

## MANAGING THE DEPLOYMENT OF UAV SYSTEMS IN SLOVAKIA

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**Abstract:** This paper affirms the anticipated utilisation of UAV (Unmanned Aerial Vehicle) systems in the market environment existing in Slovakia. Significant use of UAV systems can be considered in light of corporate management's own lack of readiness to employ them practically. The purpose of the article is to monitor the issue in Slovakia and identify the basic starting points that the company needs to solve in the case of process management of the implementation of UAV systems in internal company processes. The methodology of the issue took place through sociological inquiries in the form of questionnaires and document analyses. The result of the investigation is that the Slovak market does not offer relevant data on the active use of UAV systems in the field of ensuring the operation of internal company management processes. Based on the information obtained, it is clear that the need to introduce UAV systems will be crucial in the future, as well as the need to develop recommendations for the process management of the implementation of UAV systems in individual areas of industry in the conditions of Slovakia.

**Key words:** UAV technology, business, process management, management decision-making, Slovakia

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### Introduction

The main problem of the research is the lack of readiness of companies and the ability to implement UAV systems in the conditions of the Slovak economy. Failure to keep up with technological advances can cause the company to switch customers to competitors who can fulfill their requirements more easily, quickly and cheaply. With a decrease in orders, sales also decrease, which can cause the company to reach a loss and be forced to cover it either with its own or external resources. However, in terms of external resources, this represents a degree of responsibility. If, however, the company were to implement the given technology in its corporate structure under certain circumstances, it would gain a potential competitive advantage, it would be

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able to more efficiently fulfill customer requirements, react to them and thereby ensure long-term profit generation and a more stable position on the market.

The aim of the research work is therefore to create the state of the researched environment, which, in addition to defining the basic theoretical base regarding UAV systems, also responds to their usability in society and their current perception. The created analysis should help to set up and understand the main problem related to the insufficient readiness of companies for the use of UAV systems in the conditions of Slovakia.

As part of the implementation of the research work, we worked with the qualitative and quantitative side of the research. The main attention was directed mainly to the quantitative side in the form of a questionnaire. A survey was conducted within the framework of a sociological inquiry to ascertain the current state of the issue, where the population was composed of large enterprises employing over 250 people. It sought to gather background information about investments, implementation and the future of UAV systems, as well as the usability of these systems and the obstacles they face. Unfortunately, Slovakia's market currently offers no relevant data about the active use of UAV systems in internal management processes. The information obtained from the survey clarifies the critical need to introduce UAV systems in the future, and deciding how fast they are implemented in corporate management processes will be likewise crucial.

Unmanned aerial vehicle (UAV) systems, also called drones, constitute a significant advancement in contemporary modern technology. These systems have spurred rapid developments in internet-supported aviation, autonomous robotics, and the internet of things (IoT), as well as smart devices and also smart cities. Socially and economically, the current situation makes it possible to consider the significant use of UAV systems. This significance is underscored in Single European Sky Air Traffic Management Research or SESAR (Jenčová, 2021). Yet drones have to be first socially accepted before the economic expectations from them can be developed and exploited. In addressing the issue, there is a presumed assumption that successful deployment of UAV technology requires the benefits from utilising it to outweigh the problems expected to come from the introduction and use of UAVs. Findings obtained from the earlier mentioned survey confirm the availability of services bringing the benefits of UAV systems to society, such as emergency medical transport, support in rescue operations and searches and response to short-notice disasters, and concurrently accentuating the high-level of economic expectations associated with them, in particular the use of drones in the industrial sector. Like all present-day technological solutions, several disadvantages of UAV systems and disturbing elements connected with them can be noted. They include noise and loss or reduction of privacy. Given the legislative constraints that currently exist at the local and global level, it is imperative for the restrictions imposed in the name of mere airspace safety to be considered, too (Macias et al., 2020).

UAV technology can be applied across the consumer spectrum and in commercial applications, aerospace defence, or logistics and transportation. Historically, the first

attempts to create and implement UAV systems were geared toward strategic use, starting as early as the First World War. Despite long-term knowledge available about this technology, development has progressed at only a moderate pace and the most significant changes have only become evident in recent years. Today, drones still dominate just in air defence and the military sector. However, information available from secondary data sources point toward significant use of these systems appearing in the corporate sector, logistics, transport, shipping and remote data collection. The forecast covers the next decade. In the vast majority of cases, all the available information underscoring the benefits of UAV systems either is only theoretical in nature or have only been implemented in limited operations. This phenomenon may be due to the high price of the technology, insufficient promotion of the benefits from using drones or the lack of qualifications among staff that would be using them.

A similar trend in the utilisation of UAV systems can be anticipated in the market environment currently existing in Slovakia. Nonetheless, such an assertion cannot be currently supported by quantitative data regarding the active use of UAV systems in corporate management because no such data are available. However, publicly accessible information indicates the need to introduce these systems in the very near future and they are considered crucial for future commercial sustainability.

Insufficient legislation covering UAV systems may be responsible for the potential limitations to implementing and using them under current conditions in Slovakia. The legislative framework for UAV systems since 2021 is not even adapted to the standards the European Union has introduced.

Accordingly, it needs to be mentioned that the state of affairs points toward UAV systems not being very extensively discussed among educational institutions, which may ultimately also adversely affect their use and especially the transformation of management processes from the introduction of UAV systems in the internal management system environment among enterprises in Slovakia.

The conclusions of the SESAR study have clarified that, although UAV systems have presently a number of shortcomings, the benefits from their use in the future will be substantial and define the future development of the economy on a global scale.

### **Literature Review**

Over time, drones have also found use in the commercial space, for example in logistics for the efficient transport of goods, in sports, in the film industry or in the healthcare sector, but also in ordinary households, which use them to capture images or shoot videos from a different, unusual point of view. (Rojas et al., 2020; Moshref-Javadi and Winkenbach, 2022) Drones can fly different distances, starting from small, micro and nano distances indoors, to long distances representing tens of meters to thousands of kilometers. (Hassanalien and Abdelkefi, 2017) By creating visuals through UAV devices in real time over Wi-Fi. This solution enables the evaluation of the situation without the necessary direct human intervention. (Shrama

and Arya, 2022) Networked UAV technology brings future challenges in AI integration, connectivity, routing, electrical efficiency, spectrum management, security and regulations, which are approached in this section. (Rovira-Sugranes et al., 2022) For the future, it is necessary to introduce a combination of technologies that detect people based on visual, thermal (body) and sound recognition. (Wankmüller et al., 2021). UAVs with AI in the future present problems for the ethical side, in connection with liability for caused damage, which leads to problems in the field of justice. (Konert and Balcerzak, 2021) In a French laboratory called Lasco, researchers discovered the fact that one of the biggest advantages of drones is artificial intelligence, which allows them to recognize living objects from predefined targets. (Black, 2019)

Nowadays, unmanned aerial vehicles (UAVs) are one of the fastest developing technologies (Skorupka et al., 2017). Terms associable with unmanned aerial systems include an unmanned aerial vehicle, remotely piloted aerial system, multi-copter, or drone. All of them can refer to the same or similar elements of aeronautical technology (Lidynia et al., 2016). UAV originated as a designated technology in the late 1950s. however, the kite would probably fit the definition of the first UAV (Fahlstrom and Gleason, 2012). The UAV system was mainly based on multiple re-entry after a flight. Despite the designation, development of unmanned aircraft has been happening ever since World War I. In wartime, these systems were employed mainly to handle the logistics behind dropping of explosive ordinance at selected locations. The Kettering Bug, an unmanned aerial torpedo developed by Orville Wright and Charles F. Kettering, is considered the first ever example of a UAV system. The system included a mechanical computer, barometer and gyroscope. Its limitations, due to the technology available in the early twentieth century, were subsequently overcome by Charles Stark Draper, whose navigation system augmented gyroscopes and accelerometers to enable the measurement of minute changes in an object's position. He also designed the initial control inputs for unmanned systems. The new system was tested on a transcontinental flight by a U.S. Air Force B-29, which is believed to have been the first official flight of an unmanned system or aircraft (Muraldeharan and Cohen, 2020).

Presently, the most widely used definition of UAV systems is of an unmanned aircraft or system able to fly with no pilots on board. The system contains several basic components, specifically the aircraft itself, sensors and a ground control station. A UAV system can be controlled either by electronic devices on board the aircraft or the devices on the ground directing it. If wireless communication is directing the system from the ground, it is called a drone or remotely piloted vehicle (RPV). Because of the limited range of communication, specialised control systems can be designed for larger unmanned aircraft and directly implemented either on board it or in a device trailing the drone in order to approach it (Golizadeh et al., 2018).

Big data analysis is the process of examining, cleaning, converting and modeling exponentially growing data in order to realize useful information that improves

various decision-making management processes. (Mohamed, 2020) UAV devices mainly for transporting orders. Drones with such a focus can deliver the order despite the possible occurrence of car convoys or other adverse traffic situations that could increase the time of delivery of the food to the consumer. (Hwang, 2019) Unmanned units are an ideal means of patrolling large areas, so they can be used to protect property or protect national borders. They can also carry out aerial photographs used for geodesy, archeology, advertising purposes. (Kardasz, 2021)

#### ***UAV system legislation***

The legislative framework for UAV systems is mainly composed of European law and how it is transposed to Slovakian law under current conditions. The European legislative framework is covered by Commission Implementing Regulation No 947/2019 and Commission Delegated Regulation 945/2019. Both regulations unify the rules for flying UAV systems and cover Slovakia, too (Kacvinský, 2022). The establishment of European legislation should encourage the development of more advanced rules for UAV systems on a global level.

The main obligations embodied in the regulations are the creation of a registration system for UAV system operators and the completion of online training for selected drone pilots (European Commission for Mobility and Transport, 2019).

No legislation has been adopted yet in Slovakia to establish systems for registering UAVs or to provide online training in them. Current rules put in place by the (Slovakian) Transport Authority allow UAV systems to be flown with a permit only for professional activities (Transport Authority, 2019; Kacvinský, 2022).

#### ***Possible deployment of UAV systems***

UAV systems and unmanned aerial vehicles are currently employed in various situations, some of which are include: i) Delivery of shipments, materials and products; ii) Monitoring of traffic; iii) Moving of objects; and iv) Monitoring in high-risk environments.

When objects need to be moved, optimal trajectories have to be planned beforehand for flying the unmanned systems under practical conditions. In contrast to terrestrial autonomous systems, the trajectory planning algorithms for UAV systems need to be configured in three dimensions. Compared to a two-dimension environment, there is a higher degree of uncertainty involved. In particular, a UAV system needs to interact dynamically with other flying or static objects that may appear in the flight path. At present, it is a major factor limiting the use of UAV systems. For this reason, planning routes on a global level ranges from extremely difficult to virtually impossible (Mahmoud et al., 2021).

In Radio Wave Propagation in Vehicular Environments (Azpilicueta et al., 2021), the authors foresee enterprises increasing and enhancing their utilisation of UAV systems in practice because of the ever greater development and deployment of unmanned systems in corporate management processes. The factors listed below are especially driving this phenomenon:

Simple operation

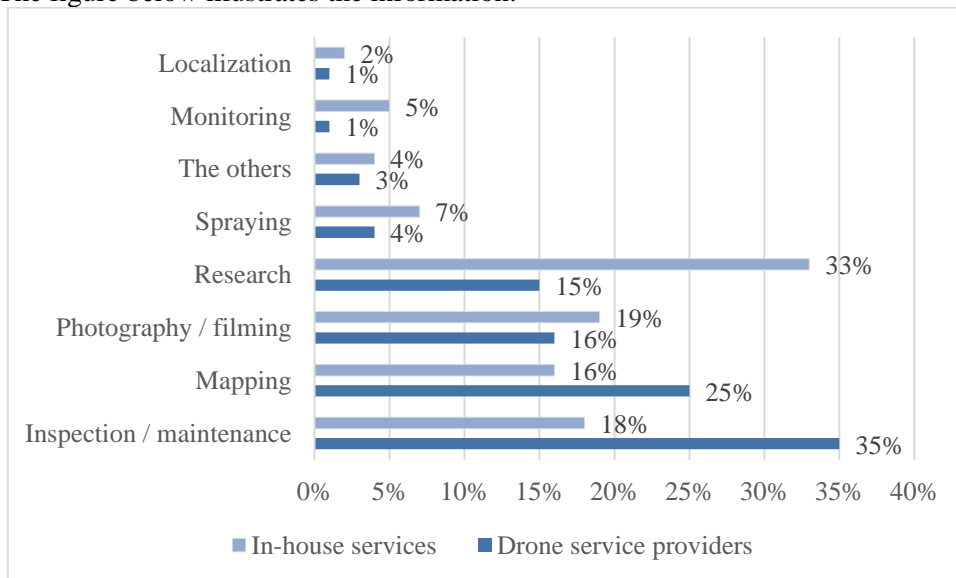
Multiple flights

- High manoeuvrability
- Growth in load weight

-Real-time support for a variety of civilian applications

The following can be included among the potential applications of UAV systems in practice, based on available information (Azpilicuet et al., 2020, p. 315): i) Monitoring difficult-to-access areas; ii) Traffic control; iii) Remote data collection; iv) Remote surveillance and monitoring; v) Response to natural disasters; vi) Creating a visual record; vii) Transporting goods and merchandise; viii) Facilitating communication; ix) Recreation; x) Delivery of packages; and xi) Support for mobile broadband and wireless local area networks

Information from available secondary data sources imply exploitation of the services provided by UAV systems both within a corporation's own internal management processes and by external contractors mainly for inspection and maintenance, mapping, imaging and surveying. This came out of research conducted on a sample of 679 companies. Environmental monitoring is another significant activity carried out by UAV systems. There is a particularly significant difference between the use of in-house UAV systems and outsourcing in management of mapping and inspections, with up to 35% and 25% respectively outsourced. On the other hand, visual recording and surveying are handled internally by corporate management. The decision to keep these activities inside may have been driven specifically by accessibility to sensitive information and protection of know-how (Statista, 2020a). The figure below illustrates the information.



**Figure 1: Global share of drone services by activity in 2020**

Source: Statista, 2020a



Based on the available information, future applications of UAV systems can be foreseen in construction and civil engineering, agriculture, energy and data transfer (European Commission for Mobility and Transport, 2021).

### **Research Methodology**

At present, deployment of a UAV platform in Slovakia may be impeded by corporate management's own insufficient readiness to employ them practically. Because the commercial potential of this technology is forecast to be significant, neglecting such a technological innovation might lead to the loss of customers to competitors able to meet their demands better, faster and/or cheaper. A declining customer base also has an impact on turnover, where a reduction in sales can lead to financial difficulties. Similar to other information and communication technology (ICT) solutions, the more efficient response and fulfilment of customer requirements UAV technology provides has the potential to give enterprises a competitive advantage, which has a positive impact on their long-term sustainability and ability to secure a stable position in the market. Therefore, the main objective of the research conducted here was to obtain the information necessary to identify opportunities among industries in Slovakia to deploy UAV platforms.

The research sought to determine current readiness, especially by large enterprises, to deploy UAV systems in their internal management processes within Slovakia. Other undertaken tasks were to ascertain the options for applying UAV systems in Slovakia and investing in modern ICT, which corporate managements have either at their disposal or the opportunity to use under current conditions in Slovakia for supporting the implementation of UAV systems in their managerial processes. The purpose behind this research is to identify issues related to the lack of readiness to utilise UAV systems, raise awareness and provide more information to corporations about how they could apply UAV technology in their management processes.

Planned research encompasses a presentation of the procedure for conducting it, specifying in more detail the methods to be used for collecting data and processing what has been collected.

Research was conducted by inquiry. A questionnaire was developed in order to obtain primary quantitative data. It was distributed to the respondents electronically or emailed to them. The questionnaires were sent to addresses that had been obtained from publicly accessible sources. Google Forms was the software platform used to collect the questionnaire data. An audiovisual technique was adapted for direct online communication with the ultimate respondent whenever the enquiry was made electronically.

The population drawn upon for research was composed of large enterprises currently operating in Slovakia. Data on these enterprises are registered by the Statistical Office of the Slovak Republic. In 2020, Slovakia recorded a total of 671 large enterprises (defined as having over 250 employees). Further data on these companies were collected from either the industry section of DATAcube, a public database, or in the financial portal FinStat. Since the condition of large enterprises employing

more than 250 people had to be fulfilled in order for the questionnaire to be completed, good judgement – a deliberate technique – had to be put in practice. Respondents most likely to provide relevant information were approached. They were deliberately chosen for their primary qualitative data collection. The calculated recommended sample size for this exercise was 194 respondents, at a 90% confidence level and a 5% margin of error.

The questionnaire was designed to obtain primary information of a quantitative nature in terms of the research that was being conducted and structured as follows:

-The main or primary part seeking to obtain information about the possible use of UAV systems in corporate management processes. It was divided into sections to enable respondents not using a UAV system to complete the questionnaire, too. The main section also briefly explains what a UAV system comprises in order to facilitate the completion of the questionnaire in terms of the issue to be addressed and in order to obtain the most relevant replies.

-The secondary part sought to obtain information about the options available for financing business management innovations with links to UAV systems.

-The tertiary part of the questionnaire discussed the respondent's basic characteristics. Based on the data obtained from this part, information about the geographical location of the respondent's activities, sector and line of business could be found.

-The final part contained space for the respondent to indicate a contact if there was interest in the processed results. The questionnaire likewise concluded with a message thanking the respondent for their time and willingness to complete the questionnaire.

### **Results and Discussion**

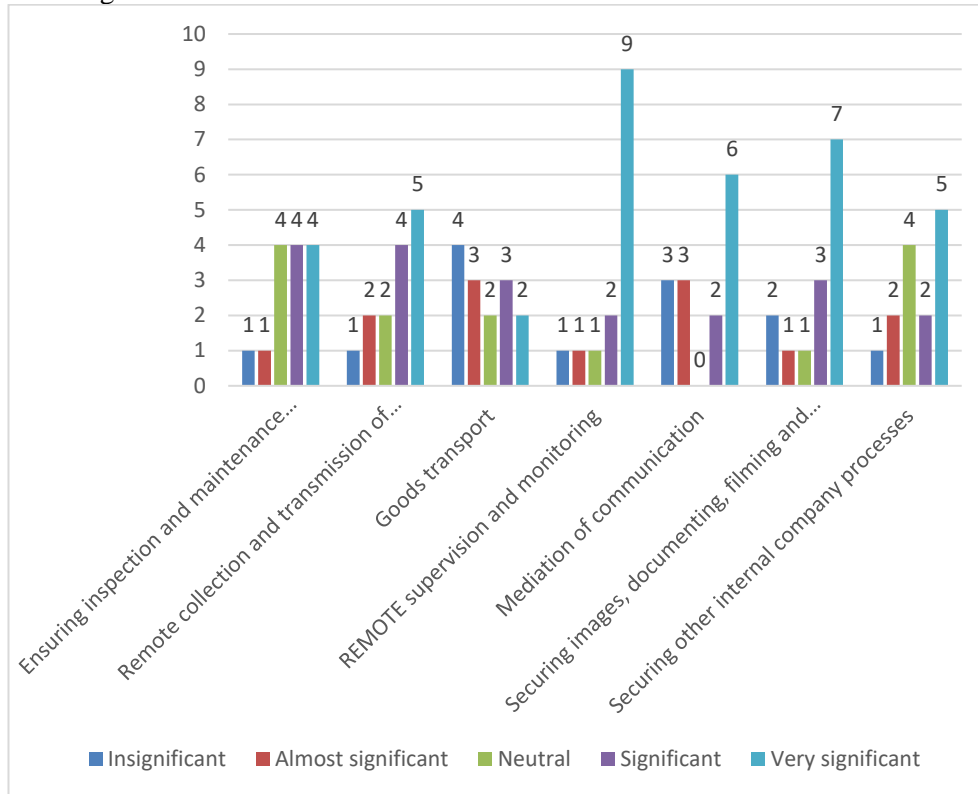
Corporate management in Slovakia actively implementing UAV systems in their management processes stated that they were currently considering their implementation to be insignificant, almost significant or had a neutral opinion.

As many as 32% of respondents considered corporate management's implementation of UAV systems to be important to very important for the future, while the same percentage of respondents were undecided about whether their enterprise's implementation of the technology would be critical or not critical to remaining in business. The largest number of respondents currently deploying UAV systems was found to be operating in the construction sector, followed by manufacturing and logistics. UAV systems were utilised to the same extent in the energy, agriculture, telecommunications and service sectors. At the bottom, the ICT sector is not actively using the systems at all.

During research, the respondents mentioned several functions from the UAV systems they use in corporate management. These can also be identified as advantages of using UAV systems in corporate management processes. The respondents identified major functions of UAV systems to be remote surveillance and monitoring, providing footage, documentation, facilitating communication and



use in other internal management activities. These interpreted findings are illustrated in the figure below.



**Figure 2: Most significant UAV system functions implemented in corporate management**

Under current conditions in Slovakia's market, it can be considered a major challenge to define exactly what the most effective deployment of UAV systems in a company's internal management processes should look like. Automotive production and related supplier-customer management processes dominate in Slovakia. The research shows them not intending to deploy UAV management systems in the near future. When considering the long-term horizon, trends also observable in the automotive industry point toward a more profound significance of drones in business. The trend is becoming increasingly popular especially outside Slovakia as a tool for efficient administration and implementation of internal management processes. Therefore, enterprises implementing UAV systems cannot be ruled out in the distant future as an ineffective move. The management of these processes is important for the proper functioning of the market as such. This is, for example, a new solution in smart cities; increasing the sustainability of business sector management (Sulyova and Kubina, 2022), or the correct use of technology for

monitoring customer behavior (Bubelíny et al., 2021; Blašková et al., 2022; Pollák et al., 2021; Peng et al., 2022; Shah et al., 2022; Kita et al., 2022).

The research conducted here was able to identify several factors that would drive effective implementation of UAV systems in the management of enterprises located in Slovakia. These identified factors include the following:

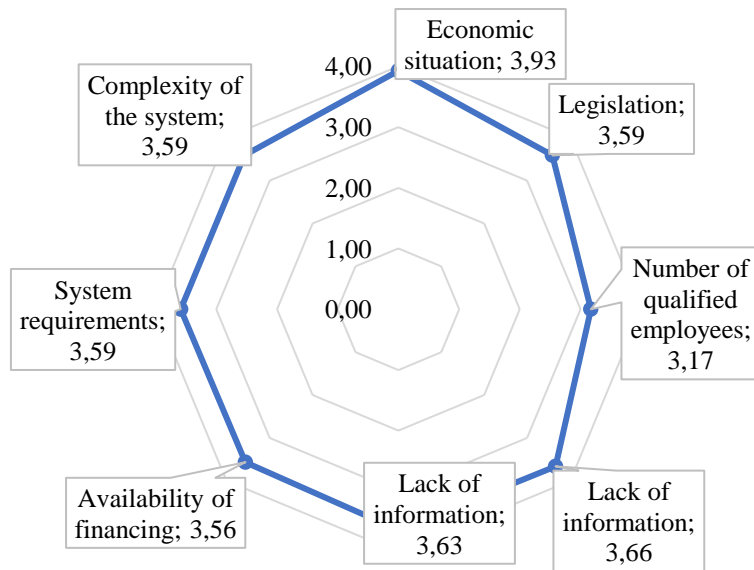
1. The actual preparation phase for implementing UAV systems in corporate management processes, chiefly and specifically the acquisition and sorting of data indicating the benefits and risks of implementing the technology. Research revealed corporate management's own processes to have no access to adequate information about the issue of UAVs and their significance in corporate management processes. These findings were confirmed from the conclusions drawn in indicative analysis, which shows the options available for effectively implementing UAV systems in enterprise management to be currently at an early stage.
2. Financial stability within an enterprise's internal management environment, where the actual decision to implement (were the enterprise to have sufficient funds to do so) should be in line with future operating and maintenance costs and the expenditure for corporate management from updating the implemented solution. Results from research point toward the importance of cost, as the financial position of enterprises experienced in the past have kept new systems from being implemented into internal management processes. Problems of a financial nature could be solved, for example, by pressuring government to provide enterprises with repayable and advantageous financial grants to enable them to successfully implement UAV systems in internal management processes. The lack of financing options available to put in-house UAV solutions into place underlines the current outsourcing of UAV solutions by enterprises. The advantage outsourcers have is greater expertise and a potentially lower financial burden. A risk might be the security of sensitive data in the hands of external solution providers.
3. The approach current corporate management systems take toward continuous improvement and innovation to ensure corporate management remains competitive also plays a role and an enterprise has to be ready to innovate its own system to meet current market needs and requirements. This approach is also linked to constant monitoring or controlling of implemented innovations like UAV systems from the initial stages of the solution for such a project.

Similar functionalities, like those mentioned above, are likewise considered critical by the corporate managements not currently using UAV systems within their own management processes. Both groups of enterprises consider inspection and maintenance to be less significant benefits. In this case, it is necessary to consider how important the functions are to the enterprise's own business and management

strategy. Not all industrial sectors find the functionalities mentioned in the previous paragraphs of UAV systems to be useful.

Besides the above functionalities, it was significant to note the perception by respondents using UAV systems in their businesses of increased time efficiency as the greatest advantage alongside their overall efficiency in corporate management. They also considered the collection of more information and the saving of financial resources to be equally significant.

Respondents were given the opportunity during research to indicate the benefits of financing innovation in their corporate management. The question was deliberately open-ended, with the respondents free to express their opinion without being limited by closed headings for their answers. More than 50% of the respondents answered the question by citing financial stability as the most important benefit of investing in innovation.



**Figure 3: Barriers to implementing UAV systems in corporate management**

As with the adoption of any technology, UAV can present limiting factors when an enterprise implements it. The enterprise's own economic situation was considered by respondents to be the biggest barrier to the implementation of UAV technology. Such a reply may have been mainly due to the market situation unleashed by the COVID-19 pandemic. Respondents concurrently attributed similar weights to other factors, which they had the opportunity to rate on a scale from 1 (least important) to 5 (most important). These findings point to the poor economic situation businesses are currently facing and their reluctance to invest in modern technologies despite the positive, critical role they see UAV systems playing in future corporate management. The figure below graphically illustrates the dilemma.

Besides the earlier mentioned management processes in the internal environment of companies operating in logistics or construction, UAV systems can also be applied to management processes associated with natural disasters or supporting security forces, for example at the smart city level. Outside of Slovakia, UAV systems have been widely used in these areas and thereby become an indispensable tool such as in rescue operations. The main cause driving the application of UAV systems is chiefly advances in drone manoeuvrability, their already high manoeuvrability before such enhancements and increasing payload carrying capacity, among other things. This information is also confirmed in Radio Wave Propagation in Vehicular Environments (Azpilicueta 2021). It can be supported by B2B model and created using selected ICT technology of Electronic Data Interchange type (Łobaziewicz, 2013).

Another possible application of UAV systems in Slovakia is in mapping, monitoring and documentation of monitored environments. Secondary information from the indicative analysis implies the wide use of these systems in these management processes. In practice, UAV systems are used for these purposes, for example, in Greece, where they mainly provide informative management processes by capturing critical data about environmental damage that has been caused (Ekathimerini, 2021). In Australia, UAV systems have been tested to extinguish large fires within a mapped area. There have been impressive results from the deployment of drones to fight fires in the state of Victoria (Crumley, 2021). Decision of stakeholder can be based on the asset of services in which need to meet their expectations (Ingaldi, 2021).

We present the initial state in the following table.

**Table 1. Inner state UAV in Slovakia**

Initial state
In Slovakia, we register almost 66% of companies that do not work with UAV systems as part of their internal processes. This statement also reflects the fact that there is currently not much interest in these systems in the business environment in Slovakia. There are several reasons why this is so. These are, for example, insufficient legislation, immature education, or a lack of financial resources.
In the Slovak Republic, however, the sector of construction, manufacturing industry and logistics is very widespread. The latter is also at the forefront in the use of innovative technologies, and it is no different in the use of UAV systems. It can be said that they are among the more developed and advanced industries in Slovakia.
Slovak companies currently do not consider it very beneficial or efficient to use drones in their corporate structures. However, they see room for improvement in the future. This may mean a certain increase in both awareness and actually more significant use of UAV systems, as we can already observe abroad today.
companies that do not currently use UAV devices see far fewer benefits associated with their use compared to companies that actively use the devices in their business strategies.

### ***Recommendation for further research***

On the basis of the obtained information from the conducted research, it is possible to identify basic recommendations for further investigation and modeling of the implementation of UAV systems in internal company processes.

The first issue that businesses should pay attention to is: What key processes will be performed by UAV systems? Answering the above question is important precisely within the mentioned part of the effective application of UAV systems in companies. The result of answering the question should be the definition of the importance of UAV systems in the company, i.e. j. what the company wants to achieve by introducing the system.

The second way out is dedicated to the market environment. The management of the company should answer the question: Is it possible to precisely define the environment in which UAV systems will be used? It follows from the above that the company should thoroughly identify the current situation on the market and maximize the results to its advantage.

The third way out is oriented to the configuration itself or setup of UAV systems. In this case, the task of the company's management is to answer the question: How can UAV systems be implemented in the company's internal environment?

From the point of view of the mentioned starting points, it is also advisable to pay attention to possible causalities in terms of proper implementation:

- Is there a conflict between process management and the environment in which the company conducts business?
- Does the configuration of UAV systems meet the requirements of process management within the internal environment of the company?
- Can UAV systems operate correctly on assigned process tasks, in terms of their configuration or settings?

### **Conclusion**

The research shows extensive use of UAV technology in the most diverse sectors, ranging from personal to commercial use, aerial defence, logistics and the transport of goods and merchandise. Globally, defence is currently the dominant segment where UAV systems are applied. They are also conspicuous in logistics, transport and remote data collection. The results from the research can also be pointed out in this respect, where it indicated mapping and documentation to be quite vital to management of internal activities, and these are associated with the use of UAV systems in Slovakia. Related to what has been earlier discussed, application of these systems in the internal corporate management environment can be anticipated in the next decade. The trend toward UAV systems can even be expected in Slovakia. Unfortunately, its market currently offers no relevant data about the active use of UAV systems in internal management processes. The information obtained from the survey clarifies the critical need to introduce UAV systems in the future and deciding how fast they are implemented in corporate management processes will be likewise crucial. However, the information gathered from research shows the current situation

in Slovakia to be hardly favourable for utilising UAV systems, especially in terms of current legislation.

The establishment of an institution or organisation for intensively spreading knowledge about the opportunities to be grasped from the application of UAV systems in corporate management practice would appreciably improve the situation in Slovakia. It may likewise be helpful, as a support tool, to intensify the publication of case studies where UAVs were applied and to organise conferences and discussions with international experts about the issues and problems associated with them. All of these mentioned activities would have a positive impact in raising awareness about the significant deployment of UAV systems in the management processes of enterprises in Slovakia. In recent years, there have been more active discussions of the involved issues published in international educational databases. In Slovakia, it would be advisable for educational institutions to specify them in broader conclusions that can be drawn for the promotion of UAVs in the corporate management environment. It would also make sense to intensify cooperation regarding UAV systems among public and educational institutions, and also in the private sector itself. It could overcome the negative externalities that broadly influence the application of UAV systems in management processes.

A major finding from the conducted research is the problem of introducing UAV systems into corporate management processes. Complicating the application of these systems in the business environment is the current, inadequate shape of enterprises, which limits or prevents them from implementing such systems. The issues standing behind the implementation of UAV systems in enterprise management are diverse and range from technical limits to financial difficulties and little government support. Neither did the COVID-19 pandemic and the related measures and restrictions put in place lend support to what has been an unfavourable situation, aggravating the negative impact on corporate management in Slovakia.

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## ZARZĄDZANIE WDRAŻANIEM SYSTEMÓW UAV NA SŁOWACJI

**Streszczenie:** W artykule potwierdzono potencjalne wykorzystanie systemów UAV (Unmanned Aerial Vehicle – bezzałogowych statków powietrznych) w warunkach rynkowych istniejących na Słowacji. Stopień intensywności wykorzystania systemów UAV można rozpatrywać pod kątem braku gotowości kierownictwa przedsiębiorstw do ich praktycznego zastosowania. Celem artykułu jest monitorowanie niniejszej problematyki na Słowacji oraz identyfikacja podstawowych warunków, które przedsiębiorstwo musi spełniać w przypadku procesowego zarządzania implementacją systemów UAV wspierających wewnętrzne procesy firm. Metodologia badawcza obejmowała badania socjologiczne obejmujące kwestionariusze i analizy dokumentów. W wyniku przeprowadzonego badania stwierdzono, że rynek słowacki nie oferuje istotnych danych na temat aktywnego wykorzystania systemów UAV w zakresie zapewnienia funkcjonowania wewnętrznych procesów zarządzania przedsiębiorstwem. Na podstawie uzyskanych informacji można stwierdzić, że potrzeba wprowadzenia systemów UAV będzie w przyszłości kluczowa, jak również istnieje potrzeba opracowania zaleceń dotyczących zarządzania procesami wdrażania systemów UAV w poszczególnych sektorach przemysłu na Słowacji.

**Słowa kluczowe:** Technologia UAV, biznes, zarządzanie procesowe, podejmowanie decyzji zarządczych, Słowacja

### 管理斯洛伐克无人机系统的部署

**摘要:** 本文肯定了斯洛伐克现有的市场环境中对UAV（无人驾驶飞行器）系统的预期利用。考虑到企业管理层自身缺乏实际应用无人机系统的准备，可以考虑大量使用无人机系统。文章的目的是监测斯洛伐克的问题，并确定在公司内部流程中实施无人机系统的流程管理情况下，公司需要解决的基本出发点。该方法是通过问卷调查和文件分析形式的社会学调查进行的。调查的结果是，斯洛伐克市场没有提供关于在确保公司内部管理流程运作领域积极使用无人机系统的相关数据。根据所获得的信息，很明显，在未来，引入无人机系统的需求将是至关重要的，同时，在斯洛伐克的条件下，需要制定在个别工业领域实施无人机系统的过程管理建议

**关键字:** 无人机技术，商业，过程管理，管理决策，斯洛伐克