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PERCEPTION OF SECURITY AND SAFETY NEED: VOLUNTERY FIRE PROTECTION AS A PART OF VOLUNTEERING ON SLOVAK REPUBLIC:

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Abstract. Volunteering is generally considered an unpaid, conscious activity which is undertaken of a person's own free will and for the benefit of other people or society. Volunteering on the field of fire protection is a specific and extremely valuable that volunteer firefighters are not only willing to help others selflessly. They are willing to risk at any time to save others their lives, health. This article points out the importance and activity of the voluntary fire protection in Slovakia. It deals with the statistics on the development of volunteer fire department in Slovakia as well as the statistics on fire alarms. The study also includes results of the public opinion poll and its evaluation, from which we can say that the public response to the work of volunteer fire department is positive.

Keywords: voluntary fire protection, public response, Slovak republic

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1. Introduction

Today's society is mature enough to realize the need to help others voluntarily. Volunteering is developing in all areas of life. The voluntary fire protection was created and developed in order to help others selflessly and to protect people at risk of life, health or property loss. Volunteering related to fire protection is specific and immensely valuable because volunteers are not only willing to help others but also selflessly risk their own lives and health at any time. The role of a firefighter has changed over the last few years and it will continue that way (Holmgren, 2012). Firemen's work is no longer just about putting out the fire. Firefighters are engaged in traffic accidents, spills of hazardous substances, natural disasters, emergencies and dangerous situations. If a man finds himself/herself in distress and needs help, the fire department is one of the main services providing such aid.

The history of voluntary fire protection in Slovakia started in 1921 when conditions for establishment of the

nationwide fire protection organizations started to develop intensively. On 6th August 1922, the Land Fire Union was founded in the city of Trenčín. The aim of the organisation was expressed by the motto: “For the glory of God and my neighbour’s good.” Up to the present day, this credo stands out on every single flag of the fire department. Later people demanded an establishment of the institution for professional firefighters which eventually led to change of the Slovak name of the profession (from “hasič” to “požiarnik”). The name of volunteer fire departments changed from “Dobrovoľný požiarny zbor” to “Dobrovoľný hasičský zbor” at the beginning of the year 2003 (Hurbanisová, 2012; www.dposr.sk; Tánczos, 2012).

2. Volunteering in general

Volunteering is generally considered an unpaid, conscious activity which is undertaken of a person’s own free will and for the benefit of other people (except for family and relatives) or society. Volunteering can also be defined as a voluntary and free decision to participate on an unpleasant incident of other people in exchange for good feeling and experience.

A male/female volunteer is a person which freely and without any financial reward devotes his/her time, abilities, knowledge and energy for the benefit of other people or society (Brozmanová et al., 2009). Volunteering leads to philanthropy, respect and love, thus to the essence of humanity. Only that man who carries humanity in himself/herself and keeps the phenomenon alive, is able to become a volunteer. Volunteering is an evidence of the level of society and also of the person’s maturity (Pavlovičová, 2012).

The Universal Declaration on Volunteering was adopted by the International Association for Volunteer Effort (IAVE) in 2001 which was the International Year of Volunteering. According to the declaration, volunteering is defined as follows:

- it is based on a personal motivation and free choice,
- it is a way of supporting the active civic participation and interest in community development,
- it has a form of a group activity which is carried out within a particular organisation,
- increases human potential and quality of everyday life, strengthens human solidarity,
- provides solutions to key challenges of our society and contributes to creating a better and more peaceful world,
- conduces to a vitality of economic life and creation of new jobs and professions.

According to Mikuš (2012), the core of volunteering comes from the Christian philosophy. The teaching proceeds from philanthropy and encourage people to do charity which has always been considered to be one of the most important human virtues. Mikuš also thinks that volunteering is among the best “fruits” which resulted from Christian traditions. And on these same traditions is, according to the constitution, based our homeland.

In terms of the time span, we can divide the volunteer activities into involvement of the volunteers in one-time events (campaigns, collections), long-term voluntary aid which is provided repeatedly and regularly, and volunteer service that is usually carried out abroad and lasts several months (Tošner-Sozanská, 2002).

From the point of view of historical development, volunteering can be divided into:

European model – an evolutionarily older type of the volunteer activity which has the nature of a communal volunteer work. This kind of volunteering arises on the basis of mutual interests and spontaneous meetings in the natural environment. Here belong especially church, sports or children’s organisations which can transform into professional centres but they should always preserve community features such as personal friendships.

American model – evolutionarily younger type of the volunteer activity. It has a managerial nature because male and female volunteers collaborate with professional centres. These centres seek after volunteers and provide them with the opportunity to engage in such activity. The centres are organized by professionals whose social conscience and intelligence enable them to carry out this profession (Tosner, 2002).

According to Mydlíková (2001), there are three basic types of volunteers in the Slovak volunteer practice:

- people working in organisations without financial compensation (including members of the voluntary fire protection),
- male and female experts (e.g. translators, lawyers) who provide highly specialized services and get only symbolic reward,
- members of the boards of organisations.

Nowadays, the most of volunteer organizations are non-profit organizations. The ways in which non-profit organizations operate are complex and multi-layered. There is an overlap between social enterprises who seek to help people and those who seek to help the environment, and between those whose activities are focused locally and those who have special interest groups at the centre of their aims. In addition to their employed workforce, social enterprises and non-profit organizations rely heavily on volunteer labour. (Dees, 1998, Hockerts, 2006, Šebestová-Haltofová, 2014)

3. The background of volunteer firefighters as part of volunteering

One of the basic state functions is to ensure security. Already in the 20th century began to spread safety agenda on non-military aspects. (Nečas-Ušiak, 2010) Security is ensured mainly by means of particular components of the Integrated Rescue System. There are many people in Slovakia who are willing to cooperate and help, or simply said, to be actively engaged in various areas of social life. Because of these people, the cultural and socio-political attitude towards the volunteering is still changing. Our society begins to realise that the transformation process of the state is simply not enough (Gut'an, 2012). Volunteer firefighters represent an important element in performing this function.

Volunteering is usually understood as unpaid activity where someone gives their time freely to help an organisation or an individual who is not a relative. (Pryce-Hall-Hill, 2015) Volunteering is basically a willingness to help people who are not directly in a friendly or family relationship with the volunteers. It is a willingness to help a man who finds himself/herself in distress and various unpleasant incidents. However, this helpfulness must not be taken for granted. We should underline it, support and appreciate. This applies especially in the case of voluntary fire protection. In addition to the constant and selfless help, its members are voluntarily exposed to imminent danger, and risk their own health and lives. They often work in difficult conditions, e.g. when they fight the fire, or are engaged in traffic collisions, accidents, natural disasters, various kinds of emergencies such as heavy snowfalls or floods.

4. Characterization of the present-day voluntary fire protection in the Slovak Republic

The voluntary fire protection is currently on the rise and its positive progress also affects the development in legislative area. The year 2014 was a turning point because the Act no. 37/2014 about the voluntary fire protection came into force.

This Act defines the Voluntary Fire Protection of the Slovak Republic as an independent legal entity with the headquarters in Bratislava. It operates on the entire territory of Slovakia, and performs task related to the fire protection, fire fighting and rescue work. The Voluntary Fire Protection of the Slovak Republic is a member of the Slovak National Committee of the International Association for Fire and Rescue Services. It is also integrated into the International Technical Committee for the Prevention and Fire Fighting and a member of the World Federation of Volunteer Firefighters based in Tokyo. The Voluntary Fire Protection of the Slovak Republic also cooperates with the volunteer firefighter organisations from different countries.



Fig.1. Logo of the Voluntary Fire Protection of the Slovak Republic

Source: www.dposr.sk

The basic organisational unit of the Voluntary Fire Protection of the Slovak Republic is the volunteer fire department. In terms of a territorial basis, these volunteer fire departments are represented by provincial and territorial committees of the Voluntary Fire Protection. There are also eight county committees which are established on a delegation principle. Each county has a representation in the Committee of the Voluntary Fire Protection of the Slovak Republic. The Voluntary Fire Protection of the Slovak Republic is a legal entity. Its president and secretary-general also function as the statutory representatives. (dposr.sk)

Role of the Voluntary Fire Protection of the Slovak Republic

The aim and role of the voluntary fire protection is a good performance and cooperation in the following areas and activities:

- education and training of the population to protect themselves against fire and during dangerous incidents,
- education of the population in the area of fire protection, especially in relation to children and youngsters,
- special preparation, training and practice of the population in the area of prevention, fire fighting, rescue works during emergency situations,
- financial support of the regional volunteer fire departments and other civic associations included within a nationwide deployment of forces and means,
- the work of members of the Voluntary Fire Protection of the Slovak Republic,
- protection of inhabitants,
- volunteer activity related to protection against fire and dangerous incidents,
- community service, public enlightenment, educational and cultural activities,
- organisation of sports events and competitions which are related to fire protection,
- preservation and enhancement of the historic and cultural heritage in the area of fire protection,
- cross-border cooperation,
- creation, protection, maintenance and improvement of the environment.

Numerous contracts and cooperation agreements were concluded in connection with the tasks which should be fulfilled by the Voluntary Fire Protection of the Slovak Republic. The above-mentioned entity made an agreement with the Ministry of Interior of the Slovak Republic in order to achieve a higher level of efficiency and fulfilment of the tasks in the field of fire protection. Another agreement was made on mutual cooperation in safety measures, police interventions, search and rescue services and other activities of the Police Force. An agreement was also made with the Ministry of Defence which deals with the collaboration in ensuring a training for drivers and operators of special vehicles. The second agreement refers to the cooperation in fire protection. Another contract is the Memorandum of Cooperation between the Voluntary Fire Protection of the Slovak Republic and the Association of Towns and Communities of Slovakia. This agreement aimed at the education of population in the area of fire protecting, rescue works, natural disasters and other emergency situations. The cooperation agreement with the Association of the Samaritans of the Slovak Republic has a similar content and focuses on the mutual collaboration and assistance in protecting the environment and person's health, life and property against fire. They are also engaged in carrying out the rescue works in case of fire, natural disasters and other emergency situations.

The fact is that fires, natural disasters or any other emergency situations have no limits. The immediate need of forces and means from the neighbouring countries is never out of the question. "When it comes to helping people

affected by a natural disaster, the national boundaries for a volunteer are only an imaginary line on a paper...“ (Hašek, 2012).

For these reasons the Voluntary Fire Protection of the Slovak Republic made cooperation agreements with foreign organisations. Among them is the cooperation agreement with the Association of Firefighters of Bohemia, Moravia and Silesia, the Volunteer Firefighter Association in Hungary, and the Voluntary Fire Service in Poland.

Volunteer Fire Departments of the Municipality

It is necessary to mention that the volunteer fire department of the village/town is not the same as the volunteer fire department. The volunteer fire department of the municipality is a community fire unit which was established by a village/town. It carries out the following tasks:

- rescues people at risk of fire and puts out the fire,
- rescues animals and property at risk of fire,
- performs rescue works during natural disasters,
- according to technical capabilities and professional qualification, it provides assistance in accidents and emergency situations when a person's life is at immediate risk,
- ensures that the fire-fighting equipment and components are ready for action, it establishes professional mechanical, anti-gas and communication services,
- conducts the training of its employees and members within the specified range,
- reports rescues without delay to the district board and informs it about the firefighting and rescue works during natural disasters and other emergency situations,
- prepare and keep the documentation of the fire unit.

Categorisation of the volunteer fire departments of the municipalities

Over the last few years, the categorisation of the volunteer fire department of the municipality has changed several times. On 1st September 2015, the Amendment to the Regulation no. 611/2001 on fire units came into force. It deals with the various types of volunteer fire departments of the municipalities which can be divided into categories according to the degree of risk of the cadastral communities as follows: Category A1, Category A, Category B, Category C, Category D.

Each category has a fixed minimum number of its members as well as its functional structure, material and technical equipment, a number of the fire-fighting equipment, etc.

5. Current status of the volunteer fire departments in Slovakia

The following statistics give the evidence of the activity and operation of the volunteer fire departments. Nowadays, there are nearly 2300 volunteer fire departments in Slovakia. Evolution of the number of volunteer fire departments in 2007-2015 is presented in the following diagram.

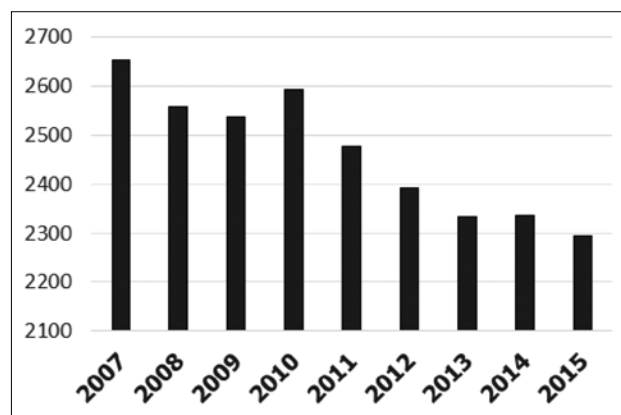


Fig. 2. Overview of the number of volunteer fire departments in 2007-2015

Source: Statistics of the Ministry of Interior of the Slovak Republic

Statistics on the number of rescues are more relevant than the statistics related to the number of volunteer fire department. This is because the latter also includes the inactive volunteer fire departments. On the diagram you can see the increase in the number of rescues. The numbers do not show how many times the volunteer fire department managed to save a life or a property, however, they point out how many times the department voluntarily, freely and selflessly tried to do it.

Table 1. Overview of rescues made by the voluntary fire departments in 2005-2014.

Year	Trips to fires	Trips because of technical and ecological problems	False alarm	Trainings	Total number of trips
2005	1 177	1 250	53	0	2 480
2006	932	1 783	0	0	2 715
2007	1 401	2 641	0	0	4 042
2008	1 069	1 403	0	0	2 472
2009	1 229	1 891	57	1 802	4 979
2010	1 159	3 669	69	2 480	7 377
2011	1 638	3 110	76	2 885	7 709
2012	2 333	3 428	376	2 576	8 713
2013	1 558	3 438	101	2 887	7 984
2014	1 456	4 425	138	3 345	9 364

Source: Statistics of the Ministry of Interior of the Slovak Republic

Research was conducted by: The Technical University in Zvolen in cooperation with The University of Security Management in Košice. Principal Investigator: Ing. Jozefína Drotárová

6. Methods and tools

Data collection method: survey. The primary aim of this research was to determine how people perceive the need for volunteer fire departments and what their opinion on them is.

The survey was conducted in the form of an online questionnaire. For the creation, distribution and evaluation of the questionnaire was used the website “www.survio.sk”. The questionnaire was distributed by sending direct internet link via e-mails, social networks and intranets of universities.

Time of the survey: 19th February 2016 – 24th March 2016, i.e. 35 days. During this period which lasted over one month, 607 people of all ages over 15 years were involved in the survey. Although younger people can be involved in the survey, no participant chose the answer “less than 15 years”. The survey was nationwide. People from all districts took part in it, therefore we consider this research sample to be relevant.

The evaluation of closed questions was made by using simple statistical methods. To all questions was assigned a specific number of answers followed by a percentage of the total number of respondents who answered this particular question.

In case of semi-open questions, to all questions was assigned a specific number of answers followed by a percentage. Responders’ reactions to the type of answer “other” were classified into several groups which are also followed by the number and percentage of the answers.

There weren’t any open questions used in this questionnaire.

Results of the research

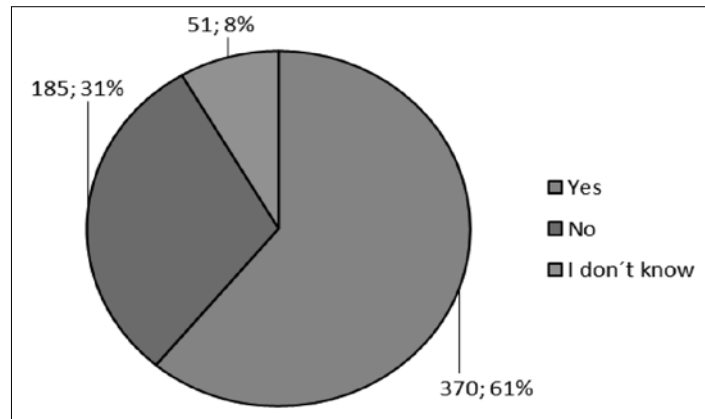
The questionnaire consists of 11 questions, from which we have chosen these ones:

Are you familiar with the activity/work/rescues carried out independently by the members of the volunteer fire departments of the municipalities, or in a cooperation with the Fire and Rescue Corps?

Type of question: closed Number of answers: 606

Answers:

Yes	370	61,10%
No	185	30,50%
I don't know	51	8,40%

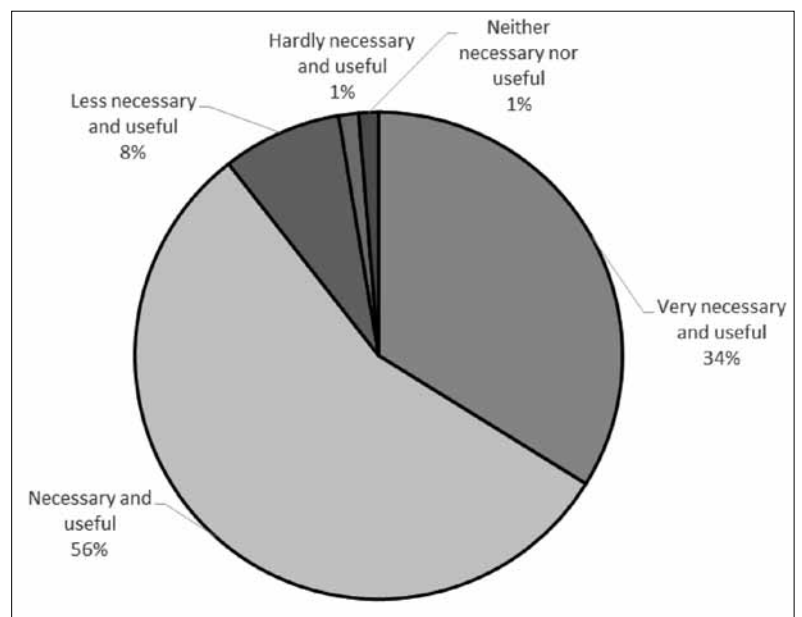


How do you see the need for the activities carried out by the volunteer fire department of the municipality?

Type of question: closed Number of answers: 606

Answers:

Very necessary and useful	205	33,80%
Necessary and useful	337	55,60%
Less necessary and useful	48	7,90%
Hardly necessary and useful	8	1,30%
Neither necessary nor useful	8	1,30%



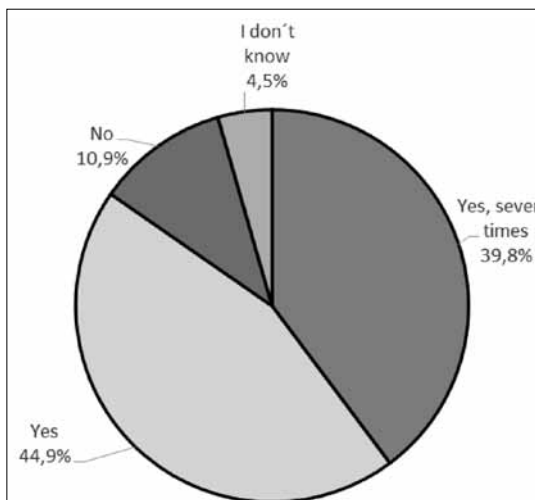
This main question demonstrates an unequivocally positive attitude of the Slovak society towards the activity of the volunteer fire departments. Nearly 90% of respondents consider their activity necessary and beneficial.

Have you ever witnessed the work/rescue of the volunteer fire department of the municipality, or have you seen it/heard about it in the media?

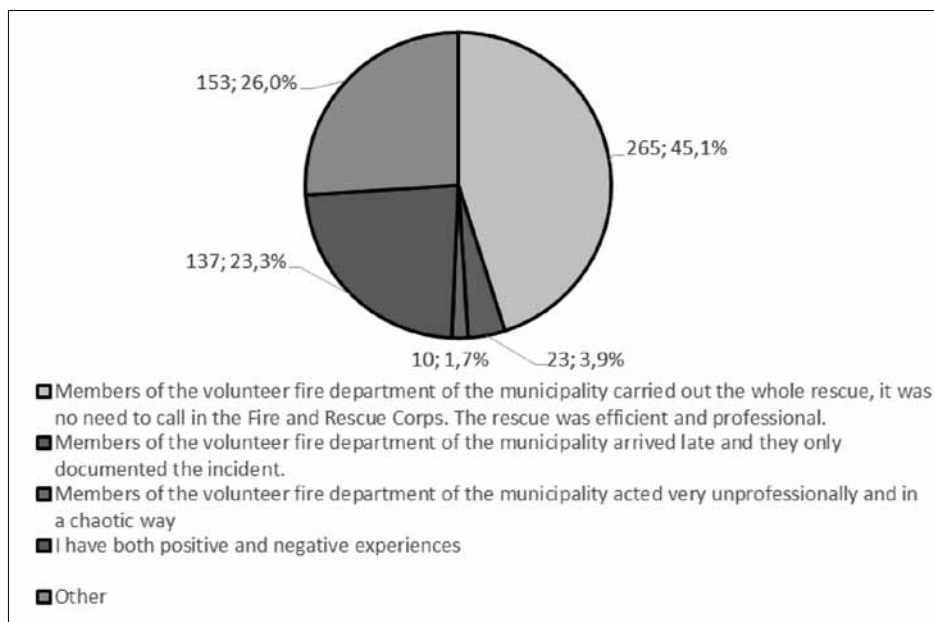
Semi-open question. Number of answers: 588.

Answers:

Yes, several times	241	39,8%
Yes	272	44,9%
No	66	10,9%
I don't know	27	4,5%



How would you characterise the work of the voluntary fire department of the municipality during the rescue?

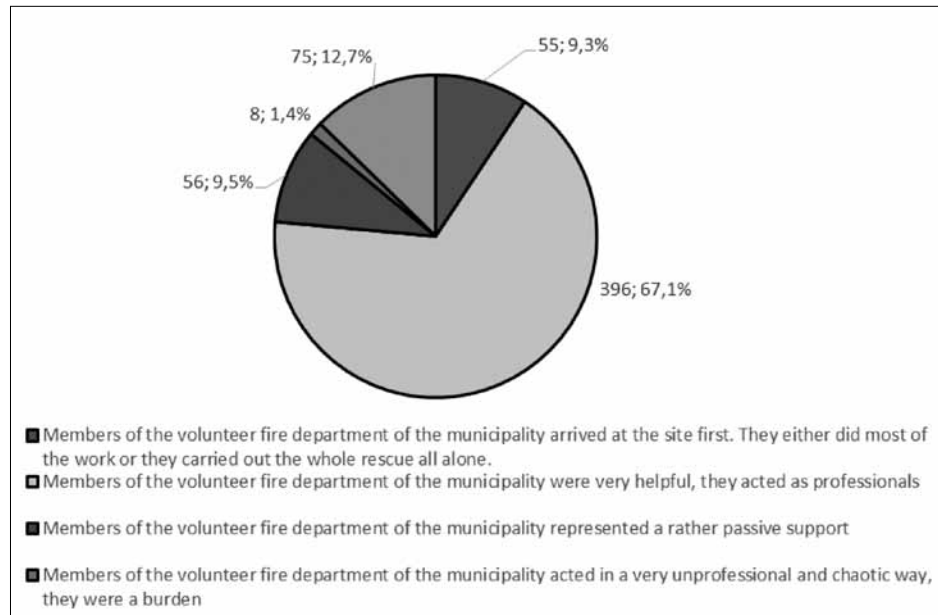


The Answers "Other" meant:

I don't know	47	30,7%
I have no experience	39	25,5%
Inadequate answer	1	0,7%
Positive evaluation of the rescue	61	39,9%
Negavite evaluation of the resque	2	1,3%
I have both positive and negative experiences	1	0,7%
Poor technical equipment of the volunteer fire department	2	1,3%

How would you characterise the work of the volunteer fire department of the municipality if it collaborates with the professionals from the Fire and Rescue Corps, or other forces of the Integrated Rescue System? (Have you seen such intervention, or have you ever heard about it?)

Semi-open question. Number of answers: 580



The Answers “Other” meant:

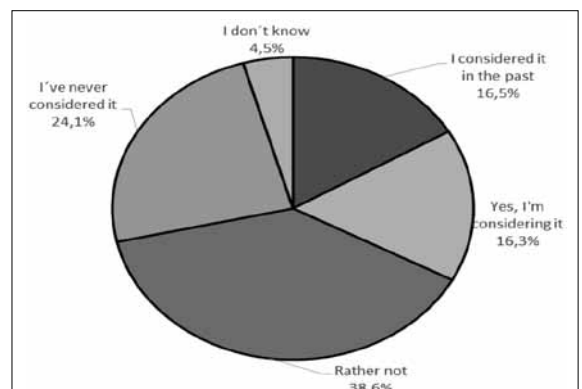
I don't know	36	48,00%
I have no experience	31	41,30%
Inadequate answer	2	2,70%
Positive evaluation of the rescue	2	2,70%
I have both positive and negative experiences	2	2,70%
Poor technical equipment of the volunteer fire department	1	1,30%
The Fire and Rescue Corps didn't need help of Voluntary Fire Department	1	1,30%

It can be concluded from the respondents' answers and reactions that people who have experienced the rescue of the volunteer fire department of the municipality, either as an independent action or in collaboration with the Fire and Rescue Corps, evaluate these interventions positively.

Have you ever considered, or are you considering now the possibility to work in the volunteer fire department of the municipality? Closed question. Number of answers: 606.

Answers:

I considered it in the past	100	16,5%
Yes, I'm considering it	99	16,3%
Rather not	234	38,6%
I've never considered it	146	24,1%
I don't know	27	4,5%



This question demonstrates that people in Slovakia (but not all of them, of course) consider the work of the volunteer fire department of the municipality to be necessary. They have even considered to become a member of the volunteer fire department.

Conclusions

The progress of volunteering resulted from its publicity, educational campaigns, bringing the public closer to volunteers and especially from the development of the volunteer centres (Andronic-Andronic, 2011). Volunteers represent an essential pillar for the success of the non-profit organisations, government, business and philanthropic organisations. We should also care about the mental health of volunteers, since they can be affected by the burnout syndrome (Shecherer-Aler-Hart, 2016). In case of accidents, every second counts and that's why it is important to establish a volunteer fire department in smaller towns where the station of the Fire and Rescue Corps is not present, or its arrival takes too long. Results of the survey show that the public feedback on the volunteer fire departments is positive and that most people have positive experiences with them. The good thing is that inhabitants of the Slovak Republic are interested in involvement in these brigades, and so are ready and resolved to voluntarily help each other. Of course, the development of the Voluntary Fire Protection of the Slovak Republic still has a long way to go. It is not possible to carry out a professional and successful rescue without a high-quality and modern material and technical equipment. Fortunately, the Slovak Republic progresses in this area and the possibility to obtain financial, material and technical support continues to increase. The work of volunteer firefighters is very important, therefore we wanted to contribute to its propagation. This study is one of the aims of the institutional project which focuses on the development, optimisation, modernisation and ultimately on the efficiency of the training of members of the volunteer fire departments.

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References

- ANDRONIC, R-L. - ANDRONIC, A-O. 2011. Counselling and Guidance of Volunteers in Romania –a psychological approach, *Procedia - Social and Behavioral Sciences* 30: 1852 – 1856, Dostupné na: sciencedirect.com: http://ac.els-cdn.com/S1877042811021847/1-s2.0-S1877042811021847-main.pdf?_tid=55286264-f5c5-11e5-8cd0-0000aabb0f26&acdnat=1459266539_61b104edf8f06f043a0e31515fb102cd
- BROZMANOVÁ GREGOROVÁ- MARČEK-MRAČKOVÁ. 2009. *Analýza dobrovoľníctva na Slovensku*, [Analysis of Volunteering on Slovakia] Banská Bystrica, Published by PDCS,o.z. – PANET
- DEES, G., 1998. *The Meaning Of Social Entrepreneurship*. [Online]. Retrieved November15, 2013from http://www.Caseatduke.Org/Documents/Dees_Sedef.Pdf.
- GUŤAN, D. 2012. Hodnota a význam dobrovoľníctva, In. *Poslanie a práca dobrovoľníkov v Trnavskom samosprávnom kraji*, Trnava, Published by Úrad TTSK
- HOCKERTS, K. 2006. *Entrepreneurial Opportunity in Social Purpose Business Ventures*. In: Mair, J., J.Robinson and K. Hockerts(Ed.) *Social entrepreneurship*. Basingstoke : Palgrave Macmillan p.14-152
- HOMLGREN, H. 2012. *Preparations for practical exercises in vocational education: Can ICT-based distance instruction be an alternative to face-to-face instruction? An empirical contribution*, *Procedia - Social and Behavioral Sciences* 46: 1152 – 1161, Available on sciencedirect.com: http://ac.els-cdn.com/S187704281201395X/1-s2.0-S187704281201395X-main.pdf?_tid=25e186fc-f5c0-11e5-a871-00000aacb35e&acdnat=1459264312_f789125c1ec1543563d880a76fbeb315
- HURBANISOVÁ, M. 2012. *Dobrovoľníctvo- Dobrovoľná požiarňa ochrana- Dobrovoľní hasiči*, [Volunteering- Volunteer Fire Protection- Volunteer Firefighters].In. *Poslanie a práca dobrovoľníkov v Trnavskom samosprávnom kraji*, Trnava, Published by Úrad TTSK
- MYDLÍKOVÁ, E. et al. 2002. *Dobrovoľníctvo na Slovensku alebo čo si počať s dobrovoľníkom*. [Volunteering in Slovakia or what to do with a volunteer] Bratislava. Published by ASSP
- NEČAS, P.-UŠIAK, J. 2002. *Nový prístup k bezpečnosti štátu na začiatku 21. Storočia*, [New approach to National Security in the 21st century] Liptovský Mikuláš, Published by AOS
- PRYCE,H.- HALL,A.- HILL, R.G. (2015)s *The role of volunteer support in the community for adults with hearing loss and hearing aids*, *Patient Education and Counseling* 98: 954 Available on sciencedirect.com: <http://ac.els-cdn.com/S0738399115001858/1-s2.0->

S0738399115001858-main.pdf?_tid=60d43114-ff21-11e5-abc6-00000aab0f26&acdnt=1460295632_6a793614de3774cfaa170ce711857d25

SCHERER,A.- ALLEN,J.- HARP, E. 2016. *Grin and bear it: An examination of volunteers' fit with their organization, burnout and spirituality*, Burnout Research 3: 1–10, available on: sciencedirect.com : http://ac.els-cdn.com/S2213058615200241/1-s2.0-S2213058615200241-main.pdf?_tid=2c610110-ff20-11e5-9214-00000aab0f27&acdnt=1460295115_799c0b2181b04a057f08d2219ac1342d

SOZANSKÁ, O -TOŠNER, J. Dobrovolníci a metodika práce s nimi v organizacích. [Volunteers and methodology of work with them in organizations]. Praha: 2002, ISBN 80-7178-514-8s. 39-40

ŠEBESTOVÁ, J.-HALTOFOVÁ, P. 2014. Volunteer Work in the Context of *Social Services in the Czech Republic*, Procedia Economics and Finance 12: 670 – 678, Available on:sciencedirect.com: http://ac.els-cdn.com/S221256711400392X/1-s2.0-S221256711400392X-main.pdf?_tid=ece6a4fa-ff23-11e5-8c5b-00000aacb35d&acdnt=1460296727_daa525591e85984c72b5dd619e79a532