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METHODOLOGICAL BASICS OF ACCOUNTING ENGINEERING FOR UKRAINIAN ENTERPRISES

Abstract. *Aggressiveness of modern business environment highlights the problem of substantiation of theoretical, organizational and methodological principles of accounting engineering, as accounting and analytical support for the economic security system of domestic enterprises. Purpose. The research is aimed at the development of stages of improvement of methodological approaches to the application of the latest economic mechanism – the practical implementation of accounting engineering into activity of Ukrainian enterprises. Methods. Methods used in the article are based on the dialectic of cognition, which allows to assess the effectiveness of accounting and analytical support for modern enterprise management. In particular, the following methods were used: scientific abstraction, synthesis, induction and deduction, modeling, tabular method, as well as methods of logic. Results. The obtained results are presented by the methods of accounting engineering for accounting and analytical data support by means of formation of complex accounting objects: 1) in the field of production – as combination of procedural budgeting, normative method of accounting, procedural operational and cost analysis of deviations with reflection in the daily register of accounting “Report on fulfilment of budgets by business processes of responsibility centers”, in order to ensure operational regulation of production consumption of material and labor resources and funds; 2) in the financial field – by daily grouping of cash and financial flows by types of business processes on risk, liquidity and solvency in other separate monitoring registers – “Derivative balance sheets”, in order to establish current and future level of net assets and net liabilities, as indicators of the level of risk activity of enterprises. Also, the research substantiates practical aspects of the methodology of accounting engineering as a new direction of accounting and analytical support for management and control of the enterprise with a specific focus on business processes involving in-depth objects of accounting.*

Key words: economic security, business processes, accounting engineering, accounting engineering tools, operational accounting registers, net assets and net liabilities.

JEL classification: M41, L66.

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**МЕТОДИЧНІ ОСНОВИ БУХГАЛТЕРСЬКОГО ІНЖИНІРИНГУ
ДЛЯ УКРАЇНСЬКИХ ПІДПРИЄМСТВ**

Анотація. У сучасних умовах господарювання, що характеризуються загостренням конкуренції, а також мінливістю й агресивністю бізнес-середовища, виникає нагальна потреба в розробленні нових підходів до обліково-аналітичного забезпечення прийняття управлінських рішень на вітчизняних підприємствах. Одним із напрямів її вирішення є використання бухгалтерського інжинірингу. З огляду на викладене, а також ґрунтуючись на результатах проведеного дослідження, у статті запропоновано нові методичні підходи до обліково-аналітичного забезпечення управління бізнес-процесами на підприємствах України. Надані пропозиції дають можливість перетворити бухгалтерський облік із фіксатора господарсько-фінансових операцій на ефективний механізм управління сучасним суб'єктом господарювання.

Ключові слова: економічна безпека, бізнес-процеси, бухгалтерський інжиніринг, інструменти бухгалтерського інжинірингу, оперативні облікові реєстри, чисті активи і чисті пасиви.

Табл. 3. Літ. 35.

Instability and aggressiveness of modern business-environment cause an urgent need for a significant reorientation of management and control objects to business processes. In turn, business processes, from the point of view of scholars in the field of accounting, are a complex object of information, which combines: in the production sphere – process budgeting, normative method of accounting, operational and cost analysis of deviations, and in financial sphere – the impact of various risk factors on cash flows. This has led to the development of the latest method of accounting and analytical support for the management of a functioning enterprise (including ensuring its economic security) – accounting engineering. It is based on an engineering approach to modeling, design, development and integration into a single complex of accounting system of various economic instruments.

General theoretical and methodological principles of accounting engineering have been studied in a number of scientific works of foreign scholars such as D. F. Marshal, Vipul K. Basal [1], M. Hammer, D. Champy [2], H. J. Harrington [3], A. A. Thompson, A. J. Strickland [4], C. Redhead, C. Hughes [5], K. Drury [6], J. D. Finnerty [7], V. M. A. Akhtar [8], C. Hongren, J. Foster [9], B. Andersen [10], H. Bredrup [11], A. Rolstadas [12], J. Peppard, P. Rowland [13], R. G. Anthony [14],

E. J. Kane [15], G. Dufey [16], F. S. Mishkin [17], T. Kim [18], P. F. Druker [19], D. W. Edwards [20], P. Per-Gaute [21].

N. Horodyska [22] carried out the generalization and review of concepts of engineering, systematized and explored points of view of various economists. Some domestic scholars in their works have considered accounting engineering as an accounting technology, in particular R. Brukhansky [23], I. Herasymovych [24], I. Zamula, M. Prodanchuk, T. Kovalchuk, A. Myhalkiv, K. Simakov [25], V. Markarovych, O. Sydorhuk [26], I. Nahorna, O. Chumak [27], I. Yukhymenko-Nazaruk [28]. In their works these economists disclosed the essence and meaning of accounting engineering, investigated and learned retrospectives of its development, described basics of mechanism of functioning and tools of accounting engineering. Their works are also focused on the possibilities of accounting engineering in the context of management decisions.

Scientific work by M. Shumeiko, E. Kuznetsova, I. Tkach [29] investigates and generalizes main basics of functioning of accounting engineering and proposes engineering theory of accounting with own subject and objects. In addition, these economists have proposed an engineering method of accounting.

Some issues that touch upon reporting in frames of certain elements of accounting engineering were disclosed in the work by A. Kukoba [30] and L. Kindratska [31].

Currently there is no method of accounting engineering in Ukraine, which is adapted to peculiarities of market relations in Ukrainian enterprises. Only some of domestic authors, namely S. Holov and V. Iefimenko [32], I. Kryshchyna [33], S. Lehenchuk [34], V. Zhuk [35] made an attempt to cover general approaches to such problem, however in methodological, and, thus, in organizational terms, it is not resolved.

The purpose of this research is to develop the way of improvement of methodological approaches to application of the latest economic mechanism – the practical introduction of accounting engineering into activities of Ukrainian enterprises.

The research hypothesis of the study provides that an important aspect of the enterprise's economic security is the development of methods of accounting engineering for accounting and analytical data through the formation of complex objects of accounting in the field of production (as an organic combination – process budgeting, regulatory accounting method, process operational cost analysis deviations reflected in the daily register of accounting in order to ensure the operational regulation of production consumption of material and labor resources and cash) and in the financial sector (by means of daily grouping of cash and financial flows by type of business processes on risk, liquidity, solvency and other separate monitoring registers of accounting for establishing current and future level of provision of the enterprise with net assets and net liabilities as indicators of the level of risk activity of enterprises).

A new stage of the scientific and technological revolution, which has been started in late 1980s, the deepening of globalization of the economy, and fierce competition have led to the need for fundamental change of priorities of management and control: in production sphere – to technological processes that consume resources in cost items that only summarize them, and in financial activities – for continuous business processes in which risks arise, reserves are created, liquidity, solvency, etc. are determined.

Fundamentally new mechanisms and accounting tools based on the engineering approach to their formation are needed in order to provide information to the business process management system.

From the time of Luca Paccioli until the beginning of the last century, eight traditional elements of the method were used in the accounting system: accounts and double entry, balance and reporting, documentation and inventory, estimation and calculation, which by the end of the last century began to be filled with engineering content. In particular:

- appearance of aggregate (complex) mega-accounts and aggregate integrated correspondence of accounts, use of market and fair valuation, electronic document management and reporting, development of the latest accounting registers and control methods, namely: daily Report on fulfilment of budgets by business processes of “responsibility centers” in the production sector and “Derivative balance sheets”, which do not only show the real situation in terms of risks, reserves, liquidity and solvency, but also forecast their level based on future hypothetical processes;
- multidimensional application, in the management of economic processes of algorithms, matrices, models, derivative balance sheets, time and space factors of quadruple and sixfold records, aggregate accounting correspondence, indicators of net assets and net liabilities (according to market and fair value assessment) in the work of the enterprise.

Such directions of accounting development have led to the formation of its engineering system, which is typical for the current century and aimed at ensuring effective management of objects and processes at the business process level with the use of engineering aggregate mega-accounts built into computer programs of management accounting and strategic accounting.

Thus, accounting engineering is a set of developed new methods, techniques and schemes, as well as accounting records that ensure the implementation of new projects and transformations. In other words, this is a new accounting mechanism that uses all its tools to manage economic processes as an object of accounting.

Such methodological innovations, in accordance with the economic realities of the current century in accounting engineering, developed in countries with highly developed market economies, are the basis for their application in Ukrainian enterprises, where its feasibility depends mainly on the simplicity of its methodology.

Considering foreign practice and experience gained by some domestic enterprises, we have taken into account this factor and offer a fairly simplified (compared to foreign counterparts) methodology of accounting engineering, which provides full information about business processes for operational control and management regulatory and preventive measures, both in the production and in the financial sphere of the functioning Ukrainian enterprise.

During the study it was found that the most typical business processes of main production shops as “centers of responsibility” are: in the food industry – “Receiving raw materials”, “Washing raw materials”, “Mechanical grinding and pressing”, “Cooking”, “Packaging”, “Labeling”, “Packaging in sales containers”; in mechanical engineering, instrument making and furniture manufacturing – “Debugging equip-

ment”; “Procurement (supply) of raw materials”; “Production transformation (consumption) of resources”; “Installation of products”.

Necessary and obligatory condition is budgeting of business processes by “centers of responsibility” for the production of relevant products, without which management of business processes is impossible.

Each, separately taken, technological business process is a separate complex object of accounting, which combines: in the production sphere – budgeting tools, regulatory accounting methods (“standard cost” or “direct cost”), process operating cost analysis of deviation indicators. This allows to create a comprehensive mechanism for combining (engineering approach) of mentioned tools, which is presented in an expanded and in-depth form as “Report on fulfilment of budgets by business processes of responsibility centers” on the level of use of material, labor and financial resources in the process of manufacturing of various types of products in the shops of the main production of industrial production. It was tested on the example of PJSC “Bila Tserkva Cannery” in Kyiv region (Table 1).

This report both provides management with information on the level of budget execution by type of product and specifies the role and impact of each of the business processes for quick regulation the level of costs that shape these budgets. And this is achieved even at the level of usual computer software of 1C type and creates conditions for affordable usage of accounting engineering techniques at Ukrainian enterprises.

An effective method of internal control over technological costs in business processes of industrial enterprises is the use of methodology of their operational and cost analysis. It works by means of structuring the costs of technological redistributions as business processes, and comparing cost options for different types of technologies used, and thus establishing the level of cost-effectiveness of the respective types of technologies (Table 2).

Data in Table 2 show the effectiveness of the methodology of operational and cost analysis of technological business processes, as one of the tools of accounting engineering, as when comparing different production technologies, it is possible to choose the most economical one. The methodology is of practical importance as a direction of in-depth control over business processes, but not only of “centers of responsibility”.

Through the transfer pricing mechanism, it is possible to determine the contribution of each “center” to the results of the enterprise as a whole, as well as other structural units related to its activities.

It is carried out with the help of appropriate methodology of accounting engineering, which takes into account and groups, according to complex accounting objects, different types of cash flows, where the swift information elements are:

- 1) identification and classification of business management processes as “centers of accounting for financial situations”,
- 2) aggregated mega-accounts and aggregated correspondence of accounts on the principle of double entry,
- 3) accounting registers – daily monitoring transformation “Derivative balance sheets”,
- 4) net assets as indicators of the level of risk in the enterprise, defined in the monitoring, transformation derivative balance sheets.

Table 1
Report on fulfilment of budgets by business processes of responsibility centers of fruit and vegetable canning enterprise PJSC "Bila Tserkva cannery" of Kyiv region

Business processes of responsibility centers	Costs, thousand UAH												Total		
	Raw materials			Remuneration with accrual			Overhead costs			Budget	Fact	Deviation	Budget	Fact	Deviation
	Budget	Fact	Deviation	Budget	Fact	Deviation	Budget	Fact	Deviation						
<i>Center of responsibility "Production of apple juice"</i>															
1. Acceptance of raw materials	4,7	5,5	+0,8	0,3	0,4	+0,1	0,7	0,6	-0,1	5,7	6,5	+0,8			
2. Washing raw materials	24,9	26,9	+2,0	1,4	1,5	+0,1	3,5	3,2	-0,3	29,8	31,6	+1,8			
3. Sorting and inspection of raw materials	43,1	46,0	+2,9	2,5	3,3	+0,8	6,0	5,5	-0,5	51,6	54,8	+3,2			
4. Squeezing the juice	13,5	14,8	+1,3	0,8	0,7	-0,1	1,9	1,7	-0,2	16,2	17,2	+1,0			
5. Juice cooking	12,8	14,0	+1,2	0,7	0,7	-	1,8	1,6	-0,2	15,3	16,3	+1,0			
6. Packaging in jars	97,4	115,0	+17,6	5,7	5,8	+0,1	14,6	13,4	-1,2	117,7	134,2	+16,5			
7. Sterilization	47,6	55,8	+8,2	7,4	6,8	-0,6	7,4	7,0	-0,4	62,4	69,6	+7,2			
8. Capping	26,9	29,4	+2,5	1,7	1,8	+0,1	3,8	3,5	-0,3	32,4	34,7	+2,3			
9. Labeling	10,3	11,9	+1,6	3,1	2,9	-0,2	1,8	1,6	-0,2	15,2	16,4	+1,2			
10. Packing in containers for transportation	3,2	15,3	+12,1	16,5	8,7	-7,9	2,9	2,7	-0,2	22,6	26,7	+4,1			
Total under the current technology	284,4	334,6	+50,2	40,2	32,6	-7,6	44,4	40,8	-3,6	369,0	408,00	+39,0			
Including reduction options in % to the current one	X	X	+17,6	X	X	-18,9	X	X	-8,1	X	X	+10,6			
etc. on other "centers of responsibility" by types of manufactured products															

Developed by the authors.

Table 2
Results of assessment of costs of the “responsibility center” for the business processes of various technologies of production of apple juice at PJSC “Bila Tserkva cannery” of Kyiv region

Essence of business process operations	Current technology		Updated technology				Cost of the business process, UAH	
	Man-hours	Cost of the business process, UAH	Option I “Reducing of the complexity of combining of functions”		Option II “Reduction of spoilage”			Option III “Realization in large containers”
			Man-hours	Cost of the business process, UAH	Man-hours	Cost of the business process, UAH		
	Amount of cost reduction							
Preparation of raw materials (reception, washing, sorting)	5,76	96,67	1,62	18,78	18,84	-	-	
Squeezing the juice	1,56	18,36	-	-	-	-	-	
Juice cooking	1,50	17,10	-	-	-	-	-	
Packaging in jars	11,28	156,18	6,42	7,62	11,29	2,89	38,68	
Sterilization	14,40	84,30	-	-	15,58	-	-	
Capping	3,12	40,56	-	-	18,18	1,03	4,04	
Labeling	6,60	18,30	5,09	3,96	12,85	0,52	10,33	
Packaging in containers	34,32	32,52	3,40	17,45	7,21	1,55	10,88	
Total	78,54	463,99	16,53	47,81	83,95	5,99	63,23	
Possible reduction in% to the current technology	X	X	21,04	10,30	18,09	7,62	13,63	

Developed by the author.

The most important tools here are “Derivative balance sheets” and the work plan of mega-accounts. Mega-accounts are essentially a consolidation of accounts by sections of the current Ukrainian balance sheet, based on their economic content: “Non-current assets”, “Current assets” (if necessary, in more details: “Inventories”, “Production costs”, “Finished products and goods”, “Cash”, “Buyers and debtors”), “Equity”, “Ensuring subsequent costs and payments”, “Long-term liabilities”, “Short-term liabilities”. The objects of accounting here are separate “Centers for accounting of financial situations” on risks, reserves, solvency, etc.

The mechanism of accounting engineering is presented in the monitoring “Derivative balance sheets”, which includes four groups of operations:

- 1) operations on adjustment the historical value of assets to market (fair) value;
- 2) operations on hedging (protection) against adjusted balance sheet risks;
- 3) operations on current and expected risks;
- 4) calculating the amounts of net assets and net liabilities, after recording into accounting system of each group of transactions and obtaining information on their actual level, as well as taking into account transactions from possible expected future sales of non-current and current assets and repayment of long-term and short-term liabilities – in order to calculate amounts of net assets and net liabilities as indicators of the level of actual and projected risky financial activity of the enterprise.

Such methodological approaches, which were implemented in practice, have been tested on the basis of risk hedging operations based on the materials of the PJSC “Bila Tserkva Cannery” and include two main stages.

At the first stage, these transactions are reflected in the relevant accounting register, which reveals the direction of financial flows that are associated with the assessment of their risk.

At the second stage, transactions are reflected in the monitoring “Derivative balance sheet”, which determines and analyzes the amount of net assets and net liabilities for the possibility of their resistance to real risks.

The data (Table 3), obtained on the basis of the mechanisms and tools of accounting engineering described above, indicate the true level of both actual (current) and forecast (strategic) activities of the enterprise with risks, which cannot be provided by the current methodology by means of using the method of coefficients based on the results of the monthly balance.

In particular, according to historical estimates, the amount of net assets is UAH 9,244 thousand, and taking into account the market assessment and existing risks only UAH 8,691 thousand or UAH 553 thousand (9.5%) less. This determines the level of safety margin: respectively, not 21.0%, but in reality – 19.7%, and indicates the fact of a negative trend in the growth of risky work of the enterprise.

The practical application of the above-mentioned methodological approaches has also been tested at enterprises of other types of economic activity, namely the Kyiv Machine-Building Plant “Kvazar” and a number of enterprises of the food industry. The results testify their high factual reliability, and hence expediency.

The latest stage of the scientific and technological revolution, which has started during late 80's of the twentieth century, caused a fundamental change in priorities of management and control from cost items to business processes that shape it in

Table 3

Monitoring Transformation “Derivative Balance Sheet Report” on net assets as indicators of risk activity of PJSC “Bila Tserkva Cannery” at the end of the day on September 13, 2018 (in UAH, thousand)

MEGA – ACCOUNTS													
Mega accounts	Non-current assets		Current assets		Equity		Long-term liabilities		Short-term liabilities		Balance Sum	Net assets	
	Debit	Credit	Debit	Credit	Debit	Credit	Debit	Credit	Debit	Credit			
Introductory balance	1606		42490			9244			750		34602	44096	9244
<i>Hedged operations</i>													
1. At the expense of expectation of profit, an insurance reserve is created for the expected risks as self-insurance						1) 6							1) 6
2. To prevent risk, an increase in revenue and profit is formed to create a reserve			2) 10			2) 10							
3. Debt collection from bad debtors as risk avoidance					3) 5	3) 5							
4. Risk transfer to the insurance company					2) 2				4) 2				
Hedged balance	1606					9241			252		34608	44101	9241
<i>Risky operations</i>													
5. Potentially unprofitable risky operations		3) 25		5) 75	5) 100								
6. Potentially profitable operations	6) 35		6) 115			6) 150							
Balance taking into account risks	1616		42532			9291			252		34608	44151	9291

End of table 3

MEGA – ACCOUNTS												
Mega accounts	Non-current assets		Current assets		Equity		Long-term liabilities		Short-term liabilities		Balance	
	Debit	Credit	Debit	Credit	Debit	Credit	Debit	Credit	Debit	Credit	Debit	Sum
<i>Forecast and strategic operations</i>												
7. Full realization of non-current assets at historical cost		7)1616	7)1016		7)600							
8. Full realization of current assets at their historical value			8)42535	8)42535								
9. Repayment of long-term liabilities at the expense of non-current and current assets				9)252		9)252						
10. Repayment of short-term liabilities at the expense of non-current and current assets				10)34608					10)34608			
Net assets as a result of the full realization of assets and repayment of liabilities			8691			8691				-		8691

Developed by the authors.

the manufacturing sphere, and the ratio of financial condition on the monthly balance – for continuous management of business processes from cash flows every day, which cause risks, form reserves, determine liquidity and solvency. In turn, they necessitated the latest accounting and analytical support – accounting engineering, which focuses on engineering approaches to modeling, designing and developing up-to-date accounting mechanisms and tools. The result of the conducted research is the development of new methodological foundations on construction of complex accounting facilities – business processes, which combine in certain operational accounting registers: in manufacturing sector – process budgeting of material and labor costs, regulatory methods of accounting for their real level, and operational and value analysis of deviations, and in financial – reflection of operations on aggregate mega-accounts in terms of valuation options, calculation of amounts of net assets and net liabilities, as the main indicators of risk in the enterprise at any time, which is fundamental from the standpoint of preservation and development of business.

The use of these methodological approaches to accounting and analytical support of business process management at Ukrainian enterprises, transforms accounting from a fixer of economic and financial transactions to a mechanism for managing a modern enterprise.

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