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ORGANIZATIONAL AND ECONOMIC ASPECTS OF FIRE SAFETY

Based on the key statistical figures analysis on fires in Ukraine during 2000–2013, a dynamic multifactor model has been built revealing the dependence of direct losses as a result of fires on the number of fires, the number of deaths caused by fires and the number of injured in fires. The problematic issues are outlined and solutions on the organizational and economic aspects of fire safety are offered.

Keywords: fire; fire safety; direct losses caused by fires; organizational and economic aspects.

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ОРГАНІЗАЦІЙНО-ЕКОНОМІЧНІ АСПЕКТИ ПОЖЕЖНОЇ БЕЗПЕКИ

У статті на прикладі аналізу основних статистичних показників стану з пожежами в Україні за 2000–2013 рр. побудовано динамічну багатофакторну модель залежності прямих збитків унаслідок пожеж від кількості пожеж, кількості загиблих унаслідок пожеж, кількості травмованих під час пожеж. Визначено проблемні питання та запропоновано рішення щодо організаційно-економічних аспектів пожежної безпеки.

Ключові слова: пожежа; пожежна безпека; прямі збитки унаслідок пожеж; організаційно-економічні аспекти.

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ОРГАНИЗАЦИОННО-ЭКОНОМИЧЕСКИЕ АСПЕКТЫ ПОЖАРНОЙ БЕЗОПАСНОСТИ

В статье на примере анализа основных статистических показателей состояния с пожарами в Украине за 2000–2013 гг. построена динамическая многофакторная модель зависимости прямых убытков в результате пожаров от количества пожаров, количества погибших в результате пожаров, количества травмированных во время пожаров. Определены проблемные вопросы и предложены решения относительно организационно-экономических аспектов пожарной безопасности.

Ключевые слова: пожар; пожарная безопасность; прямые убытки в результате пожаров; организационно-экономические аспекты.

Problem statement. The state of fire safety provision in inhabited localities and at business entities of different forms of ownership is in direct correlation with socio-economic processes taking place in society. Year by year material losses caused by life threatening fires are increasing.

Fire effects are not limited to purely material losses with respect to total or partial destruction of production and non-production assets, commodities and materials, personal possessions of population, expenditures related to fires and recovery work, amends to aggrieved persons etc. The most drastic are the social consequences, loss of life and injuries as well as the impact on psychological condition of victims, increase of the incidences rate and social anxiety as a result of housing resource and job losses.

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Ecological consequences of fires such as environmental pollution by combustion gases, fire-fighting equipment, stuff badly damaged by fire, destruction of the ozone layer, atmosphere deoxygenation, thermal pollution, intensification of greenhouse effect etc. should be taken into account as well.

It is not surprising that there is a direct interest in the reduction of fire risks and effects. The achievement of this aim is a very acute and complex socioeconomic task.

Latest publications analysis. Scientific research on fire safety problems are widely covered in national literature by many scientists. Research guidelines of such scholars as V.A. Domanskyi (2004), A.D. Kuzyk (2011), V.Y. Nazarenko (2013), K.M. Pasynchuk and T.O. Shcherba (2010), O.V. Sydorchuk et al. (2011), O.O. Trush (2003), M.V. Udod (2004) and others are as follows:

- state management of fire safety of Ukraine;
- risk as a characteristic of fire safety state;
- management of "fire safety" as an integral component of national security;
- structural and functional provision of territory management for emergency prevention and response;
- administrative and legal regulation of fire safety provision in Ukraine.

Unresolved issues. At the same time Ukrainian scientific studies devoted to economic aspects of fire safety are not numerous. The research of the interrelation of fire and economic safety as national security constituents was pioneered by O.M. Martyn (2013). Development of organizational and economic mechanism of state management of fire safety of Ukraine is represented by O.O. Kalashnikov (2011), who analyses the problem of fire insurance, that doesn't cover the overall problems of organizational and economic aspects of fire safety. The choice of topic is determined by the lack of publications.

Research objectives. The analysis of the statistical key figures on fires in Ukraine during 2000–2013 is to be taken as an example to build a dynamic multifactor model of the dependence of direct losses as the result of fires on the number of fires, the number of deaths caused by fires and the number of injured in fires; to outline the problematic issues and offer solutions on some organizational and economic aspects of fire safety.

Key research findings. Provision of fire safety on the territory of Ukraine, relations regulation between government authorities, local self-government bodies, business entities and individuals in this field are carried out in accordance with The Civil Code Ukraine (403-VI, 2.10.2012), laws and other regulatory acts.

To provide fire safety is to make state economic arrangements intended for life and health protection, individual property protection, national wealth and environment protection.

To prove the need for the proper economic support, the emergency statistical data of the latest period should be taken into consideration as well as the general analysis of the damages caused by them.

According to the facts in the fire records delivered to The Ukrainian Scientific Research Institute of Civil Defense by The Head Department of The State Emergency Service of Ukraine in The Autonomous Republic of Crimea, regions, the cities of Kyiv and Sevastopol, in 2013 there were registered 61114 fires as compared to 71443 on the previous year, that is 14.5% less (Table 1).

Table 1. Dynamics of the statistical key figures of fires in Ukraine for the period 2000–2013

Years	Direct losses, ths UAH	Fires	Number of deaths as the result of fires	Number of injured people
2000	58016	58156	3199	1528
2001	77832	57925	3523	1824
2002	88956	59679	3798	1766
2003	89546	61286	3914	1849
2004	90493	47698	3784	1828
2005	130383	49944	4187	1895
2006	201930	48084	4031	1900
2007	479362	50583	4001	1867
2008	431956	46476	3876	1775
2009	483098	44015	3209	1634
2010	665396	62207	2819	1537
2011	802846	60790	2869	1525
2012	860070	71443	2751	1682
2013	710863	61114	2494	1584

Source: Composed by the authors according to the data (Analysis of fire records..., 2013).

Material damage caused by fires make 2,952,584,000 bln UAH, including direct losses of 710,863,000 mln UAH and incidental damage make 2,241,721,000 bln UAH; besides, the amount of direct losses decreased by 17.3%, the amount of incidental damage decreased by 10.3%. On average 168 fires, 8 deaths and 5 injuries as the result of fires were registered every day in Ukraine in 2013.

Any natural or social phenomenon couldn't be perceived without explanation of its correlation with other phenomena. To perceive the essence of phenomena is to find out relations between them, determine quantitatively the impact of any objective and subjective factors. For this reason there has been made the regression analysis comprising the following: direct losses, number of fires, number of deaths and injuries as the result of fires. The built dynamic multifactor model of the dependence of direct losses as the result of fires on the number of fires, the number of deaths caused by fires and the number of injured in fires is as follows:

$$DL = 1437866 - 5.35 \times F - 606.36 \times D + 768.31 \times I, \quad (1)$$

where DL – direct losses as the result of fires; F – number of fires; D – number of deaths caused by fires; I – number of injured in fires.

The value of the R -squared equals 0.5625. It means that the coefficient of dispersion of DL result, due to the regression, makes 56.25%.

After processing of data the results of approximation of the direct losses caused by fires can be showed in Figure 1. According to the Decree of The Cabinet of Ministers of Ukraine (On Approval of the Procedure for records of fires and their consequences, December 26, 2003, #2030):

- incidental damage caused by fires are the evaluated expenses on fire extinction (cost of fire-fighting agents, combustive and other materials etc.), liquidation of fire consequences (including socioeconomic and ecological losses), comprising the reconstruction of the object; losses due to the production hold-up, interruption of work, changes in transport schedule etc;
- direct losses caused by fires are the evaluated material losses destroyed and/or damaged due to the direct impact of dangerous fire factors.

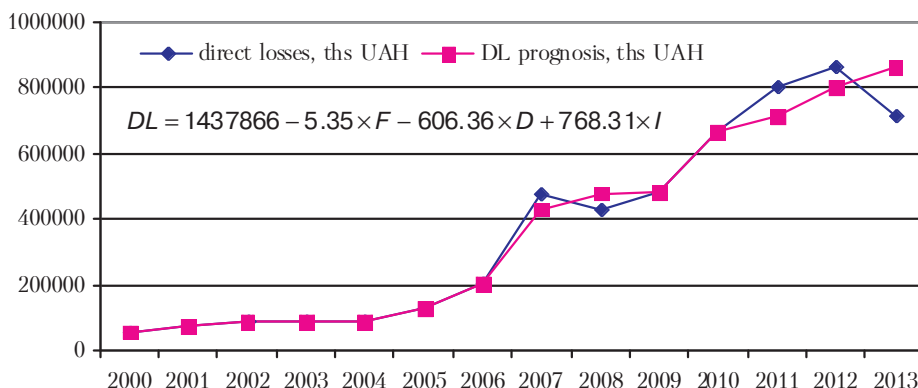


Figure 1. **Approximations of direct losses caused by fires,**
constructed by the authors on the basis of their own calculations

According to the Decree of The Cabinet of Ministers of Ukraine (On Approval of the Procedure for records of fires and their consequences, December 26, 2003, #2030) depending on material losses fires can be of the following types:

- fires with extensive material losses – the direct losses caused by such fires make more than 300 non-taxable minimum incomes;
- fires with extremely extensive material losses – the direct losses caused by such fires make more than 1000 non-taxable minimum incomes.

Fires damage heavily the economy of the country, material losses caused by fires in 2013 made almost 0.05% of the gross domestic product, and in 2012 – more than 0.06%. We propose the scheme of basic organizational and economic aspects of providing fire safety in Ukraine (Figure 2).

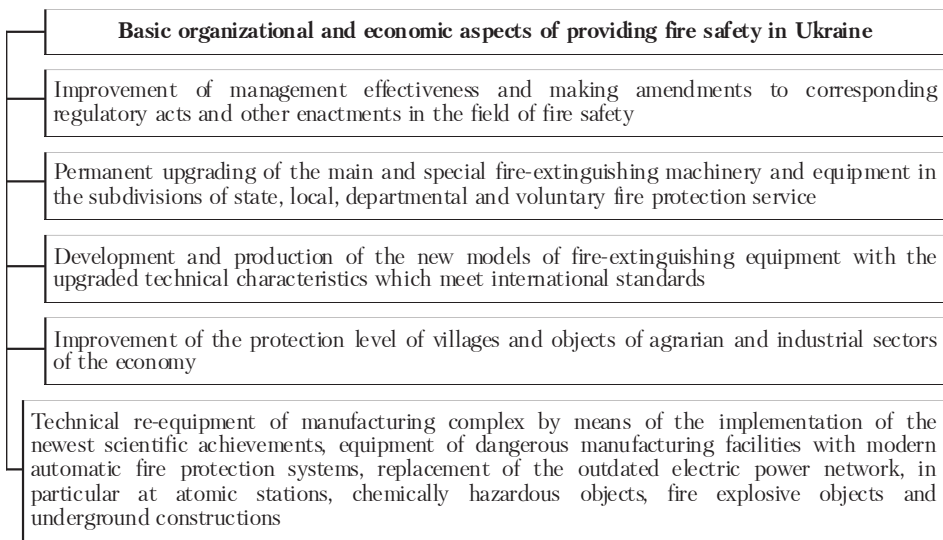


Figure 2. **Basic organizational and economic aspects of providing fire safety in Ukraine,** developed by the authors

We agree with the opinion of O. Martyn (2013) that state economic strategy as well as state fire strategy should comprise scientific and methodological, regulatory, organizational, material and financial support arrangements which will promote the realization of strategic approaches of safety insurance which can be classified as emergency, priority and long-range measures.

Summary and research perspectives. It is evident that organizational and economic aspects of fire safety constitute an integral part of national security provision.

The study of organizational and economical aspects of fire safety should include the following issues:

- economically feasible minimization of fire hazards;
- forecasting and evaluation of socioeconomic consequences of fires, specification of the requirements in efforts, means, financial and material resources;
- the development and realization of measures aimed at maintenance of steady functioning of national economy during the fire season.

The next step in problem analysis is working out the measures aimed at maintenance of steady functioning of national economy during the fire season.

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