Marian Krupa
ORCID No. 0000-0003-3346-332X
Cavalry Captain Witold Pilecki State University of Małopolska in Oświęcim

Maciej Pękala
ORCID No. 0000-0002-4785-3583
Andrzej Frycz Modrzewski Krakow University

BI class systems and efficient management decision-making

Abstract

The key competitive indicator of contemporary organizations is the skill to transfer raw business data, both on the operational and strategic level, into decision knowledge. We have to remember that this process is extremely complicated, taking into consideration the difficulties of choosing the right ratios, optimizations formulas and the quality of data needed to perform reliable analysis. Quite different issue is related to the skill of choosing and purchasing the most appropriate information technology and assuring the needed know-how in the area of the BI Project Management. The main question of this article is: What is the level of usefulness for the contemporary organizations to implement BI software solutions to support their the decision process, in spite of the industry or the size of the business.

The article consists of: 1) BI systems characteristics; 2) Analysis of the BI system and the implementation partner determination process; 3) BI systems efficiency analysis (on premise vs cloud computing); 4) BI implementation methodology and 5) case study performed with the support of SAP Analytics Cloud system. To answer all the questions, "Analysis-Synthesis" and "Simulation Modelling" methods were adapted.

Introduction

A key factor in the competitiveness of modern organizations is the ability to transform business data into decision-making knowledge, both in operational and strategic terms. However, we must remember that it is an extremely complex process from the point of view of both the selection of variables, optimization formulas and the quality of data obtained in order to perform a reliable analysis and diagnosis. Another completely different issue is the ability to choose, purchase and implement technological solutions as well as to provide adequate "know-how" in the management of such a project, which significantly affects the success or failure of this type of undertaking. However, the question arises: To what extent can contemporary organizations, regardless of the scale of their activity, the industry or sector of economy represented, use modern system solutions, with particular emphasis on Business Intelligence solutions, in terms of supporting the process of efficient decision making?

The study covers: the characteristics of BI solutions in the context of knowledge management; analysis of the conditions in the selection of the system and supplier; comments on the implementation methodology of the BI class system, usability assessment of the above solutions, including a description of the advantages and disadvantages of "on-premise" applications, as well as the so-called "Cloud technologies". The SAP Analytics Cloud system will be used as an illustration of BI solutions in the field of data processing.

In order to answer the questions posed, the analytical and synthetic method was used, as well as simulation modelling carried out with BI software SAP Analytics Cloud.

1. Characteristics of Business Intelligence solutions and knowledge management

In 2003, Gartner defined "Business Intelligence" as "a user-oriented process of collecting, exploring, interpreting and analysing data, which leads to the improvement and rationalization of the decision-making process. These systems support

the managerial staff in making business decisions in order to create an increase in the company's value"[1]. After a dozen or so years, a number of modifications were made to the understanding of this concept. Currently, on the Gartner website in IT Glossary, we have the following definition: "*Business Intelligence* (BI) is a general term encompassing applications, infrastructure and tools, and best practices, that enable information to be accessed and analysed to improve and optimize decisions and performance"[2].

Reflecting on the theoretical and technological foundations, we will reach for such disciplines as:

- Statistics and econometrics,
- Operational research,
- Artificial intelligence,
- Database technologies, including data warehouses.

In turn, Surma[3] distinguishes the following categories of technologies in BI class decision support systems:

- OLAP tools (On-Line Analytical Processing)
- data mining tools,
- knowledge management tools.

Currently, these technologies have gained a new dimension through In Memory Computing technologies (e.g. SAP HANA) and cloud computing.

In the first part of the definition, an important element is the transformation of information into knowledge necessary to make decisions ensuring the company's competitiveness. The problem is that, as Olszak points out[4],

- knowledge is located in many places,
- knowledge is often informal,
- there is an unclear division into public and private knowledge,
- a wealth of knowledge is obtained interactively and shared in subgroups or networks,
- knowledge consists of many types and carriers.

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1 J. Surma, *Business Intelligence. Systemy wspomagania decyzji biznesowych*, Wydawnictwo Naukowe PWN, Warszawa 2009, p. 13.

2 https://www.gartner.com/it-glossary/business-intelligence-bi/ (accessed on May 21, 2019).

3 J. Surma, *Business Intelligence*, p. 13.

4 C.M. Olszak, *Tworzenie i wykorzystanie systemów Business Intelligence na potrzeby współczesnej organizacji*, Wydawnictwo Akademii Ekonomicznej w Katowicach, Katowice 2007, p. 19.

So how to deal with gathering knowledge in a single decision support system? How to provide information that can be transformed into knowledge?

Olszak[5] presents the most important methods that may be helpful in the development of IT decision-making systems, in the form of a tree as in Figure 1.

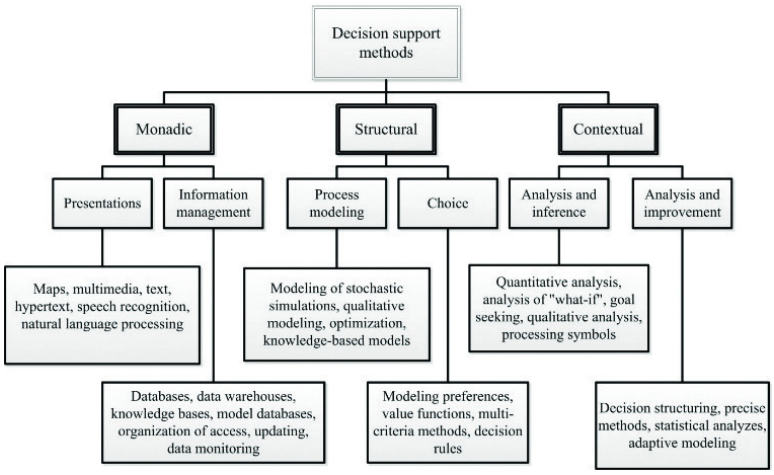

Figure 1. Methods helpful in the development of IT decision-making systems.
Source: C.M. Olszak, *Tworzenie i wykorzystanie systemów Business Intelligence*.

According to Olszak[6], BI systems integrate the best features of various decision support methods indicate the following characteristics of such systems through the following features:

- types of problems – structured, partially structured and unstructured,
- tasks – exploration and knowledge acquisition,
- time horizon – present, future,
- decision-making area – operational, tactical, strategic,
- technology – data warehouse, OLAP, data mining,
- typical applications – market and financial analyses, anomaly detection,
- users – decision makers at all levels of management, analysts, customers, stakeholders.

Based on the definition of BI quoted after Gartner IT Glossary, we can associate the classic sequence of data-into-knowledge transformation with the classes of management support systems, as shown in Figure 2.

5 Ibid., p. 33.

6 Ibid., p. 70.

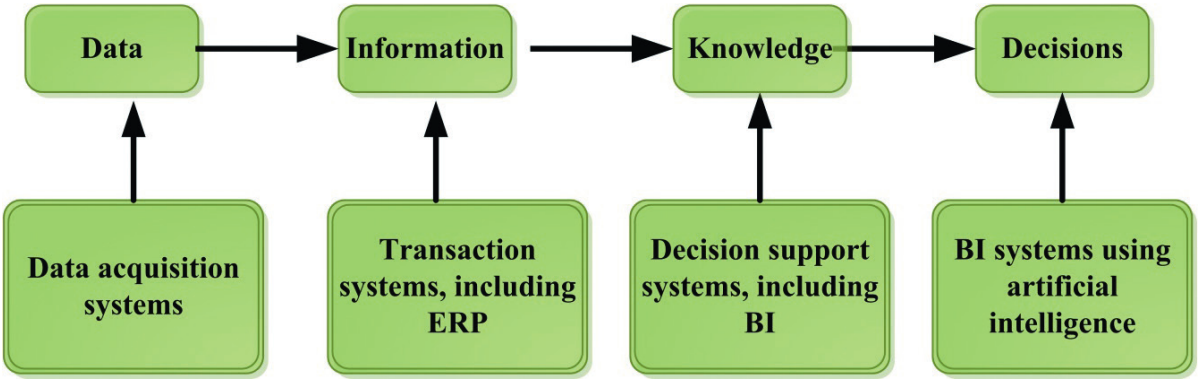

Figure 2. Linking the sequence of converting data into knowledge with the classes of management support systems.

Source: Author's own work.

To sum up, business knowledge management is always the process of transforming data obtained from various sources, including, above all, ERP class systems, into knowledge that determines making optimal decisions. This is what BI class programs are for. Therefore, it should be emphasized that the term Business Intelligence (BI) "is not an information technology but a vision of the functioning of the information system in the enterprise"[7]. BI is primarily a way to efficiently manage a company, not just a set of often extremely attractive charts or management dashboards.

2. Analysis of the conditions for choosing a BI class system and supplier

The decision to implement BI software as an element of the information and decision-making system leads directly to the dilemma of choosing the program, IT technology and the implementation service provider itself.

Based on the research (2,500 questionnaires) carried out by BARC (Business Application Research Center), 3 most important aspects related to the defined needs and preferences of BI class system users were indicated. They are: 1) Functional (analytical) capabilities of the system (51% of responses); 2) Proper relation of the software price to its efficiency (40%); and 3) Ease and user-friendliness of reporting for system users (37%). The least important ones include: good relationship with

[7] R. Sierocki, *Warunki skutecznego wdrożenia systemu Business Intelligence*, www.bi-pro.pl (accessed on May 30, 2019).

the supplier (only 6%), additional options/functions that can be used in working with the system (5%), international character of the solution (5%)[8].

Figure 3. BI software selection criteria.

Source: https://bi-survey.com (accessed on May 30, 2019).

The choice of the company that implements our BI system should be independent of the choice of the software itself, although often this assumption is not feasible in business practice. Nevertheless, it is a choice that largely influences harmonious cooperation and ultimately a positive end result of the design work. The most important are[9]:

1. Experience gained in the implementation of BI projects understood not so much as the number of implemented implementations, but rather the quality and complexity of the functionalities launched;
2. Substantive opinions of customers and BI system users obtained as a result of the study visits;
3. Quality and number of consultants available in the project, including experienced and highly rated subcontractors in the industry;

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8 Business Application Research Center, *BI Survey Report*, https://bi-survey.com (accessed on May 30, 2019).

9 G. Grupiński, *Pięć najczęściej wymienianych zagadnień, na które należy zwrócić uwagę przy wyborze firmy*, Akademia Wiedzy BCC, www.bcc.com.pl/akademia (accessed on May 30, 2019).

4. Possibility of comprehensive project management, including efficient coordination of works carried out by subcontractors;
5. Substantive knowledge in the field of business, industry and legal issues of consultants and subcontractors.

However, it should be remembered that the de facto success of the BI venture will not ultimately be determined by the choice of one program or another, but rather the selection of a reliable implementation service provider, including the right project methodology.

3. BI class system implementation project — methodological conditions

The implementation of each project, including the BI class system implementation project, requires the use of an efficient methodology, understood as 1) System (software) installation; 2) Program launch and technical verification; 3) Checking the system or solution for functionality; and 4) Handover the system to the user for productive operation[10].

From the perspective of managing this type of project at the operational level, we can distinguish the following activities[11]:

1. Development by the contracting authority of a global strategic information system of the enterprise – definition of information needs and usefulness;
2. Development of a detailed concept by the implementation company: data qualification, identification of sources, homogenization and correlation of data, data storage, presentation and analysis of reports/indicators/trends, etc., selection of technology and contractor;
3. Preparation of a prototype solution, simulation of reports, variants;
4. Testing the prototype solution, submitting comments;
5. Final acceptance of the solution and productive start;
6. Monitoring the degree of use of a new BI solution in the company's decision-making processes;
7. Searching for new needs, information opportunities within SIS – proposition of changes or BI development.

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10 Instytut Zarządzania, *Raport oprogramowania biznesowego*, Warszawa 2001, p. 18.

11 It should be remembered that in the industry literature there is a whole set of different approaches and division into individual phases or tasks. To a large extent, the system implementation service provider will decide on the choice of the preferred methodology. See M. Flasiński, *Zarządzanie projektami informatycznymi*, Wydawnictwo Naukowe PWN, Warszawa 2006, pp. 69–77.

The key determinant of the success or failure of this type of project is undoubtedly the definition of the real information needs of individual groups of decision-makers and stakeholders from the perspective of the decisions made, both at the operational and strategic levels. Unfortunately, this task is the greatest challenge for the contracting authority. It often requires him to redefine the entire information and decision-making process, including learning the latest technological solutions. The quality of the business concept in terms of developing a new management model will ultimately determine the usefulness of this type of solution, regardless of the degree of modernity of the implemented IT technology.

4. Assessment of the usefulness of the above solutions, including a description of the advantages and disadvantages of "on-premise" applications, as well as the so-called "Cloud technologies"

Changes and technological innovations determine yet another choice dilemma faced by management boards of modern companies. One example is the choice between "on-premise" solutions (the software is installed on the customer's infrastructure) and the "cloud" technology (the so-called virtual cloud of services available to the customer) enabling access to a whole range of "online" services using software and external infrastructure. We can point out the following strengths and weaknesses of these two solutions:

Table 1. "On-premise" type solutions.

ADVANTAGES	DISADVANTAGES
Full control over information resources	Full responsibility for possessed information resources (compliance with GDPR)
Faster access to data, function resources	Higher total cost of maintaining and developing systems and infrastructure
Full control over license agreements and the scope of cooperation with system suppliers	Lack of full mobility in terms of access to data, resources, functions — local access
Full adjustment of the system to the customer's needs — a full range of customization and configuration.	A limited range of services, functions, including innovative solutions available only in the cloud.
Guarantee of uninterrupted access to functions, services and resources	Longer time to start the solution — system implementation

Source: own study based on: A. Krawiec, *ERP w chmurze czy on-premise? Wybór nie jest oczywisty*, "Computerworld", www.computerworld.pl (accessed on May 30, 2019).

Table 2. Cloud solutions.

ADVANTAGES	DISADVANTAGES
Data protection risk transfer (GDPR, ZBZI)	Lack of full control over information resources
Lower total cost of maintaining and developing systems and infrastructure	Slower access to data, resources and functions
Full mobility in terms of access to data, resources, functions – local access	Unpredictability in terms of license agreements, costs, scope of cooperation
Wide range of services, functions, etc.	Necessity to use preconfigured solutions – minimal scope of customization
Relatively fast time to launch the solution – system implementation	Guarantee of uninterrupted access to functions, services and resources
Access to innovative solutions	Need to provide a fast and reliable internet connection

Source: A. Krawiec, *ERP w chmurze czy on-premise?*

Taking into account the advantages and disadvantages of both technologies, one of the possible options is to implement a hybrid solution whose functional modules operate partly "on-premise" in the client's infrastructure, and in part in an externally purchased private, public cloud or in hosting[12]. Such a strategy enables the development of an optimal model in terms of ensuring the sustainable development of each company.

5. SAP Analytics Cloud as an example of a BI solution in the field of business data processing

Cloud computing and storage has been gaining in importance in recent years and is used both for business and private purposes. However, entrepreneurs approach this type of solutions with particular caution. While most of them use client-server solutions, they are wary of cloud-based storage and use of the management system and data. One of the models of using cloud computing is remote access to applications via a web browser – Software-as-a-Service (SaaS). In order to increase the level of trust in this solution, providers use the most modern methods of ensuring the security and confidentiality of data and transmission when accessing the application. SAP AG (Systemanalyse und Programmentwicklung AG, headquarters Walldorf, Germany) has developed its own SaaS BI solution under the name SAP Analytics-Cloud (SAC). The above BI solution is the only commercially available solution

[12] S. Jagiełło, *Hybrydowe ERP – czy to się opłaca?*, blog.macrologic.pl (accessed on November 24, 2015).

that combines three possibilities: analytical: reporting, planning and prediction[13]. The system located in the cloud ensures fast data processing and visualization of the result. The transmission speed and the device on which the web browser is running are important. SAC allows you to connect various data sources, not only cloud ones. The user can select the reporting method depending on the type of device: stationary or portable. Another advantage is access from anywhere with internet access. Figure 4 shows a diagram of the connection to data sources and the use of SAC.

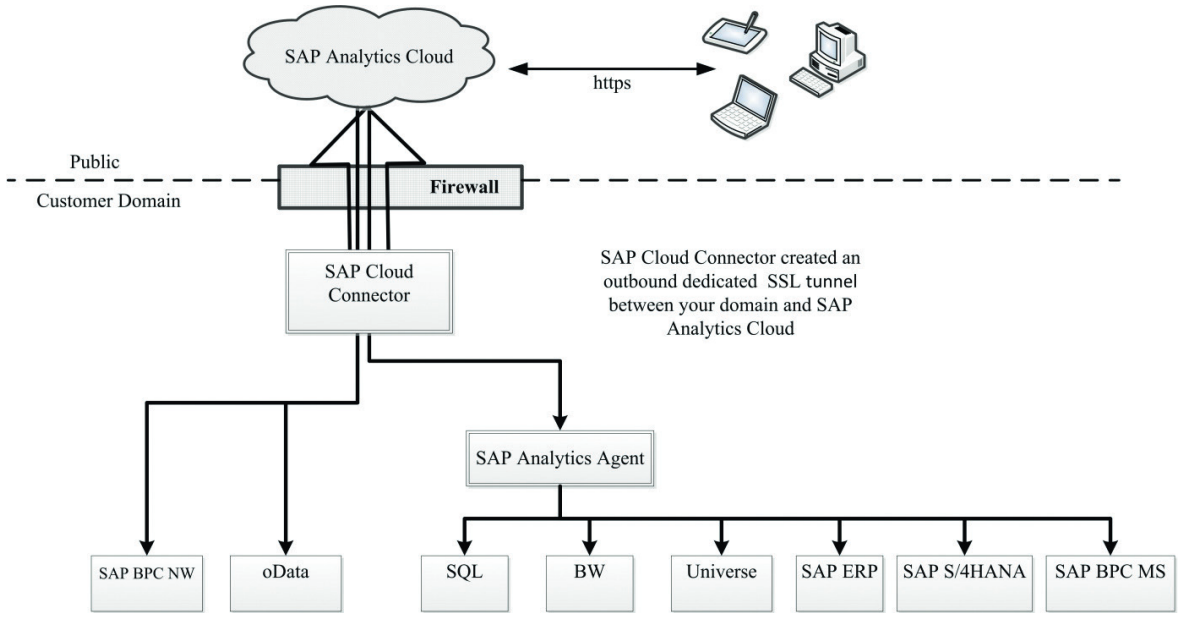

Figure 4. Data sources and use of SAC.

Source: based on B. Woźniak, *Odkrywanie biznesu w chmurze.*

Using the SAP Analytics Cloud (SAC) system, we analysed three elements of the financial statements of three listed companies: Orbis S.A., Quantum Software S.A. and Stalexport Autostrady S.A. All predictive methods available in SAC were used, enabling forecasting for subsequent periods. The SAC system uses three methods for predicting the results: linear regression, triple exponential smoothing[14] and automatic scheduling. Automatic scheduling selects the forecast method according to the manufacturer's algorithm. There is no room here for a broader discussion of the mathematical basis of methods.

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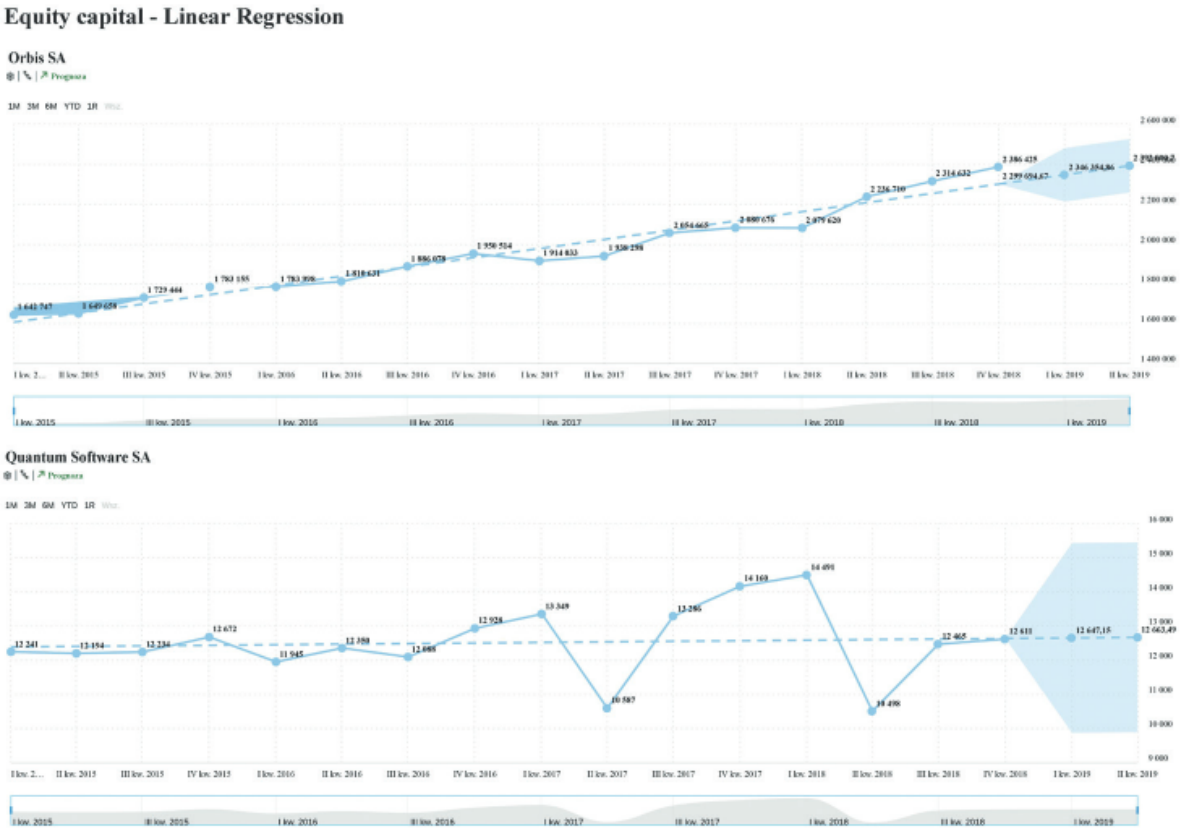
13 In the article by B. Woźniak, *Odkrywanie biznesu w chmurze. Analityka z SAP Analytics Cloud*, "Lepszy Biznes, SNP Poland", 4 (72), December 2018, there is a comparison with other similar SAP systems and information on ensuring security.

14 This method is called in the literature the Winters multiplicative method, which can be used in the case of time series containing a development tendency, seasonal fluctuations and random fluctuations, http: //www.econometria.4me.pl/metoda-wintersa.htm (accessed on May 31, 2019).

We will successively present the results of the analysis[15]. First, the results obtained in the SAC system will be presented[16] in the form of graphs, then a table collecting the results of calculations, and then the conclusions will be discussed[17].

5.1. Equity capital



15 For a comparative analysis of forecasting methods, see K. Halicka, C. Winkowski, *The use of exponential smoothing methods to forecast the EUR selling rate*, http://yadda.icm.edu.pl/baztech/element/bwmeta1.element.baztech-dfd3932f-e56c-4ae0-9df5-31bf54514757 (accessed on May 31, 2019).

16 SAC was used in the SAP Analytics Cloud for Higher Education version with the "Academic Account" license. Academic Account includes complete business analysis, planning, predictive analytics and SAP Digital Boardroom functionality in a collaborative learning environment.

17 Data for analysis was obtained from Reports of listed companies: Money.pl, *Raporty spółek giełdowych*, https://www.money.pl/gielda/raporty (accessed on May 10, 2019).

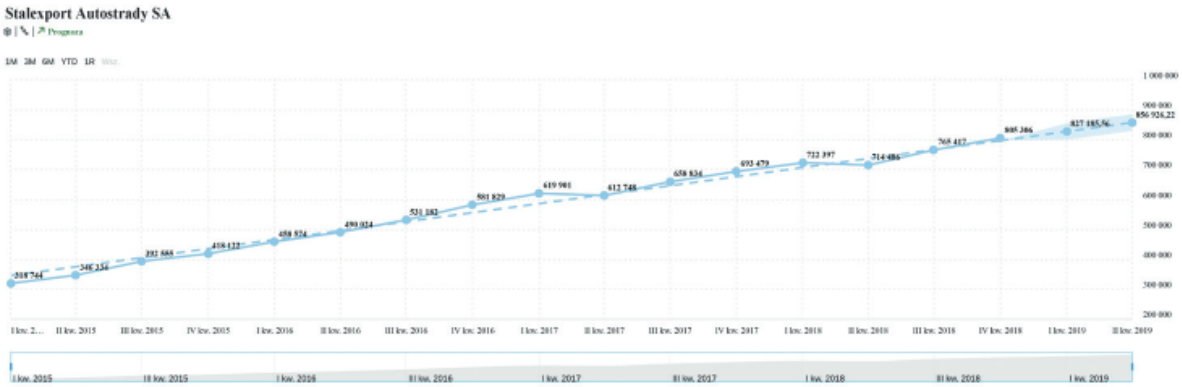


Figure 5. Equity, method: linear regression. SAC system report source.

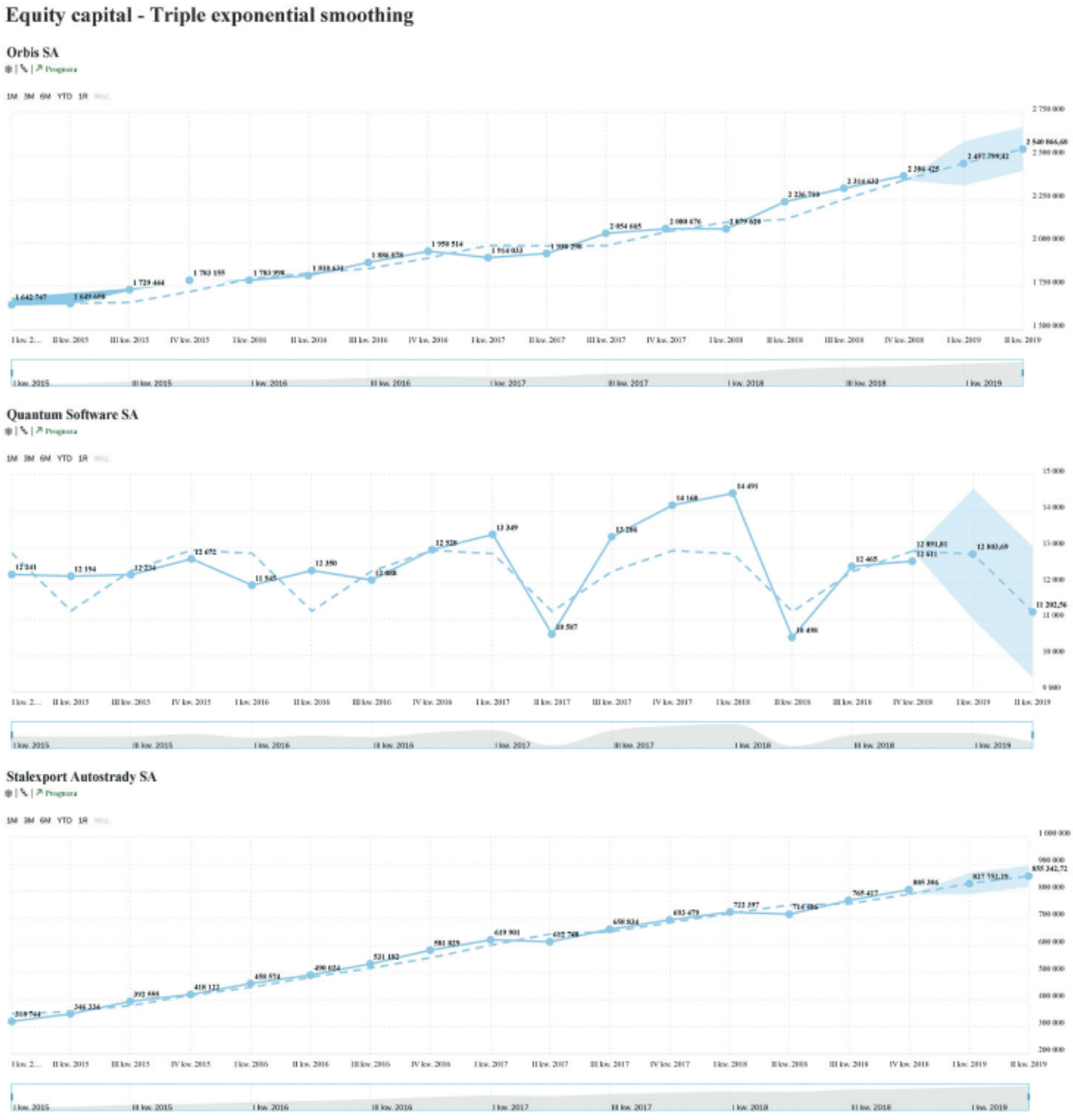


Figure 6. Equity capital, method: triple exponential smoothing. SAC system report source.

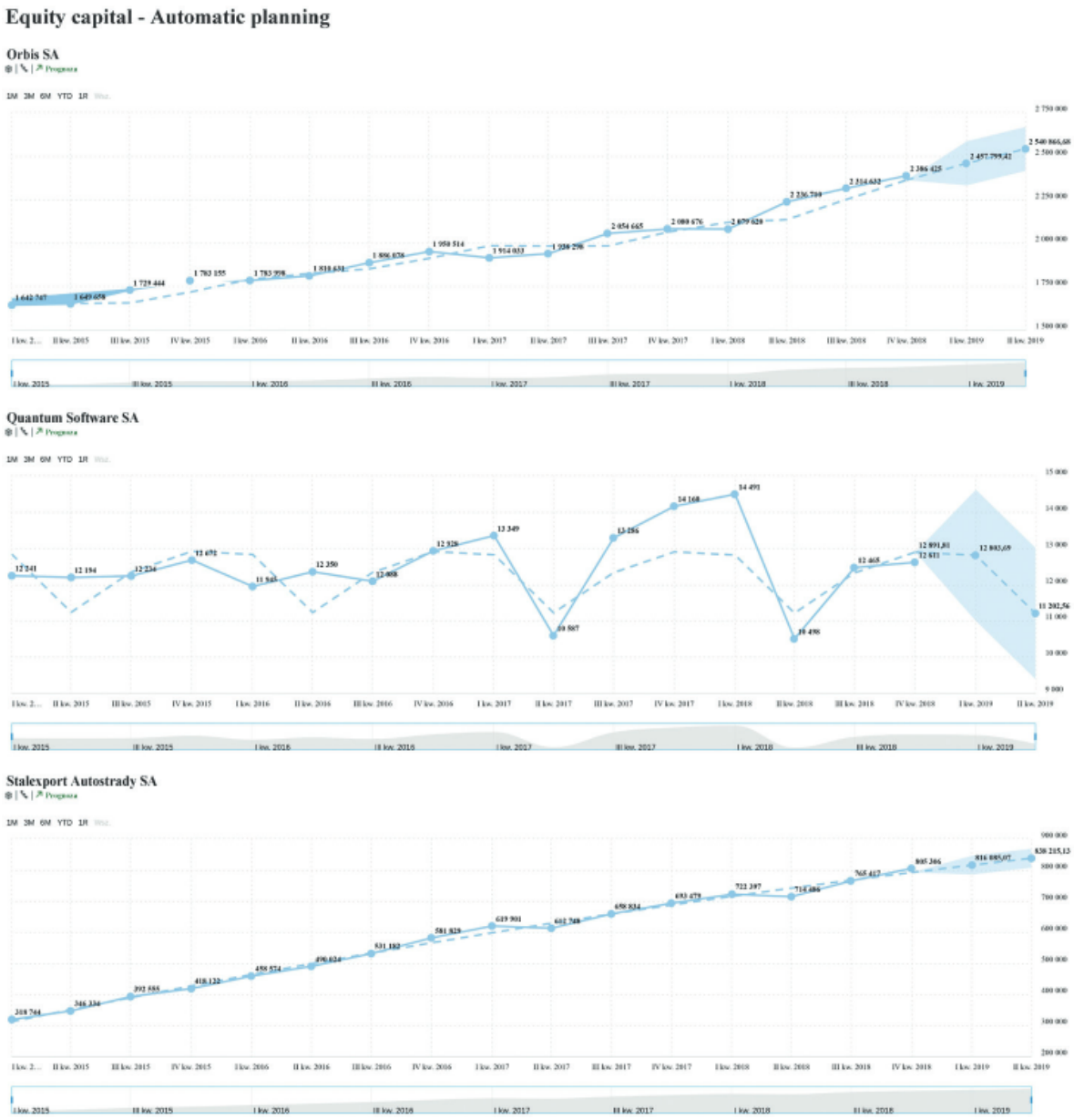


Figure 7. Equity capital, method: automatic planning. SAC system report source.

Table 3. Statement of the value of equity forecasts based on data from the SAC system.

Equity capital				
Linear regression				
		ORBIS S.A.	Quantum Software S.A.	Stalexport Autostrady S.A.
K4 2018 source		2,386,425.00	12,611.00	805,306.00
K4 2018 calculated		2,222,562.46	12,772.57	812,294.83
difference	value	-163,862.54	161.57	6,988.83
	%	-6.87	1.28	0.87
K1 2019 calculated		2,261,890.55	12,817.52	845,111.89
K1 2019 estimate min	value	2,035,558.90	9,994.30	808,960.10
	%	-10.01	-22.03	-4.28
K1 2019 estimate max	value	2,488,222.20	15,640.74	881,263.68
	%	10.01	22.03	4.28
K2 2019 calculated		2,300,363.68	12,861.50	877,215.55
K2 2019 estimate min	value	2,074,032.03	10,038.28	841,063.75
	%	-9.84	-21.95	-4.12
K2 2019 estimate max	value	2,526,390.53	15,684.72	913,367.32
	%	9.84	21.95	4.12
Triple exponential smoothing				
		ORBIS S.A.	Quantum Software S.A.	Stalexport Autostrady S.A.
K4 2018 source		2,386,425.00	12,611.00	805,306.00
K4 2018 calculated		2,368,104.94	12,877.11	789,083.05
difference	value	-18,320.06	266.11	-16,222.95
	%	-0.77	2.11	-2.01
K1 2019 calculated		2,461,011.70	12,790.23	828,028.12
K1 2019 estimate min	value	2,336,194.32	10,953.38	867,508.24
	%	-5.07	-14.36	4.77
K1 2019 estimate max	value	2,585,829.08	14,627.08	788,549.99
	%	5.07	14.36	-4.77
K2 2019 calculated		2,543,159.61	11,235.22	856 619.12
K2 2019 estimate min	value	2,418,342.23	9,398.37	816 139.99
	%	-4.91	-16.35	-4.73

Equity capital				
Triple exponential smoothing				
		ORBIS S.A.	Quantum Software S.A.	Stalexport Autostrady S.A.
K2 2019 estimate max	value	2 667 976.99	13 072.06	895 098.24
	%	4.91	16.35	4.49
Automatic scheduled				
		ORBIS S.A.	Quantum Software S.A.	Stalexport Autostrady S.A.
K4 2018 source		2,386,425.00	12,611.00	805,306.00
K4 2018 calculated		2,266,910.93	12,465.00	792,977.99
difference	value	-119,514.07	-146.00	-12,328.01
	%	-5.01	-1.16	-1.53
K1 2019 calculated		2,320,173.27	12,611.00	815,149.43
K1 2019 estimate min	value	2,148,554.31	8,234.45	782,785.53
	%	-7.40	-34.70	-3.97
K1 2019 estimate max	value	2,491,792.23	16,987.55	847,513.34
	%	7.40	34.70	3.97
K2 2019 calculated		2,373,985.58	12,611.00	835 457.27
K2 2019 estimate min	value	2,202,366.62	7,867.18	803,093.37
	%	-7.23	-37.62	-3.87
K2 2019 estimate max	value	2,545,604.54	17,354.82	867,821.17
	%	7.23	37.62	3.87

Source: own material.

Table 3 shows the results of the forecast for the change in equity for all firms and methods. For Orbis S.A., the tiniest error in estimating the change in capital is given by the "Triple exponential smoothing" method and in this case can be the basis for making a decision. The best forecast results and the smallest estimation error have been obtained for Stalexport Autostrady S.A. Here, regardless of the forecast method, the decision will be correct. However, in the case of a company Quantum Software S.A., none of the methods gives an error small enough to make decisions based on it.

5.2. Sales revenue

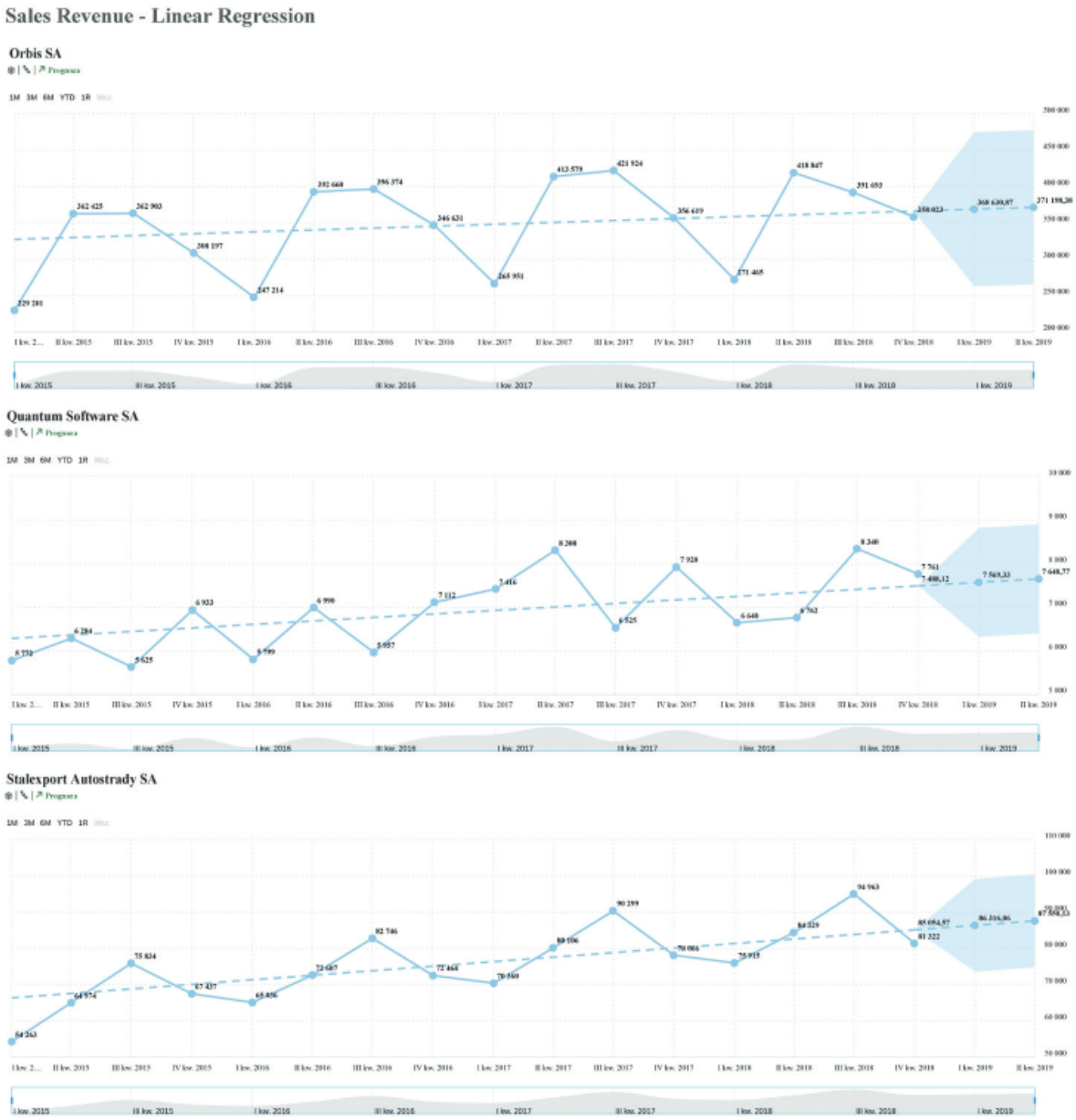


Figure 8. Sales revenue, linear regression method. SAC system report source.

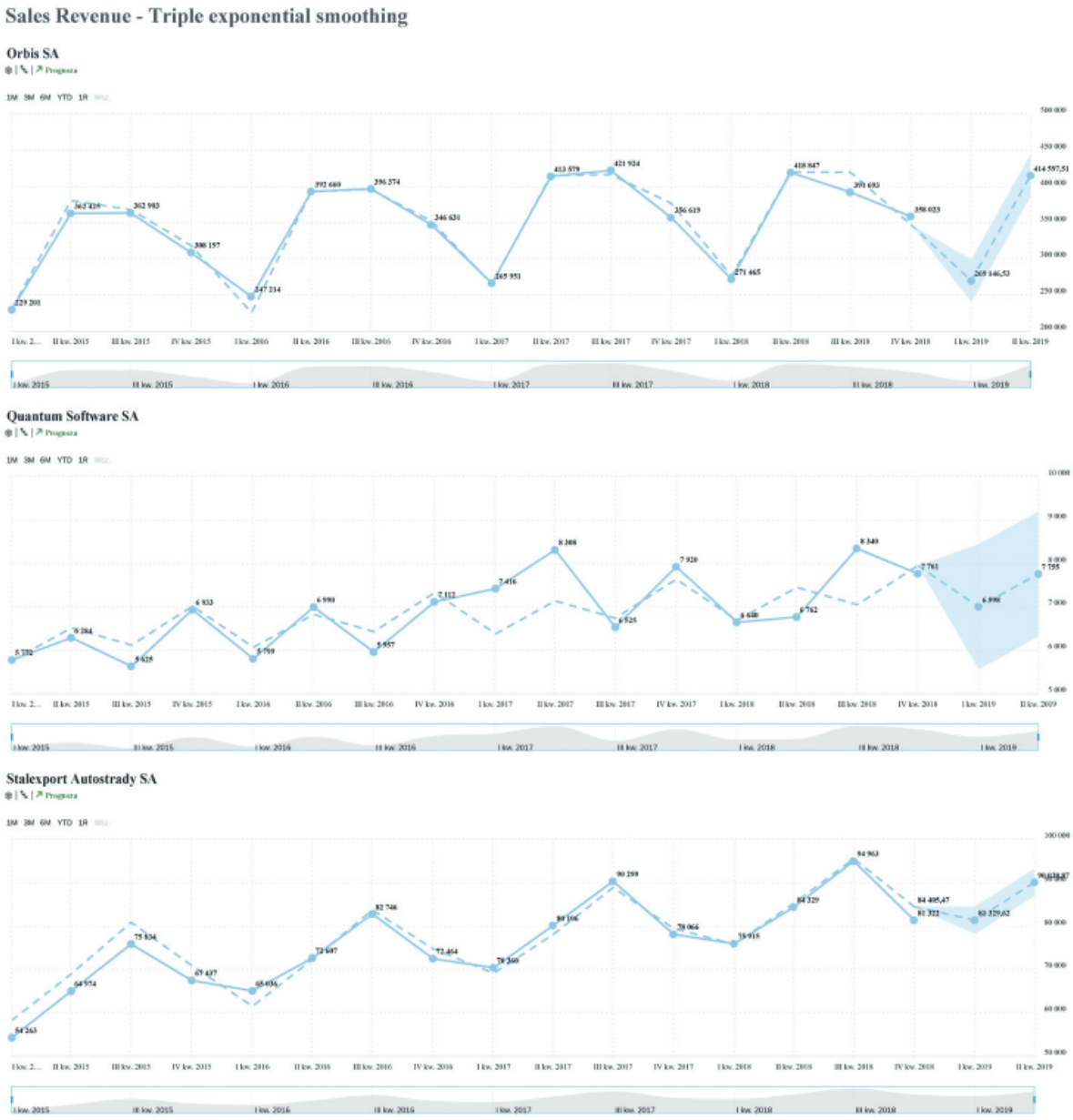


Figure 9. Sales revenue, triple exponential smoothing method. SAC system report source.

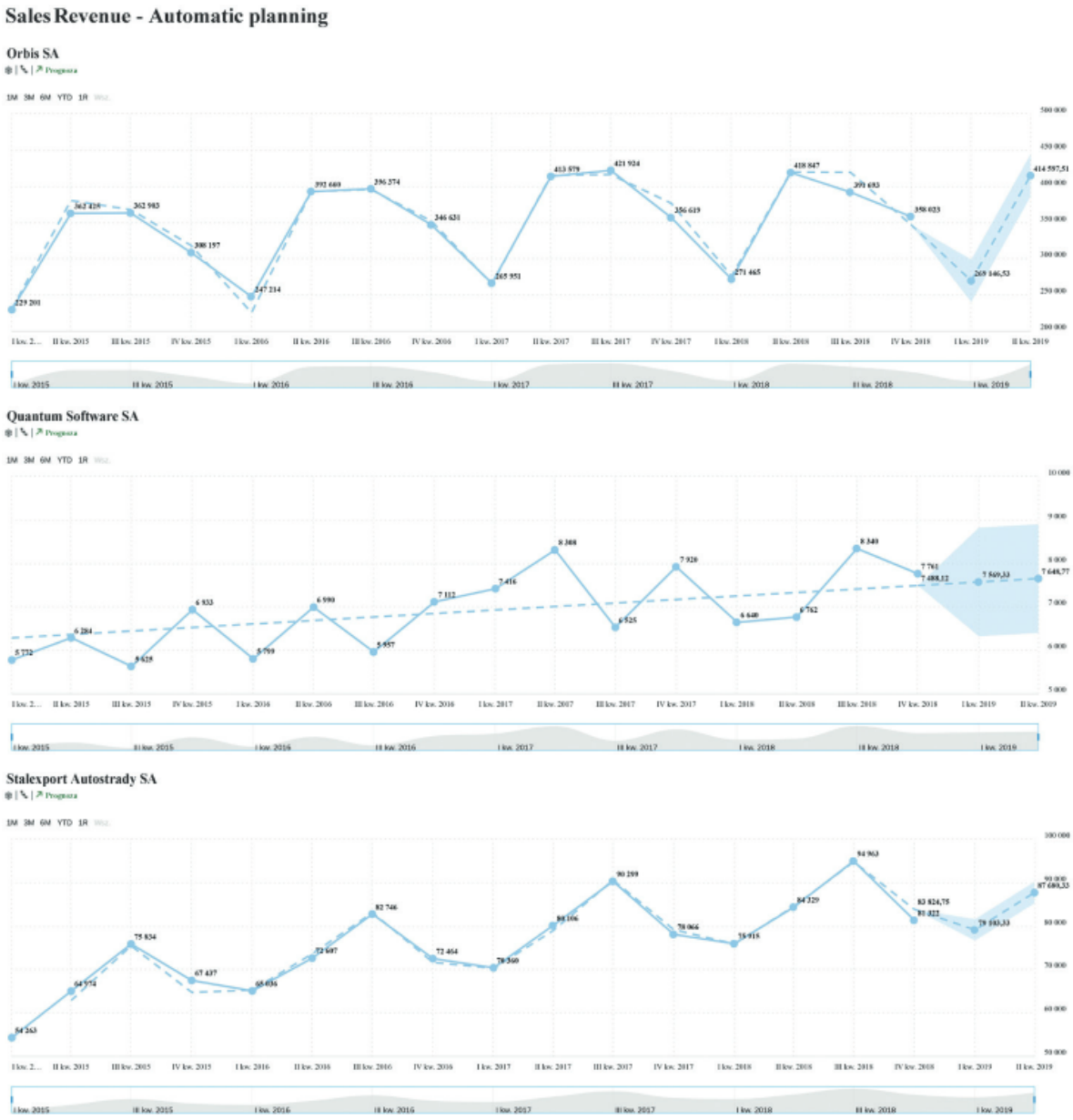


Figure 10. Sales revenue, automatic planning method. SAC system report source.

Table 4. Summary of sales revenue forecasts based on data from the SAC system.

Revenues from sales				
Linear regression				
		ORBIS S.A.	Quantum Software S.A.	Stalexport Autostrady S.A.
K4 2018 source		358,023.00	7,761.00	81,322.00
K4 2018 calculated		367,596.58	7,552.01	85,245.47
difference	value	9,573.58	-208.99	3,923.47
	%	2.67	-2.69	4.82
K1 2019 calculated		371,867.45	7,663.67	86,742.31
K1 2019 estimate min	value	267,089.06	6,458.33	73,990.89
	%	-28.18	-15.73	-14.70
K1 2019 estimate max	value	476,645.84	8,869.01	99,493.73
	%	28.18	15.73	14.70
K2 2019 calculated		376,045.48	7,772.90	88,206.61
K2 2019 estimate min	value	271,267.09	6,567.57	75,455.19
	%	-27.86	-15.51	-14.46
K2 2019 estimate max	value	480,823.87	8,978.34	100,958.03
	%	27.86	15.51	14.46
Triple exponential smoothing				
		ORBIS S.A.	Quantum Software S.A.	Stalexport Autostrady S.A.
K4 2018 source		358,023.00	7,761.00	81,322.00
K4 2018 calculated		341,832.22	8,006.23	789,083.05
difference	value	-16,190.78	245.23	707,761.05
	%	-4.52	3.16	870.32
K1 2019 calculated		256,725.76	6,949.30	828,028.12
K1 2019 estimate min	value	227,395.29	5,458.51	76,700.18
	%	-11.42	-21.45	-90.74
K1 2019 estimate max	value	286,056.23	8,440.09	83,305.82
	%	11.42	21.45	-89.94
K2 2019 calculated		398,589.84	7,781.13	89,305.07
K2 2019 estimate min	value	369,259.37	6,290.34	86,002.25
	%	-7.36	-19.16	-3.70

Revenues from sales				
Triple exponential smoothing				
		ORBIS S.A.	Quantum Software S.A.	Stalexport Autostrady S.A.
K2 2019 estimate max	value	427,920.31	9,271.92	92,607.89
	%	7.36	19.16	3.70
Automatic scheduled				
		ORBIS S.A.	Quantum Software S.A.	Stalexport Autostrady S.A.
K4 2018 source		358,023.00	7,761.00	81,322.00
K4 2018 calculated		366,441.33	7,772.21	84,659.00
difference	value	8,418.33	11.21	3,337.00
	%	2.35	0.14	4.10
K1 2019 calculated		268,637.00	7,883.87	79 069.50
K1 2019 estimate min	value	228,444.39	6,597.01	75,780.78
	%	-14.96	-16.32	-4.16
K1 2019 estimate max	value	308,829.61	9,170.72	82,358.22
	%	14.96	16.32	4.16
K2 2019 calculated		433,728.50	7,993.10	87,728.00
K2 2019 estimate min	value	393,535.89	6,706.25	84,198.32
	%	-9.27	-16.10	-4.02
K2 2019 estimate max	value	473,921.11	9,279.96	91,257.68
	%	9.27	16.10	4.02

Source: own material

Table 4 shows the results of the forecast for the change in sales for all companies and methods. None of the methods works for Quantum Software S.A. For the remaining companies, the results of both triple exponential smoothing and automatic scheduling can be used to make a decision, with the smaller error rate given by the triple exponential smoothing method.

5.3. Book value of 1 share

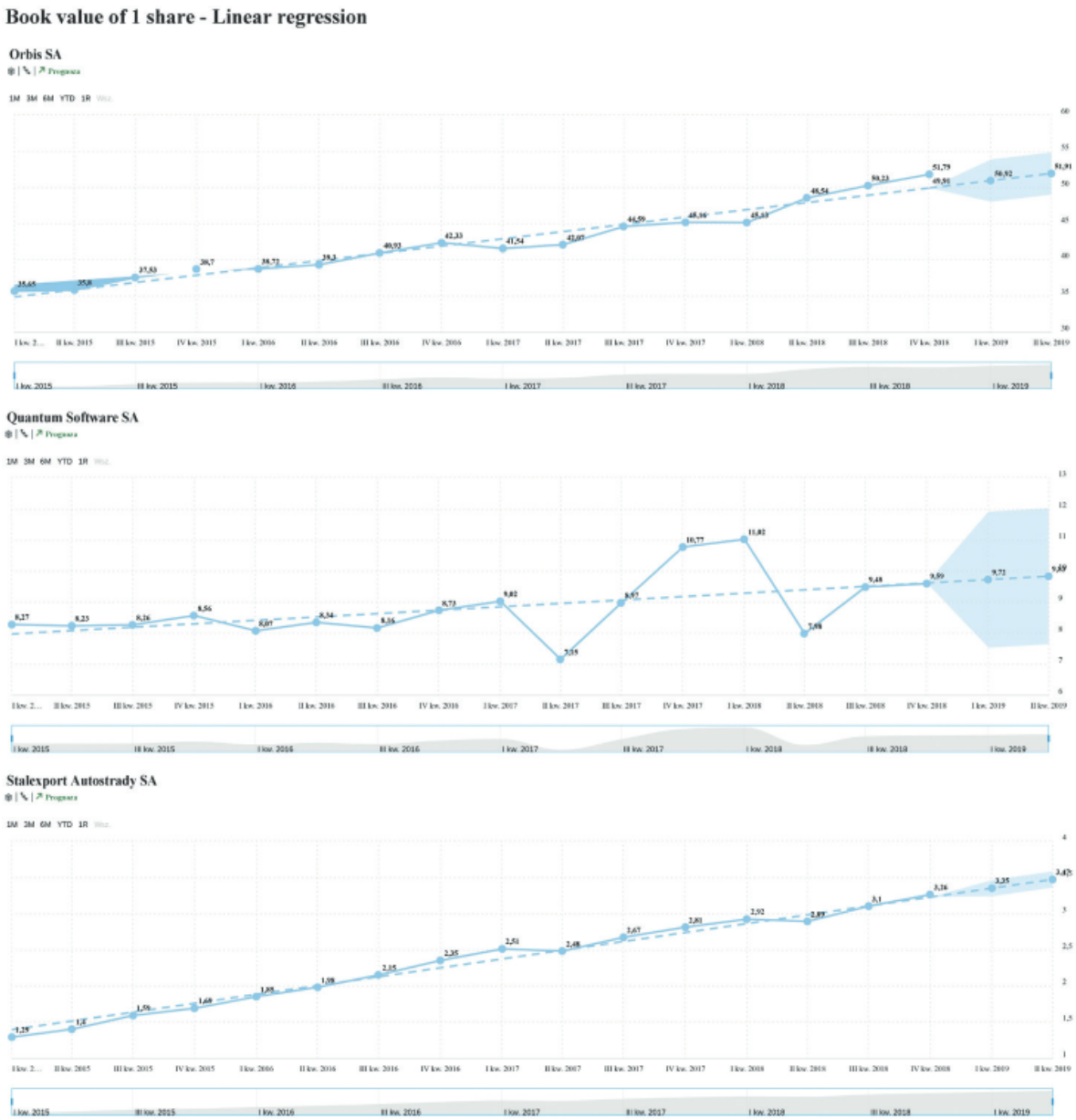


Figure 11. Book value of 1 share, linear regression method. SAC system report source.

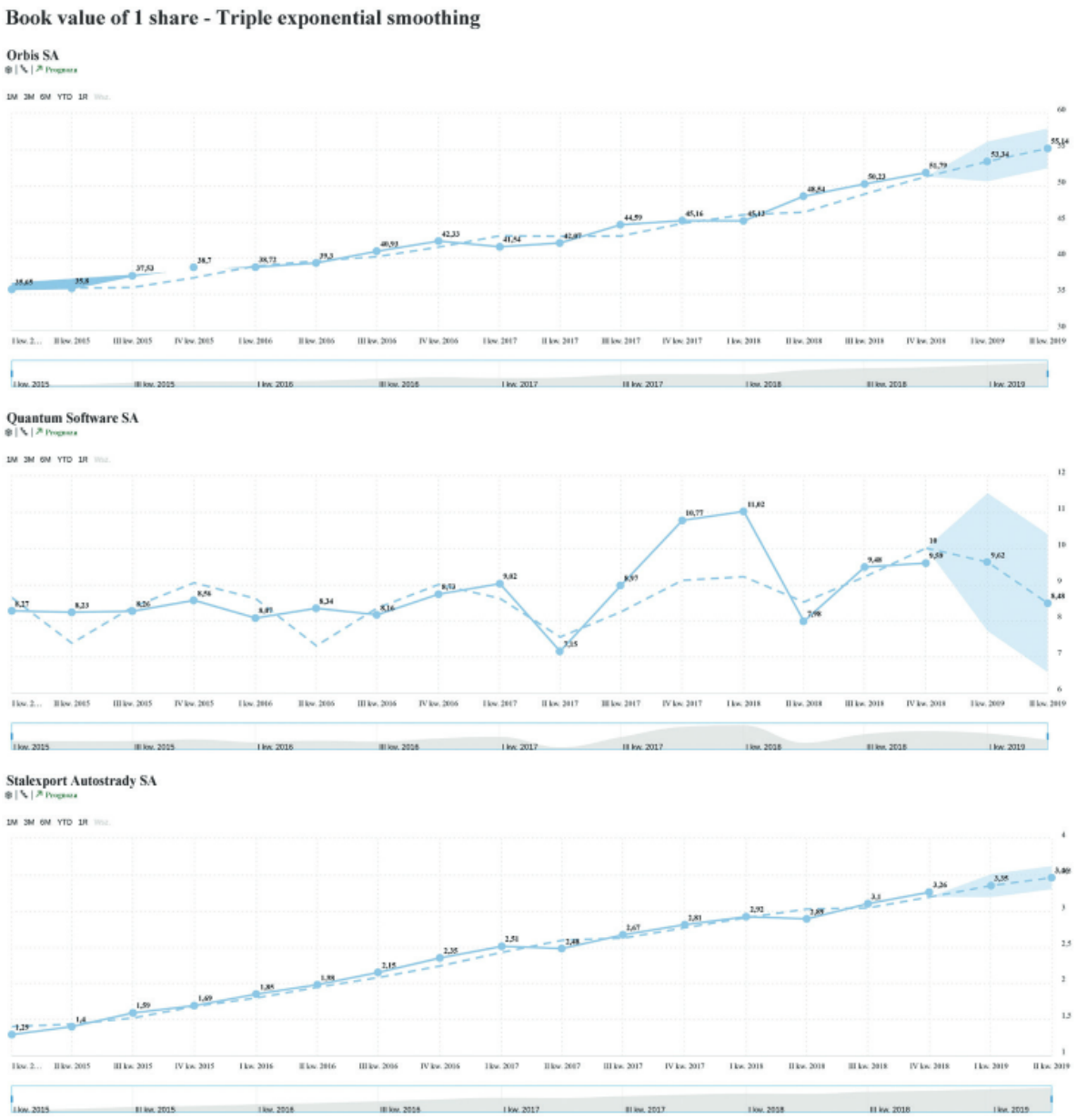


Figure 12. Book value of 1 share, triple exponential smoothing method. SAC system report source.

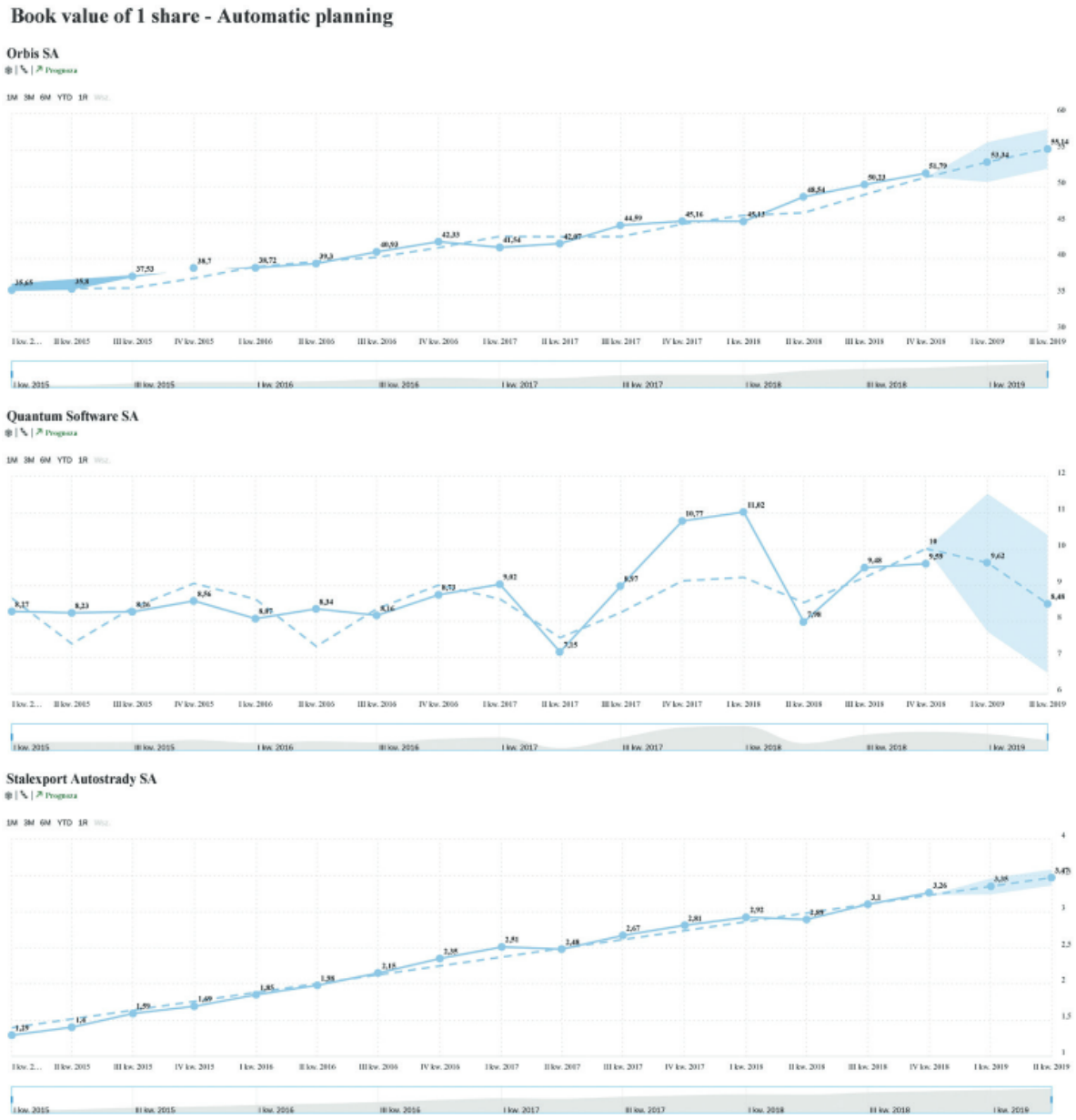


Figure 13. Book value of 1 share automatic scheduling method. SAC system report source.

Table 5. Summary of forecast values book value of 1 share based on data from the SAC system.

Book value of 1 share				
Linear regression				
		ORBIS S.A.	Quantum Software S.A.	Stalexport Autostrady S.A.
K4 2018 source		51.79	9.59	3.26
K4 2018 calculated		48.24	9.56	3.29
difference	value	-3.55	-0.03	0.03
	%	-6.85	-0.31	0.92
K1 2019 calculated		49.09	9.67	3.42
K1 2019 estimate min	value	44.19	7.47	3.27
	%	-9.98	-22.75	-4.39
K1 2019 estimate max	value	54.00	11.86	3.42
	%	10.00	22.65	0.00
K2 2019 calculated		49.93	9.77	3.55
K2 2019 estimate min	value	45.02	7.57	3.40
	%	-9.83	-22.52	-4.23
K2 2019 estimate max	value	54.83	11.97	3.70
	%	9.81	22.52	4.23
Triple exponential smoothing				
		ORBIS S.A.	Quantum Software S.A.	Stalexport Autostrady S.A.
K4 2018 source		51.79	9.59	3.26
K4 2018 calculated		51.39	10.18	3.19
difference	value	-0.40	0.59	-0.07
	%	-0.77	6.15	-2.15
K1 2019 calculated		53.41	9.86	3.35
K1 2019 estimate min	value	50.70	7.81	3.19
	%	-5.07	-20.79	4.78
K1 2019 estimate max	value	56,12	11.91	3.51
	%	5.07	20.79	4.78
K2 2019 calculated		55.19	8.79	3.46
K2 2019 estimate min	value	52.48	6.73	3.30
	%	-4.91	-23.44	-4.62

Book value of 1 share				
Triple exponential smoothing				
		ORBIS S.A.	Quantum Software S.A.	Stalexport Autostrady S.A.
K2 2019 estimate max	value	57.90	10.84	3.62
	%	4.91	23.32	4.62
Automatic scheduled				
		ORBIS S.A.	Quantum Software S.A.	Stalexport Autostrady S.A.
K4 2018 source		51.79	9.59	3.26
K4 2018 calculated		49.20	9.56	3.19
difference	value	-2.59	-0.03	-0.07
	%	-5.00	-0.31	-2.15
K1 2019 calculated		50.36	9.67	3.28
K1 2019 estimate min	value	46.64	7.47	3.14
	%	-7.39	-22.75	-4.27
K1 2019 estimate max	value	54.07	11.86	3.41
	%	7.37	22.65	3.96
K2 2019 calculated		51.52	9.77	3.35
K2 2019 estimate min	value	47.81	7.57	3.22
	%	-7.20	-22.52	-3.88
K2 2019 estimate max	value	55.24	11.97	3.48
	%	7.22	22.52	3.88

Source: own material.

Table 5 shows the forecast results for the change in book value of 1 share for all firms and methods. Again for Quantum Software S.A., none of the methods works. For the remaining companies, the results from both triple exponential smoothing and automatic planning can be used to conceptualise the decision, with the smaller error given by the triple exponential smoothing method for Orbis S.A., and automatic planning for Stalexport Autostrady S.A.

Table 6. Method suitability summary.

	Equity capital			Revenues from sales			Book value of 1 share		
	Linear regression	Triple exponential smoothing	Automatic scheduling	Linear regression	Triple exponential smoothing	Automatic scheduling	Linear regression	Triple exponential smoothing	Automatic scheduling
ORBIS S.A.	↘	↘	↘	↘	↗	↗	↘	↗	↘
Quantum Software S.A.	↘	↘	↘	↘	↘	↘	↘	↘	↘
Stalexport Autostrady S.A.	↗	↗	↗	↘	↗	↗	↗	↗	↗

↗ means that the method can be used, ↘ the method should not be used.

Source: own material.

Table 6 summarizes the effects of using predictive methods for three calculated examples for each of the companies. A simple, qualitative method of illustrating the suitability of the method for a specific case was chosen. In the row for Quantum Software S.A., all arrows are down, which means that for this company, none of the methods used in SAC can be used to forecast and justify decisions in the cases under consideration. The charts show large fluctuations in values, which may mean that the data does not meet the assumptions (conditions) required for the methods used. For the remaining companies, in each case we will find a method that allows the forecast to be used to make a decision.

Only one aspect has been presented, but it seems to be a very important aspect of the SAP Analytics Cloud system: making a forecast from the perspective of maintaining key parameters important from the company's point of view.

Conclusions

On the basis of the analysis performed, we can indicate the following conclusions and recommendations:

1. BI class solutions include both technical (IT) aspects, as well as the "vision" of the information and decision-making system functioning in the enterprise.
2. The success of a BI project is primarily determined by the choice and proper adaptation of the implementation methodology, while the choice of the system itself or the implementation company is less important.

3. The dilemma of choosing an "on-premise" or "cloud" solution is a complex problem that requires decision makers to carry out an in-depth SWOT analysis. So far, no unequivocal solutions to the above issue have been developed.
4. The SAP Analytics Cloud system presented in the study as an example of a BI solution in the field of business data processing confirms a wide range of possibilities of using forecasting functions in the field of efficient decision making in business management.
5. The presented examples of forecasting show that there is no universal method that can be applied randomly, due to the fact that the data used to perform the calculations must meet the assumptions of the selected method. As managers are generally not mathematicians by training, they should follow the slightest estimation error when selecting a method or seek advice from professional analysts.

Summing up, we can say that the importance of BI systems for enterprises will grow, especially easily available systems, the results of which can be presented on any device, in any place and at any time.

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