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МОЖЛИВОСТІ ВИКОРИСТАННЯ ТЕХНОЛОГІЙ БЛОКЧЕЙНУ ДЛЯ ЗАХИСТУ ВІД ШАХРАЙСТВА

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POSSIBILITIES OF USING BLOCKCHAIN TECHNOLOGIES TO PROTECT FRAUD

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Анотація. У статті досліджено сутність та основні види шахрайства на основі класифікації Асоціації сертифікованих експертів із шахрайства (ACFE), яка пропонує поділ шахрайства на три групи: корупція, шахрайство у фінансовій звітності та привласнення активів. Метою статті є проведення порівняльного аналізу економічних втрат від шахрайства та надання пропозицій щодо їх зменшення за рахунок використання технологій блокчейн. Методологія дослідження базується на використанні даних Report to the Nation та результатів інших опитувань, представлених на веб-сайті ACFE, для порівняльного аналізу видів економічного шахрайства за обсягами, періодами, територіальною приналежністю та протидією. На основі Report to the Nation, підготовленого ACFE, було встановлено, що найбільші щомісячні збитки компанії завдають від шахрайства з фінансовою звітністю, яке триває в середньому 18 місяців. Проаналізовано частоту випадків різних видів шахрайства залежно від галузі та встановлено, що найпоширенішими компаніями в кожній галузі є корупційні. Визначено 8 найбільш ризикованих відділів, в яких відбуваються різні види шахрайства, та було виявлено, що корупція також є найбільш поширеною в кожному відомстві. Досліджено найбільш поширені схеми професійного шахрайства за регіонами, що показало, що найпоширенішими схемами професійного шахрайства в усіх країнах є корупція, причому найвищий рівень у Південній Азії. Встановлено, що для виявлення шахрайства компанії в усіх регіонах використовуються підказку, внутрішній аудит та управлінський огляд. Дослідження найпоширеніших засобів контролю проти шахрайства показало, що найефективнішими з них є Зовнішній аудит фінансової звітності та Кодекс поведінки. Встановлено, що в більшості країн регіону в якості засобів боротьби з шахрайством використовують Кодекс поведінки та Зовнішній аудит фінансової звітності. Слід зазначити, що велика кількість компаній використовує проактивний моніторинг/аналіз даних, невід'ємною частиною якого є технологія блокчейн. Запропоновано основні етапи створення та використання технологій блокчейн для фінансових операцій компанії, що дозволить більш ефективно здійснювати контроль за боротьбою з шахрайством.

Ключові слова: шахрайство; корупція; шахрайство з фінансовою звітністю; привласнення активів; технологія блокчейну.

Формули: 0; рис.: 5; табл.: 6; бібл.: 27

Annotation. The article examines the nature and main types of fraud based on the classification of the Association of Certified Fraud Experts (ACFE), which proposes the division of fraud into three groups: corruption, fraud in financial reporting and misappropriation of assets. The purpose of the article is to conduct a comparative analysis of economic losses from fraud and provide suggestions for reducing them through the use of blockchain technology. The research methodology is based on the use of Report to the Nation data and the results of other surveys presented on the ACFE website for a comparative analysis of types of economic fraud by volume, period, territorial affiliation and counteraction. Based on a report for the nation prepared by ACFE, it was found that the company's largest monthly losses are caused by fraud with financial statements, which lasts an average of 18 months. The frequency of cases of different types of fraud depending on the industry was analyzed and it was found that the most common companies in each industry are corrupt. The 8 most risky departments with different types of fraud were identified, and it was found that corruption is also the most common in each department. The most common schemes of professional fraud by region were studied, which showed that the most common schemes of professional fraud in all countries are corruption, with the highest level in South Asia. It has been established that tip, internal audit and management review are used to detect company fraud in all regions. A study of the most common means of control against fraud showed that the most effective of them are the External Audit

of Financial Statements and the Code of Conduct. It has been established that in most countries of the region the Code of Conduct and the External Audit of Financial Statements are used as anti-fraud tools. It should be noted that a large number of companies use proactive monitoring / analysis of data, of which blockchain technology is an integral part. The main stages of creation and use of blockchain technologies for the financial operations of the company are offered, which will allow more effective control over the fight against fraud.

Key words: fraud; corruption; fraud with financial statements; appropriation of assets; blockchain technology.
Formulas: 0; *fig.:* 5; *tabl.:* 6; *bibl.:* 27

Introduction. Economic fraud, unfortunately, is an integral part of any business, which, in order to achieve its goals, must also fight its consequences and prevent its occurrence. The management of each company is aware of the need for such work and creates the conditions for neutralizing possible manifestations of economic fraud.

The COVID-19 pandemic has significantly affected the activities of all companies and their business processes. In turn, this could not but affect the transformation of both the types of economic fraud and the tools to neutralize them.

Literature review. The research of many scientists has studied the nature of fraud. Recent reviews of the relevant literature acknowledge that fraud is a social construction (Cooper, Dacin, & Palmer, 2013 [1]; Taylor, 2007 [2]; Toms, 2017 [3]). A study of types of fraud has shown that they differ depending on the type and financial activity (Biegelman, 2013 [4]; Goldmann, 2010 [5]).

The main types of fraud in the field of company management are corporate fraud (Comer, 2003 [6]; O’Gara, 2004 [7]) and management fraud (O’Gara, 2004 [7]). The main types of financial fraud are: financial fraud (Pontell/Frid, 2000 [8]; Young, 2006 [9]; Harrington, 2012 [10]; Gough, 2013 [11]), securities fraud (Cronin/Evansburg/Garfinkle-Huff, 2001 [12]; Wang, 2010 [13]; Straney, 2011 [14]; Yu, 2013 [15]), accounting fraud (Henselmann/Hofmann, 2010 [16]; Kat/Lakeman, 2010 [17]), financial statement fraud (Zack, 2013 [18]), financial institution fraud (Pontell/Calavita/Tillman, 1994 [19]; Shepherd/Wagner/Williams, 2001 [20]), fiduciary fraud (Rosoff/Pontell/Tillman, 2014 [21]), bank fraud (Subramanian, 2014 [22]), investment fraud (Naylor, 2007 [23]), brokerage fraud (Stoneman/Schulz, 2002 [24]), and insurance fraud (Viaene/Dedene, 2004 [25]).

The most complete classification of types of fraud is presented in the materials of the Association of Certified Fraud Examiners (Table 1). Association of Certified Fraud Examiners (ACFE) is an anti-fraud organisation situated in USA providing training and education. ACFE has conducted detailed studies of fraudulent occurrences of financial statement frauds to recognize such financial statement which are manipulated. ACFE has also enlisted some of the most frequently used tactics to perpetuate frauds in financial statements.

The three main types of Occupational fraud are:

1) *Corruption* is a scheme in which an employee misuses their influence in a business transaction in a way that violates their duty to the employer in order to gain a direct or indirect benefit (e.g., schemes involving bribery or conflicts of interest).

2) *Financial statement fraud* is a scheme in which an employee intentionally causes a misstatement or omission of material information in the organization’s financial reports (e.g., employee files fraudulent expense report claiming personal travel or nonexistent meals).

3) *Asset misappropriation* is a scheme in which an employee steals or misuses the employing organization’s resources (e.g., theft of company cash, false billing schemes, or inflated expense reports).

Aims. The purpose of the article is to conduct a comparative analysis of economic losses from fraud and provide suggestions for reducing them through the use of blockchain technology.

Every two years, ACFE researchers publish the results of a global survey in the so-called «Report to the Nation». Based on expert assessments, this report demonstrates not only the types of fraud, but also the global losses from them.

The research methodology is based on the use of Report to the Nation data and the results of other surveys presented on the ACFE

website for a comparative analysis of types of economic fraud by volumes, periods, territorial affiliation and countermeasures.

Table 1

Occupational fraud and abuse classification system (the fraud tree)

Type	Kind	Scheme			
Corruption	<i>Conflicts of Interest</i>	Purchasing Schemes			
		Sales Schemes			
		Invoice Kickbacks			
	<i>Bribery</i>	Bid Rigging			
		Illegal Gratuities			
<i>Economic Extortion</i>					
Financial Statement Fraud	<i>Net Worth/ Net Income Overstatements</i>	Timing Differences			
		Fictitious Revenues			
		Concealed Liabilities and Expenses			
		Improper Asset Valuations			
		Improper Disclosures			
	<i>Net Worth/ Net Income Understatements</i>	Timing Differences			
		Understated Revenues			
		Overstated Liabilities and Expenses			
		Improper Asset Valuations			
		Improper Disclosures			
Asset Misappropriation	<i>Cash</i>	Theft of Cash on Hand			
		Theft of Cash Receipts	Skimming	Sales	Unrecorded
					Understated
				Receivables	Write-Off Schemes,
					Lapping Schemes
		Refunds and Other		Unconcealed	
		Cash Larceny			
	Fraudulent Disbursements	Billing Schemes			
		Payroll Schemes			
		Expense Reimbursement Schemes			
		Check and Payment Tampering			
		Register Disbursements			
<i>Inventory and All Other Assets</i>	Misuse	Asset Requisitions and Transfers			
	Larceny	False Sales and Shipping			
		Purchasing and Receiving			
		Unconcealed Larceny			

Source: systematized by the author on the basis of Report to the Nation [26]

Results. Based on the results of Report to the Nation, fraudsters do not necessarily limit themselves to one method of stealing. According to Report to the Nation, 40% involved more than one of the three primary categories of occupational fraud. As noted, 32% of fraudsters committed both asset misappropriation and corruption schemes as part of their crime, 2% misappropriated assets and committed financial statement fraud, 1% engaged in both corruption and financial

statement fraud, and 5% included all three categories in their schemes.

Analysis of the average monthly losses of companies from various types of economic fraud, presented in Fig. 1, shows that the biggest losses the company has from the Financial statement fraud.

The average period of fraud, according to Fig. 2, is 18 months, indicating that all cases of fraud were not spontaneous. Each case of fraud was preceded by training, which could last from 6 to 12 months.

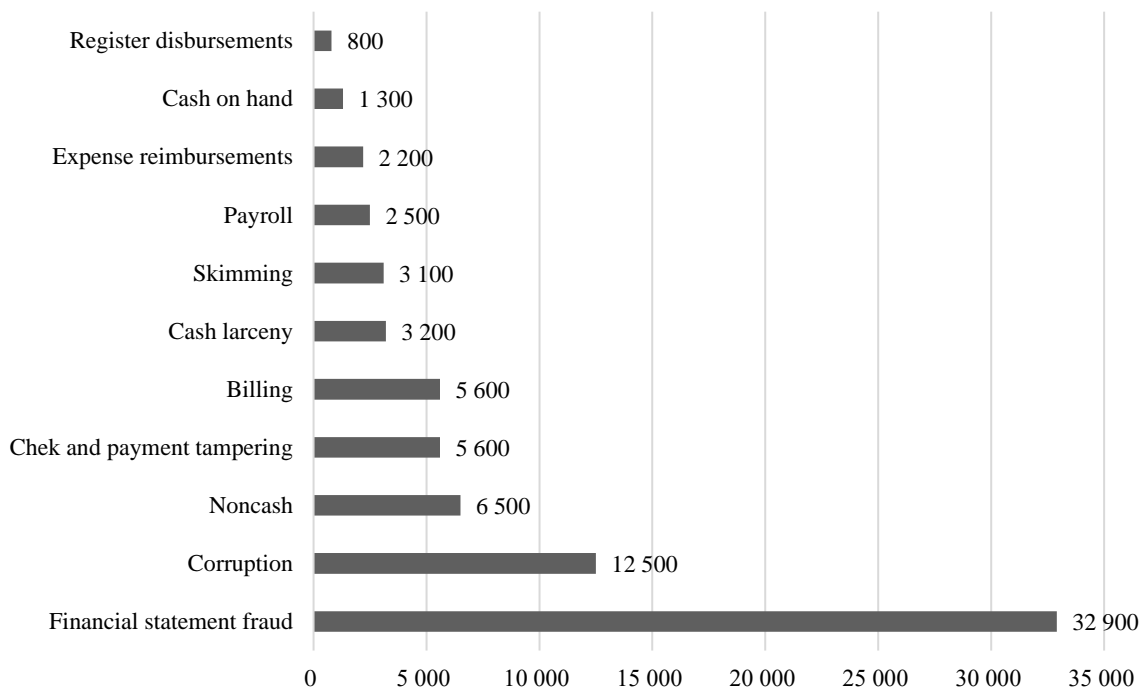


Figure 1. The average monthly loss of companies from various types of economic fraud, \$
 Source: systematized by the author on the basis of Report to the Nation [26]

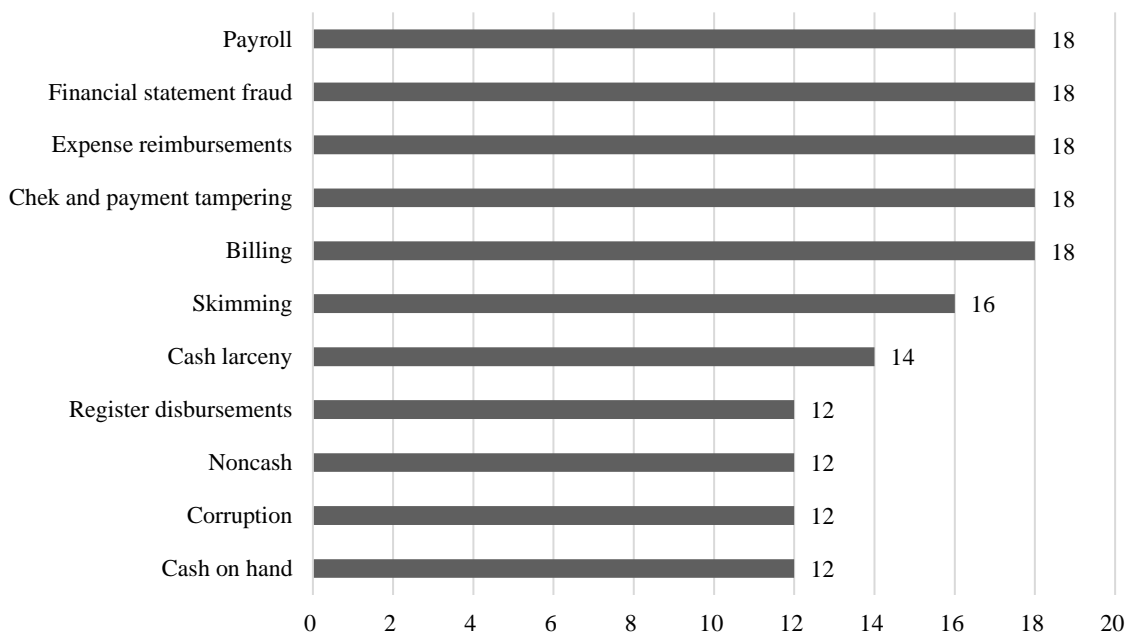


Figure 2. The average period from various types of economic fraud, months
 Source: systematized by the author on the basis of Report to the Nation [26]

Analyzing various industries and cases of fraud, we found that the most common is corruption, which occurs in more than 40% (Insurance, Retail, Banking and financial services, Education), more than 50% (Health care, Technology, Food service and

hospitality, Construction, Information, Transportation and warehousing, Manufacturing) and more than 60% (Energy). We believe that corruption in each of the industries has its own specifics and different types (Table 2).

Table 2

The most common occupational fraud schemes in various industries

Industry	Cases	Billing	Cash larceny	Cash on hand	Check and payment tampering	Corruption	Expense reimbursements	Financial statement fraud	Noncash	Payroll	Register disbursements	Skimming
Banking and financial services	351	10%	11%	14%	14%	46%	8%	11%	11%	4%	2%	10%
Government and public administration	198	21%	8%	7%	9%	57%	12%	8%	16%	16%	3%	8%
Manufacturing	194	26%	5%	9%	7%	59%	10%	12%	23%	10%	4%	8%
Health care	130	20%	6%	8%	8%	50%	11%	9%	18%	12%	2%	9%
Energy	97	24%	9%	6%	8%	64%	16%	8%	13%	6%	3%	2%
Retail	91	19%	10%	9%	9%	43%	7%	4%	24%	5%	7%	14%
Insurance	88	15%	9%	8%	10%	40%	9%	5%	8%	10%	2%	11%
Technology	84	21%	6%	10%	6%	54%	14%	8%	30%	5%	1%	1%
Transportation and warehousing	82	20%	9%	15%	4%	59%	11%	7%	22%	9%	4%	11%
Construction	78	24%	8%	10%	14%	56%	17%	18%	24%	24%	3%	9%
Education	69	26%	9%	12%	12%	49%	12%	12%	19%	14%	4%	12%
Information	60	15%	5%	5%	8%	58%	12%	12%	33%	7%	2%	7%
Food service and hospitality	52	19%	10%	21%	17%	54%	13%	13%	29%	19%	10%	17%

Source: systematized by the author on the basis of Report to the Nation [26]

The eight departments listed in Table 3 account for 76% of all professional fraud in the report presented in the Report to the Nation. In this table, we have identified the frequency of different types of professional fraud that have

occurred in each department. The information obtained can help companies assess the risks of fraud and implement effective anti-fraud tools in these high-risk areas.

Table 3

The most common occupational fraud schemes in high-risk departments

Department	Cases	Billing	Cash larceny	Cash on hand	Check and payment tampering	Corruption	Expense reimbursements	Financial statement fraud	Noncash	Payroll	Register disbursements	Skimming
Operations	273	16%	7%	8%	11%	48%	9%	6%	16%	8%	1%	6%
Accounting	230	24%	15%	13%	29%	33%	10%	10%	7%	16%	3%	19%
Executive/upper management	206	31%	9%	10%	12%	65%	18%	22%	21%	13%	2%	12%
Sales	203	11%	6%	7%	2%	51%	8%	6%	18%	4%	2%	11%
Customer service	140	8%	10%	16%	11%	44%	6%	7%	17%	6%	3%	10%
Administrative support	131	23%	8%	15%	15%	37%	16%	5%	12%	12%	5%	10%
Purchasing	131	27%	1%	4%	2%	82%	5%	2%	14%	3%	0%	2%
Finance	95	26%	7%	11%	12%	48%	20%	14%	12%	7%	3%	12%

Source: systematized by the author on the basis of Report to the Nation [26]

It was found that corruption is also the most common in each department. In the Operations Department, the second most common types of fraud are Billing (16%) and Noncash (16%); in the Accounting department - Check and payment tampering (29%); in the Executive / upper management department - Billing (31%); in the Sales Department - Noncash

(18%); in the Customer service department - Noncash (17%); in the Administrative Support Department - Billing (23%); in the Purchasing Department - Billing (27%); in the Department of Finance - Billing (26%).

The most common occupational fraud schemes by region are presented in Table 4.

Table 4

The most common occupational fraudschemes by region

Schemes	Latin America and Caribbean	Eastern Europe and Western/Central Asia	Middle East and North Africa	Southern Asia	Sub-Saharan Africa	United States and Canada	Western Europe
Corruption	57%	59%	59%	71%	62%	37%	44%
Billing	20%	13%	16%	18%	19%	24%	19%
Noncash	17%	15%	17%	15%	19%	18%	24%
Financial statement fraud	11%	17%	8%	15%	9%	8%	10%
Cash on hand	11%	9%	7%	12%	8%	11%	13%
Cash larceny	6%	5%	7%	11%	5%	10%	9%
Expense reimbursements	15%	2%	9%	10%	7%	17%	10%
Skimming	9%	7%	9%	10%	7%	13%	7%
Check and payment tampering	9%	5%	6%	5%	10%	15%	9%
Payroll	11%	4%	9%	4%	5%	16%	8%
Register disbursements	2%	3%	4%	2%	1%	4%	3%

Source: systematized by the author on the basis of Report to the Nation [26]

Table 4 shows that the most common occupational fraud schemes in all countries are corruption, with Southern Asia having the highest levels. Among other types of occupational fraud schemes, Billing can be found most often in Latin America and Caribbean region, Noncash - in Western Europe region, Financial statement fraud - in Eastern Europe and Western / Central / Asia region, Cash on hand - Western Europe region, Cash larceny - in Southern Asia region, Expense reimbursements - in United States and Canada region, Skimming - in United States and Canada region, Check and payment tampering - in United States and Canada region, Payroll - in United States and Canada region, Register disbursements - in United States and Canada region and Middle East and North Africa region.

It is very important to identify the tools that should be used to identify occupational fraud.

The main tools of occupational fraud are initially detected by region are presented in Table 4.

According to the study, tip, internal audit and management review are used to identify company fraud in all regions.

Every company understands that it is not enough to detect fraud, but it is very necessary to periodically use anti-fraud controls. The most common anti-fraud controls are presented in Figure 3.

The most common anti-fraud controls on the results of the Nations Report are the External audit of financial statements (82%) and Code of conduct (82%). The least effective anti-fraud controls are Job rotation / mandatory vacation (25%) and Rewards for whistleblowers (15%).

The most common anti-fraud controls by region are presented in Table 5.

Table 5

The main tools of occupational fraud are initially detected by region

Control	Latin America and Caribbean	Eastern Europe and Western/Central Asia	Middle East and North Africa	Southern Asia	Sub-Saharan Africa	United States and Canada	Western Europe
Tip	58%	41%	41%	51%	48%	32%	41%
Internal audit	11%	23%	24%	16%	10%	18%	16%
Management review	10%	9%	9%	7%	11%	16%	10%
Automated transaction/data monitoring	3%	5%	4%	1%	4%	5%	9%
By accident	5%	6%	1%	5%	5%	7%	6%
Document examination	5%	1%	4%	9%	6%	5%	6%
External audit	2%	4%	5%	3%	4%	4%	5%
Account reconciliation	3%	4%	7%	5%	6%	5%	2%
Surveillance/monitoring	1%	2%	-	1%	2%	5%	2%
Confession	-	-	1%	-	1%	1%	1%
Notification by law enforcement	1%	2%	2%	1%	2%	2%	1%
Other	-	1%	1^	1%	1%	1%	1%

Source: systematized by the author on the basis of Report to the Nation [26]

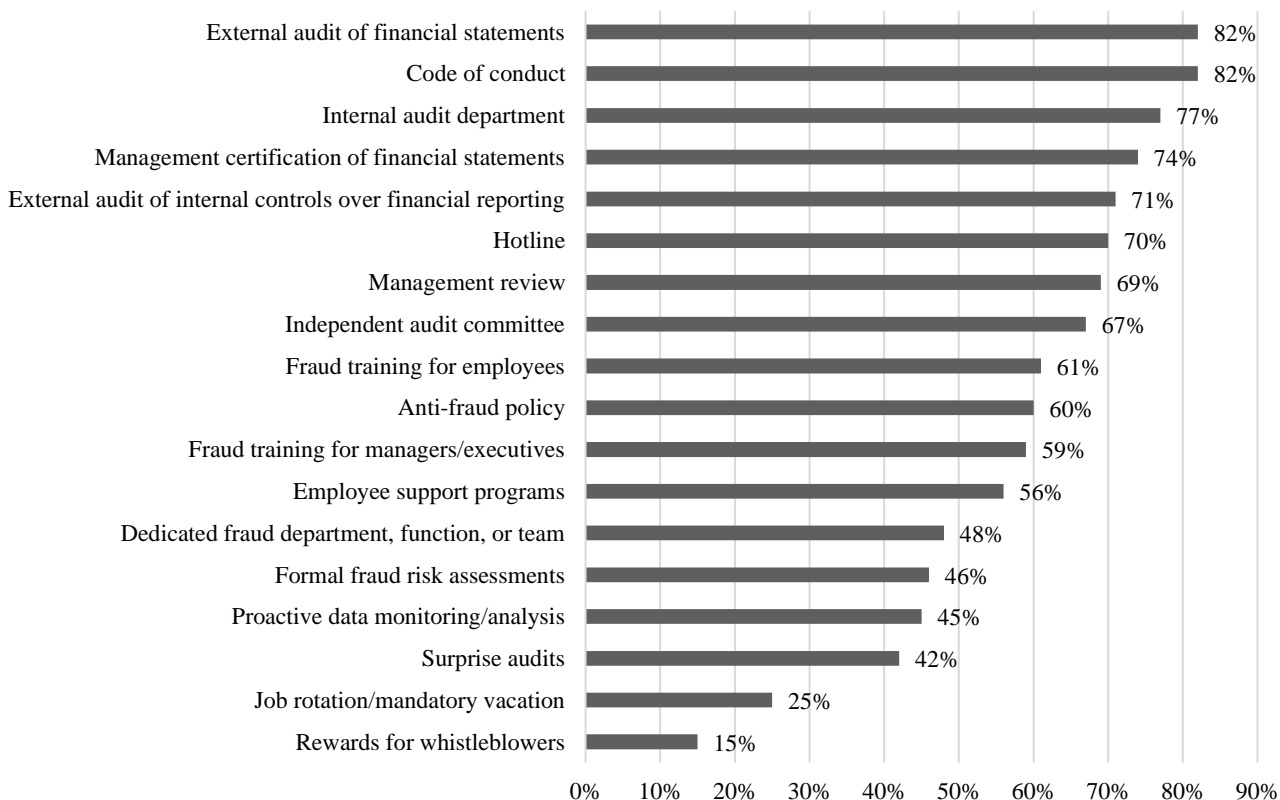


Figure 3. The most common anti-fraud controls

Source: systematized by the author on the basis of Report to the Nation [26]

Table 6

The most common anti-fraud controls by region

Control	Latin America and Caribbean	Eastern Europe and Western/Central Asia	Middle East and North Africa	Southern Asia	Sub-Saharan Africa	United States and Canada	Western Europe
Code of conduct	84%	83%	82%	88%	89%	74%	84%
Internal audit department	81%	81%	86%	85%	87%	66%	74%
External audit of financial statements	76%	83%	89%	91%	87%	72%	90%
Management review	70%	71%	71%	72%	72%	63%	72%
Management certification of financial statements	69%	68%	79%	84%	83%	65%	78%
Independent audit committee	69%	69%	71%	76%	74%	56%	65%
Hotline	67%	75%	68%	72%	76%	63%	68%
External audit of internal controls over financial reporting	65%	66%	70%	85%	76%	63%	77%
Fraud training for managers/executives	52%	60%	54%	66%	62%	55%	58%
Anti-fraud policy	52%	52%	60%	63%	69%	51%	56%
Fraud training for employees	52%	62%	58%	63%	67%	55%	59%
Employee support programs	50%	21%	32%	45%	58%	66%	51%
Dedicated fraud department, function, or team	35%	55%	44%	53%	56%	41%	47%
Formal fraud risk assessments	32%	37%	43%	45%	53%	42%	52%
Proactive data monitoring/analysis	30%	40%	43%	42%	47%	43%	48%
Surprise audits	28%	46%	48%	48%	47%	35%	40%
Job rotation/mandatory vacation	21%	21%	24%	33%	30%	20%	25%
Rewards for whistleblowers	5%	12%	14%	24%	18%	14%	7%

Source: systematized by the author on the basis of Report to the Nation [26]

Table 5 shows that in most countries in the region as anti-fraud controls use Code of Conduct - Sub-Saharan Africa (89%), Latin America and Caribbean (84%), Eastern Europe and Western / Central Asia (83%) , United States and Canada (74%), as well as External audit of financial statements - Southern Asia (91%), Western Europe (90%) and Middle East and North Africa (89%).

It should be noted that a large number of companies use proactive data monitoring/analysis (from 30% to 48%), an integral part of which is blockchain technology.

We believe that the creation and use of blockchain technologies in financial transactions is a necessary condition to protect companies from various types of fraud.

To solve this problem, we propose an algorithm for creating and using blockchain technologies at the enterprise (Figure 4).

To substantiate the need for the introduction of blockchain technologies at the company level, in the context of ensuring internal control over financial transactions between different countries, a SWOT analysis was conducted (Fig. 5).

In Figure 5 shows the results of a SWOT analysis of the implementation of blockchain technologies at the company level for financial transactions of companies between different countries. The most significant main advantages are: the ability to track changes in financial documents; minimization of delays in the preparation of financial documents; reduction of administrative efforts on internal control of financial transactions; improving the business reputation of companies that use blockchain technology; easier to detect fraud.

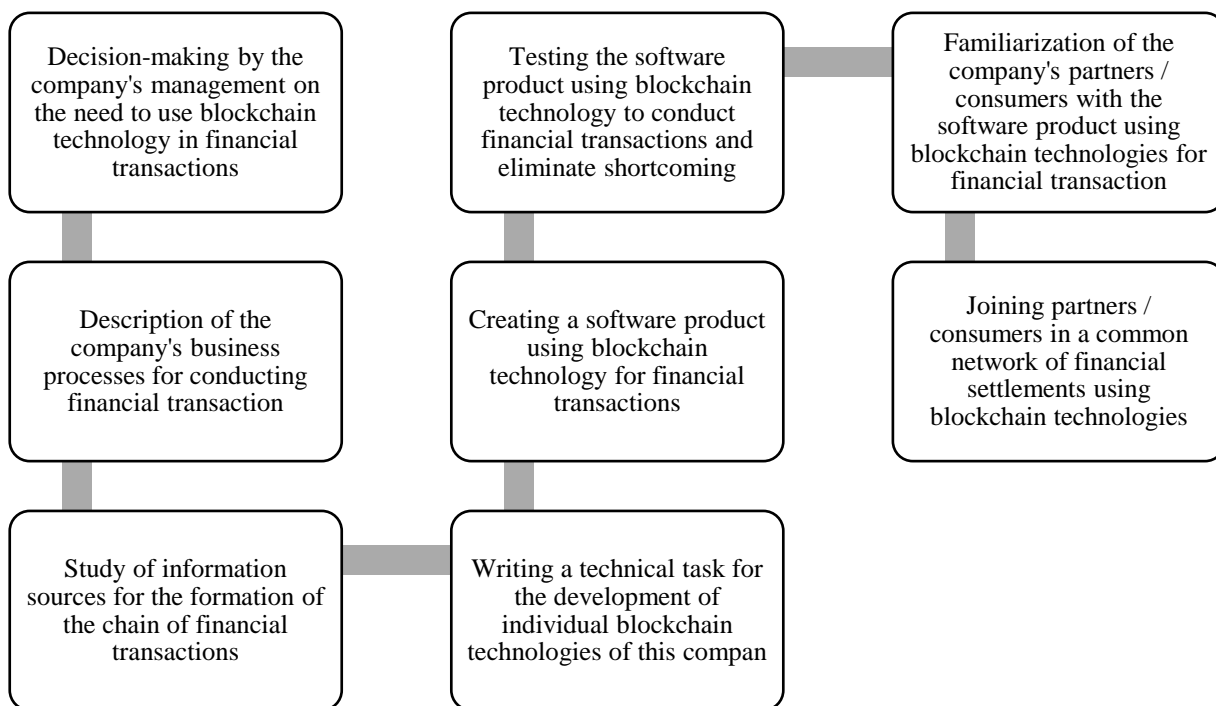


Figure 4. The main stages of creation and use of blockchain technologies for financial transactions of the company

Source: developed by the author

<p style="text-align: center;">Strengths</p> <p>the ability to track changes in financial documents; minimization of delays in the preparation of financial documents; reduction of administrative efforts on internal control of financial transactions; improving the business reputation of enterprises that use blockchain technologies; easier fraud detection, etc.</p>	<p style="text-align: center;">Weaknesses</p> <p>immature mechanism and little experience in the application of blockchain technologies in Ukraine; the need to transform the system of interaction between subjects of financial transactions; the need to develop regulatory support for the use of blockchain technologies in Ukraine</p>
<p style="text-align: center;">Possibilities</p> <p>compliance with general trends in the development of financial relations; improving the efficiency of fraud detection activities; transparency of information and computer confirmation of transactions performed</p>	<p style="text-align: center;">Threats</p> <p>lack of a universal approach in determining the criteria for cross-border exchange of financial information to be used by different stakeholders; blockchain technology must be adopted by all stakeholders to ensure that it works properly</p>

Figure 5. SWOT-analysis of the implementation of blockchain technologies for financial transactions of companies between different countries

Source: developed by the author

At the same time, among the threats are: the lack of a universal approach in determining the criteria for cross-border exchange of financial information to be used by different stakeholders; blockchain technology must be

accepted by all stakeholders for it to work properly.

So, although the blockchain is still under development, it can dramatically change the way we do business, especially in the financial transactions of companies between different

countries and can be used to ensure the economic security of enterprises.

Conclusions. According to the results of the study, the following conclusions can be drawn:

1. The article examines the nature and main types of fraud, based on the classification of the Association of Certified Fraud Examiners (ACFE), which proposes the division of fraud into three groups: Corruption, Financial Statement Fraud and Asset Misappropriation.

2. Based on the Report to the Nation prepared by the Association of Certified Fraud Examiners (ACFE), the average monthly loss of companies from various types of economic fraud and the period from various types of economic fraud were analyzed. It is established that the largest monthly losses of the company are from the Financial statement fraud, which lasts an average of 18 months.

3. The frequency of cases of different types of fraud depending on the industry is analyzed. It is established that the most common companies in every industry are corruption.

4. The 8 most risky departments in which various types of fraud occur have been identified. It was found that corruption is also the most common in each department. Thus, in the Operations Department, the second most common types of fraud are Billing (16%) and Noncash (16%); in the Accounting department - Check and payment tampering (29%); in the Executive / upper management department - Billing (31%); in the Sales Department - Noncash (18%); in the Customer service department - Noncash (17%); in the Administrative Support Department - Billing (23%); in the Purchasing - Billing department (27%); in the Department of Finance - - Billing (26%).

5. The most common occupational fraud schemes by region were studied. It has been established that the most common occupational fraud schemes in all countries are corruption, with Southern Asia having the highest levels.

6. The main tools of occupational fraud are initially detected by region. It is established that the type, internal audit and management review are used to identify company fraud in all regions.

7. The study of the most common anti-fraud controls showed that the most effective of these are the External audit of financial statements (82%) and Code of conduct (82%). The least effective anti-fraud controls are Job rotation / mandatory vacation (25%) and Rewards for whistleblowers (15%).

8. It is established that in most countries in the region as anti-fraud controls use Code of Conduct - Sub-Saharan Africa (89%), Latin America and Caribbean (84%), Eastern Europe and Western / Central Asia (83%), United States and Canada (74%), as well as External audit of financial statements - Southern Asia (91%), Western Europe (90%) and Middle East and North Africa (89%). It should be noted that a large number of companies use proactive data monitoring / analysis (from 30% to 48%), an integral part of which is blockchain technology.

9. The main stages of creation and use of blockchain technologies for financial transactions of the company are offered, which will allow to carry out anti-fraud controls more effectively.

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