Science Journal of Business and Management
2015; 3(1-1): 18-24
Published online December 26, 2014 (http://www.sciencepublishinggroup.com/j/sjbm)
doi: 10.11648/j.sjbm.s.2015030101.14
ISSN: 2331-0626 (Print); ISSN: 2331-0634 (Online)

Creating new types of business and economic indicators using big data technologies

Péter Szármes

Multidisciplinary Doctoral School of Engineering Sciences, Széchenyi István University, Györ, Hungary

Email address:
peter.szarmes@sze.hu

To cite this article:
Péter Szármes. Creating New Types of Business and Economic Indicators Using Big Data Technologies. *Science Journal of Business and Management.* Special Issue: The Role of Knowledge and Management's Tasks in the Companies. Vol. 3, No. 1-1, 2015, pp. 18-24.
doi: 10.11648/j.sjbm.s.2015030101.14

Abstract: Today, every business is a data business. Data is available from internal and external sources about transactions, processes, customers, competitors, trends, technological changes, etc. The challenge is to create actionable information and useful knowledge for the company. If companies are not leveraging their data assets, then competitors will outperform them. Big data technologies can provide a very efficient tool for the discovery of knowledge hidden in the company and its environment. Creating company specific indicators by analyzing large datasets can lead to valuable insights and better decisions. Big data technologies can also provide new and faster methods to calculate economic indicators (GDP figures, tax revenue forecasts, etc.). It can help the work of economic policy makers by reducing the latency of data that allows for timely intervention if necessary. It can also create new, not yet available information.

Keywords: Indicators, Big Data, Business Analytics

1. Introduction

"Data is the new oil," declared Clive Humby in 2006, a Sheffield mathematician who with his wife, Edwina Dunn, helped Tesco to create its Clubcard system. Michael Palmer, of the Association of National Advertisers, expanded on this quote: "Data is just like crude. It's valuable, but if unrefined it cannot really be used. It has to be changed into gas, plastic, chemicals, etc. to create a valuable entity that drives profitable activity; so data must be broken down, analyzed for it to have value." [1]

Today, every business is a data business. Banks are critically dependent on their records, manufacturers have to manage their supply chain, and customer information is crucial for retailers. If companies are not leveraging their data assets, then competitors will outperform them. Data are available from internal and external sources about transactions, processes, customers, competitors, trends, technological changes, etc. The challenge is to create actionable information, useful knowledge for the company.

This paper gives an overview about the opportunities for new business and economic indicators made available by big data. The second section shortly describes key performance indicators and the balanced scorecard system, because new types of indicators based on big data shall be integrated into this system. The third section examines big data technology and business analytics that provides the technological foundation for new and specific indicators. Finally the fourth section gives some examples from the business and economic domains. Big data based indicators can give support in very differing topics such as online marketing campaigns, (flu) epidemics control, nationwide tourism management or economic policies (like changing taxation rules).

2. Key performance Indicators and the Balanced Scorecard System

2.1. Key Performance Indicators

Monitoring external market phenomena and internal business processes is a prerequisite for optimization. Key performance indicator (KPI) metrics can measure performance in terms of tangible operational units. On a daily basis, it is difficult to manage dollars and cents. KPIs such as overtime rate or productivity metrics often allow for the approximation of dollars and cents, and can help with long-term planning. Organizations can harness these valuable data and use them to their advantage to improve business

systems and processes [2].

For selecting the appropriate indicators, cause-and-effect relationships between a company and its market environment have to be analyzed; performance drivers have to be identified. The company must also formulate its strategic goals based on its vision. The strategic goals can then be translated into well-defined indicators (across four aspects in the balanced scorecard system for example). As the company is making actions on the market and executes its processes, these measures capture data about operations and results, thus giving information for management whether the company is on track toward its strategic objectives [2].

As more data about business processes have become available, key performance indicators have become a widely used management tool. As businesses use ERP systems more and more, they have enough data from this system to report on metrics that have direct impact on financial figures. Reports can influence management decisions, because at their best the KPIs are actionable on a day-to-day basis.

2.2. Balanced Scorecard

Probably the best-known direct performance measurement method combining both quantitative and qualitative indicators is balanced scorecard (BSC) [2]. The BSC is basically a measurement system comprised of four perspectives that are critical for a company:

- *Internal Processes*: to satisfy our customers and stakeholders, what business processes must we excel at?
- *Financial*: to succeed financially, what objectives must we achieve?
- *Customer*: to achieve our vision, how should we appear to and satisfy our customers?
- *Learning and Growth*: to achieve our vision, how will we sustain our ability to change and improve?

The first perspective is the company's internal processes that are directly responsible for the company's performance. The tangible results of the internal processes are reflected in the second perspective – the company's financial outcomes. Financial indicators alone cannot provide complete information on the firm's development nor on its potential for future progress. The latter is mirrored by the forth perspective that comprises learning and growth indicators. Independent external indicators coming from customers complete the first three perspectives as a customer perspective [2].

The combination of financial and non-financial indicators, reflecting the outcomes and processes, growth potential as well as interactions with the external environment, shifts the measurement system to a comprehensive strategic management system. The interconnections between the measurements offered by the four perspectives give an advantage because the chain of causes and effects allows all four perspectives to be analyzed together.

The cause-and-effect chain also implies that non-financial indicators are reflected in financial indicators, as they are all interdependent. Process or product improvements will increase customer satisfaction, which leads to revenue growth and will be seen in financial outcomes. The dynamics of the company development implies that all four perspectives will change in time, creating a development loop [3].

Big Data technologies enable the setup of new and faster indicators primarily in the customer perspective and in the learning and growth perspective. With the data mining of social media and customer records a company can track the brand sentiment and identify marketing trends quickly (for example if the number of Facebook likes is falling sales will probably decrease soon as well). [4] An appropriate indicator can give an early warning that allows creating appropriate marketing measures to correct the situation. A large amount of data can be collected about internal operations and processes as well. Logistics companies can apply GPS and RFID technology to track routes and objects [5]. The tracking data can be aggregated into meaningful indicators and can help to optimize supply chains and deliveries.

In his article "(Mis) leading indicators" Zachary Karabell argues for "bespoke indicators, tailored to the specific needs of governments, businesses, communities, and individuals". The technology already exists to provide them: using big data technologies customized indicators are available with a minimal cost. The implementation should start with answering the question: "What do you need to know in order to do whatever you need to do?" GDP figures are less important to global companies than the specific dynamics of the markets where they operate. Companies can develop their own metrics to answer the questions important to them. Governments should make their own productive use of big data because it would allow targeting their policies and measures more precisely [6].

3. Big Data and Business Analytics

3.1. What is Big Data

There is some disagreement about how to define the term big data. Some experts refer to the massive and new sources of data as well as to the supporting storage, management, governance and analytics in their definitions. Others consider the data as separate from the technologies that enable their processing.

The classical definition of Big Data defines it across three dimensions: volume, variety and velocity (the three Vs) [7].

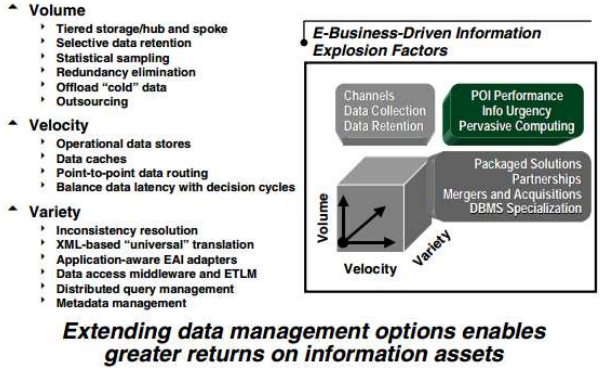

Figure 1. *the three dimensions of big data [7]*

Steve Lucas from SAP thinks that big data is different from

traditional databases rather by intent and timing of its usage. Traditional databases are about transactions, and when they are recorded, it is too late to do anything about them: companies are 'managing out of the rear-view mirror'. With big data data is used as signals to anticipate what's going to happen, and intervene in time [8].

Big Data can be also seen as opportunity. Matt Aslett from 451 Research says, "What is different about Big Data now is that organizations are starting to realize a competitive advantage by illuminating "Dark Data" - data that was previously ignored due to the limitations of traditional data management technologies designed to handle its volume, velocity and/or variety." This growing awareness drives the adoption of new exploratory analytics technologies and techniques exploiting the value hidden in data [9].

There is a lot to learn from unstructured data of various sources and formats, if it is big enough. Traditional databases were designed for structured data, but today the volume and significance of unstructured data is on the rise. A large amount of new data comes from social media, streaming, blogs, the web and so on. It is bringing new opportunities to organizations: businesses can get new perspectives on day-to-day operations and react faster to change; it can give more accurate answers by applying predictive analytics to various data (texts, social media, pictures, etc.)

Web applications, mobile devices and other technologies caused a major change about data: their volume, variety and velocity increased significantly. Traditional tools and methods cannot process this massive flow: data are highly distributed, loosely structured or unstructured and their volume is growing fast. Big Data is generated by a number of sources, including [10]:

- *Social networking and media*: there are hundreds of millions Facebook, Twitter or LinkedIn users, who create new posts, updates, comments all the time, and a complex post consists of multiple data points.
- *Mobile devices*: there are billions of mobile phones worldwide. They generate calls, text messages or use many different applications, track location data, and all these activities create a staggering amount of data.
- *Internet transactions*: the Internet is used for various transactions, e.g. for online purchases, stock trading, commercial and financial transactions between companies. These transactions generate data which are used by retailers, banks, credit card companies and others.
- *Networked devices and sensors*: the number of network connected sensors monitoring a process or activity (such as energy meters, temperature sensors, surveillance cameras) is growing fast. They also create a large amount of data.
- *Computer systems*: modern server systems generate a large amount of log data, e.g. a web server about web traffic, visitors and their computers, etc. These data if analyzed can prove useful for improving operations and achieving a better service quality.

3.2. Business Analytics

Underlying every business analytics practice are data. In the past it meant mostly structured data created and stored by the enterprises themselves, such as customer data in CRM applications or operational data in ERP systems, as well as unstructured data from external (or even internal) data sources. Big Data combined with business analytics applications can give unprecedented insights into customer behavior and market conditions. These insights can be used for data-driven decisions to beat the competition.

Big data provides gigantic statistical samples, which enhance analytic tool results. Generally, the larger the data sample, the more accurate are the statistics and other products of the analysis. Analytic tools and databases can now handle large datasets executing big queries and parsing tables quickly. Effective business analytics – from basic reporting to data mining and predictive analytics – allows businesses to extract insights from data, that, when translated into action, deliver higher levels of efficiency and profitability to the enterprise [11].

It is important to note that data by themselves have little value to business. Value is created by using the data to improve decision-making and the performance of a company. These improvements have to be reflected in more traditional KPI figures, such as shorter delivery times, reduced delivery costs, revenue growth, market share etc. Well-designed KPIs measuring key aspects of a company's performance help to maximize the value of any big data initiative. As Bernard Marr said, big data is nothing without its little brother – traditional KPIs [12].

Analytical applications support the analysis of data in order to gain insights, make better decisions and ultimately generate value for the company. It is of vital importance in a quickly changing and competitive business environment. According to an IBM survey [13] companies investing in business analytics are outpacing their competitors: they show significantly higher revenue and profit growth. Business analytics is a combination of hardware and software components and special system solutions, which allow organizations to create valuable information from the data mass in order to make better decisions or find new business opportunities.

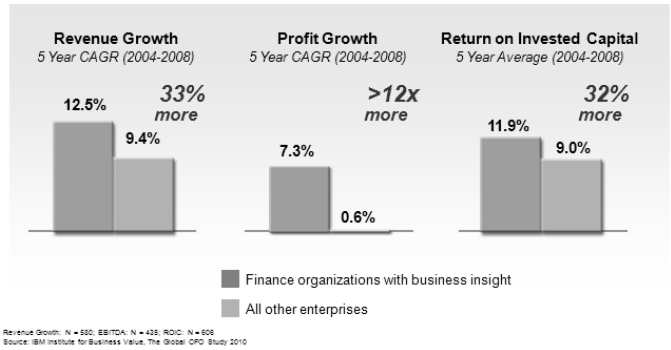

Figure 2. *the impact of business analytics on financial figures [13]*

Using external information about economic environment,

market, clients and competitors even more detailed analysis can be made, but working with constantly expanding data on such a large scale requires new and innovative methods. Nowadays with big data technology the collection, storage and analysis of high volume data is available even in real-time. Applying these new solutions valuable information can be created from the huge mass of data generated by clients and business transactions day-by-day. This information can help making better decisions, develop new products and services, what result in higher profit in the end.

With the help of high-volume, high-variety, high-velocity data and special data processing technologies new, big-data-based indicators can be created. Phenomena and processes hardly measurable before can be measured or at least estimated now, indicator values can be followed in real-time, which allows setting alerts for specific events for example. The next challenge is the automation of these information and knowledge processes, since today they still require intense human interaction.

4. Big Data Based Indicator Examples

Big Data technologies can improve the operations of numerous companies across different industry sectors. Banks can increase their customer focus by analyzing various data sources to understand customers better, optimize interactions and provide customized offerings. Insurance companies can manage their claim-handling better by analyzing internal and external data sources to determine the likelihood of fraud. Government entities can discover anomalies in submissions for social programs and taxes. Manufacturers and trading companies can monitor their supply chain closer so that they can identify issues quicker. They can thus optimize their logistics and avoid material delays, overstock or out-of-stock conditions. Hotels, restaurants, retailers or telecommunications companies can gain a better view about customer preferences, market trends, and they can build a more loyal and profitable customer base. Public utilities can follow the public usage of their services in a more detailed way, so they can optimize their service quality and prevent problems or shortages [11].

Important source of big data are web applications and e-commerce systems. Appropriate analytics can help to understand web site user behavior. This insight can then lead to better designed websites and more efficient online sales, which means higher income and more profit in financial terms.

The Internet has provided greater availability of advertising data. Potential customers visit a website, where they see an advertisement (impressions), if they click on it (clicks), they go to a landing page, which is designed to sell a product or service (conversions). The effectiveness of this process can be monitored by click-through rates and conversion rates [14]. These indicators can be calculated for different groups of customers allowing for a detailed analysis, which can serve as the basis for an action plan to increase sales.

$$\text{click-through-rate} = \text{clicks} / \text{impressions} \quad (1)$$

$$\text{conversion rate} = \text{conversions} / \text{clicks} \quad (2)$$

More detailed data can be collected about visitors, visits, page views and hits. It is possible to track the paths visitors take during a visit. This path is called the clickstream, and it refers to the sequence of clicked links while visiting multiple sites. The analysis of clickstream data often yields significant customer insights [15].

Clickstream data can help to improve the measurement of audience size and characteristics: more accurate measures of reach (unique visitors) and exposure frequency (repeat visits) are achievable. Clickstream data also provides the detailed information on consumer interactions with the website, which can be used for sophisticated targeting actions: for example, online product recommendations based on collaborative filtering are possible because clickstream data is continuously collected and processed by websites while users browse and search for specific products [15]. Clustering users with similar clicking behavior and analyzing click-stream data allows the discovery of their interest patterns. E-commerce companies can then personalize their offerings to the customers' preferences and thus increase their sales revenue [16].

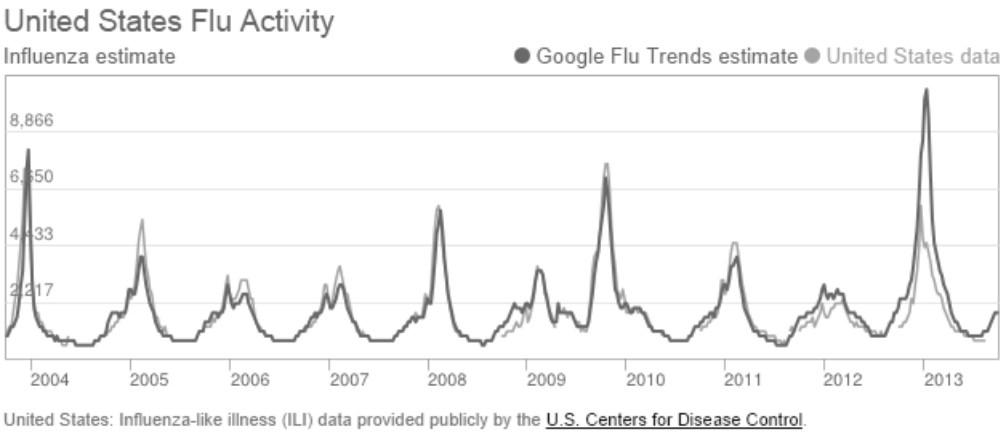

Figure 3. *Google Flu Trends (source: http://www.google.org/flutrends/intl/en_us/about/how.html)*

There are great perspectives in analyzing web search data. Google noticed that certain search phrases correlate well with the intensity of flu epidemics. Millions of people are looking for health-related information online. During the flu season there are more flu-related searches, while during the allergy season there are more allergy-related searches. The Google Flu Trends are using aggregated data from Google searches to estimate how much flu is circulating currently in different countries or regions. By this technology, Google can monitor flu epidemics better than health agencies [17].

Mobile phone data and data about financial transactions can also provide valuable knowledge to businesses. In Spain Telefónica and RocaSalvatella produced a study [18] about tourism using Big Data technologies. The analysis of the vast amount of data from the electronic activity of foreign tourists shows opportunities for the tourism industry, particularly for hotels. Data came from the telecommunications company Telefónica Móviles Espana and the bank BBVA. The former provided data about foreign phones using Telefónica's network, the latter provided data on electronic payments by foreign cards processed by the bank's infrastructure. Aggregated data from 680,928 mobile handsets and 168,921 bankcards during two weeks were included in the analysis.

Previously, the tourism board and the industry relied on data from surveys and interviews, which take only a small sample of tourists and gives data about intentions or answers to questions instead of real actions. Data in this study, however, were produced by the real actions of tourists. The study showed the visitors' country of origin, their length of stay, their preferred days and places, and their average daily spending and cumulative spending. The analysis showed which visitors which cities and hotels preferred or who spent the highest and lowest amount. The analysis allows creating a marketing action plan: which services hotels should offer to which customers to win them.

The data of mobile handsets and bankcards are structured and georeferenced, which makes possible to connect them with data from other sources, such as social media (e.g. georeferenced photos, posts), open public data, etc. New types of analyses can be then made, new business opportunities can be discovered, and so companies can increase their revenues.

An important objective of forecasting is to make ex ante estimates of the likely values of certain variables. Choi and Varian (Google's chief economist) released a paper [19] showing how to use the company's search data to measure car sales and consumer spending. For instance, search engine queries in the „Vehicle Shopping" category could be good candidates for forecasting automobile sales, while queries such as „file for unemployment" could be useful in forecasting initial claims for unemployment benefits [20]. The models are based on connections between key search terms and related economic indicators.

Nowcasting has recently become popular in economics. The term 'nowcasting' is a contraction of 'now' and 'forecasting'. Standard statistical figures describing the state of an economy (e.g. the GDP) are based on a rigorous method of collecting data, and they are accurate and reliable, but are published with a lag of some weeks or months. It means that they are giving information about a past state and not the current one [21].

Economic indicators play an important role in policy-making, providing a foundation for discussions and decisions about economic measures. However, the timing can be very important at economic policy measures, therefore economists are interested to forecast the present or the recent past, because much of the „official" data are too delayed to be useful. Signals about the GDP can be extracted from heterogeneous data sources (e.g., unemployment figures, industrial orders, web search data, etc.) before GDP itself is published. In nowcasting, these data are used to compute sequences of current quarter GDP estimates in relation to the real time flow of data releases.

At the University of Michigan, Antenucci et al. analyzed billions of tweets for references to unemployment (hunting for expressions like "axed", "pink slip" or "downsized"). They indexed the findings and compared them to government statistics building a social media signal of job loss that closely tracks initial claims for unemployment insurance. Despite differences in the underlying processes generating unemployment insurance claims and tweets about job loss, the indicator based on social media tracks the official data remarkably well [22].

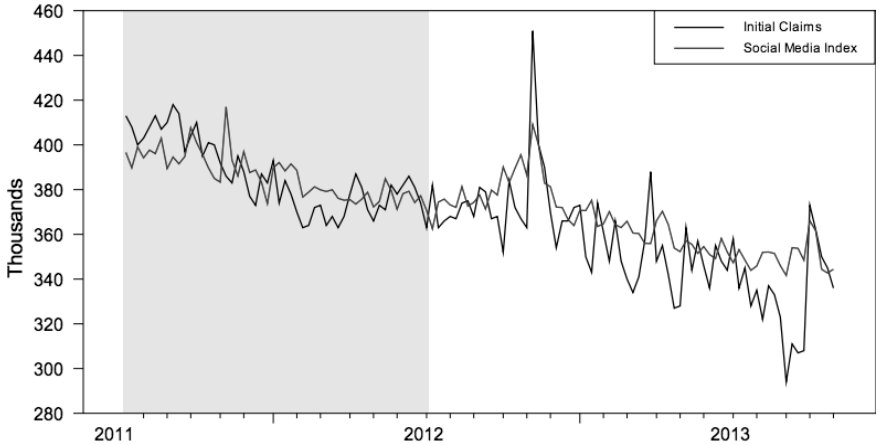

Figure 4. *unemployment claims and social media index [22]*

Big Data clearly provides new opportunities for estimating economic or business indicators. However, it also raises important questions, for example how to avoid drawing unreliable conclusions. The use of search engine data in an unstructured way can readily lead to spurious results. The Google Trend service provides data for millions of search queries and hundreds of search categories. Given the processing power readily available, relationships which are apparently statistically significant, can quite easily be discovered ex post between search terms and some potential dependent variable. These relationships may, at the same time, not provide a satisfying causal explanation.

One of the main challenges of using big data is its short history: Twitter was created in 2006, the US government began calculating gross domestic product in the early 1930s [6]. Daily point-of-sale records are not comparable without an adjustment for seasonal patterns, and seasonal patterns can be gauged only from longer data series. There are concerns that people using the Internet and social media do not represent the broader public, thus creating biased results. The frequency of particular search terms can be measured to estimate demand for travel, jobs or homes. But searches can be conducted just out of curiosity, creating „noise" that obscures the true signal. However, once these shortcomings are overcome, information from big data may be used much more in decision-making.

5. Conclusion

In a fast-paced world new and faster analytical methods will provide a tool to gain knowledge and make better decisions. Big data analytics will become more prevalent in the future: after governments and large organizations small and medium size enterprises will use it soon, because all enterprises must become intelligent, using appropriate analytics in order to stay competitive. Companies not able to manage information for business benefits will be pushed out from the market.

The appropriate selection and systematic evaluation of indicators is a powerful tool to monitor strategic business areas more closely and allows for better decisions. Hidden relations can also be revealed between different business factors, product ideas can be generated, facilitating innovation. Ultimately, the appropriate measurement and analytical system supports continuous learning that is a crucial factor in a turbulent business environment.

This system can become the "nerve system" of an intelligent enterprise as more efforts are put into the research, development and application of methods and techniques that explore the relationship between business processes, market events and company results. It necessary for the better utilization of the large and exploding data assets, because it allows for timely intervention if needed and helps to create new, marketable products and services. Fundamentally, it means the discovery of knowledge hidden in the company and its environment, and the use of this knowledge to create tangible business benefits.

References

[1] Ch. Arthur, "Tech giants may be huge, but nothing matches big data", The Guardian, 23 August 2013, URL: http://www.theguardian.com/technology/2013/aug/23/tech-giants-data (May 5, 2014)

[2] R. S. Kaplan and D. P. Norton, "The balanced scorecard - Measures that drive performance", Harvard Business Review, January-February 1992, pp. 71-79

[3] E. Enkel, M. Rumyantseva and G. Gurgul, "Integrated Performance Measurement System for Knowledge Networks for Growth" in Knowledge Networks for Business Growth (eds. A. Back, E. Enkel, G. von Krogh), Springer, 2007, pp. 165-190

[4] J. Haji, "The reality of Big Data", conference lecture, CNMEOnline.com - Big Data Symposium, 20 May, 2013, URL: http://cnmeonline.com/bigdatasymposium/docs/Jassim-Haji.pdf (April 30, 2014)

[5] S. Mika, "Telematics Sensor-Equipped Trucks Help UPS Control Costs", Automotive Fleet, July 2010, URL: http://www.automotive-fleet.com/article/story/2010/07/green-fleet-telematics-sensor-equipped-trucks-help-ups-control-costs.aspx (May 30, 2014)

[6] Z. Karabell, "(Mis)leading indicators", Foreign Affairs, March/April 2014, URL: http://www.foreignaffairs.com/articles/140749/zachary-karabell/misleading-indicators(September 24, 2014)

[7] D. Laney, "3D Data Management: Controlling Data Volume, Velocity, and Variety", META Group, 2001, URL: http://blogs.gartner.com/doug-laney/files/2012/01/ad949-3D-Data-Management-Controlling-Data-Volume-Velocity-and-Variety.pdf (November 29, 2013)

[8] S. Lucas, "Beyond the Balance Sheet: Run Your Business on New Signals in the Age of Big Data", SAP Hana blog post, August 21, 2012, URL: http://www.saphana.com/community/blogs/blog/2012/08/21/beyond-the-balance-sheet-run-your-business-on-new-signals-in-the-age-of-big-data (October 25, 2014)

[9] L. Burgelman, "Attention, Big Data Enthusiasts: Here's What You Shouldn't Ignore", Wired, Innovation Insights, February 8, 2013, URL: http://insights.wired.com/profiles/blogs/attention-big-data-enthusiasts-here-s-what-you-shouldn-t-ignore (October 21, 2014)

[10] J. Kelly, "Big Data: Hadoop, Business Analytics and Beyond", Wikibon blog post, February 5, 2014, URL: http://wikibon.org/wiki/v/Big_Data:_Hadoop,_Business_Analytics_and_Beyond (October 29, 2014)

[11] IBM Business Analytics, "Business Analytics for Big Data: Unlock Value to Fuel Performance", IBM Corporation, Software Group, June 2013, URL: http://www-01.ibm.com/software/analytics/solutions/big-data/ (September 30, 2014)

[12] B. Marr, "Big Data Is Nothing Without Its Little Brother", Smart Data Collective Blog, March 18, 2014, URL: http://smartdatacollective.com/bernardmarr/191631/big-data-nothing-without-it-s-little-brother (September 19, 2014)

[13] IBM, “Global CFO Study 2010”, IBM Corporation, 2010, URL: http://www.ibm.com/services/us/cfo/cfostudy2010/ (May 5, 2014)

[14] Google, “Clickthrough rate (CTR)”, AdWords Help, Google, URL: https://support.google.com/adwords/answer/2615875?hl=en (October 14, 2014)

[15] R.E. Bucklin, C. Sismeiro, “Click Here for Internet Insight: Advances in Clickstream Data Analysis in Marketing”, Journal of Interactive Marketing 23 (2009), pp. 35–48

[16] Q. Su, L. Chen, “A method for discovering clusters of e-commerce interest patterns using click-stream data”, Electronic Commerce Res. Appl. (2014), http://dx.doi.org/10.1016/j.elerap.2014.10.002

[17] J. Ginsberg, M. H. Mohebbi, R. S. Patel, L. Brammer, M. S. Smolinski and L. Brilliant, “Detecting influenza epidemics using search engine query data”, Nature 457, 19 February, 2009, pp. 1012-1014

[18] V. O. Sust, E. G. Illera, A. S. Berengué, R. G. García, M. V. P. Alonso, M. J. T. Torres, G. R. Verard, O. L. Albert, X. C. Ramos and P. R. Rodríguez, “Big Data And Tourism: New Indicators For Tourism Management”, RocaSalvatella and Telefónica, Barcelona, May 2014, URL: http://www.rocasalvatella.com/en/big-data-and-tourism-new-indicators-tourism-management-0 (September 19, 2014)

[19] H. Choi and H. R. Varian, “Predicting the Present with Google Trends”, Technical Report, Google, December 18, 2011, URL: http://people.ischool.berkeley.edu/~hal/Papers/2011/ptp.pdf (October 10, 2014)

[20] S. L. Scott and H. R. Varian, “Bayesian Variable Selection for Nowcasting Economic Time Series”, Technical Report, Google, July 2012, URL: http://people.ischool.berkeley.edu/~hal/Papers/2012/fat.pdf

[21] M. Banbura, D. Giannone and L. Reichlin, “Nowcasting”, Working Paper Series No. 1275, December 2010, European Central Bank, URL: http://www.ecb.europa.eu/pub/pdf/scpwps/ecbwp1275.pdf (October 5, 2014)

[22] D. Antenucci, M. Cafarella, M. Levenstein, Ch. Ré, M. D. Shapiro, “Using Social Media to Measure Labor Market Flows”, Working Paper No. 20010, National Bureau of Economic Research, March 2014, URL: http://www.nber.org/papers/w20010.pdf (October 24, 2014)

[23] This work was supported by the European Union and the European Social Fund through FuturICT.hu project (grant no.: TAMOP-4.2.2.C-11/1/KONV-2012-0013).