistics processes and inventory preparation. Most common uses: for product identification in the case of automated industrial systems; in the case of production lines, to identify parts; to track unit packages.

Ultra High Frequency (UHF), ultra high frequency chips are systems using 433 MHz and the 860 – 930 MHz frequency range. Both active and passive members appear in this category, which provide fast data transfer and, especially for active members, a reading distance of more than 30 meters. Common areas of application: tracking; safety equipments; anti-theft devices.

Ultra Wide Band and microwave. We can talk about microwave members in the case of chips using the frequency range between 2.45 GHz and 5.8 GHz. These can be exclusively active or semi-active devices. They are capable of extremely fast data transfer and have a reading distance of around 2 meters. In the case of 3.1 - 10 GHz, we mean UWB chips, the equipment with the highest speed and under the right conditions can be read from a distance of up to 200 meters. These types are mainly used to identify vehicles during transport.

Another grouping method can be separated based on the physical appearance and packaging of the chip and its antenna. It is also clear from the variety of appearance forms shown in the figure that the number of possibilities inherent in the technology is much greater than that of one- or two-dimensional barcodes that allow only optical identification. The main groups are:

Dry- and Wet-Inlay: These RFID tags consist of an antenna and chip in a simple transparent plastic housing. The only difference between the two is that the dry-inlay also has a side coated with a self-adhesive adhesive surface.

Paper-Inlay: It is most comparable to the wet-inlay type, with the difference that the member is embedded in a paper-based label. A big advantage is that the paper surface can be printed, so it can be provided with data content that can also be used by systems suitable for optical identification.

Plastic Inlay: Similar to the paper-based chip, but due to its material, it is more resistant to external environmental factors, but it is less flexible and difficult to print.

Hard- and Metal-Tag: RFID antenna and chip with a metal housing. The casing is extremely resistant and gives the data storage unit a high degree of protection against external influences.

Other special encapsulations: As you can see, depending on the application environment, RFID tags can have many forms of appearance. In Hungary, the member built into the watch-shaped wristband is perhaps best known from the beach baths, which resists heat well and protects the chip with its water resistance. In addition to keeping pets, a transponder in the form of a capsule not much larger than the size of a grain of rice is also known. These are implanted in the animals to facilitate identification. Chips come in many different shapes and designs. In fact, anything that is not exposed to extreme external influences and is suitable for storing a chip about 2 centimeters by 1 centimeter in size can be suitable for connection to the RFID system.

From the point of view of storage and device handling, the most important of the above categories is the paper-inlay type. As I mentioned, this is a self-adhesive, printable paper, which is actually a programmable RFID tag built into an etiquette label. Thanks to the double, optical and radio frequency-based identification, it provides a great opportunity even in the movement of assets between companies using different systems. These types can be found in everyday anti-theft systems. In contrast to identification solutions based on the optical principle, which

can only be identified if they are in a visible place, this chip can be detected even if it is not in sight.

The possibility of double identification can also be an essential factor in the case of inventory preparation, because thanks to this, the number of possible errors during the identification of devices can be reduced. If the chip is damaged or cannot be read due to some disturbing circumstance, it can be identified using the printed surface and, thanks to the information stored on it, the label can be easily reproduced later.

The advantage of RFID-based registration is that thanks to the insertion of middlewear, accurate scanning is possible, the data can be filtered perfectly and multiple scans can be avoided. It enables multi-step verification, and can even be combined with optical identification. devices are scanned simultaneously or in small groups, the speed of data acquisition is significantly accelerated. Thanks to the fast work, the time and human resource requirements of individual work processes are reduced, thus a significant cost reduction can be achieved in the long term. The data can be read regardless of physical visibility, so identifiers can be placed less carefully.

The disadvantage of RFID-based registration is that it can be an expensive system due to the high infrastructure requirements and the relatively high price of the equipment. Technology that is difficult to use in metallic or wet environments, because these surfaces can interfere or absorb radio signals.

In the analysis of weaknesses and opportunities, it should be emphasized that factors interfering with radio signals can be effectively filtered out by changing the frequency of the signal. In the case of strengths and threats, the most important thing is to calculate the time interval in which the return on the initial investment can be realized during the system planning phase. This is a difficult process, because it is difficult to calculate the future costs of RFID technology and human resources in the absence of knowledge.

Even in the case of examining weaknesses and threats, the biggest risk is the cost of production, implementation and operation. It is important that the selection of the technology and the construction of the system are preceded by thorough planning in order to be able to function efficiently.

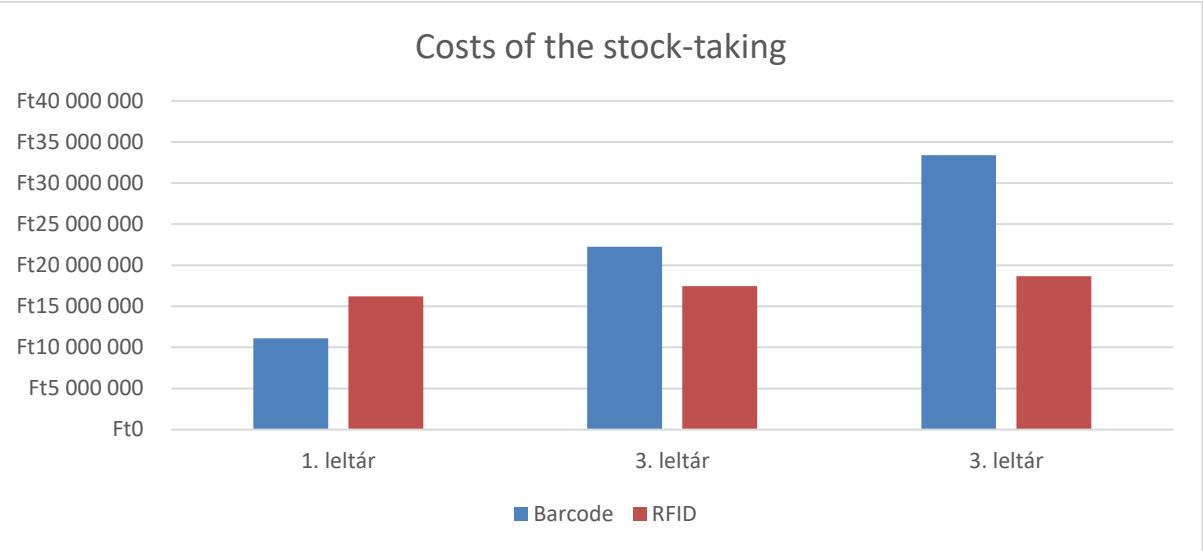
3. RFID OPPORTUNITIES OF APPLICATION IN THE STOCK-TAKING PROCESS AT DISASTER MANAGEMENT

The Capital Disaster Management Directorate (FKI) uses an information system based on optical identification and using barcodes to identify devices. The majority of devices are found in an office environment. The asset register typically includes IT equipment, tools required for the performance of professional tasks, and furniture. The barcodes required for identification are usually affixed invisibly in several places on a given type of device for aesthetic reasons, which means that their search takes a lot of time. In many cases, it is necessary to move the devices for identification, which can not only entail serious physical strain, given that a furnished office or meeting room cannot be rearranged during the inventory taking, or only very minimally. From the point of view of inventory preparation, the biggest advantage of the RFID system is that there is no need to physically see the identifiers, and the data is not read one by one. This condition can increase the number of devices that can be inventoried per hour by five times. [5]

The following data were used to determine the costs of the inventory: The FKI has 39,000 active assets, which are divided between 17 inventory districts. I calculated the implementation of the barcode inventory with 65 devices/hour, 6 hours of active time per day. A committee of 3 people will be formed per inventory district, which will carry out the barcode inventory in 6 working days. The persons taking the inventory are drawn from the staff of officers employed in the official work schedule, and their average gross salary of HUF 554,820. An inventory process thus results in a gross personnel cost of HUF 11,126,451.

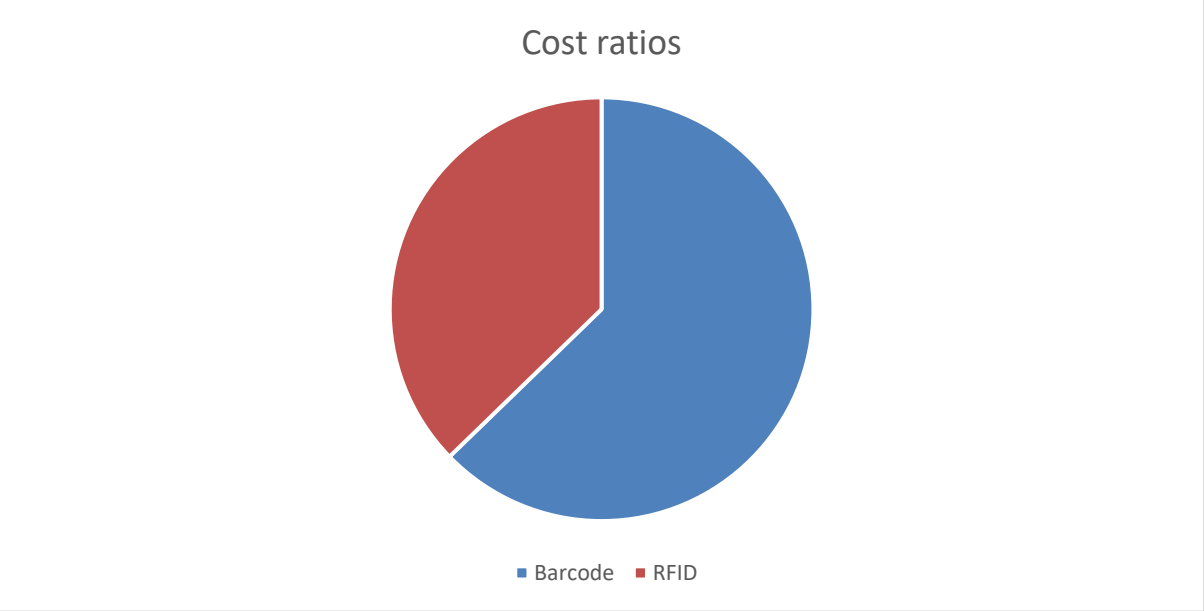
In relation to the implementation of the inventory based on RFID technology, 325 devices/hour, with an active time of 6 hours per day, based on the personnel costs described above, results in a gross cost of HUF 1,606,466, which includes the one-time costs of the introduction of RFID, which consists of an RFID writing and printing device , 1 piece of manual data collector, an intermediate reading and data translation device, and a quantity of labels corresponding to the size of the asset portfolio, I took into account the retail prices [6] determined in the amount of ~ HUF 15,000,000. When determining the amount, I did not take into account the costs of equipping the devices with RFID tags and the training required to manage the devices, due to

the fact that the costs also arise in the case of the current barcode-based system, so no additional investment is necessary.



1. figure: Costs of the stock-taking. Made by the author, 2022.

When examining the payback, it is necessary to analyze that the data loss recorded on passive RFID systems occurs on average in periods of 8-10 years, thus requiring replacement after three inventory cycles.



2. figure: The cost ratios of the stock-taking process. Made by the author, 2022.

When analyzing the data, it can be concluded that the use of RFID technology can result in a significant reduction in personnel costs and that the inventory process based on optical data collection technology covering 3 cycles can be implemented from 63% of the total cost.

4. CONCLUSIONS

The presented data collection techniques have clear advantages and disadvantages, however, due to the difficult-to-quantify data, the parallelization process is not easy.

During my research, I learned about the strengths and weaknesses of technologies based on optical and radio frequency identification and described them in the publication. Based on all of this, it can be said that optical identification systems have reached the peak of their technological development. However, RFID can be considered as the technology of the future in terms of asset registration and inventory. Thanks to developments, it appears in everyday life in new and new ways, thus this method of radio frequency identification can overcome optical identification systems.

The initial high investment cost of RFID due to the high procurement and construction costs of the system elements will clearly pay off in the long term due to labor and time savings. Thanks to its development, the use of this technology will become cheaper and cheaper in the future, thereby reducing the time required for payback. Considering all of this, it can be said that the justification for the introduction of technology, which is already increasingly used in trade, can also be demonstrated in the organizational system of the Disaster Management. In addition to the creation of financial resources, the development of the currently used database management program for the interpretation and coordination of the data generated by this technology is a prerequisite for the introduction of the technology.

In the field of doctoral training in disaster management [7], the development of the logistics capabilities of disaster management is given a prominent role, an objective that is well addressed in this article.

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Dr. Kiss Ádám István tűzoltó főhadnagy, főelőadó
Fővárosi Katasztrófavédelmi Igazgatóság
kiss.adam92@gmail.com
first lieutenant Ádám István dr. Kiss, Capital Disaster Management Directorate
orcid.org/0000-0001-5703-4082