BUSINESS INTELLIGENCE AS A KEY INFORMATION AND KNOWLEDGE TOOL FOR STRATEGIC BUSINESS PERFORMANCE MANAGEMENT

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Introduction

Measuring and managing business performance is a relatively complex and difficult process which is undergoing significant changes both in practice and in research. Despite the ongoing effort to improve the methodology used, it seems that the traditional business performance management based primarily on financial management has reached its limits and in recent years we have seen the development of new non-traditional indicators, methods and models based primarily on non-financial methods, in particular on strategic and other qualitative indicators. The current dynamic business environment makes it essential to understand the importance of one of the company's most valuable and volatile intangible assets – "knowledge". Knowledge is sometimes considered a fifth factor of production in the current economy and its generation plays a critical role in the firm's competitive advantage and its economic performance. Organizations attempt to use knowledge in order to strengthen their competitiveness for both customers and employees (Singh & Samalia, 2014). The present tendencies are expanding worldwide due to three main directions: the globalization which implies increased international competitiveness, technological changes, organizational behaviour, ICT, knowledge, innovation are considered priorities (Szabo, Šoltés & Herman, 2013). Many organizations continue to increase their investment in implementing various types of information systems, such as Enterprise Resource Planning (ERP) and Customer Relationship Management (CRM), primarily because of belief that these investments will lead to employees' increased productivity (Hou, 2012). Most businesses

already have a solid market research capability that helps them understand their customers' needs and expectations. However, knowing one's customers is not enough and companies must also be aware of their competitive environment (Nofal & Yusof, 2013). The results of our empirical scientific study provide interesting and valuable findings that the overall performance of industrial enterprises in Slovakia is to be looked at comprehensively strategically and not just in financial terms. Why are some industrial enterprises more efficient than others? What methods and procedures are applied by more efficient companies? The answers to these questions can be found in our paper.

1. Literature Review
1.1 Common Information and Management Tools and Concepts in Strategic Business Performance Management

Rigby and Bilodeau of the company Bain & Company based in Boston, has carried out an extensive global research on the use of the most famous models and corporate performance management methods for nearly 20 years. Since 1993, each time with a pause of several years, the company examines a selection of 25 most advanced models and concepts in the field. The most recent research was conducted in 2011 on a sample of 1,230 companies from various industry segments from all over the world (Europe, Asia, North America, and Latin America). Their database, since starting the research in 1993 up to 2011, includes a sample of 11,163 companies in total. One of the conclusions of studies is that according to the

most recent data (2008–2010), the concept of BSC (Balanced Scorecard) is always in the top ten most used models and up to about 50% of the surveyed companies use this tool regularly in their practice. The research also shows that these companies are highly satisfied with the tool (Rigby & Bilodeau, 2011). Table 1 presents the world's ten most commonly used methods of business performance management of the last 20 years as found by the cited study. As seen in Tab. 1, the most recent studies (2008 and 2010) show that six most commonly used methods in the world are **Benchmarking**, which is used by about 2/3 (67%) of the surveyed businesses,

then **Strategic Planning**, **Mission and Vision Statement**, **CRM**, **Outsourcing** and **BSC**. In addition to the most common methods and concepts, businesses were found to often use other tools originating in strategic management such as *Change Management Programs*, *Mergers & Acquisitions*, *Core Competencies*, *Strategic Alliances*, *Customer Segmentation*. In 2013, the authors Rigby and Bilodeau added three more modern enterprise performance management tools, which are used more and more and these include *Zero Based Budgeting, Employee Engagement Surveys* and *Big Data Analytics* (Rigby & Bilodeau, 2013).

Tab. 1: **Top 10 most frequently used methods and management models in the world in the past twenty years**

1993	%	2000	%	2008	%	2010	%
Mission & Vision Stat.	88	Strategic Planning	76	Benchmarking	76	Benchmarking	67
Customer Satisfaction	86	Mission & Vision Stat.	70	Strategic Planning	67	Strategic Planning	65
TQM	72	Benchmarking	69	Mission and Vision Stat.	65	Mission and Vision Stat.	63
Competitor Profiling	71	Outsourcing	63	CRM	63	CRM	58
Benchmarking	70	Customer Satisfaction	60	Outsourcing	63	Outsourcing	55
Pay-for-Performance	70	Growth Strategies	55	Balanced scorecard	53	Balanced scorecard	47
Reengineering	67	Strategic Alliances	53	Customer Segmentation	53	Change Manag. Prog.	46
Strategic Alliances	62	Pay-for-Performance	52	Business Process reeng.	50	Core Competencies	46
Cycle Time Reduction	55	Customer Segment.	51	Core Competencies	48	Strategic Alliances	45
Self-Directed Teams	55	Core Competencies	48	Mergers & Acquisitions	46	Customer Segment.	42

Source: Rigby & Bilodeau (2011)

1.2 Strategic Planning and Its Impact on Business Performance

The global economy is forcing manufacturers to actively use modern management concepts and methods which would increase EVA (Rajnoha & Dobrovič, 2011). Nowadays, corporate management is in a development stage in which **strategically oriented management** dominates both the theory and practice (Rajnoha, 2010). In terms of a long-term strategic planning, business growth may consider different types of growth strategies – both internal and external. **External growth** describes joining of businesses, most commonly in the form of *Strategic Mergers & Acquisitions* or *Strategic Alliances*. In the past twenty years, external growth has been strongly preferred over internal growth. The research shows that there is a significant positive correlation between growth and diversification based on company mergers and strategic long-term performance of the merger. On the other hand, a merger has a significantly

negative effect on the short-term and medium-term performance with an average of 18% reduction in shareholder wealth, 9% decrease in the value of the company and a significant decrease in operating cash flow, up to over three years after the merger (Megginson, Morgan & Nail, 2004). Overtime, the positive effect of diversification and acquisitions on the overall economic performance prevails in the end (Graham, Lemmon & Wolf, 2002). A recent study conducted in Malaysia studied accounting and financial performance parameters of selected firms and compared them with companies that have been involved in mergers and acquisitions. Tools such as ROE, EPS, dividend and P/E ratio were used as economic performance indicators for a period of two years. The study shows that there are no statistically significant differences in business performance of the companies involved in the strategy of internal growth and companies, which focused on strategic external growth through mergers and acquisitions (Marimuthu, 2008).

Other empirical studies conducted around the world in recent years have also confirmed the relationship between strategic planning and business performance (Rudd, Greenley, Beatson & Lings, 2008). According to such studies, we can conclude that strategic planning has a positive effect on the business performance of the firm, irrespective of the sector in which it operates (Andersen, 2000). Another interesting empirical study was conducted by Spanish researchers who have recently studied the *Strategic Performance Management System* – SPMS and its effect on the firm's performance in terms of strategic planning and strategic decision-making. The study shows evidence of a positive correlation between SPMS and firm's performance in a highly dynamic environment (Bisbe & Malagueño, 2012). Similar research conducted in Spain also focused on the relation between the use of SPMS and the quality of strategic planning. The empirical data was acquired from a sample of 349 middle and large companies and the results also confirm a positive correlation between the use of SPMS and the quality of the strategic planning and the firm's decision-making (Gimbert, Bisbe & Mendoza, 2010). However, SPMS is also criticized for a number of reasons, such as the promotion of inappropriate behaviour of managers, suppression of innovation and learning, etc. (Micheli & Manzoni, 2010). Another important research in this area focuses on the examination of a strategic planning process and its link to corporate performance in highly turbulent and unstable environments. The authors conclude that strategic planning has the potential to have a positive effect on firm's performance in a highly unstable environment and strategic planning is thus an important added value for the company in terms of its higher performance (Brews & Purohit, 2007). Bento (2014) shows that IT variables, combined with system variables and organizational variables, have a significant relationship with the SPMS impact on business results across industries, geographical locations and organizational sizes (Bento, Bento & White, 2014).

In domestic conditions of Slovakia or Czech Republic have been also addressed several research of this issue in the recent past, there may be mentioned e.g. research of the SPSM and BSC methodology application in business practice. Author Gavurová presents the results of the first exhaustive survey in Slovak firms implementing BSC (Gavurová, 2011). Further research was conducted recently, which as a result brought the List of potential benefits of the balanced scorecard methodology in practice. The 20 potential benefits were grouped by their contents into four main areas, in the area of strategy and goals, corporate culture, human research management and **company performance management** (Antošová, Mihalčová & Csikosová, 2014). Important will be also its implementation, as evidenced by the results of such research in Slovakia, implementation of the BSC system only through the software solutions can lead to a false understanding of the meaning of BSC by managers, which is also a common reason for failure to implementation of this system (Šoltés & Gavurová, 2015). Other similar research based on a questionnaire survey obtained from the 91 companies from Czech Republic. This is one of the few studies which investigate the **relationship between management tools and techniques and organizational performance**. The study indicates that there is a positive significant relationship between management tools and techniques utilization and organizational performance (Afonina, 2015). Most of the above progressive methods of modern business performance management shares a strong strategic orientation of management focused on further strategic growth and business development with parallel use of information and all highly sophisticated knowledge resulting from modern enterprise information technology such as Business Intelligence, or the latest Big Data Analytics (Rajnoha & Lorincová, 2015). The importance of these problems has significantly increased during the economic crisis, because many enterprises in the world reduced their performance (Novák & Popesko, 2014). We can thus conclude from the previous research that a frequent use of SPMS can be reflected in a more complex and detailed system of strategic planning which in turn helps firms achieve higher effectivity. We can also claim that strategic planning is an integral part of strategic performance management system – SPMS.

As already stated in the introduction to this chapter (see Table 1), benchmarking has become the globally most commonly used method for company management and its

performance in the past few years (Rigby & Bilodeau, 2011). **Benchmarking** is widely recognized as a very effective tool enabling a significant increase in the performance and competitiveness of businesses (Knápková, Pavelková & Jirčíková, 2010). Depending on whether the process involves a comparison within the internal structure of the company or a comparison with other companies, benchmarking can be further distinguished as:

- **Performance benchmarking** – Focuses on the performance of the company and its comparison with the best companies based on selected performance parameters.
- **Process benchmarking** – Measures and compares the performance of individual processes and then also compares them with other companies and their processes. The performance measurement process is the basis and prerequisite for continuous improvement of processes (Tuček, Hájková & Tučková, 2013).

All of the types of benchmarking can be utilised for the purposes of strategic business performance management, but the *external – competitive and performance-based benchmarking* are especially suitable for this purpose. Corporate performance is measured in relation to the highest-performing companies of the industry and measures the achieved parameters of strategic or financial performance

(Shetty, 1993). A research study conducted in North America brought on interesting results concerning benchmarking and key relationships to emulating competitive strategies, searching for new competitive advantages, innovation, knowledge-based management and organisational learning (Drew, 1997). According to another study, competitive benchmarking can help successfully create and develop company strategy and competitive strategy designed for its particular areas of business (Chenhall & Langfield, 1998).

1.3 Strategic Controlling and Information Support Based on Business Intelligence

Another crucial part helping the company reach its goals is the **strategic controlling** which integrates the process of business information, business process analysis, business plan creation and control of their fulfilment. The fulfilment of the strategic objectives of the enterprise demands a more comprehensive analysis of the results achieved by the company than required by a simple control over implementation of the annual plan. In particular, this approach requires a wider spectrum of information (Rajnoha, 2010). The system of information building on the basis of the concepts of controlling should be oriented not only operationally but also strategically and

Fig. 1:	Components of the controlling information database

| Strategic oriented controlling information database |
|---|
| ■ Early Warning System |
| ■ Internal analysis (value chain analysis, business portfolio, strengths and weaknesses, etc.). |
| ■ External analysis of the company environment |
| **Operative oriented controlling information database** |
| ■ Basic Accounting System – operative accounts of production, purchasing etc. |
| ■ Basic accounting systems – financial accounting |
| ■ Basic accounting systems – cost accounting (cost calculation species centres and carriers) |
| ■ Activity Based Costing – ABC method |
| ■ Management accounting and diverse management calculations tools |
| ■ KPIs – Key indicators and a system of indicators |
| ■ Reporting and reporting systems |
| ■ Management Information Systems – MIS, EIS, BI |

Source: Eschenbach (2000)

should contain at least the following elements – see Figure 1 (Eschenbach, 2000). The main information objective of controlling is to ensure the required knowledge based on management accounting as a vital resource of information for management. It is therefore important to stress that controlling does not aim to provide information for all ERP IS in their broadest sense, but rather provides information (IS) for the management and business consultancy (MIS – Management Information Systems, EIS – Executive Information System, CIS – Controlling Information System based on BI).

An effective BI system not only reduces the time used for decision-making by improving various information processes and information quality, but at the same time helps to increase the quality of strategic and operative planning (Singh & Samalia, 2014). BI systems have the potential to maximize the use of information by improving the company's capacity to structure a large volume of information and make it accessible, thereby creating a competitive advantage (Petrini & Pozzebon, 2009). At present, information is becoming one of the factors of production enterprises and therefore the enterprise's information system is a key factor in business competitiveness (Frankovský, Štefko & Baumgartner, 2006). These solutions for decision-making support are based on the Integrated MIS, including specialized BI modules which are aimed to provide support in the decision-making process

of the management (Tutunea & Rus, 2012). BI is a System that turns data into information and then into knowledge, thereby adding substantial value to firm's decision-making processes (Singh & Samalia, 2014). BI is defined as a system which collects, transforms and presents structured data from multiple sources. BI is a technique and a solution that helps managers to understand the economic situation of the firm (Nofal & Yusof, 2013). Among the most sophisticated applications of BI are: statistical analysis and data mining which involve mathematical and statistical analysis of data for correlation, trend analysis, hypothesis testing and predictive analysis (Cheng, Lu & Sheu, 2009). BI performs various operations facilitating creation, modification and distribution of standard reports, analysing the data, data relationships and trends with help of relevant methodologies to draw conclusions, this process can drive revenue growth and improve operational efficiency within the organization (Nofal & Yusof, 2013). BI has been implemented in various industries. Companies such as Continental Airlines and First American Corporation have successfully implemented BI to improve their customer loyalty and increase their Return on investments (Ramakrishnan, Jones & Sidorova, 2012). Business intelligence models are also useful in hedging financial risks by incorporating market risks, credit risks and operational risks (Dash, Chen & Olson, 2014). Management is now constantly

Fig. 2:   **Advanced enterprise information systems ERP II – Business Intelligence**
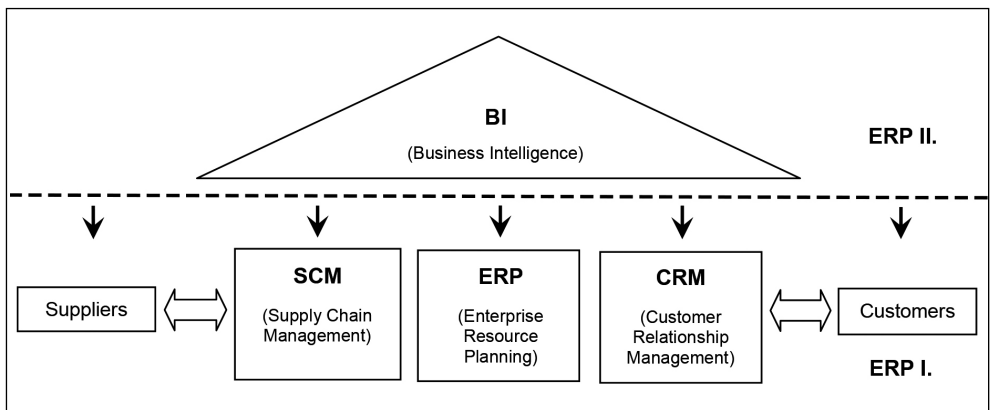
Source: Basl & Blažíček (2008)

being forced to look for other necessary information mainly on future developments. This task has most recently been fulfilled by the business information systems ERP – of the II. development type (Basl & Blažíček, 2008). Its role is to plan and simulate different scenarios of company growth in the future based on the sophisticated information system IS / BI – **Business Intelligence** (See Fig. 2).

In Figure 2, we see the thick dotted line defining the area of Business Intelligence, which represents the basis for the ERP II. The information systems **SCM/CRM** remain disputed in terms of their classification, some authors still affiliate them with the IS ERP I., i.e. the base layer IS in the enterprise and to other superstructure type IS ERP II., and therefore to management and controlling information system of business intelligence. Typical BI application scopes include: ERP, CRM, HRM (Human Resource Management), SCM and E-business (Li, Shue & Lee, 2008). Nowadays, information and knowledge represent the fundamental wealth of an organization. Enterprises try to utilize this wealth to gain competitive advantage when making important decisions. Enterprise software and information systems include ERP, CRM, and SCM systems. These systems convert and store the data in their databases; therefore, they can be used as a pool of data to support decisions and explore applicable knowledge. BI can be embedded in these enterprise systems to obtain this competitive advantage (Ghazanfari, Jafari & Rouhani, 2011). In today's competitive environment within the context of complex BI and ERP, these systems have become key strategic tools which directly influence the success of any project implementation. But little attention has been given for the integration of BI and ERP (Nofal & Yusof, 2013). It is important to note that BI systems are technology only until they are seamlessly integrated into the business thinking by top management. To be effective enterprise wide, the BI implementation shall be driven by top management – EIS (Singh & Samalia, 2014). Other researchers develop a new measure that is based on understanding of the characteristics of BI systems in a process-oriented framework. They then employ the measure in an examination of the relationship between the business process performance and organizational performance, finding significant differences in the strength of the relationship between industry sectors (Elbashir, Collier & Davern, 2008).

Most recently, enterprises begin to utilise a new information technology called **Big Data Analytics,** which aims to quickly identify previously undiscovered correlations and connections in data and provides this piece of information with a higher value-added and knowledge to help the decision-making process for managers. **Big Data Analytics – Business Intelligence – Data mining** – enables rapid extraction, transformation, recording, search, analysis and sharing the massive data files, namely in which it analyses the big integrated real-time databases. Big Data Analytics IT aims to quickly identify the previously undiscovered correlations and connections in the data, which would improve the decision-making for managers in the firm. BI and Big Data Analytics IT allows to analyse different types of data (structured, semi-structured and unstructured) located in different sources of information (internal, external), or Data Warehouses (DW). Based on predictions made by the authors Rigby and Bilodeau (2013), this concept was planned to be utilised by up to 42% firms out of the total sample of surveyed enterprises in the year 2013.

The BI Management IS can be implemented in the enterprise, similarly to basic IS ERP, via **Outsourcing**. Since in the case of BI IS the sensitivity of the data is often a concern and information on the company and its processes could be exploited by competitors, outsourcing is used less frequently. Currently, outsourcing is being replaced by an alternative technology, so called **Cloud Computing** thanks to its cost efficiency and flexibility. The current research in the computer systems and Information technology supporting data encryption could eventually predetermine Cloud Computing as the more effective solution in terms of effective application of controlling information support based Business Intelligence to Enterprise (Baars & Kemper, 2010; Chen, Chiang & Storey, 2012; Chow & Golle, 2009; Ramgovind, Eloff & Smith, 2010). Yet, in the very recent years, a new trend has emerged: BI applications no longer limit their analysis to the data inside one company. Increasingly, they also source their data from the outside. In parallel to the move of data from the Web into BI applications, we are now assisting to the move of BI applications from company-internal information systems to the Web: BI as

a service (e.g., hosted BI platforms for small and medium-sized companies) is the target of huge investments and the focus of large research efforts by industry. The idea is the one of outsourcing processing and analysis of large bodies of data and consuming BI from the cloud (Mazón, Garrigós, Daniel & Trujillo, 2012). Top management of companies of all sizes has in the last two decades struggled with a paradigm shift in the approach to strategic management. The main reason for these changes is the increased volatility and turbulence in the market, which is a result of globalization and technological progress. In order to manage the change in the competitive environment of the organization, we may utilise **Competitive Intelligence** (CI) IS as an extension of the information system part of a comprehensive CRM and BI (Molnár & Střelka, 2012).

2. Objectives, Data Collection and Methodology

The main objective of our research is to analyse the extent to which companies use traditional as well as modern indicators, methods and models of management strategic business performance on a randomly selected sample of companies of various industries in Slovakia (in particular wood processing, engineering and automotive industry, but also electro technical, construction, pulp and paper industry), to use relevant statistical methods to identify the causal links and to determine the impact on the achieved economic performance of the firms. Based on the results of causal analysis to identify the critical tools of strategic performance management system, that have a significant impact on overall economic performance of industrial company.

As is shown from research carried out at home and in the world (see Chapter 1), SPMS has a clear impact on the overall business performance. Already here we can push the limits of knowledge, which even in the recent past have been reputable view that overall business performance is primarily the result only of financial management. However, individual studies are not consistent in how the SPMS should look like, what tools and methods should be certainly applied and which have higher priority and have a significant impact on overall performance. Previously known findings indicate that one of the most dominant instruments seems the BSC system. However,

we think that if this is not carried out through high quality and sophisticated information support of knowledge-based information system of BI type, the SPMS system itself can not sufficiently bring the enough good results in managing of overall business performance. Only the establishment of these SPMS methods is not sufficient unless it is also accompanied by knowledge and information support of BI type. Based on this, our next goal was to confirm or deny mentioned; and to draw attention the scientific and professional community to obtained achievements.

The objectives mentioned above we tried to implement in the context of extensive research and we have formulated the following research hypotheses:

H 1: We assume that the use of sophisticated knowledge-based information systems leads to better business performance. We claim that if companies only use the basic IS ERP, they achieve lower performance compared to enterprises using a managerial IS (e.g. Business intelligence) or a EIS for the top strategic management of the company.

H 2: Another assumption related to the information software tool for strategic measurement and management of corporate performance is that companies with a higher value of Return on equity (ROE) clearly use specialized MIS or knowledge-based BI IS.

H 3: The implementation of BI IS, or a firm aiming to implement BI in the near future, has a positive impact on the firm's higher performance compared to enterprises that do not consider employing BI.

For the purposes of the currently presented research and in order to achieve the objectives set, we have decided to obtain the necessary data and information on the enterprises in Slovakia with the help of an extensive online questionnaire. In total 1,457 chosen businesses were asked to participate in the survey, representing selected industry segments in Slovakia.

Data about the primary database of 1,457 enterprises from selected industries of the Slovak Republic we received from information of various industrial associations and those we have subsequently supplemented by other companies on the basis of extensive online survey. The questionnaire was distributed in two consecutive rounds. First via e-mail (time for completion was two months, low latency

– there were completed only 45 research questionnaires), subsequently we are therefore used in the second round the form of telephone and the most common form of face-to-face interview (time for completion was next two months, there were filled other 119 research questionnaires). After these two consecutive rounds the questionnaires were correctly completed by 164 enterprises in the end. Relatively low return stemmed mainly from the reluctance of businesses, their negative mood and scepticism from economic development, lack of time, lack of interest and so on. Nevertheless, we consider the size of the research sample – 164 enterprises as being sufficiently representative and this is 11.26% share of the total number of companies surveyed.

Whereas for the data collection and completion of research questionnaires from businesses we used the online web form, after the conclusion of the two-round data collection it was possible to automatically generate a database of all data collected in the form of MS Excel, which was then imported to the software Statistica 10 CZ and Statistica 10 Data Mining for further mathematical and statistical processing of obtained data in form of secondary research.

For the statistical analysis of the impact of selected parameters on the performance of the company, respectively, the statistical methods of Correlation and Linear Regression were used. We examined the statistical relationships between the qualitative variables through Contingency. **The Pearson's Chi-square** is the most common test for significance of the relationship between categorical variables. This measure is based on the fact that we can compute the expected frequencies in a two-way table (i.e., frequencies that we would expect if there was no relationship between the variables). The Chi-square test becomes increasingly significant when the observations deviate further from expected pattern. Results of chi-squared tests describe selected statistics: Pearson's ch-square and significance p-value „p", Maximum-Likelihood chi-square and p-value, Pearson's contingency coefficient (CC), Adjusted contingency coefficient (Adj. CC) and degrees of freedom (df).

The results of the studied relationships for the individual sets of firms are presented in the following section which focuses on statistically significant dependencies as found by the chi-square test (p-value <0.05). The results of statistical indicators and pivot tables are also presented: the observed frequencies, expected frequencies and levels. It is evident from the results of the residues that certain logical connections can be seen and the relevant and scientifically sound conclusions can be made.

It should also be noted that our research utilised an important indicator ROE (Return on equity). Various companies were divided into several groups – categories based on the size of the ROE. We are aware that the ROE indicator is not the ideal indicator and the far better one would be i.e. Economic Value Added (EVA) indicator, but to determine it, it would be necessary to know the costs for the total equity of each of the firms and to find out its precise values, which we judged as unrealistic for the purposes of this project. To determine the actual size of ROE in each firm, a range of up to 6 possible answers was used:

- **ROE – 0**: negative value /ROE <0/;
- **ROE – 1**: positive value – ROE from 0% to 2%;
- **ROE – 2**: positive value – ROE from 2% to 4%;
- **ROE – 3**: positive value – ROE from 4% to 7%;
- **ROE – 4**: positive value – ROE from 7% to 10%;
- **ROE – 5**: positive value – ROE over 10%.

The questionnaire uses a scale rather than a specific ROE value because of the sensitivity of the information. A sufficient number of scales (6) allowed us to have a certain variability in the classification of the companies within individual categories in the subsequent mathematical and statistical research, in case it was required by the statistical method. In case of lower numbers, the six categories were narrowed down to three performance categories of enterprises when needed:

- **Inefficient firms** (ROE <0, positive value ROE – from 0% to 2%) – EVA is likely to be negative.
- **Businesses reaching average perfor-mance** (Positive value ROE – from 2% to 4%, a positive value ROE – from 4% to 7%) – EVA is likely to +/- 0 or slightly positive.
- **High performance firms** (Positive value ROE – from 7% to 10%, a positive value ROE – above 10%) – EVA is likely to be relatively highly positive.

Enterprises were therefore initially divided according to the economic performance into 6 groups (ROE of 0 to 5, the group of 0 – the lowest efficiency value with a negative ROE, Group 5 – the highest performance with the ROE above 10%). Due to a low number of companies, we encountered the problem of failing to fulfil the basic requirement of the minimum frequency in all pivot tables cells so we were forced to join some of the groups of the companies. The number of groups based on their performance was thus lowered to three in the first step, and later on to only two groups according to their ROE results, up to 4% (inefficient firms) and firms with ROE over 4% (efficient firms).

In order to **test the statistical hypotheses, the basic** (**zero**) **hypothesis H_0, an alternative hypothesis H_1 with a significance level α were formulated.** The level of significance was set as α = 0.05**.** The aim was to challenge the validity of the hypothesis H_0. The alternative hypothesis H_1 represented the opposite to the basic hypothesis. The decision to accept or eventually to reject the H_0 was carried out as follows:

- α < p H_0 cannot be rejected,
- α ≥ p H_0 is rejected in favour of H_1.

Null hypothesis – H_0: There is no correlation between the selected parameters of strategic performance management and the overall business performance.

Alternative hypothesis – H_1: There is a correlation between the selected parameters of strategic performance management and the overall business performance.

3. Research Results

The initial data set consisted of all the surveyed firms (164 enterprises), out of which we created sets specifically aimed at firms from the industries of wood processing, engineering and automotive industry. A separate set containing all the enterprises from the three industries was also studied. The final two sets are defined by their core business (focus) – manufacturing, the last set also includes enterprises of trade and services. Table 2 presents the data from the research sets.

In terms of size of company across the whole survey sample, the medium-sized (51–250 employees) and large enterprises (over 250 employees) formed 40.3% share. Small businesses (11–50 employees) accounted for 29.8% share. Micro sized to 10 employees accounted for 29.9% share of the survey sample. From that perspective the research sample was balanced and contained uniform representation of all size categories.

The Table 3 presents the results of the usage of IS of the Business Intelligence type in the research set of all enterprises (N = 164).

The introduction or the **use of BI IS** (Tab. 3) **was observed in only 11 (7%)** of 164 surveyed enterprises. The results show that especially in the higher performance groups ROE 3–5 (with ROE over 4%) the implementation of the system of BI type has a positive impact on higher performance. 71% of enterprises have not considered introducing the BI system yet. These firms were mostly represented in the lower performance groups ROE 1 and 2 (with ROE 0–4%). The results confirm previous findings that a quality BI IS based on information

Tab. 2:	Basic data on the data sets analysed	
Set	**The industry focus**	**Totals**
Set 1	All industries	164 firms
Set 2	Wood Processing Industry	34 firms
Set 3	Mechanical engineering	30 firms
Set 4	Automotive industry	16 firms
Set 5	Selected industries (Wood processing industry, Engineering, Automotive)	80 firms
Set 6	Production companies	106 firms
Set 7	Trade and Services	58 firms

Source: own

Tab. 3:	Frequency response: The use / introduction of BI

The use of BI	ROE – 0	ROE – 1	ROE – 2	ROE – 3	ROE – 4	ROE – 5	Row totals
We do not consider this option	19	37	26	15	8	12	**117**
	11.59%	22.56%	15.85%	9.15%	4.88%	7.32%	**71.34%**
We consider it long-term	3	8	4	7	1	3	**26**
	1.83%	4.88%	2.44%	4.27%	0.61%	1.83%	**15.85%**
We consider it in the near future	3	1	4	1	0	1	**10**
	1.83%	0.61%	2.44%	0.61%	0.00%	0.61%	**6.10%**
It is currently in use in the company	0	1	1	3	3	3	**11**
	0.00%	0.61%	0.61%	1.83%	1.83%	1.83%	**6.71%**
Total	**25**	**47**	**35**	**26**	**12**	**19**	**164**
The relative share	15.24%	28.66%	21.34%	15.85%	7.32%	11.59%	**100%**

Source: own

and knowledge with a high added value has a positive long-term effect on the business performance of the company.

We analyze this phenomenon more deeply, along with other selected tools and concepts of strategic business performance management, not only from the quantitative point of view – analysing the frequency of their use in the firms, but also from the qualitative point of view – namely firms' satisfaction with their use. The comprehensive results of satisfaction with the individual concepts and tools for systematic strategic enterprise performance management (as seen in Table 4 – the last three columns to the right) mostly show high levels of satisfaction, suggesting that once the company has introduced a concept, they consider it useful and they are relatively satisfied with it. The analysis of the frequency regarding use of the concepts, methods and tools for strategic management of business performance is based mostly on the data given in the first five columns of Table 4. The analysis shows that in a long-term perspective, companies most often use data mainly from financial accounting (the total as many as 86% of enterprises). The data taken from managerial accounting (47%) and quality management systems (45%) is also used quite intensely for more than 5 years. The concept of controlling is also relatively popular, as about 39% of companies reviewed use it and an additional 9% of companies plan to use it in the future. Other concepts and tools are used in very limited numbers.

The employment of the **basic information system ERP** affects the performance of the firm (Tab. 5). However, the residue levels (Tab. 6) lead us to the conclusion that companies using a basic ERP IS most often underperform and reach **a negative or very low ROE of levels below 2%.** This can be explained by weaker companies not utilising anything beyond the basic ERP system, such as the sophisticated MIS, EIS based BI which would utilise the data, information and knowledge from managerial accounting and controlling.

The BSC methodology has a demonstrable impact on the company's performance (Tab. 7). The residue levels (Tab. 8) show that by using this methodology, the firm can **reach above-average levels of ROE over 7%.** The firms that do not use the BSC methodology only achieve average or below-average results (ROE below 7%).

The application of the CRM was shown as statistically significant (Tab. 9), but residue levels (Tab. 10) show that companies that apply the system typically **achieve a lower performance level of only up to 2%.** This could be explained by the BI not being applied in the firm in a complex way as it was characterised in Chapter 1; the CRM by itself is unable to support a higher performance.

A deeper investigation into **the implementation of a knowledge-based information system BI** (not solely of the CRM), shows a statistically significant dependence (Tab. 11). Residue levels (Tab. 12) suggest that

Tab. 4: Frequency response: the use of selected concepts and tools for strategic business performance management

*Selected concepts and tools for strategic business performance management	We do not use it	We do not use it but we plan to	We have used it for <2 year	We have used it for 2-5 years	We have used it for > 5 years	We do not use it	We use it – low satisfaction	We use it – average satisfaction	We use it – high satisfaction
1 Financial indicators based on data from financial accounting	17	6	20	20	101	22	5	70	67
%	10.37	3.66	12.20	12.20	61.59	13.41	3.05	42.68	40.85
2 The outputs from managerial accounting	73	14	14	10	53	86	2	40	36
%	44.51	8.54	8.54	6.10	32.32	52.44	1.22	24.39	21.95
3 Controlling	85	15	16	13	35	100	3	30	31
%	51.83	9.15	9.76	7.93	21.34	60.98	1.83	18.29	18.90
4 Balanced Scorecard (BSC)	142	7	3	6	6	148	3	8	5
%	86.59	4.27	1.83	3.66	3.66	90.24	1.83	4.88	3.05
5 Economic Value Added (EVA)	123	7	12	8	14	128	3	15	18
%	75.00	4.27	7.32	4.88	8.54	78.05	1.83	9.15	10.98
6 ABC costing (Activity Based Costing)	116	11	6	7	24	125	1	18	20
%	70.73	6.71	3.66	4.27	14.63	76.22	61	10.98	12.20
7 Knowledge information system type BI (Business Intelligence)	134	18	3	4	5	152	0	7	5
%	81.71	10.98	1.83	2.44	3.05	92.68	0.00	4.27	3.05
8 Quality Management System	78	12	9	18	47	92	0	33	39
%	47.56	7.32	5.49	10.98	28.66	56.10	0.00	20.12	23.78
9 Lean and Kaizen management	144	4	6	5	5	147	1	8	8
%	87.80	2.44	3.66	3.05	3.05	89.63	61	4.88	4.88
10 The concept of CRM	142	8	5	4	5	149	2	10	3
%	86.59	4.88	3.05	2.44	3.05	90.85	1.22	6.10	1.83
11 The KPI (Key Performance Indicators)	129	7	4	12	12	135	0	15	14
%	78.66	4.27	2.44	7.32	7.32	8.32	00	9.15	8.54

Note: * Presented concepts were selected from a worldwide research in the area of application of various models and methods for the business performance managing, which had been realized by authors Rigby & Bilodeau (2013).

Source: own

Tab. 5: Pivot: set 1; ERP Basic Information System x Performance – Statistics

Statistics	Chi-squared	df	p
Pearson's chi-square	8.891276	df = 2	p = .01173
ML chi-square	9.075646	df = 2	p = .01070
Contingency coefficient (CC)	.2267752		
Cramer's V	.2328414		

Source: own

Tab. 6: Pivot: set 1; ERP Basic Information System x Performance – Frequency

The basic informati-on system ERP	Group 1 Poor performance (ROE <0, 0–2%)	Group 2 Medium perfor-mance (ROE 2–4%, 4–7%)	Group 3 High Performance (ROE 7–10%, above 10%)	Row totals
The observed frequency				
We do not use ERP	39	48	21	108
We use ERP	33	13	10	56
Total	72	61	31	164
Expected frequency				
We do not use ERP	47.41463	40.17073	20.41463	108.0000
We use ERP	24.58537	20.82927	10.58537	56.0000
Total	72.00000	61.00000	31.00000	164.0000
Observed minus the expected frequencies (residue)				
We do not use ERP	-8.41463	**7.82927**	**0.585366**	0.00
We use ERP	**8.41463**	-7.82927	-0.585366	0.00
Total	0.00000	0.00000	0.000000	0.00

Source: own

Tab. 7: Pivot: set 1; BSC methodology x Performance – Statistics

Statistics	Chi-squared	df	p
Pearson's chi-square	12.78406	df = 2	p = .00167
ML chi-square	10.11521	df = 2	p = .00636
Contingency coefficient (CC)	.2689137		
Cramer's V	.2791981		

Source: own

if companies do not have a complex BI system in place and do not consider implementing it, the companies tend to reach a lower performance. On the other hand, the firms that currently use a BI system achieve a **higher performance, with ROE over 4%.** However, this conclusion can be considered as statistically significant only when the selected firms are classified into two groups based on their economic performance (low-performing and high-performing).

3.1 Sectoral Benchmarking – Selected Research Results

The previously presented results were further studied from the point of view of the individual industry segments – i.e. sectoral benchmarking.

However, the analysis carried out on each of the sets of businesses within the segments did not reveal similar statistically significant relationships.

This section discusses some of the results of the **wood processing industry** and **automotive industry**. For example, the analysis of the wood processing enterprises (Tab. 13) shows that out of the total sample of 34 firms surveyed, not one of them uses knowledge-based information systems of the BI type, only 8 firms consider introducing BI in the longer run and 26 companies do not consider employing it at all. A similar was applied within the BSC methodology, which is used by a single wood processing firm and the one with foreign capital only.

Tab. 8: **Pivot: set 1; BSC methodology x Performance – Frequency**

BSC methodology	Group 1 Poor performance (ROE <0, 0–2%)	Group 2 Medium perfor- mance (ROE 2–4%, 4–7%)	Group 3 High Performance (ROE 7–10%, above 10%)	Row totals
The observed frequency				
BSC is not used	68	58	23	149
BSC is used	4	3	8	15
Total	72	61	31	164
Expected frequency				
BSC is not used	65.41463	55.42073	28.16463	149.0000
BSC is used	6.58537	5.57927	2.83537	15.0000
Total	72.00000	61.00000	31.00000	164.0000
Observed minus the expected frequencies (residue)				
BSC is not used	**2.58537**	**2.57927**	-5.16463	0.00
BSC is used	-2.58537	-2.57927	**5.16463**	0.00
Total	0.00000	0.00000	0.00000	0.00

Source: own

Tab. 9: **Pivot: set 1; CRM Information System x Performance – Statistics**

Statistics	Chi-squared	df	p
Pearson's chi-square	5.841069	df = 2	p = .05390
ML chi-square	8.120028	df = 2	p = .01725
Contingency coefficient (CC)	.1854491		
Cramer's V	.1887227		

Source: own

The comparative analysis in the automotive industry shows the results of the chi-square test with a value of p > 0.05, therefore the contingent factors or levels of residues were not further investigated. Even though a statistically significant correlation between the economic performance and the selected parameters was not found, some conclusions can still be made on the basis of **average values of performance** as measured by ROE (Tab. 14).

The analysis of use of the BSC shows that the businesses that use it outperform other firms, more specifically:

- In terms of operational management of performance within a span of one year (response 2).

- In a complex, systematic way on a regular basis for the purposes of management of operational and strategic performance (response 4).

This may indicate that the BSC methodology tends to be used in companies with above-average performance, but may not always be applied in a complex way. When using the knowledge-based information system of the BI type, the firms show an above-average performance, while companies without BI, on average, show lower performance values (Tab. 14).

Tab. 10: Pivot: set 1; CRM Information System x performance – Frequency

CRM system	Group 1 Poor performance (ROE <0, 0–2%)	Group 2 Medium performance (ROE 2–4%, 4–7%)	Group 3 High performance (ROE 7–10%, above 10%)	Row totals
The observed frequency				
Firm does not use CRM	62	57	31	150
Firm uses CRM	10	4	0	14
Total	72	61	31	164
Expected frequency				
Firm does not use CRM	65.85366	55.79268	28.35366	150.0000
Firm uses CRM	6.14634	5.20732	2.64634	14.0000
Total	72.00000	61.00000	31.00000	164.0000
Observed minus the expected frequencies (residue)				
Firm does not use CRM	-3.85366	**1.20732**	**2.64634**	0.00
Firm uses CRM	**3.85366**	-1.20732	-2.64634	0.00
Total	0.00000	0.00000	0.00000	0.00

Source: own

Tab. 11: Pivot: set 1; The introduction of BI x Performance – Statistics

Statistics	Chi-squared	df	p
Pearson's chi-square	13.56747	df = 3	p = .00356
ML chi-square	13.22566	df = 3	p = .00417
Phi coefficient for tables 2 x 2	.2876256		
Contingency coefficient (CC)	.2764190		

Source: own

4. Discussion

Based on the results presented in the previous chapter, the following conclusions are reached for the hypotheses formulated at the beginning of this research.

- **H 1: H$_0$ is rejected in favour of H$_1$** for companies using basic ERP and Management IS, as these were shown to influence the firm's performance. The results show that companies which use **MIS** most often achieve **average and above-average levels of economic performance** (with almost balanced representation of the performance groups 2, 3 and 4). The firms which only use the **basic ERP** typically underperform, with the levels of **ROE being negative or very low up to 2%.** This

finding shows that the implementation of the basic ERP within an enterprise should be further supported by the implementation and development of an MIS.

- **H 2: H$_0$ was rejected in favour of H$_1$** for companies using specialized information systems of the MIS and BI type, which had an impact on the performance. The businesses that use **MIS typically achieve ROE which is within the range of 2–10%** (no matter the classification according to performance), the businesses using a **Knowledge-based Information System of the BI type** most often achieve **ROE of 4%.** This finding shows that the implementation of MIS must be further supported by the implementation

Tab. 12: Pivot: set 1; The introduction of BI x Performance – Frequency

The introduction of a comprehensive system of business intelligence (BI)	Group 1 Inefficient firms (ROE <0, 0–2%, 2–4%)	Group 2 High performance firms (ROE 4–7%, 7–10%, above 10%)	Row totals
The observed frequency			
We do not consider it	82	35	117
We consider it long-term	15	11	26
We consider it in the near future	8	2	10
The firm already uses it	2	9	11
Total	107	57	164
Expected frequency			
We do not consider it	76.3354	40.66463	117.0000
We consider it long-term	16.9634	9.03659	26.0000
We consider it in the near future	6.5244	3.47561	10.0000
The firm already uses it	7.1768	3.82317	11.0000
Total	107.0000	57.00000	164.0000
Observed minus the expected frequencies (residue)			
We do not consider it	**5.66463**	-5.66463	0.00
We consider it long-term	-1.96341	1.96341	0.00
We consider it in the near future	1.47561	-1.47561	0.00
The firm already uses it	-5.17683	**5.17683**	0.00
Total	0.00000	0.00000	0.00

Source: own

Tab. 13: Frequency: The use / introduction of BI in wood processing enterprises

The use of BI	ROE – 0	ROE – 1	ROE – 2	ROE – 3	ROE – 5	Row totals
We do not consider it at all	6	8	7	1	4	**26**
	17.65%	23.53%	20.59%	2.94%	11.76%	**76.47%**
We consider it in long-term	2	3	1	2	0	**8**
	5.88%	8.82%	2.94%	5.88%	00	**23.53%**
Total number	**8**	**11**	**8**	**3**	**4**	**34**
The relative share	23.53%	32.35%	23.53%	8.82%	11.76%	**100.00%**

Source: own

and development of a sophisticated knowledge-based information system of the BI type.

H 3: H$_0$ was rejected in favour of H$_1$. The use of a knowledge-based Information

System of the BI type was found to have a positive impact on the performance of the firm. The analysis shows that there are two categories of companies – companies that use a BI system which achieve ROE

Tab. 14: Average performance categories – set 4: Automotive industry

The way of using the BSC methodology						
Answers*	0	1	2	3	4	All Categories:
Average ROE	2.636%	0.000%	4.000%	2.500%	5.000%	2.938%
Multiplicity	11	0	2	2	1	16
Use of IS of BI type						
Answers	We do not use an IS of BI type		We use an IS of BI type			All Categories:
Average ROE	2.583%		4.000%			2.938%
Multiplicity	12		4			16

Note: *Response: 0 – We do not employ the BSC in our company, 1 – The BSC is used in irregular reporting of selected indicators of business performance, 2 – The method is mostly used in the operative management of business performance in the timespan of one year, 3 – The BSC is primarily used to implement corporate strategies, 4 – The BSC is used in a complex, systematic way on a regular basis for the purposes of management of operational and strategic performance.

Source: own

of over 4%, and businesses that do not even consider the implementation of an IS and whose economic performance is lower, as shown by ROE below 4%.

The results also point to the overall conclusion that the companies from the selected economic industrial segments in Slovakia, which show above-average business performance, have a strong focus on the systematic management of its strategic performance by applying modern management concepts and methods. Based on our research, we have shown that **the key tool in increasing the overall performance of the enterprise in the selected Slovak industries seems to be employing a system of strategic performance management of the firm, supported by a knowledge-based Business Intelligence Information System.** However, the currently presented research show that the positive impact on the overall economic performance of the firm can only occur when other methods and tools for strategic management of economic performance, such as information from management accounting and controlling and BSC, are also employed.

Demonstration and a relatively precise quantification of the impact of financial indicators for the firm's economic performance is a fairly well-explored topic both in theory and practice of business administration and management. However, identifying and quantifying the impact of strategic, qualitative and non-financial management indicators and methods on the

business performance so far seems to be an issue that deserves additional attention and research. As it is clear from the results of our research, traditional business management based on financial performance only must be confronted with the strategic performance management methods and concepts and with simultaneous use of the knowledge-based Business Intelligence Information Systems as soon as possible. The firms from the selected industries of Slovakia, which not only use information and traditional financial accounting indicators in their management, but also employ other information outputs from management accounting, controlling, strategy-oriented BSC along with the BI IS, show above-average economic results. This argument was shown as statistically significant for the sample of the Slovak firms from the selected industries which were surveyed in this study.

On the other hand, we realize that the results of our research are far from definitive. Therefore, we continue in our research even further in an effort to bring more relevant results that would more significantly and more credibly confirm the impact of strategic management and its knowledge information support based on Business Intelligence on overall business performance.

With the currently presented issue, we enter an area of research which is not as clearly defined as it was in the case of traditional financially-oriented approach to measuring and managing corporate performance which

prevailed in the past. Nevertheless, we define our core research hypothesis which states that many of the non-financial, strategic and qualitative indicators and methods applied in management have an impact on the overall performance of the enterprise that can be measured, and despite the complexity of the issue can be sufficiently defined. Based on this assumption, the main objective of the research was set. Its aim was to investigate the presented issue and will hopefully bring in new previously unexplored findings to the strategic management of business performance.

The significance of achieved results in our research is confirmed by the fact that in our research sample was located only 40.3% of medium and large enterprises. It is generally argued that the information systems of Business Intelligence type are primarily a matter for large companies that can afford to such systems, considerable funding. From our research, however, further research hypothesis is formed for the future, consisting from the fact that the knowledge information support of BI type is already not just a matter of big companies. Therefore, we suggest for future research to focus on these aspects specifically from the viewpoint of individual size categories of companies.

It is also important to note that the SPMS and quantification of the effect on overall business performance is multiple more complex issue as opposed to a purely financial point of view to management of corporate performance. This was also confirmed by research in given area at home and in the world, which we extensively presented in Chapter 1 of this article. Although individual studies confirm the positive effect of the SPMS on the overall performance of enterprise, however, individual authors differ in the very structure of the SPMS as well as in the significance of various methods included in this system and also in the amount of their impact on the overall performance of the company. However, we mean that it is natural and logical, opposite to only traditional financial view to performance management, the SPMS is much more demanding and complex issue and until further research can bring even clearer results. It is also appreciated that relevance of achieved findings is and likely always will be affected by the overall economic development when the research being carried out, furthermore by the size and quality of the research sample, or

a parameter that is set in research to assess the overall economic performance of the company. We have determined in the research a parameter ROE, but there are offered other relevant performance parameters in the future, such as EVA, EBIT, EBITDA, etc., because each of the performance parameters may react differently with the use of individual methods included in SPMS. In case of specific conditions of Slovakia or Czech Republic, there is also additionally another significant factor and that is the massive share of foreign multinational enterprises (MNEs) operating in these countries. With this fact is closely related issue of transfer pricing of outputs within the group of MNE, what consequently impacts the financial (accounting) performance of the company acting in the territory of Slovakia or the Czech Republic and included in MNE group. To this specific but important issue from the perspective of business performance we have discussed in other articles.

Conclusion

SPMS is now relatively more complex problem than in the past with traditional financial management of business performance. The results of our research also presented in this article demonstrate several important facts. Individual parts of research confirm the positive impact of SPMS on the overall economic performance of the company, but individual writers at home and around the world differ in the very structure of the SPMS as well as in the significance of various methods included in this system and also in the size of their impact on the economic performance. On this basis, companies should begin to apply the SPMS to their management practices as soon as possible. Problematic, however, remains the overall structure of methods, tools and models that the SPMS should have implemented in a particular company in order to reach a higher overall economic performance of the company. The BSC appears to be an inseparable part of the SPMS. However, as is clear also from the results of our research, this must be supported stronger by application of knowledge BI information system. It seems that it is just the set of information tools from ERP to knowledge information systems like BI, which gives to methods and tools included in the SPMS a particular "spirit" and encouraging them dynamically towards achieving a higher

economic performance of the company. Based on our research, we have shown that the key tool in increasing the overall economic performance of the enterprise in the selected Slovak industries seems to be employing a system of strategic performance management of the firm, supported by a knowledge-based Business Intelligence Information System.

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Abstract

BUSINESS INTELLIGENCE AS A KEY INFORMATION AND KNOWLEDGE TOOL FOR STRATEGIC BUSINESS PERFORMANCE MANAGEMENT

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The indicators, methods and models applied in performance management in the past were largely based on financial indicators and financial management methods. Of course, we do not claim that financial indicators are not currently necessary or relevant, but as the business results showed, the management based only on the financial statements is no longer enough. The paper focuses on the presentation of selected research results related to strategic business performance management. With the currently presented issue, we enter an area of research which is not as clearly defined as it was in the case of a traditional financially oriented approach to measuring and managing corporate performance which prevailed in the past. The aim of the paper is to analyse and synthetize findings regarding the chosen, mainly not traditional methods and models, which have started to be used for strategic business performance management. The results of our empirical scientific study provide interesting and valuable findings that the overall performance of industrial enterprises in Slovakia is to be looked at comprehensively strategically and not just in financial terms. Why are some industrial enterprises more efficient than others? What methods and procedures are applied by more efficient companies? The answers to these questions can be found in our paper. We recommend industry enterprises to apply selected methods and models of strategic business performance management. The key tool in increasing the overall performance of the enterprise in the selected Slovak industries seems to be employing a system of strategic performance management, supported by a knowledge-based Business Intelligence Information System.