

8.2 BALANCED SCORECARD: FORMATION WITH PERSPECTIVE TO PROVIDE ECONOMIC SECURITY AND SUSTAINABLE DEVELOPMENT OF HIGHER EDUCATIONAL INSTITUTIONS

Under conditions of increasing competitiveness between higher educational institutions (HEI) for entrants, employees for qualified potential graduates from HEIs and graduates at the domestic and international labor markets, there is a necessity to balance income and expense items of HEI after liquidation or decreasing of nonproductive cost for various resources (particularly time to perform activities, which help to increase HEI efficiency) and to orient released cost to create the investment structures, such as scientific parks, startup-companies, business-incubators, innovative laboratories, intellectual property departments.

The question to form the balanced scorecard (BSC) within the strategic management by economic entities, particularly by HEIs, is studied in works of its investigators R. Kaplan and D. Norton [1; 2; 3]. In the work [3] authors focus their attention on the logic to establish relations between indicators of internal processes organization and strategic activity with purpose to increase effectiveness of the strategic tasks realization. The general character of such relation on the example of HEI is shown by authors in works [4; 5]. The scientific literature [6] observes main aspects of HEI's functioning, taking into account their specific activity and carrying out the research (they concern HEIs as economic entities), the result of which consists in estimation of the economic security; however there is no constant interpretation of the category "economic security of HEI", it is more often determined as a state of HEI, in which there are enough resources to prevent, weaken or protect HEI's activity.

If the balanced scorecard is not widely used in the public institutions' activity (even in the developed countries) with proved efficiency approaches, there is a reason to carry out studies of its use in HEI's administration, particularly those, which are included to the group "Technological, building and transport" [7] according to MES-2017 rating. Among famous variants of the indicators balance by constituents for such HEIs, strategy of "total cost reduction" is the most acceptable under conditions of the domestic educational market. Supply of educational service "by the total cost reduction" or with the best ratio "price-quality" is related to the high level of price competition and mass character of demand for educational service. Under conditions of such market conjuncture to reduce main educational service assortment (number of specialties, educational programs), providing related service (accommodation, food etc), reducing expenses for educational process provision and organization, let to suggest cheap and thus, valuable service to consumer with its quality and convenient supply acceptable degree.

Competitive advantages of cost minimization and their structure optimization are provided by the low prime cost of the study by an educational program owing to efficiency increase to use current assets, constant improvement of the internal processes without great investments, supply of the non-strategic service by the third party (outsourcing), reduction of the internal processes cycles duration (their uniting).

Therefore, in order to have enough incomes from educational (main) service supply, it is reasonable to improve not only the quality of educational processes, but also their organization, particularly as a result of informational systems and technologies use. As a rule, such improvements in organization (economic entity) are followed by the labor efficiency increase under conditions of existing resources effective use, by finding of the proper reserves or making small investments with high profitability degree.

Considering one of the main conditions to realize strategy “by total cost reduction” (constant improvement of educational process organization quality through cost reduction and effective use of resources), analysis of the labor efficiency (spending time by activity types) of the scientific and pedagogical workers (SPW) indicators of the HEI’s activity can be a statistic base to analyze and to control the fulfillment of above conditions. Taking into account the fact that specific weight of the item, which demonstrates wage and social insurance financing, is 60-70% [8] in cost estimates of domestic HEIs, results of such evaluation can be reasons to find essential reserves to control cost owing to labor efficiency growing and effective use of the labor resources.

Given the essence of the national security (which is interpreted as “protection of the human’s and citizen’s, society’s and states’ s vital interests, by which sustainable development is provided, real and potential threats for national interests are revealed, prevented and neutralized in time) in the Law of Ukraine “On National Security” [9], economic security (is a component of the national security and according to Methodic recommendations concerning Ukrainian economic security degree calculation, approved by the Ministry of economic development and trade in Ukraine, from 29.10.13 № 1277 [10] is “a state of the national economy, which enables to keep firmness in relation to the internal and external threats, to provide high competitiveness in the global economic space and characterizes the ability of national economy to sustainable and balanced growing”) and role of HEIs in sustainable economic growth provision, much attention has to be paid to develop measures, which will assist improving of their financial and economic indicators. It can be achieved, particularly owing to balancing of HEI’s income and expense items.

Analyzing the structure of actual time consuming factor (by some types of activity – time consuming factors) of SPW is carried out via spreadsheet MS EXCEL as a result of ABC-analysis use (its modified variant, which provides the distribution of indicators into four

groups – ABCD). The received results in the analysis show distribution of different works by the following groups:

A – the most labor intensive activity, which define the main result of organization’s activity, content and quality of the internal processes and have growing specific weight to 50 %;

B – activity, which can play significant role in realization of strategic and current tasks and take at least 2 % of general labor-intensive activity;

C – activity with labor intensity less than 2 %, which make at least 10 % of working time by the growing specific weight;

D – activity with labor intensity less than 1 %, which make 5 % of working time by the growing specific weight.

The carried out calculations show that only 18 types of activity (Tab. 8.2) from 96, which can be performed by SPW, have specific weight over 1 % and together are 87.2 % in SPW’s total time consuming factors of the whole university. Therefore only first five activities are characterized by the specific weight that is at least 6 % each one, and as a result their specific weight is 58 %. That is why, practically 1/5 (18.8 %) of SPW’s working time is spent to organize (prepare) the educational process that under conditions of strategy “by total cost reduction” is justified, because there is an opportunity to concentrate on improvement of educational process organization without great investments with more effective use of existing resources (time consuming factor while fulfilling SPW’s activity).

The research was continued through defining of labor-capacity impact degree of activity (regression), which have specific weight at least 1 % of the SPW’s total working time fund (1548 hours), for effectiveness (quality) of the internal processes by some educational programs or specialties (their related groups) of specialists’ training. Calculations were carried out for specialties, which are demanded at the labor market [11] and are perspective under conditions of transition to the knowledge economy.

Realization of the above mentioned is carried out through using of software product Statistika (to simplify complicated calculations), based on multiple regression to define meaningful regressors in the SPW’s time consuming factor model.

In order to form SPW’s time consuming factor model, one calculated matrix of the researched factors correlation – SPW’s activity, among which there is a high level of impact on internal processes effectiveness in: preparation to all types of classes (correlation coefficient is 0.99306); preparation of the electronic educational and methodic complex on discipline (correlation coefficient is 0.970509); examinational consultations (correlation coefficient is

0.966930); consultations on the academic disciplines (correlation coefficient is 0.963181); practical lessons, seminars, laboratory and individual classes (correlation coefficient is 0.962644).

Table 8.2

ABC (ABCD) – analysis of the time consuming factor structure by SPW's activity of university

№	Activity of SPW, included to group A and B (internal process or direction of activity)	Specific weight	Cumulative specific weight
1	Preparation of lectures, practical lessons, seminars (methodic)	18.8	18.8
2	Practical classes (educational)	17.9	36.7
3	Consultations on academic disciplines (educational)	7.9	44.6
4	Lecturing (educational)	6.6	51.2
5	Laboratory classes (educational)	6.3	57.5
6	Supervising of degree works (projects) (educational)	5.4	62.9
7	Preparation of electronic educational and methodic complex on the discipline (methodic)	3.7	66.6
8	Semester control (educational)	3.1	69.7
9	Supervising of educational and manufacturing practice (educational)	2.5	72.2
10	Publishing of articles in the native editions (including specialized ones) (educational)	2.4	74.6
11	Checking of: tests, calculating and graphic works, analytical reviews, translations, projects (educational)	2.1	76.7
12	Supervising and accepting of course papers, projects (educational)	1.9	78.6
13	Publishing of monographs; explanatory vocabulary, guide; dictionary (scientific)	1.8	80.4
14	Preparation and publishing of textbook (manual) (scientific)	1.7	82.1
15	R&D by the international program, by the governmental program, by economic contractual topic; receiving of grants by the international programs (scientific)	1.4	83.5
16	Supervising of the students' scientific work (scientific)	1.4	84.9
17	Publishing of the article in foreign scientific editions (scientific)	1.2	86.1
18	Thesis defense (scientific)	1.1	87.2

There is a connection between collinear regressors practically for all activities, except: preparation and publishing of textbook (manual), publishing of the article: in native editions (particularly specialized ones); publishing: monograph; explanatory dictionary, guide dictionary;

publishing of the article in foreign scientific editions; organization and carrying out scientific and methodic seminars with participation of lecturers, representatives from foreign and native enterprises; supervising of post graduates; defense of doctorate and candidate theses.

Results of the carried out regressive analysis, based on multiple regression to define meaningful regressors in the SPW’s time consuming factor model by activities, are demonstrated in the Tab. 8.3.

Table 8.3

Results of the multiple regressions

	Beta	Standard fault Beta	B	Standard fault B	t (1) Student’s criterion	p-level
Free member			0.0	0.000342	0.0	1,0
X 2	0.810847	0.001617	0.810847	0.001617	501.4723	0.001269
X 7	0.160941	0.001012	0.160941	0.001012	159.0674	0.004002
X 17	0.114316	0.001104	0.114316	0.001104	103.5665	0.006147
X 12	0.056014	0.001035	0.056014	0.001035	54.1274	0.011760
X 5	-0.065677	0.002323	-0.065677	0.002323	-28.2731	0.022507

Data from the Tab. 8.3 shows that among all activities duration of preparation to lectures and practical classes X2, lecturing, X5; supervising of educational and manufacturing practice, X7; preparation and publishing of a textbook (manual), X12; publishing of the article in foreign scientific editions, organization and carrying out of scientific and methodic seminars with participation of lecturers, representatives from enterprises and foreign firms, X17 were the most significant to provide effectiveness (quality) of internal processes.

Column B in the Tab. 8.3 shows coefficients of regression equation with every variable quantity and free member in the regression model, which will be shown in the following way (formula 8.1):

$$Y_i = 0,810847 \times X2 + 0,160941 \times X7 + 0,114316 \times X17 + 0,056014 \times X12 - 0,065677 \times X5, \quad (8.1)$$

where Y (i) – duration of i-type activity.

Thus, the best ratio “price-quality” with providing of educational service by the strategy “total cost reduction” is provided: firstly, owing to labor-capacity quality and control of such activities as preparation to classes (coefficients in the regression equation is 0.81).

All other activities, included to the regression model, are characterized by the small impact on total time consuming factor (coefficients 0.05-0.16), that is why they can be observed as secondary factors. Therefore time reduction for lecturing by 1 % will increase SPW's labor efficiency by 0,066 %.

Considering results of the conducted ABC (ABCD) – analysis and regressive analysis of time consuming factor by SPW's activities, balancing of internal processes indicators with indexes of financial and client's constituent have individual character for educational program, realized by concrete HEI, depending on planned and real financial indicators of its activity, level of staff provision, informational technologies in regulating and conducting of the educational process. Analysis of the time consuming factor by SPW's activities by specialties and related specialties groups of typical technological university proves reasonability to implement individual approach to form balanced indicators systems for realization of educational program or its group for related specialties.

According to data from the Tab. 8.4, there is a difference of time consuming factor by separate specialties from expenses structure in general in HEI. Particularly, group “Chemical technologies and engineering. Biotechnologies and bioengineering. Pharmacy” concentrates 12.7 % of time consuming to prepare the electronic educational and methodic complex on discipline and theses defense, which are 2.5 % in the whole university. The structure of cost by the educational programs groups for specialty “Computer sciences and informational technologies”, and “Automatization and computer-integrated technologies” distinguishes 15.7 % for such activities as article publishing (in the specialized editions) – at university 2.4 %.

Table 8.4

Comparative analysis of the time consuming factor structure by SPW's activities types by educational programs groups

№	SPW's activities (internal process or direction of the activity)	Structure, %				
		Chemical technologies and engineering. Biotechnologies and bioengineering.	Technology of light industry	Design	Marketing.Economics Accounting and Taxation. Finances, banking and insurance	Computer Sciences and informational technologies. Automatization and computer-integrated technologies
1	2	3	4	5	6	7
1	Preparation to lectures, practical classes, seminars (methodic)	16.2	18.4	20.5	17.9	18.7
2	Practical classes (educational)	–	10.1	29.3	24	6.0

Table 8.4 continuation

1	2	3	4	5	6	7
3	Consultations on educational disciplines (educational)	7.0	7.5	7.9	8.9	8.0
4	Lecturing (educational)	5.7	8.8	–	5.1	8.8
5	Laboratory classes (educational)	10.2	9.1	–	–	15.8
6	Supervising of degree works (projects) (educational)	6.6	–	4.4	5.9	8.0
7	Preparation of the electronic educational and methodic complex on the discipline (methodic)	3.6	7.2	–	–	–
8	Semester control (educational)	–	–	–	–	–
9	Supervising of educational and manufacturing practice (educational)	–	–	–	–	–
10	Publishing of articles (in the specialized editions) (scientific)	–	–	–	–	15.7
11	Checking of: tests, calculating and graphic works, analytical reviews, translations, projects (educational)	–	–	–	–	–
12	Supervising and receiving of course papers, projects (educational)	–	–	–	–	–
13	Publishing of: monograph; explanatory dictionary, guidance (scientific)	–	–	–	–	–
14	Preparation and publishing of textbook (manual) (scientific)	–	–	–	–	–
15	R&D by the international program, state program, by economic contracts; receiving of international grants (scientific)	9.0	–	–	–	–
16	Supervising of students' scientific work (scientific)	–	–	–	–	–
17	Publishing of the article in the foreign scientific editions (scientific)	–	–	–	–	–
18	Theses defense (scientific)	3.7	–	–	–	–

Analogical situation can be observed for different specialties, which are included to one group of related ones. Particularly, Tab. 8.5 shows comparison of time consuming structure by SPW's activities, which are involved in the economic educational programs realization, such as "Economics", "Marketing", "Management", "Finances, banking and insurance". The structure of SPW's time consuming, involved in the educational programs realization by sciences "Economics" and "Management", was not different from the SPW's time consuming structure of the whole university, but analysis of the specific weight of some activities showed differences from general tendencies of such activities in specialties:

- supervising of degree works (projects) for educational programs in specialties "Management" and "Finances, banking and insurance";
- preparation of the electronic educational and methodic complex on disciplines for educational programs in specialty "Management";
- supervising of educational and manufacturing practice; checking of: tests, calculating and graphic works, analytical reviews, translations, projects – for all educational programs in the specialty "Management";
- publishing of articles; publishing of the monograph; explanatory dictionary, guide; dictionary; preparation and publishing of the textbook (manual), theses defense – for educational programs in specialties "Marketing" and "Economics" (Economic cybernetic).

That is why, in spite of the general strategy "by total cost reduction" in general at HEI, peculiarities of the internal processes, used to realize different educational programs, define reasonability to investigate the separate balanced scorecard for each of such programs (their groups). Particularly, possibility to use the balanced scorecard or strategic map for an economic educational program considering result of ABC (ABCD) – analysis is observed in the work [5].

Degree of internal processes organization depends on internal management traditions, on extension of the culture to improve and to exchange experience (knowledge) between workers, personnel's readiness to work with informational systems and proper technologies. Considering demands of the internal processes, based on the SPW's rating data, who are engaged in realization of some educational programs, some works were distinguished, which determine degree of development and study. According to indicators of time consuming factor, in order to carry out such activities after their normalization, correlations matrix is built between indicators and regressive analysis is conducted, based on multiple regression on defining of significant regressors in the model of SPW's time consuming factor, which are related to development and study, results are shown in the Tab. 8.6.

Table 8.5

Comparative analysis of the SPW's time consuming structure by activity types in some economic specialties (educational programs of the related specialties)

№	Types of SPW's activities (internal process or direction of the activity)	Structure, %		
		Finances, banking and insurance	Management	Marketing. Economics
1	Preparation to lectures, practical classes, seminars (methodic)	13.7	11.3	15.4
2	Practical classes (educational)	13.4	12.0	10.8
3	Consultations on academic disciplines (educational)	11.0	13.4	7.7
4	Lecturing (educational)	7.1	4.8	8.6
5	Laboratory classes (educational)	–	–	4.7
6	Supervising of degree works (projects) (educational)	5.2	9.8	–
7	Preparation to electronic educational and methodic complex on the discipline (methodic)	6.3	–	–
8	Semester control (educational)	–	–	–
9	Supervising of educational and manufacturing practice (educational)	–	6.4	–
10	Publishing of articles (scientific)	6.1	–	–
11	Checking of: tests, calculating and graphic works, analytical reviews (educational)	–	3.6	–
12	Supervising and receiving of course papers, projects (educational)	–	–	–
13	Publishing of: monograph; explanatory dictionary, guide; dictionary, (scientific)	4.7	–	–
14	Preparation and publishing of textbook (manual) (scientific)	–	–	7.1
15	R&D by the international program, by state program, by economic contract topic; receiving of grants by the international programs (educational)	–	–	–
16	Supervising of students' scientific works (scientific)	–	–	–
17	Publishing of the article in the foreign scientific editions (scientific)	–	–	–
18	Theses defense (scientific)	–	–	6.7

Table 8.6

Results of the multiple regressions

	Beta	Standard fault Beta	B	Standard fault B	t (1) Student's criterion	p-level
Free member			0.0	0.007531	0.0	1.0
X 1	1.113464	0.080367	1.113464	0.080367	13.85466	0.005169
X 7	0.246725	0.023060	0.246725	0.023060	10.69935	0.008623
X 5	-0.200039	0.028049	-0.200039	0.028049	-7.13183	0.019099
X 14	-0.198496	0.080524	-0.198496	0.080524	-2.46505	0.132609

According to the data from Tab. 8.6, total equation of regression was made (formula 8.2):

$$Y_i = 1,113464 \times X1 + 0,246725 \times X7 - 0,200039 \times X5 - 0,198496 \times X14 \quad (8.2)$$

where Y (i) – total SPW's time consuming factor;

X 1 – time consuming factor for preparation to lectures, practical classes, seminars and individual classes – direct link;

X 7 – time consuming factor to carry out scientific and research work by the international program, by the state program, by economic contracting topic, receiving of grants by the international programs – direct link;

X 5 – time consuming factor to write and publish the article in foreign scientific editions – reverse link;

X 14 – time consuming factor to prepare and publish methodic materials on the academic disciplines in foreign language, and to republish methodic materials in foreign language – reverse link.

Correlation analysis and analysis of the multiple regression prove that some factors (types of activities), which are selected as meaningful ones by ABC (ABCD) – analysis method, according to data of the regressive analysis are characterized by small impact on the internal processes effectiveness in the part of SPW's labor efficiency. The above facts prove reasonability to use indicators, calculation and achieving of which are under control, regulating SPW's time consuming. In another case, enrollment to the time actually worked in the total amount of some SPW's activities, which is planned in norms-hours, can lead to unjustified time consuming increase, or planned time (particularly, for such important activities as preparation to classes) can be used to conduct unpredictable activities or obligatory activities with not enough justified

small time norms. It is reasonable to carry out analysis of the time consuming to conduct activities with relatively small time norms.

Therefore, results of the time consuming analysis by the activity types in comparison with their significance to perform strategic and tactical controlling tasks can be evidence of balance (or its absence) of financial and client's constituent indicators with indexes of internal processes (educational, methodic, scientific and organizational), and with indicators of SPW's development and study. Such activities with high specific weight of time consuming have to provide mostly efficiency to realize the financial and client's constituent of the HEI's educational activity strategy or separate educational program (depending on the set tasks). Under such conditions, refusal to plan such activities or to minimize time norms for their conducting can be justified from economic point of view. It can be used while investigating methodic recommendations to estimate HEI's economic security.

Taking into account the above facts, one has to ascertain that practical use of balanced scorecard, adapted for HEI's demands, will help to increase efficiency of their functioning. As a result it will also have positive impact on their economic security level increase via distribution of the released money to investigate contraction measures for negative impact of internal and external factors. They lead to appearing and deployment of threats for HEI's functioning (since internal processes efficiency decrease – educational, methodic, scientific and organizational – can be internal threats for HEI's functioning), under conditions of market relations, in general, state and national security on the whole.

1. Kaplan R., Norton D. (2001), *The Strategy Focused Organization*. – Boston : HBS Press.
2. Kaplan R., Norton D. (2005), *The Balanced Scorecard – Measures that Drive Performance* [Electronic resource]. – Access mode: <https://hbr.org/2005/07/the-balanced-scorecard-measures-that-drive-performance>.
3. Kaplan R., Norton D. (2005), *Strategicheskie kartyi. Transformatsiya nematerialnykh aktivov v materialnyie rezultaty* [Strategic maps. Transformation of intangible assets into tangible results] trans. from Eng, M, CJSC «Olympus business», 512 p [in Russian].
4. Breus S.V., Khaustova Ie.B. (2016), *Vykorystannia zbalansovanoi systemy pokaznykiv u diialnosti vyshchykh navchalnykh zakladiv* [Balanced scorecard system application in the activities of higher education institutions]. *Aktualni problemy ekonomiky* [Actual problems of the economy], 9 (183), p. 109–116 [in Ukrainian].
5. Hryshchenko I.M., Breus S.V., Khaustova I.B. (2016), *Zbalansovana systema pokaznykiv VNZ: vid stratehii do pokaznykiv roboty strukturnoho pidrozdilu* [Balanced scorecard system application in the activities of higher education institutions: from strategy to performance indicators of a structural

subdivision]. Visnyk KNUTD. Serii "Ekonomichni nauky" [KNUTD Bulletin. Series "Economic Sciences"] 2 (97), p 43–62 [in Ukrainian].

6. Martyniuk V.P. (2013), Ekonomichna bezpeka vshchych navchalnykh zakladiv v Ukraini: peredumovy otsiniuvannya. Ekonomika Menedzhment Pidpriemnytstvo [Economic Security of Higher Educational Institutions in Ukraine: Prerequisites for Evaluation. Economics Management Entrepreneurship] [Electronic resource]. – Access mode: <http://eme.ucoz.ua/pdf/252/24.pdf> [in Ukrainian].

7. Universytety tekhnolohichni, budivnytstva, transportu (2012), [Universities of technology, construction, transport] [Electronic resource]. – Access mode: <http://www.euroosvita.net/index.php/?category=60&id=2204> [in Ukrainian].

8. Stadnyi Ie. Kontseptualna model finansuvannya derzhavnykh VNZ za rezultatamy diialnosti [Conceptual model of financing of state higher educational institutions by results of activity] [Electronic resource]. – Access mode: <https://www.cedos.org.ua/uk/osvita/kontseptualna-model-derzhavnoho-finansuvannya-vnz-za-rezultatamy-diialnosti> [in Ukrainian].

9. Pro osnovy natsionalnoi bezpeky Ukrainy: Zakon Ukrainy vid 19.06.2003 № 964-IV [On the Fundamentals of National Security of Ukraine: Law of Ukraine dated June 19, 2003 No. 964-IV] [Electronic resource]. – Access mode: <http://zakon1.rada.gov.ua/laws/show/964-15> [in Ukrainian].

10. Metodychni rekomendatsii shchodo rozrakhunku rivnia ekonomichnoi bezpeky Ukrainy / Nakaz Ministerstva ekonomichnoho rozvytku i torhivli Ukrainy vid 29.10.2013 r. № 1277 [Methodical recommendations for calculating the level of economic security of Ukraine / Order of the Ministry of Economic Development and Trade of Ukraine dated October 29, 2013 № 1277] [Electronic resource]. – Access mode: http://www.me.gov.ua/Documents/List?lang=uk-UA&tag=Metodychni_Rekomendatsii [in Ukrainian].

11. Sami zatrebuvani profesii 2017 v Yevropi. Yaku spetsialnist obraty v 2017 rotsi? [The most sought after professions in 2017 in Europe. What profession to choose in 2017?] [Electronic resource]. – Access mode: <http://2017pik.pp.ua/novini-2017/507-sam-zatrebuvan-profesyi-2017-v-yevrop.-yaku-specalnst-obrati-v-2017-roc.html> [in Ukrainian].

8.3 ECOLOGICAL SLOGANS IN THE SYSTEM OF ENVIRONMENTAL PROTECTION

Today's troubles will disappear sooner or later, but the problem to keep and to improve environment will always disturb humanity. The resource problem, which appeared as a result of limitation of Earth's physical abilities and its population's constant increase, requires rational limitation of non-renewable resources (oil, gas, coal) consumption, their substitution by artificial ones etc. that is why resource conservation, wastes reduction and environmental protection have to be the scientists' subjects of attention [1, p. 99].