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Introduction

One of the fastest growing areas in the economic sciences is broadly defined area of finance, with particular emphasis on the financial markets, financial institutions and risk management. Real world challenges stimulate the development of new theories and methods. A large part of the theoretical research concerns the analysis of the risk of not only economic entities, but also households.

The first Wrocław Conference in Finance WROFIN was held in Wrocław between 22nd and 24th of September 2015. The participants of the conference were the leading representatives of academia, practitioners at corporate finance, financial and insurance markets. The conference is a continuation of the two long-standing conferences: INVEST (Financial Investments and Insurance) and ZAFIN (Financial Management – Theory and Practice).

The Conference constitutes a vibrant forum for presenting scientific ideas and results of new research in the areas of investment theory, financial markets, banking, corporate finance, insurance and risk management. Much emphasis is put on practical issues within the fields of finance and insurance. The conference was organized by Finance Management Institute of the Wrocław University of Economics. Scientific Committee of the conference consisted of prof. Diarmuid Bradley, prof. dr hab. Jan Czekaj, prof. dr hab. Andrzej Gospodarowicz, prof. dr hab. Krzysztof Jajuga, prof. dr hab. Adam Kopiński, prof. dr. Hermann Locarek-Junge, prof. dr hab. Monika Marcinkowska, prof. dr hab. Paweł Miłobędzki, prof. dr hab. Jan Monkiewicz, prof. dr Lucjan T. Orłowski, prof. dr hab. Stanisław Owskiak, prof. dr hab. Wanda Ronka-Chmielowiec, prof. dr hab. Jerzy Różański, prof. dr hab. Andrzej Sławiński, dr hab. Tomasz Słoński, prof. Karsten Staehr, prof. dr hab. Jerzy Węclawski, prof. dr hab. Małgorzata Zaleska and prof. dr hab. Dariusz Zarzecki. The Committee on Financial Sciences of Polish Academy of Sciences held the patronage of content and the Rector of the University of Economics in Wrocław, Prof. Andrzej Gospodarowicz, held the honorary patronage.

The conference was attended by about 120 persons representing the academic, financial and insurance sector, including several people from abroad. During the conference 45 papers on finance and insurance, all in English, were presented. There were also 26 posters.

This publication contains 27 articles. They are listed in alphabetical order. The editors of the book on behalf of the authors and themselves express their deep gratitude to the reviewers of articles – Professors: Jacek Batóg, Joanna Bruzda, Katarzyna Byrka-Kita, Jerzy Dzieża, Teresa Famulska, Piotr Fiszeder, Jerzy Gajdka, Marek Gruszczyński, Magdalena Jerzemowska, Jarosław Kubiak, Tadeusz Kufel, Jacek Li-

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Wanda Ronka-Chmielowiec, Krzysztof Jajuga

Dariusz Porębski

Wroclaw University of Economics
e-mail: dariusz.porebski@ue.wroc.pl

MANAGERIAL CONTROL OF THE HOSPITAL WITH SPECIAL USE OF BSC AND DEA METHODS

KONTROLA MENEDŻERSKA SZPITALI Z WYKORZYSTANIEM ZKW I DEA

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Abstract: At present, managers become more and more conscious about monitoring their unit's operations, whereas new directives impose the creation of departments for Managerial Control on hospitals. These departments are obliged to provide reports on the completion of hospital's objectives and tasks. In the paper, the author aims at presenting the application of the Balanced Scorecard tool (BSC in short) which, undoubtedly, is a helpful solution in managing a hospital, allowing at the same time to analyze its financial situation that so far has been underlined by the organs that comprise a hospital most strongly. It should also be noticed that currently NFZ would like to reward hospitals that possess ISO certificates and accreditations compliant with the BSC and that can be applied in its structure. The article will be complemented with the results of an efficiency analysis based on measures that come from the system based on the BSC and the financial analysis of Polish hospitals.

Keywords: Balanced Scorecard, efficiency Managerial Control.

Streszczenie: Obecnie wśród kadry kierowniczej rośnie świadomość monitorowania działań w jednostce, ponadto nowe rozporządzenia narzucają szpitalom tworzenie działów Kontroli Zarządczej. Działy te są zobowiązane do sprawozdań z realizacji celów i zadań szpitala. W artykule autor pragnie przedstawić zastosowanie narzędzia Zrównoważonej Karty Wyników (z ang. BSC), które jest niewątpliwie rozwiązaniem pomocnym w zarządzaniu szpitalem przy jednoczesnej analizie sytuacji finansowej na którą do tej pory najsilniej stawiały organy tworzące szpital. Należy również zwrócić uwagę, że obecnie NFZ pragnie nagradzać szpitale posiadające certyfikaty ISO i akredytacje, z którymi to BSC jest zgodna i jest w stanie wykorzystać je w swojej strukturze. Artykuł będzie wzbogacony o wyniki analizy efektywności bazujące na miernikach pochodzących z systemu opartego na ZKW i analizie finansowej polskich szpitali.

Słowa kluczowe: Zrównoważona Karta Wyników, efektywność, kontrola menedżerska.

*You can't manage what you don't
measure*

R.S. Kaplan & D.P. Norton

1. Introduction

Managing a contemporary hospital is an extremely interesting issue, important from many perspectives. Debates on this subject and official conferences are held all the time, even taking prime time on TV. Hospital surroundings are still a new study area for researchers. Why new? Because the surroundings are in permanent change. Polish hospital surroundings can be qualified as exceptionally turbulent. The hospital and its surroundings are a large, divisible, interdisciplinary area that engages people dedicated to law, social sciences, economics, environment, medical and technical sciences.

Currently, hospitals management is focused on monitoring their entities. Also, new regulations require hospitals to form management control departments. The sense of responsibility for their entities is on the increase, and it is these departments that are obliged to submit reports on the completion of hospital's objectives and tasks. In this paper, the author intends to use the Balanced Scorecard tool that is a helpful solution for managing a hospital and is strongly linked to the financial analysis of the entity. Financial analysis continues to be the most important tool for government administration, mainly for the founding organs of the hospital. For example, in Lower Silesia, the Department of Health and Voivodship Promotion of the Marshal Office in Wrocław monitors its hospitals using extended financial analysis that resembles the BSC. However, this tool is strongly focused on financial and human resources, which does not seem to be sufficient. It should also be noticed that currently NFZ intends to introduce some changes and reward those hospitals which are ISO-accredited or ISO-certified.

The article presents the situation as far as using the BSC by hospitals is concerned. It contains a suggestion of a BSC model for a hospital in relation to the source documentation produced by Polish hospitals and solutions applied by the Department of Health and Voivodship Promotion of the Marshal Office in Wrocław. Moreover, it presents development of the BSC monitoring system with the DEA efficiency assessment technique.

2. Characteristics of BSC and DEA: applying the methods in Polish hospitals

The Balanced Scorecard is a method that combines financial and non-financial measures, indexes for the results of operational activity and indexes outdoing external and internal efficiency. In the classic approach, it consists of four perspectives: Financial, Customer, Learning and Growth, Processes. The application of the BSC

in Polish hospitals is not satisfactory. In science, especially in the practice of foreign developed economies, the Balanced Scorecard method (BSC in short) is nothing new [Hill, Powell 2005].

In Poland, however, despite more than 10 years of its existence, this tool continues to be perceived as modern and innovative. It is associated with business and large organizations; yet, it has been perfectly adapted to non-profit organizations. Currently, the BSC is excellent for the completion of strategies such as: environmental protection, cities and regions, and the above-mentioned non-profit organizations. The reason for this is that the authors of the method, Kaplan and Norton, took into account its compliance with the currently valid ISO standards, the cycle for continuous improvement that they include (PDCA by W. E. Deming) and the now trendy idea of sustainable growth (compliance with concepts such as Six Sigma, TQM, CQI etc.) [Hill, Powell 2005].

The Data Envelopment Analysis (DEA in short) is a method that – based on the data collected according to the BSC – makes it possible to estimate the efficiency of an entity in all its areas of its activity. Currently, it is an exceptionally popular method of measuring efficiency. The method was developed by three Americans, Charnes A., Cooper W.W. and Rhodes E. in late 1970s. They believe that efficiency means a relation between the effects achieved and the size of the outlays involved. In this way, Data Envelopment Analysis was born, which is a method for analyzing boundary data. It is an econometric tool for assessing technical efficiency according to Farrell M.J. Its elementary feature is the possibility of simultaneous research into the relations between many outlays and results. Mathematically, the DEA model can be presented as the following relation (see: [Kucharski 2014]).

$$E_j = \frac{\sum_{r=1}^R u_r y_{rj}}{\sum_{n=1}^N v_n x_{nj}} \rightarrow \max,$$

with the limits:

$$\frac{\sum_{r=1}^R u_r y_{rj}}{\sum_{n=1}^N v_n x_{nj}} \leq 1$$

$$u_r \geq 0, v_n \geq 0$$

whereas: E_j – technical (technological) efficiency, y_{rj} – size of the r -numbered effect ($r = 1, \dots, R$) in the j -numbered object ($j = 1, \dots, J$), x_{nj} – size of the n -numbered outlay ($n = 1, \dots, N$) in the j -numbered object ($j = 1, \dots, J$), u_r – weight of each effect, v_n – weight of each outlay.

The formulae for technical efficiency presented above can be transformed to linear form using Charnes-Cooper transformations.

$$\begin{aligned}
 \sum_{r=1}^R u_r y_{rj} &\rightarrow \max, \\
 \sum_{n=1}^N v_n x_{nj} &= 1 \\
 \sum_{r=1}^R u_r y_{rj} - \sum_{n=1}^N v_n x_{nj} &\leq 0 \\
 u_r &\geq 0, v_n \geq 0
 \end{aligned}$$

The mentioned approach does not require knowing the form of the efficiency function. By using empirical size of outlays and effects, weights that maximize efficiency are sought (for a given object that in English literature is usually called as Decision Making Unit, DMU in short). In this way we receive a task for mathematical programming that is meant to set the efficiency of given objects with regard to a full group of them. The DEA method is based on boundary analyses, and its graphical illustration is partly a linear function that links the most effective decision making units (DMU).

The best practice frontier is estimated based on empirical data related to outlays and effects. The units that are located on the curve are considered to be effective, and their efficiency equals $\hat{\theta} = 1$. DMUs that are located under the efficiency curve are dominated by objects located on the curve, thus are ineffective. Their efficiency equals $1 - \hat{\theta}$, and the measurement itself is carried out without any need to calculate the mean for the data [Kucharski 2014].

At present, the DEA method is very popular; several thousand articles and other academic papers have been devoted to it. The issue of DEA is taken up by many, but analysis results with the DEA method can be completely different, because to a large extent they depend on the scope of variables adopted for the method; what is more, new models are created all the time for this method. Among the most important ones, Ziębicki lists: the CCR model, the super-efficiency model, the non-radial efficiency model [Kucharski 2014].

The basic example of a model oriented towards outlays, where constant benefits of scale are assumed, is the CCR model. The name of this model comes from the first letters of its authors: Charnes, Cooper and Rhodes [1978]. On the other hand, the BCC model, designed by Banker, Charnes and Cooper [1984], is a model oriented on effects, where changing benefits of scale are assumed. This model will be applied in the hospital efficiency analysis.

3. The role of the BSC and DEA methods in hospital management control

The author of this paper conducted research by sending an offer to 140 Polish hospitals to collect data and analyze the entities free of charge with respect to their efficiency and BSC usage. The most important and largest hospitals in the country were selected. The attempt was directed at hospitals of diverse referential levels. The offer was professionally prepared. The aim was not to burden the hospital administration with data collection. Reference was made to existing documents that hospitals have, and obligatorily and regularly send to statistical offices and marshal offices. 20 positive and 7 negative responses were received. There were also 10 responses that were difficult to specify, as the initially positive reply would not develop into a regular contact.

A positive reply does not mean using the BSC by hospitals, but a simple willingness to cooperate. The result turned out to be surprising. Hospital managers were not aware of the documentation that their hospital is obliged to send to the Central Statistical Office or Ministry of Health offices. Vast disorganization was observed in the entities, as well as top management lacked knowledge about which departments collect, for example, statistical or HR data, or settlements with NFZ.

Certainly, anyone who has not tried this in practice will claim that it is impossible, but for example the MZ-29 documents about hospital's general activities is prepared by statistical departments, and there have been cases where it has been prepared by hospital's settlement departments even though the document contains quite a lot of HR data. As it happens, the F-03 document about fixed assets is prepared by the financial department, sometimes the accountancy, and yet other times – the statistical department. Similarly, settlements with NFZ are not always created by the settlement department; the author is familiar with cases where it is carried out by the department of didactics and organization.

Hospitals also have a range of internal documents that are difficult to learn anything about. For example, this can be monthly information about the entity's activity or a report by the quality proxy. These, in turn, are not obligatory documents, and if they exist, they tend to contain interesting data. It is sometimes surprising that several departments at the same hospital reuse the same data without even being aware of this or trying to do something about it.

The MZ-03 and MZ BFA documents (also prepared in various departments) and the traditional financial reports prepared by the hospital's chief accountant are also worth mentioning. In fact, all the documents mentioned mean that the financial report is copied, although they include discrepancies as far as costs by type or calculations are concerned. Strangely enough, marshal and statistical offices do not aim at unifying and decreasing the number of these reports, because they add a lot of work for the hospital administration, which, according to the author and several managers,

is unnecessary. The sole good solution was applied by the Lower Silesian Department of Health and Voivodship Promotion of the Marshal Office in Wrocław. The system of this Department of Health shall be described in the following paragraph.

On the basis of the replies to the offer and interviews with hospital administration, it can be concluded that the notion of the BSC is unfamiliar in 90% of cases or that there is no interest in this subject. Mostly, district hospitals use simple budgeting, whereas voivodship and clinical hospitals usually use controlling. An attempt was made at gaining knowledge about using the BSC through personal contact at hospitals that are known on the Internet to be using the BSC.

The hospitals are described by Michalak [2012] and Cygańska [2013]; also the author once tried to describe the solutions. In practice, after contacting the administration, the hospital in Sosnowiec did not want to give any information about its alleged use of the BSC. On the other hand, the hospital in Cracow which still has strategy containing the BSC model, probably after the manager change resigned from the solutions suggested by the previous board. It can also be assumed that at hospitals BSC currently functions only as a paper template and an element of the strategy in the form of a project.

Thanks to research, the author came across hospitals in Olsztyn that do use the method. Above all, it is reflected in the knowledge of the personnel which is familiar with the BSC. The BSC is a system for monitoring and reporting that is used in practice. As it is known, using the BSC allows to quickly create reports about units. Whereas most hospitals showed some chaos and disorganization.

4. The alert system of the Health Department and the BSC

The above-mentioned alert system that monitors hospitals has been developed by the staff of the Lower Silesian Department of Health and Voivodship Promotion of the Marshal Office in Wrocław. It is based on a unified monthly report that is prepared by the hospitals that are supervised by the Office. This monthly information about the hospital's activities is a source of data that is used by the supervisory body for hospital assessment. This way, it is possible to quickly react to critical situations. Undoubtedly, this system plays the same role as the BSC; however, in fact, each hospital should introduce such a system. In Lower Silesia, this duty has been assumed by the Department of Health and Voivodship Promotion of the Marshal Office.

At its core, the system is based on three indicators: net financial results + amortization, total obligations and statutory debt ratio. Obviously, this is just the core of the system, as the template for the report contains more items.

The elementary financial analysis involves profitability ratios supplemented by the level of overspending. Invoiced and non-invoiced overspending is especially important, because profitability ratios towards the end of the year do not reflect its actual state. A high level of invoiced overspending demands a more favourable view on the elementary profitability ratio. It is the first and the most crucial part of the report.

The second one includes the analysis of working assets, as well as of liquidity ratios. The third one deals with employment and work costs, including the important ratio of salaries with regard to total income. Salaries are the highest cost in hospital operations, and their level is incredibly important. Besides, the document provides information on the number of staff: doctors and nurses per patient. Also, a list and

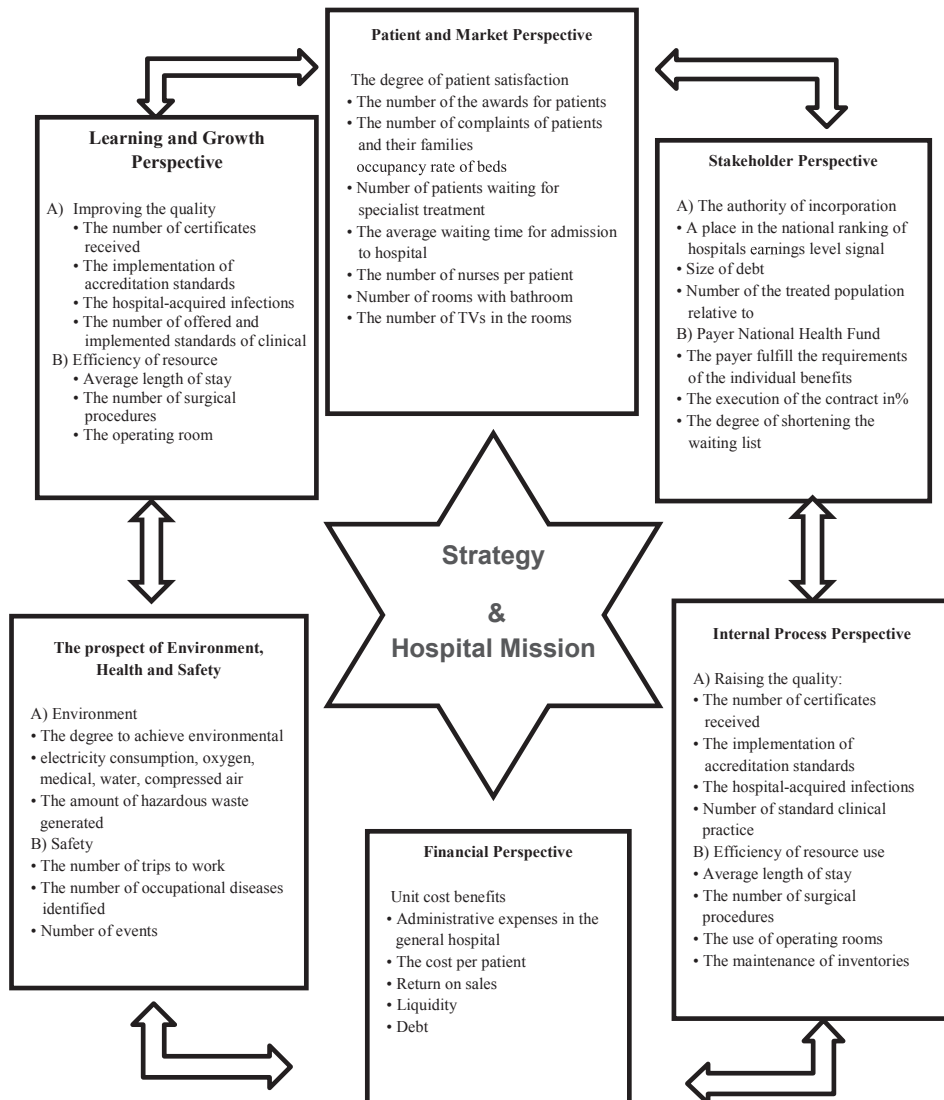


Figure 1. BSC future project for Polish hospital

Source: [Porębski 2014].

value of investments is presented, as well as the value of staff training. Further, the value of the contract and the degree of its completion are stated. Then, operational costs and income are presented, and the financial part is rounded up with an analysis of obligations and amounts due¹.

Towards the end, there is yet another analysis of departments with respect to using the resources. The number of patients, person-days in wards and the number of beds occupied are monitored. Qualitative data provides us only with the average time spent per patient in the ward and the number of consultations and surgeries conducted.

Undoubtedly, the system created by the Department of Health and Voivodship Promotion of the Marshal Office in Wrocław is based on hard financial data. It uses a considerable number of indexes for the law known as Ministry of Health's law on monitoring and assessing the economic and financial situation at hospitals that are included in the hospital network, which has not come into effect and was submitted for external arrangements on March 7, 2007. Most interestingly, by adding data about the NFZ completion or qualitative data, as well as by the approach based on monthly reporting, this is a system that, once developed, can become the BSC system for Lower Silesian hospitals.

Confronted with the board of a Lower Silesian specialist hospital, the above-mentioned information allowed the author to build a modern and updated model of the BSC for a healthcare unit. Its balanced character is based on six perspectives; additionally, the following picture presents sample measures that the Lower Silesian hospital is able to generate and that can be applied in the BSC perspectives given.

This type of scorecard is the future, because it also contains data related to environmental protection and NFZ. The Health Department system very much resembles this type of card. Currently, NFZ demands quality to be monitored at hospitals. On the other hand, UE norms may impose environmental data to be monitored. Hospital units often do this on their own. Supplemented with this data, the Department of Health and Voivodship Promotion of the Marshal Office in Wrocław will certainly get closer to, or even become, the BSC method. Currently, this type of BSC solution is applied by the Voivodship Specialist Hospital in Olsztyn on their own. As one of few entities in Poland, it approaches the issue of hospital management in an innovative way.

5. Analysis of hospital efficiency with the use of BSC supported by DEA

With the data collected by the system of monitoring, it is possible to take the right decisions and react to problems that occur in the unit. The more developed the

¹ Based on materials by the Department of Health and Voivodship Promotion of the Lower Silesia Marshal Office.

system, the better. Finance is an obvious basis for hospital management, but it is not the only source of analysis. Equally important are also elements related to patients and the quality of processes. Data sources and sorting data according to the BSC provides interesting results and gives an option of further application.

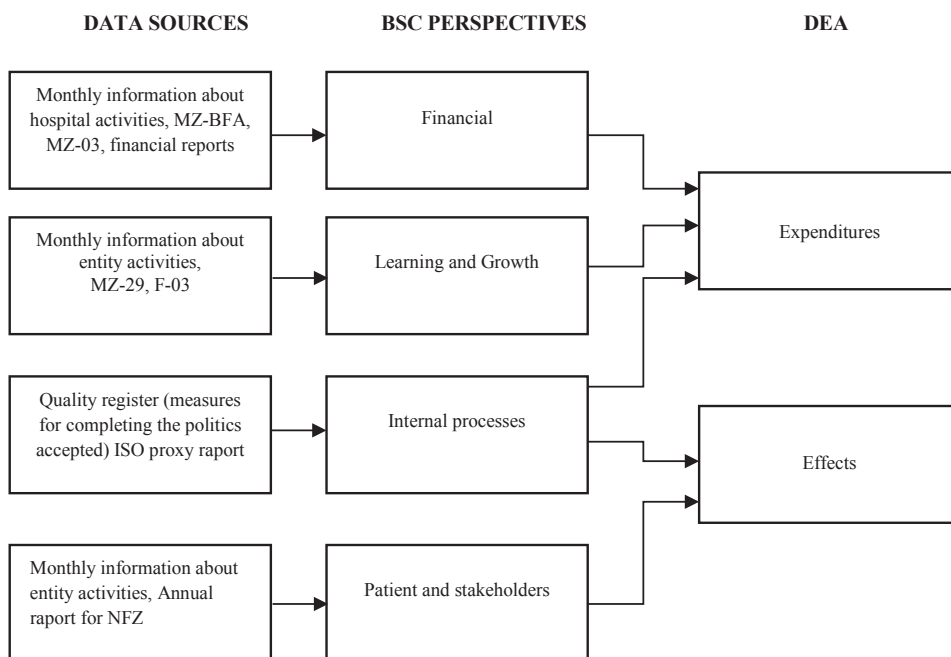


Figure 2. Combing data sources and the BSC methods with DEA

Source: Author’s own study.

The BSC monitors the measures that can be used for example for calculating the efficiency using the DEA method. In the financial perspective, data means outlays understood as costs or hospital’s assets. A strong source of outlays is the perspective of learning and growth focused on HR resources: the level of salaries and trainings.

Internal processes are a perspective related to quality and it is a source of both outlays and effects. One should be careful with data such as shortening the time of serving a patient, because it is an inhibitor achieved in fact at the expense of the activities taken up by the staff. However, the quality of services, the number of new services or apparatus should be treated as effects. Finally, the perspectives of the patient and stakeholders are the source of effects. One should not, however, misplace financial analysis profitability indicators under the financial perspective due to their name. Profitability is an effect that is very much desired by the units that are responsible for a hospital.

The efficiency analysis was carried out based on the DEA method and its CCR model. The analysis was conducted according to five criteria:

- 1st expenditures: number of beds and employment in total; effects: income, overspending and number of patients;
- 2nd expenditures: operational costs, number of beds, employment; effects: net financial result plus amortization, life-saving overspending, patients;
- 3rd expenditures: number of doctors, number of nurses, number of beds; effects: number of patients;
- 4th expenditures: operational costs, number of doctors, number of nurses, number of beds; effects: number of patients;
- 5th expenditures: assets, number of doctors, number of nurses, number of beds; effects: number of patients, person-days.

The data is presented in full in Table 1.

Table 1. Hospitals data

Name	Income	Operational costs	Net results + amortization	Overspending	Life-saving overspending	Assets
Hospital 1	194,321,817 PLN	197,886,285 PLN	12,680,220 PLN	3,451,145 PLN	110,887 PLN	206,258,689 PLN
Hospital 2	125,226,724 PLN	133,716,967 PLN	151,789 PLN	2,683,235 PLN	376,350 PLN	115,135,272 PLN
Hospital 3	124,281,090 PLN	124,874,288 PLN	4,043,263 PLN	21,228 PLN	0 PLN	76,078,844 PLN
Hospital 4	32,811,160 PLN	38,869,434 PLN	-4,121,395 PLN	275,009 PLN	275,009 PLN	27,100,729 PLN
Hospital 5	136,826,576 PLN	144,326,489 PLN	-5,182,832 PLN	6,897,651 PLN	5,015,619 PLN	110,484,734 PLN
Hospital 6	140,192,602 PLN	146,579,811 PLN	-4,854,502 PLN	5,230,943 PLN	1,125,408 PLN	105,467,002 PLN
Hospital 7	159,428,223 PLN	171,074,641 PLN	7,275,354 PLN	3,670,374 PLN	2,830,363 PLN	111,788,477 PLN
Name	Number of doctors	Number of nurses	Beds	Patients	Person-days	Employed
Hospital 1	149	597	685	48 309	152 227	1481
Hospital 2	102	403	528	22 401	156 922	991
Hospital 3	115	515	565	28 846	160 250	1270
Hospital 4	51	212	255	11 063	56 887	487
Hospital 5	78	560	773	32 227	174 402	1488
Hospital 6	88	577	585	29 708	157 935	1129
Hospital 7	93	590	652	31 566	171 091	1487

Source: Author's own work.

The results of the efficiency analysis with the use of DEA are presented in the table below.

Table 2. Results of DEA analysis with the CCR method

Name	Hospital 1	Hospital 2	Hospital 3	Hospital 4	Hospital 5	Hospital 6	Hospital 7
Variant 1	100%	97%	77%	69%	100%	100%	90%
Variant 2	100%	72%	92%	100%	100%	91%	100%
Variant 3*	100%	68%	76%	66%	100%	94%	93%
Variant 4	100%	68%	91%	100%	100%	94%	93%
Variant 5	100%	75%	100%	100%	100%	100%	98%
Total	5	3.8	4.36	4.35	5	4.79	4.74

* A similar variant was already applied by Rój [2003].

Source: Author's own work.

The example shows that this type of analysis is possible and provides interesting solutions. Data from specific hospitals is used here, unlike in other papers, where authors often use data aggregated in a voivodship supplement (see: [Biernacki 2013; Guzik 2009; Hass-Symotiuk (ed.) 2011]) and published online on the website of the Healthcare Information Systems Centre. For this paper, data was collected by means of personal contact with hospitals and the Department of Health and Voivodship Promotion of the Marshal Office in Wrocław.

The example provides data from 2014 collected from seven largest hospitals in Lower Silesia that are supervised by the Ministry of Health.

6. Conclusions

This article presents a proposed application of BSC solutions at the hospital. The situation, as far as using the tool at the hospitals, was described in short. By combining financial and non-financial data, systems that monitor and collect data, and are based on the BSC, can be developed further with a profitability analysis.

In the article, the profitability analysis was carried out based on the DEA method and its CCR model. Analysis according to five criteria was conducted. The results seem to be reliable, because Hospital 1 is the Voivodship Specialist Hospital in Wrocław and the Search and Development Centre (previously the Hospital of the 40th Anniversary), probably the best unit in Lower Silesia, in the author's opinion. This is the reason for so good efficiency results with respect to the use of the resources, even when the size of assets is applied in the last variant, amounting to nearly PLN 200 million. The results show that it is not an outlay that burdens the hospital's good scores.

This paper is in fact an introduction to further, larger research, where the BSC method implementation in WSS in Olsztyn will be presented, as well as more thorough financial and DEA efficiency analyses for hospitals. The number of entities for research shall also be increased, which will occur in further studies.

At present, when public administration places great stress on managerial control, the suggested BSC tool seems to be a good solution. It allows to unify the data that the hospital generates from the departments of statistics, accountancy, settlements and quality control into one unified system. It is an exceptionally helpful tool for the staff that are burdened with the obligation to provide data for the Central Statistical Office, Healthcare Information Systems Centre, etc. What is important is that with the tool, the management receives a unified system for monitoring the unit. The system makes it possible to use the data not only to monitor and assess the financial situation, but also to use methods of efficiency analysis.

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