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MODELING, ACCOUNTING AND CONTROL OF FORMATION AND USE OF RESOURCES (ON THE EXAMPLE OF THE CONSTRUCTION INDUSTRY)

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ABSTRACT

The aim of the article was to build analytical models in the construction industry based on the analysis of its economic indicators and the use of positive foreign experience, as well as by identifying opportunities to optimize resources using better accounting and control systems. The achievement of the goal was based on the results of canonical correlation analysis. Its application allowed us to conclude that there is a long time lag (5 years) of making strategic management decisions on the formation and use of resources in construction companies and their results. This is due to the significant duration of construction work and the frequent commissioning of residential premises with a delay of 1-2 years due to political, economic, financial and other problems. Based on the analysis of Ukrainian and international experience in accounting and control over the formation and use of resources, proposals have been developed for the use of flexible schedules for the supply of material and technical resources using the latest information and computer technology (ICT), work calendars (desktop, wall) and electronic devices with reminders of dates of payment of invoices of suppliers and

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contractors, dates and forms of financial and administrative reporting, etc. The object of research is the process of complex interaction of accounting, control, analysis and modeling to ensure effective management of material, technical and financial resources of construction companies in 24 regions of Ukraine, European and other countries. The subject of research is the theoretical and practical principles of application of modeling and analysis in accounting and control over the formation and use of material, technical and financial resources of construction companies. It is revealed that the enterprises of the construction industry of Ukraine, many European countries and countries of other continents do not fully use the existing potential of the latest information and computer technologies and modern modeling methods for the organization and optimization of business processes; establishing logistical links between business partners; systems for managing the processes of supply, warehousing, construction production, marketing; reducing costs at all stages of the life cycle of construction products. Based on this, two hypotheses are derived, the first of which indicates the potential of construction companies to effectively carry out financial and management accounting, internal control; to put construction objects into operation quickly, efficiently and in a timely manner. The second hypothesis points to the fact that construction companies for various reasons violate the procedure for accounting for resources, do not perform planned measures of internal control; allow disruptions of construction processes and terms of commissioning of construction objects; allow the lack and misuse of material and financial resources. The practical application of proposals to optimize the use of resources modeled in the research process and proposed ways to improve the efficiency of information and computer technology can be effectively implemented to ensure business processes in construction, in particular the implementation of logistics in the search and delivery of resources. construction projects and warehouses.

This will significantly reduce the cost of accounting and control support of construction work, without reducing their quality and timeliness.

Keywords: *Resources (Material, Technical, Financial), Accounting, Resource Formation, Resource Use, Modeling, Canonical Correlation Analysis, Analytical Models, Construction Industry, Control*

1. INTRODUCTION

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Construction in different countries is characterized by significant volumes, the use of many technologies, automation of accounting and control. What they have in common, however, is that in each country this industry influences the formation of national gross domestic product (GDP). According to available statistics, according to our research, this percentage in different countries is even more than 10%. Hence, we conclude that the construction industry is one of the most profitable components of national economies (Gumenna-Derij, et al., 2021). At the same time, this industry needs to attract a significant amount of resources, the formation and use of which is accompanied by a number of problematic issues that need to be addressed. Hence the need for quality management of these resources. It is possible to achieve this goal through constant accounting, analysis and control over them.

We believe that in the construction industry can be effectively used for resource optimization canonical correlation analysis of nominal wages, incomes, investment in this industry, the state of credit policy. Such an analysis will make it possible to form forecast construction plans, develop a strategy for management and strategic accounting, anticipate economic risks and strengthen external and internal control over resources. This confirms the relevance of the chosen research topic.

2. LITERATURE REVIEW

During the selection of literature, we focused on the study of world and Ukrainian experience on construction problems and ways to solve them through analysis, accounting and control.

Scientists from Malaysia (Tangtinthai, Heidrich & Manning, 2019) identify factors that affect construction activities and materials, taking into account regions and countries. Such factors include: population, economy, urbanization, building policy and regulations, and so on.

From the standpoint of our study, these factors are more important for analysis than for accounting and control. But in the construction industry, they affect these systems indirectly, due to the need for mandatory accounting and control actions during construction. Moreover, the above factors are necessarily characterized by many risks that must be taken into account and anticipated, including not only in the formation of optimization models for resource provision, but also in the formation and accounting of appropriate reserve funds.

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For example, according to a study of Turkish construction companies, scientist Genc (2021), the main risk factors in construction include: disasters and force majeure; project management and technical management; appearance of the building and design and estimate work; unskilled subcontractors, workers and personnel involved in the construction process; late payments, economic problems, including inflation, price speculation; inquiries from project stakeholders regarding changes to the order and non-performance within the expected budget constraints.

Accordingly, various types of estimates are used in accounting, including revalued value (which is realized through the indexation of the value of fixed assets, or revaluation of inventory), as well as other accounting techniques, approaches and methods.

The United States, which is one of the most developed countries in the world and accounts for more than 18% of world GDP (almost 75 trillion US dollars) (Countries with the largest gross domestic product (GDP) 2020, 2020), also has some problems in the construction industry. In modern conditions, one of the most pressing problems of the US construction sector is the lack of qualified personnel. This leads to a decrease in the pace of construction, and therefore construction companies are forced to implement various forms of incentives to attract workers.

Sunday, Shukor Lim and Malzan (2021) identified five main components of the impact of the Strategy for Sustainable Affordable Housing and Housing for the Poor in Nigeria. In particular, scientists identify social, economic, environmental, institutional and technological components.

We believe that the research of these scientists on affordable housing programs is relevant not only for Nigeria, but also for all countries where wages are significantly lower than the cost of one square meter of housing. Such analytical data can be used to achieve efficient resource provision and its use.

Equally important is research on European construction trends. The construction sector plays a significant role in the EU economy (approximately 9% of GDP, 18 million jobs and 3 million enterprises) and in achieving key Commonwealth policy goals (Objectives of the European construction observatory, 2021).

Taking into account the dynamics of construction and analysis of existing needs for new facilities helps to develop a strategy for the development of this industry in the future.

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Also, a balanced approach saves money and resources, which has a positive impact not only on economic but also on social results.

In particular, the issue of building environmentally friendly houses and reducing waste and harmful emissions from the production of construction products is now relevant in Europe. This is important because the construction sector is the most environmentally threatening in the EU.

In particular (EU construction sector: in transition towards a circular economy, 2019), in 2016 it generated 923 million tons of construction waste (CDW). As the pressure on environmental solutions grows, the CDW recycling market is also growing. But the question of how to optimize the audit of waste and what are the best practices for their management is currently not fully resolved.

A positive example is the experience of housing construction in Spain, where private construction companies are involved in investing in social housing.

In other European countries, on the other hand, funding is from the state budget. The Spanish experience shows a responsible attitude of business to social issues, which also indicates the fact of awareness of existing environmental threats and financial literacy of construction workers.

This was pointed out, in particular, by Mahdzan, Zainudin and Yoong (2021), who proved that a person with higher investment literacy will have a much higher chance of retaining investments in mutual funds Therefore, to improve the accounting and control of a particular construction company, you should be interested in the development of this industry in order to choose the right solution.

In Ukraine, the issue of construction and investment financing is also very important. Ukrainian scientists (Pavelko, Lazaryshyna & Dukhnovska, 2021) claim that in the structure of capital investments the largest share is occupied by own funds of enterprises – 70,8% (data for 2018). Sources of investment also include bank loans, which account for 7,7%. Household expenditures on housing construction are 6.0%.

Other sources are used, but their share is much smaller. The reason for the decline in household spending since 2014, scientists believe the increase in interest rates on loans and the difficulty of obtaining them. In addition, lending conditions for legal entities have become much more difficult. Instead, history has shown that in countries such as Germany and the

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United States, mortgage lending has contributed to economic growth. Relevant policies were implemented in them: Erhard's course and Roosevelt's new course.

The major information on contractual relations for the accounting and monitoring system is the contracting of the products (works, services) delivery time, which affects the conditions for recognizing the debt and ways to repay it. In the accounting system, it is necessary to set up the function of informing on the number of days remaining until the expiration of the agreement terms performance (Zadorozhny et al., 2018).

It is especially important to use optimization models for the construction industry. For example, scientists (Battissacco, et al., 2020) and practitioners believe that computer modeling has great potential in the field of industrial technology as a tool to support decision-making, as it allows you to model the functioning of a real system using logical connections to observe its behavior in different scenarios. and et

However, it cannot be stated unequivocally that the Ukrainian construction industry is actively using positive foreign experience. Of course, it is necessary to adapt it to the current national regulatory requirements and practices.

The purpose of the article was to build analytical models in the construction industry based on the analysis of its economic indicators and the use of positive foreign experience, as well as by identifying opportunities to optimize resources using better accounting and control systems.

3. DATA AND METHODOLOGY

Statistical, empirical, monographic and other methods were used to develop an integrated approach to building analytical models in the construction industry based on the analysis of economic indicators and their use to optimize resources and implement better accounting and control systems.

In particular, the monographic method was used to review scientific publications of Ukrainian and foreign economists on modeling, financial and management accounting, internal control of enterprises to identify the results of previous studies. On this basis, the own development of models of economic analysis is presented and measures to improve the accounting and control of material, technical and financial resources in the field of housing construction are proposed.

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Canonical correlation analysis and modeling were used to assess the impact of 6 selected indicators (household income; loans on capital investments; household funds; average monthly nominal wages; investment in housing; GDP) on 4 result indicators: number of apartments built per 1,000 population; the total area of commissioned residential buildings; percentage of profitable construction companies; amount of profit. Calculations have shown that there is a close relationship between the proposed indicators and the results of canonical analysis are statistically significant.

The coefficient method allowed to translate economic indicators into one currency (taking into account the official exchange rates on the relevant date) to achieve their comparability. For such calculations, an electronic calculator was used to convert the exchange rates of different countries.

The tabular method was used to compare the price of 1 sq. M of housing and the average monthly wage and present the results of such a comparison (the price of 1 sq. m of housing divided by the average monthly wage (in euros)).

The sources of the study were: statistical indicators of construction companies in 24 regions of Ukraine and financial statements of 3 Ukrainian construction companies; data on construction in European and other countries.

This allowed to propose measures to improve the efficiency of resource use (material, technical, financial), including by improving the methods of modeling, accounting and control over them.

4. RESULTS AND DISCUSSION

The formation and use of resources is one of the most important tasks not only at the enterprise level, but also at the state level. At the enterprise level, issues related to resource accounting are relevant. Financial resources play an important role in construction. Therefore, it is important to identify sources of funding for the construction process and ensure the correctness of the reflection of transactions on their receipt.

Settlements with all contractors involved in the construction must be timely. If this process is organized rationally, it is easier for the accountant not only to keep records and prepare reports, but also to control the company's liabilities and ensure that there are no unproductive losses.

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Control is extremely important in construction, as various resources are used for construction. To optimize them and balance the needs, it is advisable to conduct different types of analysis.

In particular, at the first stage of finding ways to optimize, the level (or share) of gross domestic product from construction (GDP from construction) should be analyzed, it has a significant impact on the total gross domestic product of the state. Among other important indicators should be examined the financial resources of the population for the purchase of housing, namely wages. In addition, an important indicator is the ratio of wages to the price per square meter of housing.

Table 1 shows the relevant data by different European countries. They characterize the main indicators that significantly affect the volume of construction.

The results of this rating indicate unevenness in the development of construction, caused by the influence of the selected 4 indicators.

Switzerland has the most developed construction industry, with Ukraine and Serbia in last place. These and many other countries need to develop the structural components of construction development. To do this, it is advisable to create more favorable lending conditions, provide preferences in the taxation of the construction business, as well as help increase wages (Yankovoj, 2002).

Table 1: Indicators that have an impact on the construction process in Europe in 2020

Countries	GDP from construction, million euro		Salary per month, euro		Price per Square Meter, euro		How many times the price per square meter is higher than the monthly salary (1)		Average rating (2)	Rating
UK	30798	/3	2421,55	/7	4 870	/6	2,01	/10	6,50	/4
Germany	50280	/2	2567,35	/5	5446,58	/3	2,12	/13	5,75	/2
France	27245	/4	2275,65	/9	5 485	/2	2,41	/16	7,75	/6
Italy	19224	/6	1447,08	/11	3 110	/12	2,15	/14	10,75	/9
Spain	16295	/7	1408,53	/12	2 976	/14	2,11	/12	10,75	/9
Netherlands	7694	/9	2627,65	/4	4 214	/8	1,60	/4	6,25	/3
Switzerland	75634	/1	5629,77	/1	10 893	/1	1,93	/6	2,25	/1
Turkey	19674	/5	326,86	/28	848	/28	2,59	/19	20,00	/17
Poland	8816	/8	853,86	/19	2 189	/19	2,56	/18	16,00	/11
Sweden	7190	/10	2535,91	/6	4 911	/5	1,94	/7	7,00	/5
Belgium	4918	/12	2110,06	/10	3 313	/11	1,57	/3	9,00	/7
Norway	5206	/11	3333,3	/2	3 967	/9	1,19	/1	5,75	/2
Denmark	3391	/14	3108,7	/3	5 027	/4	1,62	/5	6,50	/4
Finland	2987	/15	2414,93	/8	4 741	/7	1,96	/9	9,75	/8
Romania	435	/27	593,91	/24	1 471	/25	2,48	/17	23,25	/19
Czech Rep.	2117	/16	1192,62	/14	3 809	/10	3,19	/25	16,25	/12

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Portugal	1940	/17	860,18	/18	2 593	/16	3,01	/24	18,75	/16
Greece	855	/20	743,1	/22	1 628	/24	2,19	/15	20,25	18
Hungary	1152	/19	738,64	/23	1 915	/20	2,59	/19	20,25	/18
Slovak Rep.	1261	/18	894,23	/17	2 328	/ 18	2,60	/20	15,72	/10
Bulgaria	825	/21	590,07	/25	1 108	/27	1,88	/8	20,25	/18
Croatia	640	/24	804,76	/21	2 574	/17	3,20	/26	17,00	/14
Lithuania	3621	/13	954,66	/16	2 703	/15	2,83	/22	16,50	/13
Serbia	671	/23	462,85	/26	1 881	/22	4,06	/27	24,50	/20
Slovenia	515	/25	1143,49	/15	3 084	/13	2,70	/21	18,50	/15
Latvia	472	/26	843,79	/20	1 775	/23	2,10	/11	20,00	/17
Cyprus	362	/28	1244,86	/13	1 822	/21	1,46	/2	16,00	/11
Ukraine	776	/22	390,33	/27	1 134	/26	2,90	/23	24,50	/20

Notes: / - rating (for 1 indicator (r1); for the second indicator (r2); for the third indicator (r3); for the fourth indicator (r4)); (1) - the rating for this indicator is set in reverse order; (2) - calculated by the formula (r1 + r2 + r3 + r4): 4; initial data for rating obtained on the basis of sources (Countries with the largest gross domestic product (GDP) 2020, 2020; Price Rankings by Country of Price per Square Meter to Buy Apartment in City Centre (Buy Apartment Price, 2022); an electronic calculator for currency conversion was used to convert currency into euros (CURRENCY CONVERT, 2021); calculation of GDP in the country of Lithuania is carried out by the calculation method through the use of electronic statistical site (Countries with the largest gross domestic product (GDP) 2020, 2020).

In addition, it is advisable to encourage the construction of social housing for private businesses, including private construction companies. Preferential taxation may be the most acceptable incentive.

From the point of view of accounting, such measures require the opening of separate accounts for cost accounting, as well as accounts for the reflection of social housing in fixed assets.

The second important stage of the analysis for the construction of the optimization model is proposed to be considered relative indicators.

In particular, thanks to the calculations of the ratio of the cost of a square meter of housing in the city center with the average monthly salary in Europe (Trading Economics, 2021) we found that the easiest person to buy a home in Norway, and most difficult in Serbia (Figure 1).

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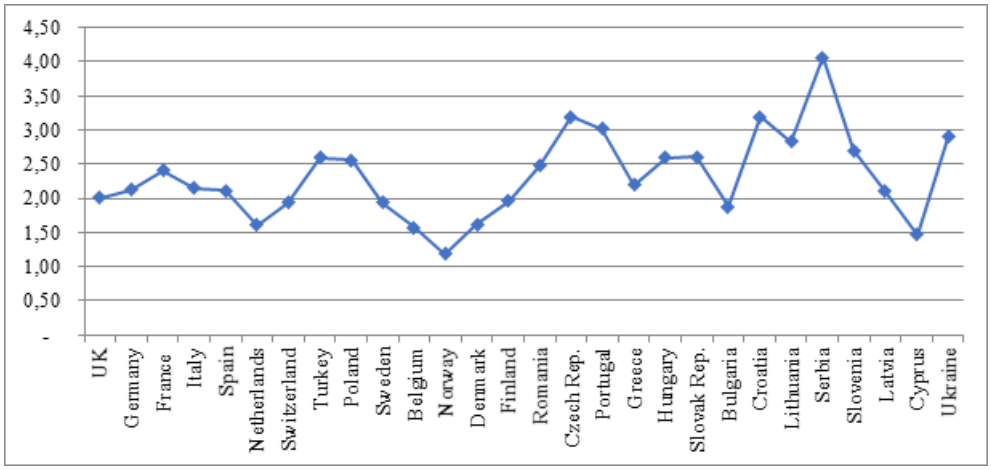

Figure 1: Coefficients of cost ratio of 1 sq. m of housing and average wages (excess of the cost of 1 sq. m of housing over the average wage, times)

We have identified the factors that most affect the speed of construction and sale of residential buildings. We believe that in low-wage countries, the most problematic resource for construction is financial resources. After all, people who need housing do not have the opportunity to raise funds to purchase it. The way out is the introduction of affordable housing programs at the state level and the reform of the financial system in terms of its lending.

In all spheres of human activity of a developed intellectual society, any systemic, balanced decisions are impossible without prior risk assessment and forecasting the state of the system. In this case, the most effective tools are mathematical and statistical methods and information technology (Berezka et al., 2013).

In our opinion, the next step towards solving the problem of optimizing construction resources and their accounting and control should be a canonical correlation analysis. McKeon J.J. notes that most methods of linear statistical analysis (multiple regression, principal component method, discriminant analysis, analysis of variance) are isolated cases of canonical correlation analysis (Mckeon, 1965; Sunday et al., 2021). This type of analysis is most closely related to multiple regression and principal components.

The advantages of using canonical correlation analysis to conduct our study are as follows: 1) we can quite clearly distinguish between independent and dependent variables; 2) such analysis allows the use of several dependent variables and in the field of construction they are really available; 3) it is possible to build latent indicators for multidimensional relationships between two sets of variables, which is most useful and acceptable for the development of alternative business models.

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The task is only to choose how many of the functions to be interpreted, but in most cases the first function is the most important.

For the result indicators (hereinafter referred to as the first set) we have chosen: Y1 - the number of apartments built (in rural and urban areas) per 1000 population; Y2 - total area of residential buildings put into operation, thousand m2; Y3 -% of profitable construction companies; Y4 - amounts of profits received by profitable construction companies, UAH million. For predictor variable (hereinafter referred to as the second set) we have chosen: X1 - household income, million UAH; X2 - bank loans and other loans for capital investments, million UAH; X3 - funds of the population for housing construction, million UAH; X4 - average monthly nominal salary, UAH; X5 - volume of investments in housing construction, million UAH; X6 - GDP in construction, million UAH.

The simulation will be carried out in the Statistic environment on the basis of statistical data for 2004-2020 (Ukrstat.org, 2021), taken from statistical yearbooks of Ukraine.

Analysis of the data shows that the canonical correlation coefficient R is 0.99991 and shows a very close relationship between the canonical variables. The obtained results of the canonical analysis are statistically significant ($p < 0.01$). The total fraction of variance of the first set of variables Y1 – Y4 included in the first canonical variable y1 is 100%, and the total fraction of variance of the features of the second set of variables X1 – X6, which are selected by the canonical variable x1, is 93.6068%. Total redundancy indicates that 90.40% of the variation in the values of the first group of variables Y1 – Y4 is determined by changes in X1 – X6, and 87.97% of the variation in the values of X1 – X6 is determined by changes in Y1 – Y4. This indicates that the constructed canonical model has a fairly high accuracy, as only 9.6% of the variance of the variables Y1 – Y4 depend on factors not taken into account in the analysis (Figure 2).

N=17	Canonical Analysis Summary Canonical R: ,99556 Chi?(24)=114,15 p=0,0000 Left Set	Right Set
No. of variables	4	6
Variance extracted	100,000%	93,6068%
Total redundancy	90,4011%	87,9694%
Variables: 1	Y1	X1
2	Y2	X2
3	Y3	X3
4	Y4	X4
5		X5
6		X6

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Figure 2: General results of the research

Analyzing the matrix of correlations between variables, we see that Y1 is closely related to X3 and X5, and Y4 - with X1, X2, X4, X5, X6. Other result indicators are less related to the factors identified for the study (Figure3).

Root Removed	Correlations, left set with right set (Spreadsheet_12_12_2021)					
	X1	X2	X3	X4	X5	X6
Y1	0,620042	0,515203	0,873738	0,580616	0,879204	0,546842
Y2	-0,024906	0,473680	0,444393	-0,091641	0,515110	-0,061391
Y3	0,592858	0,246492	0,465882	0,633637	0,525064	0,601234
Y4	0,910699	0,763848	0,639951	0,916017	0,725568	0,939792

Figure 3: Matrix of correlations

Characteristic roots are shown in Figure 3. Their significance is checked by the criterion $\chi 2$ (Figure 4 and 5).

Root	Eigenvalues (Spreadsheet_12_12_2021)			
	Root 1	Root 2	Root 3	Root 4
Value	0,991141	0,962839	0,840846	0,637578

Figure 4: Characteristic roots

Root Removed	Chi-Square Tests with Successive Roots Removed (Sprea					
	Canonicl R	Canonicl R-sqr.	Chi-sqr.	df	p	Lambda Prime
0	0,995561	0,991141	114,1527	24	0,000000	0,000019
1	0,981244	0,962839	64,5259	15	0,000000	0,002143
2	0,916976	0,840846	29,9547	8	0,000216	0,057681
3	0,798485	0,637578	10,6569	3	0,013743	0,362422

Figure 5: Verification of the significance of characteristic roots

We see that the first three roots are statistically significant ($p < 0.01$).

Let's analyze the first pair of canonical variables that have the closest relationship: r1 = 0.995561. Consider the factor structure of the first set of variables (Figure 6).

Root Variable	Factor Structure, left set (Spreadsheet_12_12_2021)			
	Root 1	Root 2	Root 3	Root 4
Y1	-0,369471	0,399885	-0,837450	0,047550
Y2	0,467973	0,549053	-0,690055	-0,058013
Y3	-0,711871	0,147438	-0,377533	-0,573560
Y4	-0,721746	0,680438	-0,056123	0,113741

Figure 6: Factor structure of the first set of variables

Y4 (the amount of profit received by profitable construction companies) and Y3 (% of profitable construction companies) strongly correlate with the first canonical root. Their correlation is lower with Y2 (total area of commissioned residential buildings) and Y1 (number

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of apartments built (in rural and urban areas) per 1000 population). The first canonical root explains 34.58% of the variance from the first set of variables (Figure 7).

Given the values of the variables in the second set of variables, we can explain about 34.27% of the variance in the first set of variables, based on the value of the first canonical root (Figure 7 and 8).

Root Factor	Variance Extracted (Proportions), left set	
	Variance extractd	Reddncy.
Root 1	0,345796	0,342733
Root 2	0,236526	0,227736
Root 3	0,330795	0,278147
Root 4	0,086884	0,055395

Figure 7: The share of the explained variance of the first set of variables

Among the variables of the second set, the first root is most dependent on household income, average monthly nominal wages, GDP in construction (Figure 8), the least – on bank loans and other loans for capital investments.

Root Variable	Factor Structure, right set (Spreadsheet_12_			
	Root 1	Root 2	Root 3	Root 4
X1	-0,801883	0,456502	-0,178906	0,225826
X2	-0,182945	0,923157	-0,105811	0,116486
X3	-0,435655	0,391144	-0,713447	0,319765
X4	-0,846301	0,430594	-0,123026	0,155094
X5	-0,414770	0,568022	-0,647864	0,164523
X6	-0,799596	0,524971	-0,054360	0,131480

Figure 8: Factor structure of the second set of variables

The first canonical root explains 39.9% of the variance in the second set (Figure 9). Changing the value of the first set based on the first canonical root can explain almost 39.54% of the variance in the second set.

Root Variable	Variance Extracted (P	
	Variance extractd	Reddncy.
Root 1	0,398982	0,395448
Root 2	0,332877	0,320507
Root 3	0,165005	0,138743
Root 4	0,039204	0,024996

Figure 9: The share of the explained variance of the second set of variables

To calculate the values of canonical variables, we use the canonical weights of the first and second sets (Figure 10 and 11).

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Variable	Canonical Weights, left set (Spreadsheet_12			
	Root 1	Root 2	Root 3	Root 4
Y1	-0,612926	-0,988488	-1,31768	1,37396
Y2	0,878138	1,082599	0,08043	-0,86455
Y3	-0,200118	0,040232	0,02236	-1,49950
Y4	-0,305009	1,168284	0,70464	0,21507

Figure 10: Canonical weight values of the first set

Variable	Canonical Weights, right set (Spreadsheet			
	Root 1	Root 2	Root 3	Root 4
X1	5,08777	-0,33408	5,84680	13,01243
X2	-0,53292	0,46047	0,02384	0,77570
X3	-0,93845	0,10621	-1,77952	0,09990
X4	-9,46122	-4,03745	-5,25706	-7,14457
X5	1,20425	0,30718	-0,27166	-2,08415
X6	3,66947	4,28575	0,80563	-4,63858

Figure 11: Canonical weight values of the second set

Canonical variables, which are latent indicators:

Zy = -0.61 Y1 + 0.88 Y2 - 0.20 Y3 - 0.31Y4,

Zx = 5.09X1 - 0.53X2 - 0.94X3 - 9.46X4 + 1.20X5 + 3.67X6

are statistically significant, reliable.

Based on the canonical correlation analysis, it can be concluded that the annual economic performance of construction companies is more influenced by the average monthly nominal wage, household income, GDP in construction, and less - bank loans and other loans for capital investment, funds for housing construction, investment in housing construction.

The most informative of the results indicators were the total area of residential buildings put into operation thousand m2 and the number of built apartments (in rural and urban areas) per 1000 population, and% of profitable construction companies, the amount of profits received by profitable construction companies, million UAH have less information load.

Canonical variable Zy, including the number of apartments built (in rural and urban areas) per 1000 population, the total area of residential buildings put into operation (thousand m2),% of profitable construction companies, the amount of profits received by profitable construction companies (million UAH) gives a generalized description of the annual results of economic activity of construction enterprises. The canonical variable Zx, which includes household income, bank loans and other loans for capital investment, household funds for housing construction, average monthly nominal wages, investment in housing construction,

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GDP in construction gives a generalized description of financial and economic factors that significantly affect effective indicators of economic activity of construction enterprises.

The correlation coefficient (0.99556) is close to 1, and the scattering diagram of the canonical values (Figure 12) shows a fairly close relationship between the linear combinations of variables Zx and Zy. That is, results indicators are closely linked to financial resources. Thus, our chosen system of statistical indicators that characterize the financial and economic factors of construction and economic activities of construction companies is not an arbitrary list of indicators, but is an adequate system.

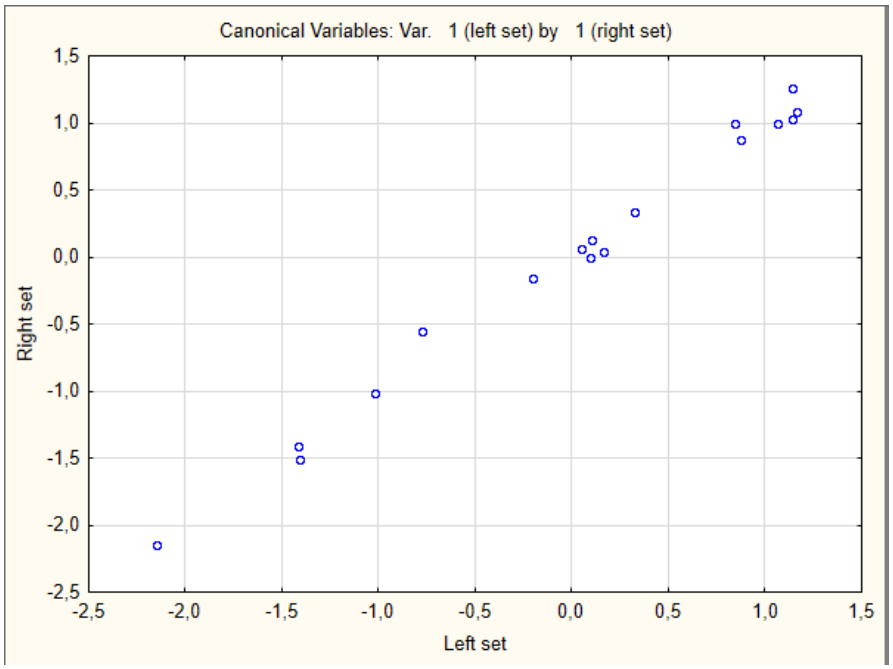

Figure 12: Diagram of scattering of canonical values

We have lag models typical of Y3 -% of profitable construction companies and all X, except loans.

Table 2: Correlation dependence of % of profitable construction enterprises on the indicators of the second set

Time lag / Indicators		τ = 0	τ = 1	τ = 2	τ = 3	τ = 4	τ = 5	τ = 6
X_1	Correlation coefficient	0,58	0,59	0,60	0,72	0,88	0,94	0,93
X_3		0,47	0,58	0,61	0,76	0,87	0,91	0,83
X_4		0,61	0,62	0,63	0,70	0,85	0,91	0,90
X5		0,43	0,48	0,53	0,60	0,74	0,79	0,69
X_6		0,53	0,55	0,60	0,66	0,85	0,94	0,85

The table shows that the cross-correlation function becomes most important in the fifth period. In this period of time, the largest increase in the % of profitable construction companies

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should be expected due to the growth of indicators. Dynamic models of distributed lag have the form:

$$y_t = 53,44 + 0,000012x_{1_{t-5}},$$

$$y_t = 56,91 + 0,000617x_{3_{t-5}},$$

$$y_t = 54,35 + 0,005233x_{4_{t-5}},$$

$$y_t = 53,22 + 0,000445x_{5_{t-5}},$$

$$y_t = 52,32 + 0,000112x_{6_{t-5}}.$$

The models show - an increase in household income by 1 million UAH leads to an increase in the number of profitable construction companies by 0.000012% in five years, an increase in household funds for housing construction leads to an increase in the number of profitable construction companies by 0.000617% in five years, an increase in the average monthly nominal wage by 1 UAH leads in five years to an increase in the number of profitable construction companies by 0.005233%, an increase in investment in housing construction by 1 million UAH. leads in five years to an increase in the number of profitable construction companies by 0.000445%, an increase in GDP in construction by 1 million UAH leads to an increase in the number of profitable construction companies by 0.000112% in five years.

All the parameters of the above models are significant at a high level according to the Student's t-test.

There are still more or less normal paired linear models.

Between Y1 and X5: Increase in investments in housing construction by 1 million UAH leads to an increase in the number of apartments built (in rural and urban areas) per 1000 population by 0.00006. Between Y1 and X3: Increasing the population's funds for housing construction by 1 million UAH leads to an increase in the number of apartments built (in rural and urban areas) per 1000 population by 0.000082. Between Y4 and X1: Increase in household income by 1 million UAH leads to an increase in the amount of profits received by profitable construction companies by 0.0046 million UAH. Between Y4 and X2: Increase in bank loans and other loans for capital investments by 1 million UAH leads to an increase in the amount of profits received by profitable construction companies by 0.3244 million UAH. A similar situation is observed with funds - $y = 0.3327x + 1829.2$. $R^2 = 0.4095$ slightly too small

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R^2. Between Y4 and X4: Increase in the average monthly nominal wage by 1UAH leads to an increase in the amount of profits received by profitable construction companies by 1.5603 million UAH. Between Y4 and X5: Increase in investments in housing construction by 1 million UAH leads to an increase in the amount of profits received by profitable construction companies by 0.2864 million UAH. Between Y4 and X6: Increase in GDP in construction by 1 million UAH leads to an increase in the amount of profits received by profitable construction companies by 0.0318 million UAH.

From this we can conclude that the most relevant and problematic in market conditions are financial resources, because their formation and use affects the material and technical resources. Factors such as financing, investing, the wages of the able-bodied population and the availability of a credit system for ordinary citizens play an important role in this case.

Regarding the formation of financial resources in construction, the tasks of accounting and control should be:

- ensuring full and timely reflection in the accounting and control over the receipt of financial resources from individual developers;
- strengthening banking and audit control over the receipt, internal movement and use of financial resources invested in construction;
- creation of the official "Register of individual developers" with the assignment of these developer's specific future apartments and accounting for the status of settlements with each of them.
- To perform these tasks requires at least:
- to form in the information system of the account at the building enterprise the register of violators of terms of payment of means;
- formation of own reserves to overcome the risks associated with customers' violation of the terms of payment of housing contributions.

When using financial resources in construction, the tasks of accounting and control should be:

- prevention of potential losses of financial resources during the conclusion of agreements and purchase and sale of construction products (work services);

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- introduction of daily accounting and control over cash income and expenses of the construction company;
- tracking the amounts of receivables and payables for each partner, each agreement, the timing of their occurrence and repayment in order to prevent the occurrence of doubtful and debts;
- implementation of operational accounting and control over the centers of profit, investment.

To implement them, you need to: implement in the enterprise information accounting system an application for risk assessment, signal applications for liability control; to appoint responsible persons of profit and investment centers; establish an effective management accounting system.

In the formation of material resources in construction, the tasks of accounting and control should be: ensuring the correct and timely formation of commercial agreements and current orders for the supply (for each supplier) of material resources in terms of types and names, their volumes, prices, terms of payment, terms and conditions of delivery; clear definition of places and terms of delivery of material resources and delimitation of transportation costs, loading and unloading costs between the supplier and the buyer and their reflection in the accounting and control system; modeling, planning, accounting and control of warehousing costs at the level of the construction company and individual construction sites.

As Rodrigues and Otávio (2010) say: the inventory-management models are differentiated by the degree to which the variables represent the reality, such as volume and size of the cargo stored, economic lot of buying and production and forecasting demand. The companies most concerned with the management of inventories take into account issues such as rate of production / receipt of materials, uncertainties in demand and in time, changes in price / cost, depending on the quantity purchased / produced, number of distribution centers, among other factors.

This is also very important for Ukrainian construction companies. Therefore, there is a need to develop optimization models and improve the accounting and control of resources in their receipt and use.

When using material resources in construction, the tasks of accounting and control should be: accounting and control over compliance with norms and standards of consumption

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of material resources in accordance with the developed design and estimate documentation, cost budgets; improving the effectiveness of control over the use of material resources at individual construction sites in order to reduce the amount and volume of construction waste.

The implementation of the above tasks requires at least the formation of a reserve for insurance payments and a reserve to cover unforeseen losses, as well as the application of regulatory accounting.

The formation of technical resources in construction in terms of accounting and control should be carried out in the following areas: improving the level of accounting and control over the preparation and implementation of agreements on the purchase of construction machinery and equipment from suppliers, as well as on their financial and operational lease; ensuring the completeness of reflection in the accounting of the value of purchased construction machinery and equipment, the cost of their delivery and bringing into working order.

When using technical resources in construction in terms of accounting and control, it is advisable to provide: improving the efficiency of accounting and control over the use of construction machinery and mechanisms with the introduction and application of the latest five-dimensional method of displaying information about the construction project (5D BIM); proper accounting and control over the cost of rent (financial, operational), rent payments and operation of construction machinery and equipment, etc.

5. CONCLUSIONS AND RECOMMENDATIONS

The proposed problematic resources in modern conditions are financial. Regarding their accounting and control in construction, it is necessary to draw the following conclusions:

1) The money invested in construction projects is highly liquid or medium liquidity. On the other hand, housing construction is illiquid, so construction companies will have a long time to make a profit. This situation is accompanied by a number of conditions: changes in exchange rates, inflation, the emergence of new technologies. All these conditions adjust the price of housing, which is different in the first and last stages of construction.
2) Management of financial resources may result in profit or loss of the construction company. Therefore, it is important that construction companies analyze the received and spent money. All these basic and intermediate calculations should be accompanied

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by the formation of intermediate and basic calculations, as well as through the formation of an abbreviated quarterly statement of cash flows.

3) Unconsidered and unplanned risks of unfinished construction projects lead to losses. Therefore, the company must first introduce a plan of potential risks and ways to overcome them.
4) As the construction process is long, there should be increased control over the use of material, technical and financial resources. If individual customers (buyers of housing) intend to buy it in installments, then enter into an agreement with the construction company on the phased payment. At the same time, they use the Schedules of phased payment of funds that do not have a form approved at the legislative level, and each company forms them independently. We suggest automating these schedules to make the payment procedure easier.

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