“Modern technologies of detection and prevention of corruption in emerging information society”

AUTHORS	Natalia Maslii Natalia Zakharchenko Viktoriia Butenko Oksana Savastieieva Tetiana Butenko Liudmyla Shyriaieva

ARTICLE INFO	Natalia Maslii, Natalia Zakharchenko, Viktoriia Butenko, Oksana Savastieieva, Tetiana Butenko and Liudmyla Shyriaieva (2018). Modern technologies of detection and prevention of corruption in emerging information society. *Problems and Perspectives in Management*, *16*(1), 58-67. doi:10.21511/ppm.16(1).2018.06
DOI	http://dx.doi.org/10.21511/ppm.16(1).2018.06
RELEASED ON	Wednesday, 31 January 2018
RECEIVED ON	Friday, 29 September 2017
ACCEPTED ON	Friday, 27 October 2017

LICENSE	This work is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License

JOURNAL	"Problems and Perspectives in Management"
ISSN PRINT	1727-7051
ISSN ONLINE	1810-5467
PUBLISHER	LLC “Consulting Publishing Company “Business Perspectives”
FOUNDER	LLC “Consulting Publishing Company “Business Perspectives”

NUMBER OF REFERENCES	NUMBER OF FIGURES	NUMBER OF TABLES
21	2	3

© The author(s) 2024. This publication is an open access article.

BUSINESS PERSPECTIVES

LLC "CPC "Business Perspectives"
Hryhorii Skovoroda lane, 10, Sumy,
40022, Ukraine

www.businessperspectives.org

Received on: 29th of September, 2017
Accepted on: 27th of October, 2017

© Natalia Maslii, Natalia Zakharchenko, Viktoriia Butenko, Oksana Savastieieva, Tetiana Butenko, Liudmyla Shyriaieva, 2018

Natalia Maslii, Ph.D. (Economics), Associate Professor, Odessa I. I. Mechnikov National University, Ukraine.

Natalia Zakharchenko, Ph.D. (Economics), Associate Professor, Odessa I. I. Mechnikov National University, Ukraine.

Viktoriia Butenko, Ph.D. (Economics), Associate Professor, Odessa I.I. Mechnikov National University, Ukraine.

Oksana Savastieieva, Ph.D. (Econ), Associate Professor, Odessa I. I. Mechnikov National University, Ukraine.

Tetiana Butenko, Ph.D. (Economics), Associate Professor, Odessa Regional Institute for Public Administration of the National Academy for Public Administration under the President of Ukraine, Ukraine.

Liudmyla Shyriaieva, Doct. Sci. (Economics), Professor, Odessa National Maritime University, Ukraine.

This is an Open Access article, distributed under the terms of the Creative Commons Attribution-Non-Commercial 4.0 International license, which permits re-use, distribution, and reproduction, provided the materials aren't used for commercial purposes and the original work is properly cited.

Natalia Maslii (Ukraine), **Natalia Zakharchenko** (Ukraine), **Viktoriia Butenko** (Ukraine), **Oksana Savastieieva** (Ukraine), **Tetiana Butenko** (Ukraine), **Liudmyla Shyriaieva** (Ukraine)

MODERN TECHNOLOGIES OF DETECTION AND PREVENTION OF CORRUPTION IN EMERGING INFORMATION SOCIETY

Abstract

With the development of the information society, there has been rapidly growing number of international research on the role of various (information, innovation, intelligent) technologies as a catalyst to fight corruption. As you know, the problems posed by corruption are economic, social and political consequences. In recent years economists and various researchers have shown increasing interest in studying the phenomenon of corruption. Many researchers in the field of studying corruption phenomenon are of theoretical nature, which studied different behaviors without having developed effective methods and technologies to identify and prevent corruption in the various spheres of government. In this regard, there is a need to study the world experience of application of technologies in the prevention of corruption and anti-corruption platform in Ukraine. This will allow to adapt them to positive experience in the implementation of mechanisms to identify and prevent corruption in Ukraine. The authors believe that to obtain a more accurate picture of the corruption situations that provide characteristics and its quantitative description is possible only by means of modelling the corruption phenomenon. In this regard, the analysis of theoretical models of corruption was made: the modelling made by the mathematical notation of the models and conclusions on the effectiveness of their application in management. Using simulation, the authors came to the conclusion that the detection and prevention of corruption should be carried out with the use of technologies and the system approach: from the study of statistics and use of anti-corruption platforms, public registers and databases to logical and probabilistic (LP) risk models of corruption.

Keywords information technology, corruption, model, modeling, anti-corruption platforms, database, logical equations, information society, detection

JEL Classification O17, O29, C89

INTRODUCTION

Corruption is one of the main problems in the world, which is constantly in the centre of the international community. Talking about the negative consequences of this phenomenon is based on very general arguments – corruption destroys trust in society, undermines the system of values, promotes oligarchy and unfair enrichment of officials by ordinary citizens. However, other than the moral aspect, corruption leads to equally important economic consequences: in corrupt countries, the pace of economic growth has slowed down, there is irrationality in public spending, reduced budget revenue, less attracted private investment, etc. In the modern conditions of information society and transition to intellectual economy that require a wide application of information technology (IT) for regulation of problems in all areas of life, it is relevant to use IT both for the simulation of the cor-

ruption situation and creation of technologies to prevent it. Thus, it is necessary to explore the existing model, and use IT to adapt to their positive experiences before preventing corruption in Ukraine. In this regard, there is a need to study the world experience of application of technologies in the prevention of corruption and within the anti-corruption platform in Ukraine. This will allow to adapt them to positive experience in the implementation of mechanisms to identify and prevent corruption in Ukraine.

1. LITERATURE REVIEW

Rose-Ackerman (1975) considered corruption as an economic behavior in terms of risk associated with the accomplishment of the crime and possible punishment. He analyzed corruption between the bureaucrat (the contractor) and firms competing for government contract (customers). The model allows to draw some qualitative conclusions. Corruption is not simply a function of the amount of resources spent on supervision and prosecution, it depends on the structure of relations between government and the private sector. These relationships can encourage corrupt behavior or limit it. So, if the government buys a product that is sold also in the private market, the motives for bribery are much less than in the case where the state is the sole buyer. In the case where goods are ordered by the government specifically for public use there, should be developed measures to reduce ambiguities in the instructions – the requirements for these goods, which will reduce the cost of effective supervision of right choice of contractor, and increase the likelihood of identifying cases of corruption.

Shleifer and Vishny (1993) analyze the distribution of public resources by the bureaucrats, and the effect of competition between bureaucrats (performers) and between consumers (clients) on the level of bribes. In the simplest model in the work of Shleifer and Vishny (1993), the problems are investigated which are similar to those considered in the work of Rose-Ackerman (1975), namely the possibility of "stealing" the benefits from the state which are distributed to public servant, the role of monopoly and monopsony in the spread of corruption, the relationship of political structures, economic institutions and the level of corrupt activity. The authors operate on the standard tools for the microeconomic analysis: marginal productivity, marginal cost, etc. Corruption is defined as a sale by of state property public servants for private purposes. The work suggests two important reasons why corruption may be costly to economic development. The first reason is the weakness of the central government, which allows various governmental agencies and government officials to independently collect bribes from private agents who obtain interrelated permission from these agencies. The second important reason why corruption is costly is the distortion caused by the need to keep corruption secret. The requirement of secrecy can shift investments in the country from the most advantageous projects (health, education) towards potentially useless projects (defence, infrastructure), if the latter provide the best conditions for concealment of corruption. Thus, the economic and political competition can reduce the level of corruption and its adverse consequences.

The model proposed in the work of Hillman and Katz (1987) is one of the first models of corruption in a bureaucracy with a hierarchical structure. In this work, the main subject of this study is the corruption within the organization that has some hierarchical structure, and the main goal of the analysis is to estimate the social costs of corruption in such a system. As seen in the work, not the bribes themselves are the cause of social costs, and the bribes are subject to competition from bureaucrats (contractors). It is assumed that the organizational structure of the bureaucracy is fixed, however there is competition, for specific locations within. The lower-level bureaucrat "sells" the bribe to the customer which is actually a competitive product – an annuity, and this bribe is divided with the higher-level bureaucrat who, in turn, shares a part of the bribe with his boss, etc. Therefore, the bribe is distributed among bureaucrats with different levels of the hierarchy. At each level, there is a competition of officials for the "warm place" where they can join in the sharing of bribes, and this place will be only at this level of the hierarchy. The model is based on the idea that, first, the profit is distributed as a bribe "shifting" it from the purchaser of the annuity (the client)

to the bureaucrat receiving a bribe; and, secondly, the activities associated with the struggle for occupation by bureaucracy "warm places", and material resources that is the cause of social costs. From the model it follows that if there is competition for rents used material resources and bribes, and taking into the position of the competitive recipients of bribes, the resulting structure of the bureaucracy is likely to be multilevel, not flat. From model calculations it also follows that in the case of perfect competition and competition with a small number of participants with increasing numbers of hierarchy levels, the social costs increase. This result reinforces the proposal of some economists to consolidate the constitutional limitation of the size and structure of governmental organizations.

This component includes the work of Bac (1996) on the problem of "host – controller – contractor". In terms of a performer, his model examines different types of hierarchies. In the paper, we assume that each executor (bureaucrat) at any level of hierarchy from the outside is offered a bribe. The bureaucrat can take or refuse. The level of "external" corruption is the number of bureaucrats in the hierarchy taking outside bribes. In addition, lower-level bureaucrats can bribe the higher-level bureaucrats (in this case, there is internal corruption in the organization). The aim of the manages is to minimize the costs of achieving a given level of "external" corruption in the organization. In such a system, it is examined what will be the optimum form of hierarchical structure and incentive scheme for bureaucrats 1) in the presence of internal corruption, 2) in its absence. As pointed out by the author, it would be interesting to include in the model such factors as more complex control systems, e.g., direct control of the parent company by the chief artists of all underlying levels. The model also can include competition for performers of lower level bribes for a place in the hierarchy.

In work of Mikhailov (1999), is a hierarchical structure also considered in the chain of institutions, each of which obeys a superior. Under the proposed dynamic macroeconomic model, we examine the system of "power society" where power is vested in the above chain of institutions, and the society is able to influence the redistribution of power in the chain of institutions. In the hierarchy of institutions there can exist internal corruption, which is reflected in the model as an opportunity to subsidiary company "shopping" for a bribe to "share the power" of the parent company. In the study of the effectiveness included in the model measures for suppression of corruption, the view was obtained opposite to the traditional one, the conclusion was made that the major efforts to reduce corruption should be aimed at the lower echelons of the chain of institutions.

Mookherjee (1995), for example, in a simple game model of the type "owner – contractor – client", explores the relationship between compensation policy of officials and corruption.

In the work of Levin and Satarov (2012), the problems of modeling corruption are discussed as socio-economic and political phenomena, an overview of existing directions and approaches to the modeling of corruption is provided. Approaches to the study of basic categories and concepts related to corruption, as well as attempts to classify mathematical models of corruption, cover the basic model of corruption and its modifications.

Buehn and Schneider (2009) studied the relationship between corruption and the shadow economy. The authors believe that, theoretically, they either substitute or complement each other showing a negative or positive relationship. The results of their research showed the close relationship between corruption and the shadow economy and substantiated the hypothesis that the shadow economy influences corruption more than corruption influences the shadow economy.

Levin and Satarov (2012) suggested using the intellectual innovative information technology (I3 technology) for preventing the bribes and corruption. I3 technology uses statistical data, logical and probabilistic (LP) risk models and knowledge base (KB). The author proves that without I3 technology, the scientists cannot solve the problem of preventing the bribes and corruption their. In study they, described the effect of LP model of bribes risk in the institution on the results of its functioning, the officials on the basis of the description of their behavior, institutions and officials on the basis of analysis of maintenance options.

The purpose of this article is to analyze the world experience of application of technologies in the prevention of corruption and within the anti-corruption platform in Ukraine.

The modern study involves searching the causes of corruption, signs of corruption, assessing its impact and developing the methods of resistance. That is, the technologies used to detect and prevent corruption should be:

- informational – use of database and automated processing of statistical data;
- innovative –use of logical probability (LI) models of risk (Transparency International), which provide advantages in accuracy estimates;
- intellectual – use of knowledge bases in the form of logic equations that allows to gain new knowledge and solve new problems.

Due to the illegality of corruption, corrupt deals remain in the shadows, so the statistical evaluation of this phenomenon is extremely challenging. Most studies reveal the overall level of corruption by public opinion polls. Research has shown that the phenomenon of corruption is not limited to specific regions and levels of economic development. According to research Transparency International (2), the global index of perception of corruption in 2015 in the lowest corruption is widespread of Denmark, Finland and Sweden.

For Ukraine, CPI (Corruption Perceptions Index) is 27 points out of 100, and in a worldwide ranking of the 168 positions, it takes 130 place. Figure 1 shows the ranking of states with different levels of CPI. It is a composite index, which is a combination of surveys and estimations of corruption, data collecting from various reputable organizations. The number of points received by country / territory shows the perception of public sector corruption on a scale of 0 to 100, where 0 means that the level of corruption in the public sector is considered high, and 100 – very low.

The forms of corruption in the countries around the world include bribery, extortion, cronyism, nepotism, commercial bribery, receiving kickbacks, appropriation of another's property or money. Barometer World Corruption (poll conducted by Transparency International) shows that the most corrupt is the sphere of public administration. Thus, according to the International Consortium for investigative reporting (3), the list of persons mentioned in the documents of Panama comprises the names of current and former officials around the world.

Sociological study of "The level of perception of corruption in Ukraine" (12) shows that the most corrupt are the state agencies in Odesa, Zaporizhfhia and Khmelnytsky regions. The least corrupt is are Volyn, Zakarpattia and Poltava regions. Rating of the most corrupt sectors of activity (public perception) in Ukraine, compiled on the basis of the survey population, is shown in Figure

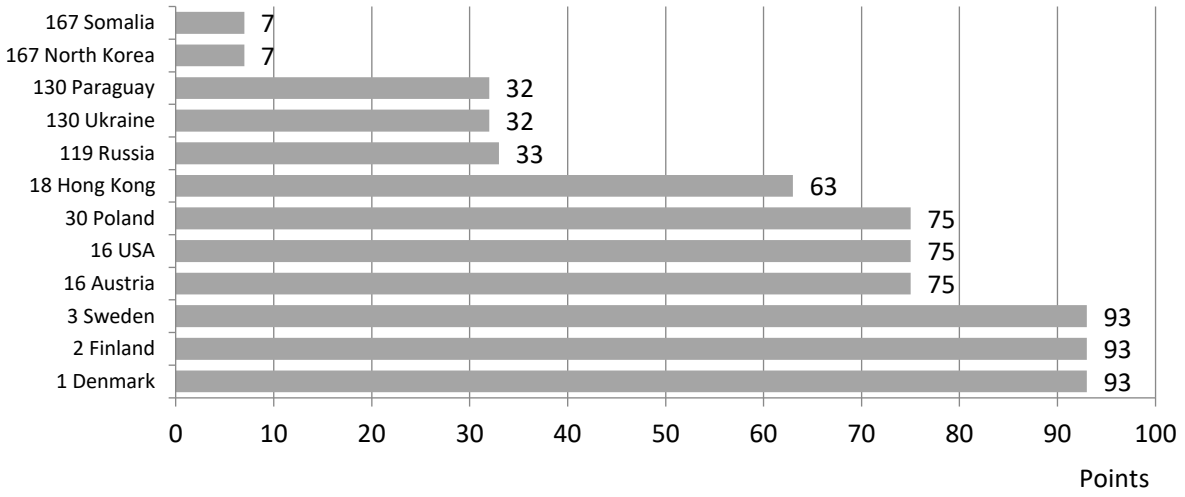

Figure 1. Rating of certain states with different CPI (2015)

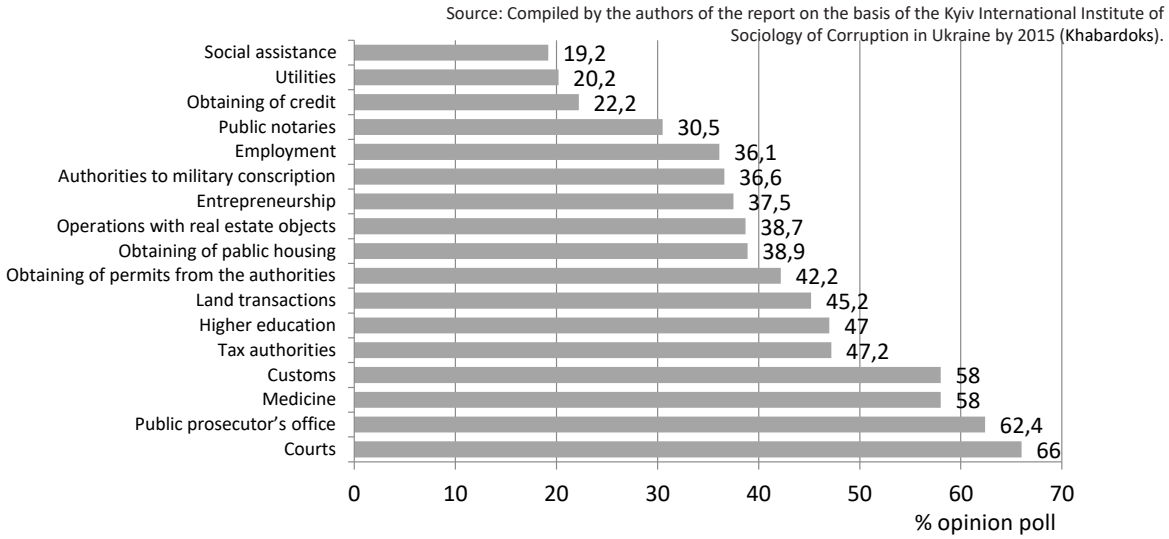

Figure 2. Rating of the most corrupt sectors of activity in Ukraine

2. Rating starts with the judicial system, which is called corrupt by two-thirds of respondents. The list of the five most corrupt sectors the perception of the population also includes prosecution, medicine, customs and fiscal services according to.

Today in Ukraine the following agencies are established that carry out work to prevent corruption: The National Anti-Corruption Bureau of Ukraine, anti-corruption prosecutors, the National Agency for Prevention of Corruption.

According to the results of survey, conducted by the Center for Economic Strategy (5), between the economy and corruption link:

1. Corruption definitely slows down the economic growth the following relationship is observed. For example, according to our estimates based on the research, if the level of corruption in Ukraine has decreased to the level of Poland, GDP per capita in Ukraine for the past 10 years would have increased have to 2824 dollars per capita.

2. In corrupt countries, public spending is ineffective: in particular, there is less spending on education and healthcare, but more – on military projects. Because today in the country there are objective reasons for the increase in military spending, which is vulnerable to corruption, transparency and the necessary controls for these costs.

3. In corrupt countries, there is less revenue. In Ukraine, 62% of taxes, are evaded and almost half of them are bribes.

4. Corrupt countries attract less private investment because of the higher risks and higher cost of capital. If the level of corruption in Ukraine has reached the level of Poland, the foreign direct investment in Ukraine would have increased to USD 2.2 billion.

5. Shadow economy. In Ukraine, 41-46% of the economy is shadow.

6. Reduced efficiency of the economy – for example, due to increased cost of capital or its reduced performance. If the level of corruption in Ukraine has reached the level of Poland, the capital productivity in Ukraine would have increased to 6.4%, and the annual GDP thus would have risen to almost USD 21 billion.

The network for preventing the corruption of information and marketing centers is based on providing the access to economic and administrative information, and providing electronic licenses, certificates, etc. for public institutions Table 1 shows examples of different countries implementing the initiatives for applying IT in the prevention of corruption.

As for the Ukrainian experience of using IT in preventing the corruption, the authors also noted

Table 1. Examples of implemented initiatives for applying IT in the prevention of corruption

Source: Compiled by the authors based on Buehn and Schneider (2009).

Case	Country	Characteristic
Supervisor	Slovenia	On-line application to the Commission for the Prevention of Corruption. The application provides information on the financial transactions of the legislative, judicial and executive authorities, independent state authorities and local communities.
BASE	Portugal	National online portal on public contracts. BASE receives data from the official journal of certified electronic platforms and publishes contracts arising from all types of procedures, information on their implementation. Mandatory publications are also amendments that increase the budget by 15% of contracts concluded, as well as potential fines.
Electronic database of government procurement	Croatia	The web portal of public procurement and electronic database features that not only integrates information related to the implementation of public procurement procedures and companies. Electronic database also includes information about the assets and interests of civil servants. Such aggregated data make it possible to carry out cross-checks.

the implementation of such anti-corruption platforms as Khabardoks, 007, Prozorro (Table 2).

Khabardoks platform facilitates the collection of materials about the corruption schemes, expanding the evidence base of anti-corruption investigations, ensuring the anonymity of informants. Similar tools use such publications as The New Yorker (Strongbox), Forbes (Safe Source), Zeit (Online briefkasten), Al Jazeera (Transparency Unit), and the institutions of the European Union such as the European Anti-Fraud office (OLAF), journalistic platforms in Holland (PubLeaks), Serbia and Bulgaria (BalkanLeaks), Spain (Filtrala) and Italy (MafiaLeaks). Implementation of Khabardoks in Ukraine was made possible by Tallinn University of Technology and Data Research and Development Agency (data RADA) funded by the Ministry of Foreign Affairs of Estonia.

Search and analytical system 007 is a web-service based on publicly available data from the field of public finance. It provides the ability to search, analyze and visually present the information on how the government uses taxpayers' money. Service uses information from various sources: portal E-data, data.gov.ua, State Statistics website and electronic government procurement system Prozorro. The leader of the "Search and analytical system 007" is Natalia Kravchenko.

The system Prozorro gained international recognition and has shown the world that positive changes already take place in Ukraine, and that we are on track to overcome corruption. In May 2016, in London, the Ministry of Economic Development and Trade of Ukraine has received an international award for the creation and implementation of e-procurement system with a unique architecture. The project manager of Prozorro was nominated in the category of "public sector". IT coordinator of Prozorro is Andrew Kucherenko.

More accurate picture of the corruption situation characterized and quantified can be described by

Table 2. Anti-corruption platforms of Ukraine

Source: Compiled by the authors based on the materials of Khabardoks, 007, Prozorro.

System	The purpose of creation	Structure of the system
Khabardoks	Protection of those who disclose corruption during the anti-corruption investigation	Khabardoks tool – a combination of programs that protect your communications during investigation. Free anonymizer helps to anonymously disclose evidence of corruption cases and protect the "pressing". Messages and files are encrypted using Global Leaks.
007	To simplify the search and visualize public finance data on Ukraine	The modules implemented in the system 3 are as follows: search for the transactions, namely transactions of spending units in terms of regions, cities and districts of individual institutions or facilities; monitoring content database open for public finance data – information on how intensely managers open their accounts; analytical – any Ukrainian can analyze the processes in the field of public finance.
Prozorro	A significant reduction in corruption in procurement by public funds	The system comprises the following modules: add and search the tender; analytics module – reflecting all purchases conducted through Prozorro.

modelling the corruption phenomenon. Analysis of recent research and publications enables to define the following types of general patterns of corruption: the basic model, game-theoretic model, the model of corruption in hierarchical structures, econometric model.

1. Basic model (Rose-Ackerman, 1975). The model is based on the principle of imitation economic relations in the triad "customer – agent – client". It considered the competition of private firms seeking to obtain government contracts by bribing officials: G – profit bureaucrat, p_i – profit seller, then:

$$G\left(X^i\right)\cdot X^i - J\left(X^i\right) - R\left(X^i\right),$$

$$p_i\left(X^i\right) = P^i q - T^i - X^i - D^i\left(X^i\right) - N^i\left(X^i\right),$$

where X^i – the total amount of bribes paid by the seller, P^i – unit price of the product seller, q – the quantity of product, required state (assuming the set), $J\left(X^i\right)$ – the average fine for bureaucrat, $R\left(X^i\right)$ – moral costs for bureaucrats while taking bribe X^i, T^i – the total cost of production units for the seller, $D^i\left(X^i\right)$ – the average fine for the seller, $N^i\left(X^i\right)$ – moral costs to the seller at giving bribes X^i.

Admissible domain seller is defined by the ratio:

$$X^i \le P^i q - D^i\left(X^i\right) - N^i\left(X^i\right).$$

The effectiveness of actions to prevent corruption depends not only on the severity of the punishment, but also on factors such as profit firms, probability of detecting corruption, and quality of formalization.

2. Game-theoretic model (Chhartyshvili, 2004). The model considered N agents – official additional income, each of which is proportional to the amount of bribes to him x_i. Each agent is characterized by its type r_i, which is not known to other agents. Behind corruption $\left(x_i \ge 0\right)$, regardless of its size, the agent may be fined $\chi_i\left(x, r_i\right)$, which depends on the actions $x = \left(x_1, x_2, ..., x_n\right)$ is R_+^n all agents and type of agent. Thus, the objective function of i-th agent is as follows:

$$f_i\left(x, r_i\right) = x_i - \chi_i\left(x, r_i\right) \text{ is } N.$$

Function of fines is as follows:

$$\chi_i\left(x, r_i\right) = \varphi_i\left(x_i, Q_i\left(x_i\right), r_i\right),$$

where Q_i – the overall level of corruption of other officials.

If officials are observing the average level of corruption, this average level in a stable situation does not depend on mutual perceptions of corruption types about each other. It does not matter whether these ideas themselves are true or false.

3. Hierarchical model (Myhaylov, 1999). The object of study in this model is the hierarchical structure (hierarchy) ordered by seniority of institutions vested with discretionary powers on behalf of the state. Internal corruption within this model is understood as the possibility of obtaining subordinate elements of the hierarchy of authority disparaging elements. The distribution of power in the hierarchy of p type describes solution of the equation as follows:

$$n(x)\frac{dp}{dt} = \frac{d}{dx}\cdot\left(k(x, t, p)\cdot n(x)\frac{dp}{dt}\right) +$$
$$+n(x)\cdot F(x, t, p),$$

$$n(x)\frac{dp}{dt}\Big|_{x=0} = n(x)\frac{dp}{dt}\Big|_{x=1} = 0,$$

where n determines the amount of elements at different levels of hierarchy; function F describes the reaction of society on policy decisions implemented hierarchy; k factor determines the elements of strategic behavior and hierarchy i. When corruption can mean the loss of the power structures of authority in the territory, then

$$\frac{dp}{dt} = e^{-\beta x}\cdot\frac{d}{dx}\left(De^{\beta x}\frac{dp}{dx}\right) +$$
$$+k_1\left(H - kx - p - \varphi(x)\cdot p\right),$$

where the function $\varphi(x)$ – density of distribution losses caused by corruption.

The higher the level of authority, the more resources it can bring to its defence. In addition, the larger the bribe, the more corrupt authority is ready to spend on its defence.

4. Econometric model (Buehn & Schneider, 2009). We consider the structural model (SM) relationship between corruption and the shadow economy, which act as latent variables. Research is conducted using covariance structures between these factors and indicators of these variables. SM consists of two parts: a structural equation model (SEM) and measurement model (MM). SEM has the following form:

$$\eta = B\eta + \Gamma x + \xi,$$

where B – matrix influence of the shadow economy on the level of corruption, each x_i is x – potential causes for the one of latent variables, contained in vector η, Γ – matrix connection between the variables and their causes, ξ – vector error.

MM provides information on 1 indicator model. It is determined by:

$$y = \Lambda\eta + \varepsilon,$$

where y – vector indicator of corruption and the shadow economy, Λ – matrix of regression coefficients, ε – the white noise unrest.

Additional correlation between corruption and the shadow economy is observed in low-income countries.

However, as already noted, in modern times, these models are unsuitable for quantitative studies conducted by the state in the fight against corruption.

Adaptation to any system to detect corruption is LI risk model system states. LI model of success in solving the general problem of preventing corruption is simple in mathematical calculation:

$$\text{Success} = D\,\&\,O \text{ States} \cap D\,\&\,O \text{ Business } \cap$$
$$\cap D\,\&\,O \text{ Services economic crime} \cap$$
$$\cap D\,\&\,O \text{ IT Developer } \cap D\,\&\,O \text{ Community},$$

where $D\,\&\,O$ – desire and opportunity of subjects, which depend on the solution of the problem.

That is, a logical function of successful solution of the problem of corruption is described as logical multiplication of logical variables for the subjects. Criteria willingness and capacity are seen as logical variables with communication $\cap$. At the they request, it refers to intention to fight corruption and their motives. Opportunity – is the availability of resources, technologies and techniques to get results.

The desire to fight corruption in the state apparatus exhibits numerous declarations and the creation of various anti-corruption commissions. Thus, according to the Anti-Corruption Strategy (Єдиний державний реєстр судових рішень [Yedynyi derzhavnyi reiestr sudovykh rishen]) in Ukraine, in 2014–2017, National Agency for Prevention of Corruption began its work. Today, the Agency provided direct access to databases of public authorities and local governments.

In the sphere of business corruption, two parties are concerned: the briber and bribe taker, each of which gets its own benefit. And although honesty is not applicable to business, business is interested in the creation of stable rules that reduces the risk of bankruptcy.

Old investigative service was not interested in the effective fight against corruption, as the existing system is still operating the search tools, which brought them considerable revenue. However, the creation in Ukraine of new specialized anti-corruption bodies involves the building of a new system of operational search tools based on the agent's conscientious attitude to their duties.

Developers have created IT LI model of fraud risk for workers, managers and scams on investment model which was built to detect risks of corruption in government. That is, informational and methodological level of the problem of detecting corruption is almost solved.

The community is showing its capacity to fight corruption through the media, rallies, demonstrations, etc. However, the Ukrainian people have a high tolerance for corruption. Thus, according to Transparency International, 22% of Ukrainians justify corruption. To change the mentality of society on perception of corruption, creative social advertising should be established, exposing corruption as a destructive phenomenon. Nowadays in Ukraine, a campaign was designed titled "Corruption must be seen".

Table 3. LI models of risk corruption for solving particular problems

Source: Compiled by the authors based on the materials by Chkhartishvili (2004).

Private problem	Structure model
Corruption in the institution	Elements LI risk models corruption in the institution are functional departments $Z_1, Z_2, \dots, Z_n$, in each of which $N_j \left(j=\overline{1,n}\right)$ are officials who make decisions. Elements related to logical connection are "$\cap$, $\cup$, $-$" and can be cycles. Official sj – subdivision $Z_{j1}, Z_{j2}, \dots, Z_{jN_j}$ form a group of incompatible events (GIE). Construction LI mod built list calculate probability P_{jr}, $j=\overline{1,n}$, $r=\overline{1,N_j}$, with which according statistics officials take bribes.
Corruption of officials	Elements LI risk models corruption officials are signs of bribery $Z_1, Z_2, \dots, Z_n$: the duration of work in institution; buying houses, cars, etc., whose value doesn't match the salary; availability of debt; financial requests; addiction to gambling; a way of life that goes beyond; the availability of complaints; criminal past; the lack of independent inspections; the lack of relevant documents and requests; disregard for the rules. The sign has several shades. Gradation for j-sign $Z_{j1}, Z_{j2}, \dots, Z_{jN_j}$ to constitute the GIE. The logical model in disjunctive normal form: $Y = Z_1 \cup Z_2 \cup \dots \cup Z_n$. The logical function after orthogonalization is: $Y = Z_1 \cup Z_2 Z_1 \cup Z_3 Z_2 Z_1 \cup \dots$. The model is identified to calculate probability P_{jr}, $j=\overline{1,n}$, $r=\overline{1,N_j}$, with which according to statistics suspicion of corruption officials take bribes.
Corruption at service	The risk of corruption is calculated according to statistics of the parameter service. Each parameter value is assigned a number of gradation. The gradation constitutes GIE. The probability of event gradation is given by: $P_j = N_j / N$, where N_j – the number of parameters in the statistics of this gradation, N – size (statistics). Parameter service Y is admissible value Y_{ad}. Probability $P\{Y < Y_{ad}\}$ shows the risk of corruption.

Private LI corruption risk models are based on the description of the behavior of the institution, officials and end customer value sets and their distribution – discrete series for behavior parameters, objects and sets of values administered event parameters, and event gradations, respectively, to construct a knowledge base and a system of equations according to LI based statistics.

In the role of the knowledge base for preventing of corruption in Ukraine can be the following government registers: Unified Government Register of Court Decisions; Unified Register of Notaries, Website of public procurement, Unified Government Register of Legal Entities and Natural Persons – Businessmen and Community Groups, the only government electronic database on education, etc. Examples of LI models of risk corruption for solving particular problems are presented in Table 3.

It should be noted that detection technology and anti-corruption can also be seen as a logical model. That is, information, intelligence and innovation of technologies should be linked with logical link $\cap$. Thus, prevention of corruption should be a systematic approach, research and statistical data processing, application of anti-corruption platform, public registers and databases and LI risk models corruption phenomenon.

CONCLUSION

The carried out research allows to conclude that the corruption is something that develops over time and space. There are general theoretical models that revealed important properties of socially dangerous phenomenon, but remain ineffective to explain anti-corruption policy measures.

In modern conditions, effective when detecting and preventing corruption is the use of information and innovation and intellectual technologies, based on research and processing of statistical data, application of anti-corruption platform, public registers and databases and LI models of risk of corruption phenomenon.

Based on the provisions of the LI model of success in solving the general problem of preventing corruption, Ukraine has rather good chances to fight corruption by way of the following stages:

- implementation of measures within Anti-Corruption Strategy;
- use of the experience of other countries and implementation of own anti-corruption IT;
- educating people intolerant to corruption.

The use of elaborated IT for solving problems in all spheres of fight against corruption as a concept can disappear from use, because "computer program does not take bribes, overcoming corruption in a way that will lead to faster economic growth will raise living standards.

Thus, the further direction of the development of this problem is to improve the existing system of public registers and implement more anti-corruption platforms; development of IT that can be used in the creation of social advertising to change the mentality of the Ukrainian people.

The analyses of the world experience of application of technologies in the prevention of corruption and within anti-corruption platform in Ukraine will allow to adapt them to positive experience in the implementation of mechanisms to identify and prevent corruption in Ukraine.

REFERENCES

1. Bac, M. (1996). Corruption and supervision costs in hierarchies. *Journal of comparative economics, 22.* Retrieved from http://www.sciencedirect.com/science/article/pii/S014759679690013X
2. Buehn, A., & Schneider, F. (2009). Corruption and the Shadow Economy: A Structural Equation Model Approach. *Bohn, 39.* Retrieved from http://ftp.iza.org/dp4182.pdf
3. Chkhartishvili, A. R. (2004). Теоретико-игровые модели информационного управления [Teoretiko-igrovye modeli informatsionnogo upravleniya] (227 p.). Moscow: PMSOFT.
4. Hillman, L., & Katz, E. (1987). Hierarchical Structure and The Social Costs of Bribes And Transfers. *Journal of Political Economy, 34.* Retrieved from http://www.sciencedirect.com/science/article/pii/0047272787900168
5. Levin, M., Satarov, G. (2012). Коррупция в России: классификация и динамика [Korruptsiya v Rossii: klassifikatsiya i dinamika]. *Voprosy ekonomiki, 10,* 4-29.
6. Mikhailov, A. P. (1999). Модель коррумпированных властных иерархий [Model korrumpirovannykh vlastnykh ierarkhiy]. *Matematicheskoe modelirovanie, 11*(1), 3-17.
7. Mookherjee, D. (1995). Corruptible law enforcers: how should they be compensated? *The Economic Journal, 105,* 145-159.
8. Rose-Ackerman, S. (1975). The economics of corruption. *Journal of Public Economics, 4,* 187-203.
9. Shleifer, A., & Vishny, R. (1993). Corruption. *The Quarterly Journal of Economics, 107*(33), 599-617.
10. Solozhentsev, E. D. (2009). Управление риском и эффективностью в экономике. Логико-вероятностный подход [*Upravlenie riskom i effektivnostyu v ekonomike. Logiko-veroyatnostnyi podkhod]* (242 p.). Izd-vo S.-Peterb. un-ta.
11. Transparency International. Retrieved from http://www.transparency.org
12. Електронна система публічних закупівель Prozorro [Elektronna systema publichnykh zakupivel Prozorro]. Retrieved from https://prozorro.gov.ua
13. Єдина державна електронна база з питань освіти [Yedyna derzhavna elektronna baza z pytan osvity]. Retrieved from http://www.inforesurs.gov.ua
14. Єдиний державний реєстр судових рішень [Yedynyi derzhavnyi reiestr sudovykh rishen]. Retrieved from http://www.reyestr.court.gov.ua
15. Єдиний державний реєстр юридичних осіб, фізичних осіб – підприємців та громадських формувань [Yedynyi derzhavnyi reiestr yurydychnykh osib, fizychnykh osib – pidpryiemtsiv ta hromadskykh formuvan]. Retrieved from https://usr.minjust.gov.ua
16. Єдиний реєстр нотаріусів [Yedynyi reiestr notariusiv]. Retrieved from http://ern.minjust.gov.ua
17. Закон України "Про засади державної антикорупційної політики в Україні (Антикорупційну стратегію) на 2014–2017 роки» № 1699-VII [Zakon Ukrainy "Pro zasady derzhavnoi antykoruptsiinoi polityky v Ukraini (Antykoruptsiinu stratehiiu) na 2014–2017 roky" No. 1699-VII]. Vidomosti Verkhovnoi Rady Ukrainy. Retrieved from http://zakon3.rada.gov.ua/laws/show/1699-18#n16
18. Пошуково-аналітична система 007 [Poshukovo-analitychna systema 007]. Retrieved from http://www.007.org.ua
19. Сайт державних закупівель [Sait derzhavnykh zakupivel]. Retrieved from https://tender.uub.com.ua
20. Стан корупції в Україні. Порівняльний аналіз загальнонаціональних досліджень: 2007, 2009, 2011 та 2015: звіт [Stan koruptsii v Ukraini. Porivnialnyi analiz zahalnonatsionalnykh doslidzhen: 2007, 2009, 2011 ta 2015: zvit]. Kyiv. mizhnar. in-t sotsiol. Retrieved from http://www.kiis.com.ua/materials/pr/20161602_corruption/Corruption%20in%20Ukraine%202015%20UKR.pdf
21. Хабардокс [Khabardoks]. Retrieved from https://www.xabardocs.org