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ЗАБЕЗПЕЧЕННЯ БЕЗПЕКИ ТРАНСПОРТУ ОРГАНАМИ ПОЛІЦІЇ ТА ПІДРОЗДІЛАМИ КРАЇН-ЧЛЕНІВ ЄВРОПЕЙСЬКОГО СОЮЗУ

Анотація. *Органи та підрозділи поліції є окремою ланкою в системі забезпечення всіх рівнів національної безпеки, у тому числі транспортного. Глобалізація, технічний прогрес і урбанізація призводять до збільшення автомобільного транспорту та вантажних перевезень, що робить необхідним забезпечення безпеки транспорту. Мета наукової роботи полягає в тому, щоб визначити фактори, що впливають на безпеку транспорту та вплив органів поліції та підрозділів Європейського Союзу на безпеку транспорту. Для досягнення поставленої мети були використані такі методи, а саме: статистичний аналіз, кореляція, факторний аналіз, узагальнення та аналогія. Встановлено, що існує позитивний взаємозв'язок між кількістю поліцейських, кількістю дорожньо-транспортних пригод та кількістю постраждалих на дорозі на Кіпрі. Доведено негативний взаємозв'язок між кількістю поліцейських та кількістю дорожньо-транспортних пригод у Німеччині, Фінляндії, Греції, Бельгії та Швеції. Виявлено позитивну взаємозалежність між кількістю поліцейських і постраждалих у дорожньо-транспортних пригодах на Кіпрі, Німеччині, Фінляндії та негативну взаємозалежність у Греції, Бельгії, Швеції. Виявлено низький рівень взаємозалежності між кількістю автомобілів і кількістю дорожньо-транспортних пригод у Швеції та Німеччині, негативний взаємозв'язок на Кіпрі, Греції, Бельгії та Фінляндії. Встановлено фактори, що впливають на безпеку транспорту, а саме: законодавче регулювання, рівень впровадження інноваційних цифрових технологій, транспортна інфраструктура, географічне розташування, протяжність доріг, психофізичні фактори водіїв, соціальні. Доведено, що органи та підрозділи поліції, враховуючи інші фактори, що впливають на безпеку транспорту, недостатньо забезпечують транспортну безпеку в Європейському Союзі*

Ключові слова: *дорожньо-транспортна пригода, транспортний засіб, аварія, дорожній рух, правоохоронні дії*

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ENSURING TRANSPORT SAFETY BY POLICE AUTHORITIES AND UNITS OF MEMBER STATES OF THE EUROPEAN UNION

Abstract. *Police authorities and units are a separate link in the system of ensuring all levels of national security, including a transport one. Globalization, technological progress and urbanization are leading to an increase in vehicular transports and freight carriage, which makes it necessary to ensure transport safety. The purpose of the academic paper is as follows: to identify the factors that affect transport safety and the impact of police authorities and units of the European Union on transport safety. In order to achieve the purpose outlined the following methods have been used, namely: statistical analysis, correlation, factor analysis, generalization and analogy. It has been established that there is a positive interrelationship between the number of police officers, the number of road traffic accidents and the number of casualties on the road in Cyprus. A negative interrelationship has been proved between the number of police officers and the number of road traffic accidents in Germany, Finland, Greece, Belgium and Sweden. The positive interdependence has been revealed between the number of police officers and casualties of road traffic accidents in Cyprus, Germany, Finland, and a negative interdependence in Greece, Belgium, Sweden. It has been found that there is a low level of interdependence between the number of cars and the number of road traffic accidents in Sweden and Germany, a negative interrelationship in Cyprus, Greece, Belgium and Finland. Factors influencing transport safety have been established, namely: legislative regulation, level of introduction of innovative digital technologies, transport infrastructure, geographical location, length of roads, psychophysical factors of drivers, social ones. It has been proved that police authorities and units, taking into account other factors that affect transport safety, do not sufficiently ensure transport safety in the European Union*

Keywords: *road traffic accident, vehicle, accident, road traffic, enforcement*

INTRODUCTION

Transport safety is a major problem in Europe due to human losses and social-economic costs connected with road traffic accidents [1]. The growth in the number of vehicular transports and freight carriage over the past decades has increased the likelihood of road traffic accidents and other negative aspects such as accidents, emissions, vibration and noise that cause social, economic and environmental problems. Considering that around 1.3 million people die annually in vehicular transports and the cost of accidents exceeds 200 000 000 000 euros in the European Union (EU), there is a need to develop measures in the field of transport security [2].

The bodies of the European Union' member states, which have one of the objectives, namely: to ensure transport safety, include police authorities and units. Therefore, it is important to identify the factors that negatively affect transport safety, as well as the level and effectiveness of police authorities and units in their elimination and ensuring transport safety. The key performance indicators for road safety are listed in the EU strategic action plan on road safety [3]. They will be used for an overall assessment of the indicators that will determine the level of road safety in the European Union in 2021-2030. These include: speed compliance, the use of safety belts and child's restraint systems, the use of protective equipment, driving under the influence of alcohol, driver's distraction by handheld devices, safety of new cars, infrastructure safety, post-crash care [4].

Police officers keep road users under supervision through monitoring, tracking and punishment [5; 6]. Law enforcement activities concerning assurance of transport safety involve a wide range of complex objectives, many of which can only be effectively accomplished through the use of state-of-the-art police technologies (for instance, fixed and mobile speed detection devices) [7-9]. The use of automated technologies will ensure the quality and effectiveness of law enforcement authorities by increasing the level of detection and recording of violations of traffic rules, or the likelihood of this, without increasing the number of police officers and measures to encourage drivers to comply with traffic laws [10-13].

All countries of the European Union seek to provide police officers' professional training for the quality performance of the tasks assigned to them, which can be achieved through the provision of knowledge, skills and the application of advanced technologies. Road safety is one of the most important areas of security, which requires special police officers' training, and, therefore, there are special state road safety units in many countries [14]. Transport is an important part of the national economy; it affects economic development, which determines the development of freight carriage. Consequently, the risk of road accidents has increased due to the growth of freight carriage. In general, transport is dangerous for the environment and road users, causing increased emissions of pollutants, accidents and road traffic collisions [15; 16].

The purpose of the academic paper is to identify the factors that affect transport safety and the impact of police authorities and units of the European Union on transport safety. Research objectives of the academic paper are as follows:

1. To identify the factors that affect transport safety in the member states of the European Union.
2. To analyze statistics on the number of police officers in individual countries of the European Union, the number of vehicular transports, the number of road accidents, the number of casualties of road accidents in the same countries of the European Union.
3. To investigate the interdependence between the number of police officers, road accidents, the number of casualties of road accidents, as well as between the number of vehicles and the number of road accidents.
4. To establish the influence of police authorities and units on transport safety in the countries of the European Union.

1. MATERIALS AND METHODS

The study of ensuring transport safety by police authorities and units of the European Union has been carried out by applying the method of statistical analysis in order to compare data on the number of police officers and road traffic accidents, casualties of road traffic accidents and the number of vehicles in individual countries of the European Union. The following interrelationship has been established due to the method of correlation analysis, namely: between the number of police officers and the number of traffic accidents in the period from 2015 to 2018 separately in Cyprus, Greece, Belgium, Germany, Sweden, Finland; between the number of police officers and the number of casualties of road traffic accidents from 2015 to 2018 separately in Cyprus, Greece, Belgium, Germany, Sweden, Finland; between the number of vehicles and the number of road accidents from 2015 to 2018 in Cyprus, Greece, Belgium, Germany, Sweden, Finland; between the number of police officers in Cyprus, Greece, Belgium, Germany, Sweden, Finland and the number of road traffic accidents in 2016.

Factors that affect transport safety have been identified by the method of factor analysis, generalization and analogy. In the course of the research, the most significant scientific works have been used, which reflect the development of scientific thought in the field of transport security for the period from 1980 to 2021. The following indicators have been analyzed in the research, namely:

– police officers per 100 thousand inhabitants for 2015-2018 reflected in Pordata [17];

– road deaths and relative change in road deaths for 2015-2019 reflected in European Transport Safety Council [18];

– passenger vehicles per 1000 inhabitants for 2015-2018 reflected in Eurostat [19];

– road traffic accidents for 2015-2019 reflected in Cyprus Police [20], Findicator [21], Statistics Finland [22], Hellenic Statistical Authority [23], Statbel [24], Bundesanstalt für Straßenwesen [25].

Traditional approaches to transport safety include regulatory and technical measures, leaving aside organizational factors that may contribute to road transport safety. However, modern theory of social-technical systems recognizes the need to take into account organizational factors [1]. Toward this end, member states have developed safety standards and rules concerning road safety throughout Europe [26]. Road safety policy should take into account the basic factors affecting the various peripherals identified by the World Health Organization (WHO) (finance, institutional framework, infrastructure, legislation, vehicles, as well as control and human influence). The range of measures to ensure transport safety includes: improving infrastructure (for example, safer design of roads, regulation of sidewalks and traffic lights, introduction of safe bicycle lanes), updating standards for cars, improving law enforcement authorities and training in order to increase the use of seat belts and wearing a helmet while reducing speed and driving under the influence of intoxicants [27]. Police traffic accident reports are the most common source of traffic accident data for analysis. Although the main purpose of such reports is to provide summary descriptions of accidents' statistics and information that can be used in litigation. Along with this, these reports are taken as the basis for inference analysis, especially for the development of programs to improve transport security. Therefore, the effectiveness of the transport safety program is assessed on the basis of police authorities' statistical reports. However, such reports are often biased and/or incomplete [28].

2. RESULTS

The countries of the European Union have different numbers of police officers. Therefore, in order to establish the interrelationship between the number of police officers and their impact on the number of road traffic accidents, it is necessary to identify countries that have a large number of police officers, medium and low. Cyprus has the largest number of police officers among the European Union's countries in 2015-2018, in 2018 their number was 566.3 per 100 thousand population, it is followed by Greece – 495.3 police officers, Belgium – 362 police officers, Germany – 295.3 police officers, Sweden – 196.9 police officers, Finland – 139.3 police officers. A clear trend is observed in Cyprus, Germany and Sweden in the decrease in the number of police officers during 2015-2018, and in Greece, Belgium, Finland in the increase in their number, except for Finland in 2015 (Table 1).

Table 1. Police officers per 100 thousand inhabitants

Country	2015	2016	2017	2018
Cyprus	580.7	570.7	581.8	566.3
Greece	486.6	490.1	494.6	495.3
Belgium	335.0	332.6	360.8	362.0
Germany	299.9	296.7	298.4	295.3
Sweden	203.1	201.8	196.3	196.9
Finland	140.4	137.2	136.4	139.3

***Source**: [17]*

Among the selected countries of the European Union, the largest number of road traffic accidents during 2015-2019 is observed in Germany – 300143-308721, Belgium – 40303-37699 with the dynamics of decrease, Sweden – 14086-14951 during 2015-2017, Greece – 11440-10712 with positive dynamics annually during 2015-2019, Finland – 5185-4002 with dynamics of decrease, Cyprus – 958-727 with positive dynamics (Table 2).

Table 2. Road traffic accidents

Country	2015	2016	2017	2018	2019
Cyprus	958	942	876	741	727
Greece	11440	11318	10848	10737	10712
Belgium	40303	40096	38020	38453	37699
Germany	305659	308145	302656	308721	300143
Sweden	14703	14086	14951	–	–
Finland	5185	4752	4432	4312	4002

***Source**: [20-25]*

In order to establish the interrelationship between police officers per 100 thousand inhabitants and road traffic accidents, it is necessary to conduct a correlation analysis of the indicators in Tables 1-2. The following

formula is applied in carrying out the analysis:

$$y = \frac{\sum(x_1 - x_1)\cdot(x_2 - x_2)}{\sqrt{\sum(x_1 - x_1)^2 \cdot \sqrt{\sum(x_2 - x_2)^2}}}, \quad (1)$$

where x_1 – police officers per 100 thousand inhabitants and x_2 – road traffic accidents, r – linear correlation coefficient.

The linear correlation indicator between police officers per 100 thousand inhabitants and road traffic accidents during 2015-2018 is as follows: Cyprus – r = 0.604, Greece – r = -0.975, Belgium – r = -0.973, Germany – r = -0.699, Sweden – r = -0.871, Finland – r = -0.363. Thus, a high correlation rate is observed in Cyprus; the correlation rate is negative in other surveyed countries, and, consequently, the interrelationship between the number of police officers and the number of road accidents is not significant. Confirmation of the established fact is shown by the correlation coefficient of the number of police officers of all surveyed countries and the number of road traffic accidents in 2016, which is r = -0.139.

In accordance with the tasks of the police authorities and units, the priority direction for ensuring transport security centers around reducing road traffic accidents with casualties. The highest number of road deaths in the surveyed countries during 2015-2019 was observed in Germany – 3459 in 2015; Greece – 824 in 2016, Belgium – 762 in 2015, Sweden – 324 in 2018, Finland – 270 in 2015, Cyprus – 57 in 2015. Along with this, the smallest number was observed in Cyprus – 46 in 2016, Finland – 209 in 2019, Sweden – 221 in 2019, Belgium – 604 in 2018, Greece – 699 in 2019, and Germany – 3095 in 2019. Therefore, it has been found that in most countries the highest rate of casualties was in 2015, and the lowest – in 2019 (Table 3).

Table 3. Road deaths and relative change in road deaths

Country	2015	2016	2017	2018	2019
Cyprus	57	46	53	49	52
Greece	793	824	731	700	699
Belgium	762	670	609	604	620
Germany	3459	3206	3177	3275	3059
Sweden	259	270	253	324	221
Finland	270	258	238	239	209

***Source**: [4]*

By applying the correlation method between police officers per 100 thousand inhabitants and Road deaths and relative change in road deaths, it has been established that the correlation coefficient in Cyprus amounts r = 0.796, Greece – r = -0.823, Belgium – r = -0.826, Germany – r = 0.535, Sweden – r = -0.378, Finland – r = 0.521. Thus, there is a positive interdependence in such countries, as: Cyprus, Germany, Finland, and negative interdependence in Greece, Belgium and Sweden. In order to reveal the impact on the effectiveness of transport safety by police authorities and units and on the number of road accidents in general, it is necessary to establish the dynamics of the number of vehicles owned by the population in the surveyed countries.

An increase in vehicles is observed in all surveyed countries during 2015-2018, namely: in Cyprus there were 575-629 vehicles per 1000 population from 2015 to 2018, in Greece there were 474-487 vehicles during 2015-2017, in Belgium there were 497-511 vehicles during 2015-2018, in Germany – 548-567, in Finland – 590-629 vehicles, except for Sweden, which amounted 474-479 vehicles during 2015-2018, however, in 2018 their number decreased from 479 to 476 (Table 4).

Table 4. Passenger vehicles per 1 000 inhabitants

Country	2015	2016	2017	2018
Cyprus	575	595	609	629
Greece	474	479	487	-
Belgium	497	503	508	511
Germany	548	555	561	567
Sweden	474	477	479	476
Finland	590	604	617	629

***Source**: [19]*

The correlation index between road traffic accidents and passenger vehicles per 1.000 inhabitants is as follows: in Cyprus – r = -0.936, in Greece – r = -0.981, in Belgium – r = -0.880, in Germany – r = 0.173, in Sweden – r = 0.166, in Finland – r = -0.979. Thus, weak interdependence has been revealed in Sweden and Germany, and negative interdependence has been found in Cyprus, Greece, Belgium and Finland.

3. DISCUSSION

The European integration of transport safety systems is in line with the transport policy of the European Union. Leading European organizations focus on safety (for instance, European Transport Safety Council (ETSC)), which is an important factor in building a new transport safety system [2]. Police authorities and units are obliged to ensure the safety of vehicular transport. Police officers, deeply involved with road traffic safety, have a unique opportunity to assess the effectiveness of road traffic safety policy, as they record, investigate traffic violations, apply sanctions and testify in court. There are significant differences in the requirements of the law and its enforcement, as well as between the current transport safety policy at the national and local levels and the priorities of road traffic safety, which are noted by the police officers [29]. Within the framework of a systems approach [30], law enforcement authorities are one of the tools to ensure or improve compliance with the requirements of transport safety legislation [31]. However, in the course of the research it has been found that there is no direct influence of the police authorities and units on road traffic safety. Therefore, there are other factors that affect transport safety.

According to the structural model, road traffic safety has technological, behavioral, sociological and value aspects [32]. Authors agree with F. Alonso, C. Esteban, L. Montoro S.A. Useche and C. Crowther-Dowey [33] that road traffic safety is a complex process depending mainly on the human factor and not only on technical improvements. Consequently, the need arises to study the implementation of the laws and other factors that precede behavior on the road. These include: attitudes, opinions and perceptions in the road traffic safety sphere, factors influencing the interaction with such categories as: traffic rules, police supervision, penalties. J. Bąk and D. Bąk-Gajda [34] adhere to the same position that road traffic is a complex system of actions and behavior in a specific situation in space, the interaction between a person and a vehicle. These scientists argue about three aspects of effective driving, namely: physical efficiency (determined by means of medical examinations) psychological efficiency (assessed in psychological tests of the driver) knowledge, skills and attitudes of the driver. The drivers' attitude to road traffic safety is formed not only by themselves, but also by external factors, including those that are a prerequisite for human errors on the road, namely: psychophysical properties, social adaptation, social discipline, emotional control and skills to solve such a complex task as driving a vehicle [14].

In addition to psychophysical and other human factors that affect road traffic safety, there are also external factors that shape transport safety and create conditions for the effective operation of police authorities and units, namely: introduction of innovative digital technologies, which are based on systems of automatic accounting of traffic offenses, digitization of transport infrastructure to ensure interaction between the subjects of automatic accounting of traffic offenses against the laws, implementation and operation of other systems [35], geographical location, length of roads, and infrastructure. Recent world events caused by the COVID-19 pandemic have shown that an important factor influencing transport safety is a social one. Preliminary data of 25 member states of the European Union show an average reduction in road deaths by 36% in April 2020 compared to the average of the same month over the previous three years, according to a new report of European Transport Safety Council [18]. The highest reduction in road deaths has been recorded in Italy (84%), followed by Belgium, Spain, France and Greece with a decrease of more than 59%. Authors agree with the viewpoint of L. Budd and S. Ison [36]. The scholars argue that national restrictions on staying at home and blocking, which have been introduced in many countries around the world in order to reduce virus transmission, have led to mass unemployment, distance learning, work, and unprecedented road traffic, air transport and public transport.

CONCLUSION

The results of the study and the analysis of scientific and theoretical conclusions has made it possible to conclude that the police authorities and units are a separate link in the system of ensuring transport security, performing control preventive functions and functions of legal responsibility. It has been established that only in Cyprus there is a high level of interdependence between the number of police, the number of road accidents and the number of casualties on the road. In other countries of the European Union, namely: Germany, Finland, Greece, Belgium, Sweden, the number of police officers does not affect the number of road accidents**.** However, the interrelationship between the number of police officers and casualties of road accidents has been

proven. There is a positive interdependence in such countries, as: Cyprus, Germany, Finland, and a negative interdependence in Greece, Belgium and Sweden.

A weak interdependence between the number of cars and the number of road accidents in Sweden and Germany has been proved as well as a negative interdependence has been revealed in Cyprus, Greece, Belgium and Finland. Consequently, transport safety is affected by other factors, such as: legislation, the level of implementation of innovative digital technologies, transport infrastructure, geographical location, and length of roads, psychophysical factors of drivers, and social ones. Therefore, ensuring transport safety by police authorities and units in combination with other factors is insufficient in order to achieve positive dynamics in transport safety in the European Union.

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