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Iryna Chmutova
D.Sc. (Economics), Professor,
Simon Kuznets Kharkiv
National University of Economics
9-a Nauky Ave., Kharkiv, 61166, Ukraine
chmutova_i@ukr.net
ORCID ID:
http://orcid.org/0000-0001-7932-7652

Viktoriia Vovk
D.Sc. (Economics), Professor,
Simon Kuznets Kharkiv
National University of Economics
9-a Nauky Ave., Kharkiv, 61166, Ukraine
victoriavovk@ukr.net
ORCID ID:
http://orcid.org/0000-0001-5680-2967

Olena Bezrodna
PhD (Economics), Senior Lecturer,
Simon Kuznets Kharkiv
National University of Economics
9-a Nauky Ave., Kharkiv, 61166, Ukraine
olena_bezrodna@ukr.net
ORCID ID:
http://orcid.org/0000-0002-9480-0898

Analytical tools to implement integrated bank financial management technologies

Abstract. *Introduction.* The rapid development of bank financial management technologies prompted by the increasing sophistication and scaling of control elements calls for harmonisation of its functions and improved analytical support. *The purpose* of the paper is to develop analytical tools to implement integrated bank financial management technologies, such as the balanced scorecard, benchmarking and financial controlling, which would factor in all the stages of the bank's life cycle.

The study employed the following *methods:* logical synthesis - to form a system of performance indicators to measure the bank's financial results, customer base, business processes and human resources management; canonical analysis - to establish the cause and effect relationships between the indicators.

Results. Based on the example of 27 Ukrainian banks at the intensive growth stage as a case study, the paper proves close correlation between the perspectives of the balanced scorecard: «Personnel Development»- «Business Processes»; «Business Processes» - «Customers»; «Customers» - «Finances». *Conclusions.* The proposed set of analytical tools allows observing the specifics of the cause and effect relationships at each stage of the bank's life cycle between its performance indicators of financial results, customer base, business processes and personnel management. It constitutes grounds for the adjustment of the bank's objectives maps with due regard to the cyclic nature of its development, as well as for the creation of mechanisms to apply the balanced scorecard, benchmarking and financial controlling technologies.

It is advisable to employ indicators with the closest correlation in benchmarking for setting targets when doing financial planning (using the indicators of the reference bank for this purpose), and when realising financial controlling - to find deviations of the controlled indicators from the planned figures as well as develop recommendations to eliminate the causes of such deviations. According to the results of our research, these indicators were found: for the perspective «Finances» - the total capital adequacy ratio and the share of retail loans in assets; for the perspective «Customers» - the average liabilities per one customer and the expenditure per one customer; for the perspective «Business Processes» - the operating expenditure in the total expenditure, the revenues from new products in the bank's total revenue and the share of new products in the product line; for the perspective «Personnel Development» - the intellectual potential factor and the share of employees with higher education in the total number of personnel.

Keywords: Bank; Financial Management Technologies; Balanced Scorecard; Benchmarking; Financial Controlling

Чмутова I. М.
доктор економічних наук, доцент, професор кафедри банківської справи,
Харківський національний економічний університет імені Семена Кузнеця, Харків, Україна
Вовк В. Я.
доктор економічних наук, професор, професор кафедри банківської справи,
Харківський національний економічний університет імені Семена Кузнеця, Харків, Україна
Безродна О. С.
кандидат економічних наук, старший викладач кафедри банківської справи,
Харківський національний економічний університет імені Семена Кузнеця, Харків, Україна

Аналітичний інструментарій реалізації комплексних технологій фінансового менеджменту банку

Анотація
У статті запропоновано аналітичний інструментарій урахування специфіки причинно-наслідкового зв'язку, який виникає на кожній стадії життєвого циклу банку між індикаторами результативності управління фінансами, клієнтською базою, бізнес-процесами та персоналом, що створює підґрунтя для коригування карти цілей банку з урахуванням циклічності його розвитку, формування механізмів застосування технологій збалансованої системи показників, бенчмаркінгу й фінансового контролінгу. На прикладі 27 банків України, які знаходилися на стадії інтенсивного зростання, з використанням методу канонічного аналізу доведено наявність тісного зв'язку підсистем збалансованої системи показників: «Розвиток персоналу» - «Бізнес-процеси»; «Бізнес-процеси» - «Клієнти»; «Клієнти» - «Фінанси».

Ключові слова: банк; технології фінансового менеджменту; збалансована система показників; бенчмаркінг; фінансовий контролінг.

Чмутова И. Н.
доктор экономических наук, доцент, профессор, кафедра банковского дела,
Харьковский национальный экономический университет имени Семёна Кузнеца, Харьков, Украина
Вовк В. Я.
доктор экономических наук, профессор, кафедра банковского дела,
Харьковский национальный экономический университет имени Семёна Кузнеца, Харьков, Украина
Е. С. Безродная
кандидат экономических наук, старший преподаватель кафедры банковского дела,
Харьковский национальный экономический университет имени Семёна Кузнеца, Харьков, Украина

Аналитический инструментарий реализации комплексных технологий финансового менеджмента банка

Аннотация
В статье предложен аналитический инструментарий учета специфики причинно-следственных связей, которые возникают на каждой стадии жизненного цикла банка между индикаторами результативности управления финансами, клиентской базой, бизнес-процессами и персоналом, что создает основу для корректирования карты целей банка с учетом цикличности его развития, формирования механизмов применения технологий сбалансированной системы показателей, бенчмаркинга, финансового контроллинга. На примере 27 банков Украины, которые находились на стадии интенсивного роста, с использованием метода канонического анализа доказано наличие тесной связи подсистем сбалансированной системы показателей: «Развитие персонала» - «Бизнес-Процессы»; «Бизнес-Процессы» - «Клиенты»; «Клиенты» - «Финансы».
Ключевые слова: банк; технологии финансового менеджмента; сбалансированная система показателей; бенчмаркинг; финансовый контроллинг.

1. Introduction

The problem of technologisation of management processes is an interdisciplinary one, as evidenced by a great number of economic, social, industrial, information, education and other technologies adopted by economic actors. The rapid development of technologies of managing financial and economic processes in the last decade has come as a response to the increasing sophistication and scaling of control elements, the need to harmonise its functions, tasks and tools. An analysis of the application of managerial technologies in economy and finances shows that today priorities are shifting towards transition from ad hoc to integrated management technologies.

The application of modern integrated financial management technologies in banks in a more active way is also caused by the need to strengthen the adaptability of banks to difficult conditions of the development of the Ukrainian financial sector. Despite the positive changes in the banking system at the beginning of this year, in particular solvent banks received UAH 338 million net profit in January 2017, net interest income grew by 29.5% (compared with the same period in 2016) as a result of the reduction of individual deposits and the renewal of the demand for banking services, the proportion of unprofitable banks decreased (it was 18.3% in January 2017 compared to 22.4% in January 2016), the quality of assets of domestic banks remains low. Provisions against solvent banks' asset operations in January 2017 increased by 2.45 times compared to the same period last year - to UAH 3,112 million [1].

However, the use of integrated technologies of financial management, such as the balanced scorecard, benchmarking and financial controlling, by domestic banks is limited. In addition, the management procedures that comprise the abovementioned technologies lack harmonisation and systematisation, among other things, due to the absence of common analytical tools for their implementation.

2. Brief Literature Review

The problems related to the application of managerial technologies have been quite broadly covered in economic science literature represented by the works of R. Kaplan and D. Norton (Kaplan & Norton, 1996) [2], P. Niven (Niven, 2006) [3], H. Folmut (Folmut, 2003) [4], D. Han (Han, 2005) [5], R. Camp [6] (Camp, 1989), J. Harrington (Harrington, 1995) [7] and other scientists.

The aspects of applying the balanced scorecard and benchmarking in banking have also been reflected in recent studies. In particular, different aspects of the balanced scorecard and the importance of each of the aspects and related indicators were examined by M. Rostami (2015) [8], the impact of the usage of the balance scorecard on the performance of commercial banks was defined by D. S. Ombuna, K. Omido, H. M. Garashi, O. Odera and O. Okaka (2013) [9]. E. Ozturk and A. Coskun (2014) concluded that the balanced scorecard is a strategic performance management system which brought a holistic approach to the performance measurement which is

the most important function of administrative controls [10]. Corresponding with the four balanced scorecard perspectives, i.e. finance, customer, internal business process, and learning and growth, the most important evaluation indicators of banking performance were synthesised by H. Y. Wu (2012) and D. Balkovskaya and L. Filneva (2016) [11-12].

The application of benchmarking in banking was discussed in [13; 14; 15]. It was used as a tool to investigate the determinants of net interest margins in different regions [13], estimate the bank's market position [14], provide financial security in the bank [15].

At the same time, it should be noted that the available tools rely on different analytical methods to support integrated management technologies, leading to inconsistency of managerial decisions based on the analysis of different metrics. E. Bessonova and T. Domkhokova (2016) deal with this problem by using balanced scorecard indicators for controlling purposes [16], which, though having positive aspects, makes the balanced scorecard technology an ancillary technique for controlling, despite the fact that the former is of independent significance for measuring objectives, developing strategies and adjustment of the company's strategic plan. In addition, it should be noted that the metrics used in balanced scorecard (BSC), controlling and benchmarking have been developed primarily for industrial enterprises and non-financial institutions, while banking has essential distinctions that should be considered when forming analytical support for appropriate technologies of financial management. Another problem which has not been addressed by researchers and practitioners is the need to consider the current stage of the bank's development when forming a set of analytical parameters underlying managerial technologies.

3. The purpose of the paper is to develop analytical tools to implement bank financial management integrated technologies subject to the stages of the bank's life cycle. This stems from the need to address the following tasks: 1) to form a set of indicators to measure performance of the bank's financial results, customer base, business processes and personnel management; 2) to establish the cause and effect relationships between the indicators; 3) to identify indicators with strong mutual correlation subject to the bank's life cycle stages within the scope of the «Finances», «Customers», «Business Processes» and «Personnel Development» perspectives.

4. Results

Synthesis of bank financial management integrated technologies should involve consistency of indicators used as part of these technologies. For this purpose, they should reflect the strategic goals and be interrelated so that one can trace how changes in some indicators affect the others. It is therefore proposed to form analytical tools to implement the balanced scorecard (BSC), benchmarking and financial controlling technologies in the bank by means of selecting performance indicators of financial results, customer base, business processes

and personnel management which are characterised by the strongest cause and effect relationships existing at each stage of the bank's life cycle. For this reason, one should establish cause and effect relationships between the BSC perspectives by using economic and mathematical methods, as well as by selecting indicators with the closest relationships and those that best describe a perspective. This means that during the process of implementation of bank financial management integrated technologies priority should be given to the most significant indicators.

Scientists distinguish several types of relationships among the BSC indicators: 1) those with one perspective and those within the scope of different perspectives treated as equivalent ones [17]; 2) those within the scope of different perspectives, where the financial perspective is treated as the output one [2; 3]. While employing the latter approach which is considered to be a classical one, the study assumes that the personnel development indicators affect the indicators of business processes having effect on the effectiveness of customer base management and contributing to financial indicators in its turn. Proceeding from this assumption, we have established the cause and effect relationships between the specified groups of indicators.

There is an array of available economic and mathematical tools that can be used to find casual relationships between the indicators measuring economic processes, including correlation and regression analysis, principal components analysis, factor analysis and canonical analysis [18]. However, it is proposed to use canonical analysis, since it allows determining the relationship between the two sets of variables while being a generalisation of the method of multivariate correlation as a measure of correlation between a random variable and a set of other random variables. The principle difference of canonical analysis from correlation and regression analysis is that the former makes it possible to establish an impact of factors not only on one resulting parameter, but on several of them, which contributes to practical significance of the obtained results.

In canonical analysis, the matrix of values of input variables is represented as follows: explanatory and output variables have to be constrained as $p \leq q$, where p - the number of attributes of the set of output variables; q - the number of attributes of the set of explanatory variables. In addition, all matrix data are represented as deviations from sample means.

The canonical correlations method was implemented to find interrelationships between the performance indicators of the bank's finances, customer base, business processes and personnel management by using the Statistica 8.0 package. It was expected that the strongest correlation at different stages of the bank's life cycle would be observed among different indicators of the BSC perspectives, which would underlie the differences in their composition. The proposed procedure was tested for the banks, which were at the stage of intensive growth. The main financial and economic indicators of their activities are given in Table 1.

In order to build the model of cause and effect relationships between the perspectives «Personnel Development» and «Business Processes», we have built the information space of the attributes listed in Table 2. Here, the parameters of the «Business Processes» perspective were studied as output variables, with the parameters of the «Personnel Development» perspective considered as explanatory.

The application of the canonical correlations method resulted in the canonical root with a quite

high statistical significance value. This laid the foundation for further analysis of only the first pair of canonical variables. The canonical correlation coefficient $r(U_1 V_1)$ made 0.77, evidencing close correlation between the canonical variables. Hence, the model of relationships between «Personnel Development» and «Business Processes» takes the form:

$$\begin{cases} U_1 = -0.19x_1 + 0.39x_2 - 0.45x_3 + 0.19x_4 + 0.28x_5 - 0.26x_6 - 0.32x_7 \\ V_1 = -0.27y_1 + 0.65y_2 + 0.84y_3 - 0.55y_4 - 0.55y_5 - 0.005y_6 \end{cases} \quad (1)$$

U_1 - the «Personnel Development» perspective;
V_1 - the «Business Processes» perspective.

Since the canonical root represents two weighted sums, one for each set, the interpretation of the model obtained is based on canonical weights. And the greater the value of this

Tab. 1: **The main financial and economic indicators of studied banks as of 01 January 2017, UAH thousand**

Bank	Assets	Liabilities	Equity	Profit (loss) after tax
PROMINVESTBANK PJSC	34,323,896	29,174,475	5,149,420	-4,227,140
UKRSOTSBANK PJSC	41,800,096	28,983,148	12,816,948	-10,366,698
SBERBANK PJSC	48,355,810	44,633,470	3,722,339	-2,817,967
FINANCIAL INITIATIVE CB PJSC	14,346,740	16,736,641	-2,389,900	-447,645
CREDIT AGRICOLE BANK PJSC	29,895,180	27,419,546	2,475,633	807,786
KREDOBANK PJSC	11,004,497	9,916,716	1,087,780	263,676
DIAMANTBANK PJSC	7,414,511	7,301,178	113,333	-573,015
FINBANK PJSC	650,906	489,072	161,834	-86,206
FORTUNA-BANK JSC	1,489,266	1,141,655	347,610	-330,187
BANK VOSTOK PJSC	7764880	7,241,864	523,016	95,382
BM BANK JSC	1,752,468	1036713	715754	-1759159
PROCREDIT BANK JSC	12,117,205	10,854,579	1,262,625	300,647
BANK FOR INVESTMENT AND SAVINGS	4,580,483	4,039,502	540,981	7,782
ARKADA PJSC JSCB	1,919,543	1,133,587	785,956	9,726
CREDIT EUROPE BANK PJSC	2,242,985	1,735,051	507,934	60,725
INTERNATIONAL INVESTMENT BANK PJSC	6,892,807	6,684,633	208,174	42,664
COMINVESTBANK PJSC	1,102,925	942,960	159,964	5,512
BANK GRANT PJSC	1,214,800	725,281	489,519	33,484
TRUST-CAPITAL PJSC JSB	347,035	122,908	224,127	-280
BANK SICH PJSC	1,128,597	998,699	129,897	816
CREDITWESTBANK PJSC	1,170,614	917,578	253,036	28,354
OKCI BANK PJSC	576,534	365,408	211,126	628
RADABANK PJSC JSCB	819,391	581,915	237,476	10,891
MOTOR BANK PJSC	1,199,800	1,045,324	154,476	21,349
UKRAINIAN CONSTRUCTION INVESTMENT BANK JSC	504,199	374,489	129,710	562
CONCORD PJSC JSCB	387,416	220,670	166,746	1,885
CB CENTER PJSC	217,193	87,523	129,670	883

Source: Compiled by the authors based on official data of the National Bank of Ukraine

Tab. 2: **List of indicators of the model of relationships between the perspectives «Personnel Development» and «Business Processes»**

List of output variables: «Business Processes»	Variable	List of explanatory variables: «Personnel Development»	Variable
Share of new products in the bank's product line, %	Y_1	Employee stability index	X_1
Share of unique products in the bank's product line, %	Y_2	Share of employees with higher special education in the total number of personnel, %	X_2
Share of revenues from new products in the bank's total revenue, %	Y_3	Intellectual potential factor	X_3
Share of operating expenditure in the bank's total expenditure, %	Y_4	Share personnel payroll costs in the bank's total expenditure, %	X_4
Share of standard bank products,%	Y_5	Share of personnel training costs in personnel expenditure, %	X_5
Share of standard and regulated business processes, %	Y_6	Income from operations per 1 employee, UAH thousand	X_6
		Amount of assets per 1 employee, UAH thousand	X_7

Source: Compiled by the authors

weight, the bigger the contribution of the respective indicator to the value of the canonical variable. Thus, as follows from the model obtained, the biggest contribution to the value of the canonical variable V_1 (the «Business Processes» perspective) is made by the parameter y_3 - the share of revenues from new products in the bank's total revenue, and to the canonical variable U_1 - x_3 - by the intellectual potential factor. In addition, there is a correlative relationship between these parameters, which characterises the impact of the intellectual potential factor on the share of revenues from new products in the bank's total revenue. Since the intellectual potential factor reflects the share of leading personnel in the total number of employees, the relation between the parameters is quite natural as it is the key staff that contributes most to the creation and introduction of banking innovations and new products in particular.

The next stage involves building of the model of relationship between the «Business Processes» and «Customers» perspectives. The «Customers» perspective indicators were selected as output variables, while indicators of the «Business Processes» perspective were selected as explanatory ones. The list of indicators of the set of output data is represented in Table 3.

Upon the conducted analysis, only one out of six canonical roots was found to be statistically significant. This implies that there is good reason to analyse the canonical coefficients by the first pair of canonical variables. The canonical correlation coefficient $r(U_2 \ V_2)$ made 0.71, evidencing close correlation between the canonical variables. Considering this, the model of relationship between «Customers» and «Business Processes» takes the form:

$$\begin{cases} U_2 = 0.42x_1 - 0.24x_2 + 0.47x_3 - 0.68x_4 - 0.14x_5 - 0.26x_6 \\ V_2 = -0.92y_1 - 0.03y_2 + 0.13y_3 + 0.29y_4 - 0.57y_5 \end{cases} \quad (2)$$

U_2 - the «Business Processes» perspective.
V_2 - the «Customers» perspective.

The relationship between the «Business Processes» and «Customers» perspectives is most pronounced in contribution of the parameters of the average number of customers per 1 bank branch (y_1) and the share of operating expenditure in the bank's total expenditure (x_4). It has been established that there is a medium correlation relationship between the above variables ($r(y_1 \ x_4)=0.53$). That is, the more customers are served by the bank, the higher the bank operating expenditure is. Also, there are relationships between the bank's assets per one customer and the share of revenues from new products in the bank's total revenue, since increased profitability of new banking products is an evidence of their popularity with the customer, which, in its turn, leads to expansion of demand for the bank's services and contributes to the growth of its assets.

The final stage of the analysis of cause-and-effect relationships in the BSC involves building the model of relationships between the «Customers» and «Finances» perspectives.

As output (dependent) attributes for finding cause and effect relationships between the parameters of the «Customers» - «Finances» perspectives, we took indicators of the BSC financial perspective, while the explanatory attributes were indicators of the perspective «Customers» (Table 4).

The results of the analysis of statistical significance of the canonical roots by Bartlett's criteria, lambda, level of significance ($p<0.05$) show there is a need for further analysis of the first pair of canonical variables.

The relationship established between the «Customers» and «Finances» perspectives ($r(U_3 \ V_3)=0.66$) is primarily determined by such variables as y_1 - the total capital adequacy ratio and x_4 - the average borrowings per 1 customer.

The model of relationship between «Customers» and «Finances» takes the form:

$$\begin{cases} U_3 = 0.23x_1 + 0.18x_2 - 0.41x_3 - 0.83x_4 + 0.21x_5 \\ V_3 = -0.97y_1 + 0.11y_2 + 0.32y_3 + 0.07y_4 \end{cases} \quad (3)$$

U_3 - the «Customers» perspective;
V_3 - the «Finances» perspective.

The results of the analysis of correlation between the canonical variables U_3 (the «Customers» perspective) and V_3 (the «Finances» perspective) allow to find a relationship between the variables y_1 - the total capital adequacy and x_4 - the average borrowings per 1 customer ($r(y_1 \ x_4)=0.59$) and y_1 - the total capital adequacy x_3 - the bank's average liabilities per 1 customer ($r(y_1 \ x_3)=0.51$). The economic meaning of these relationships is that when borrowing the bank bears certain associated costs and has to guarantee adequate capital base to protect the interests of its depositors. When borrowing funds from the customers, the bank has to be more active in allocating them as well; therefore, the indicator of the share of retail loans in the assets of the «Finances» perspective is also related to the parameters of the «Customers» perspective.

5. Conclusions

The results of building the models of relationships between the perspectives «Personal Development» - «Business Processes», «Business Processes» - «Customers», «Customers» - «Finances» allow us to draw the conclusion that there exist statistical relationships between their elements, which may be considered in structuring the bank's objectives and shaping the strategies to achieve them.

It will be practical to employ indicators with the closest correlation in benchmarking

Tab. 3: List of indicators of the model of relationships between the perspectives «Business Processes» and «Customers»

List of output variables: «Customers»	Variable	List of explanatory variables: «Business Processes»	Variable
Average number of customers per 1 bank branch, persons	Y_1	Share of new products in the bank's product line, %	X_1
Advertising and marketing expenses in total bank expenditure, UAH thousand	Y_2	Share of unique products in the bank's product line, %	X_2
Bank's average expenditure per 1 customer, UAH thousand	Y_3	Share of revenues from new products in the bank's total revenue, %	X_3
Bank's average liabilities per 1 customer, UAH thousand	Y_4	Share of operating expenditure in the bank's total expenditure, %	X_4
The bank's average assets per 1 customer, UAH thousand	Y_5	Share of standard bank products, %	X_5
		Share of standard and regulated business processes, %	X_6

Source: Compiled by the authors

Tab. 4: List of indicators of the model of relationships between the perspectives «Customers» and «Finances»

List of output variables: «Finances»	Variable	List of explanatory variables: «Customers»	Variable
Total capital adequacy ratio	Y_1	Average number of customers per 1 one bank branch, persons	X_1
Current liquidity ratio	Y_2	Advertising and marketing expenses in total bank expenditure, UAH thousand	X_2
Share of retail loans in assets, %	Y_3	The bank's average expenditure per 1 customer, UAH thousand	X_3
Net interest margin	Y_4	The bank's average liabilities per 1 customer, UAH thousand	X_4
		The bank's average assets per 1 customer, UAH thousand	X_5

Source: Compiled by the authors

for setting targets when doing financial planning, using the indicators of the reference bank for this purpose, and in financial controlling to find deviations of the controlled indicators from the planned figures and to develop recommendations to eliminate the causes of such deviations. According to the results of the analysis, these indicators were found to be: for the perspective «Finances» - the total capital adequacy ratio and the share of retail loans in assets; for the perspective «Customers» - the average liabilities per 1 customer and the expenditure per 1 customer; for the perspective «Business Processes» - the operating expenditure in the total expenditure, the revenues from new products in the bank's total revenue and the share of new products in the product line; for the perspective «Personnel Development» - the intellectual potential factor and the share of employees with higher special education in the total number of personnel.

Further research may involve finding special aspects of the application of benchmarking and financial controlling in banks subject to the stage of their life cycle.

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