

CHAPTER THREE

The Basics of Business Analytics

From *Business Intelligence: Making Decisions through Data Analytics*

By Jerzy Surma (A Business Expert Press Book)



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CHAPTER 3

The Basics of Business Analysis

3.1. Reporting and Data Analysis

3.1.1. Introduction

A data warehouse, which is created in accordance with your business requirements, allows you to analyze the data. If it is connected with suitable tools designed to analyze and present data, a systematic multidimensional data analysis can be made, which is called online analytical processing (OLAP).¹ As shown in Figure 2.1, the systematic analysis is directly linked to the end user.

According to Edgar F. Codd, “online analytical processing is multidimensional data analysis that is initiated by a business user and consists of complex reporting mechanisms, analyses and data visualization.” Codd, who in 1970 formulated the relational data model, is considered to be one of the main developers and promoters of OLAP.² According to Codd, a systematic analysis tool should meet 12 conditions,³ including application of a multidimensional model, an intuitive and flexible access to data, and also transparency: This is the isolation of the business user from the mode of data storage and connection with the source systems. In general, as Codd’s conditions are purely technical by nature, they will not be discussed further.⁴

3.1.2. Online Analytical Processing

Online analytical processing consists of two fundamental elements:

- The multidimensional data model (discussed in chapter 2)⁵
- The operations set.⁶ The tools that meet OLAP requirements are applied in two interconnecting areas:

- *Provision of information.* The ability to devise reports in the desired order and in accordance with the required mode of data presentation; the ability to make queries ad hoc and allow for suitable distribution; the opportunity to spread information, automatic notification of events (alerts), and personalization of access.
- *Analysis.* Analytical operations, which allow for the correct interpretation of the information provided and analysis of cause-and-effect relationships.

3.1.3. Data Model

Let us consider the example of a chain of used car dealers in Poland. Here the sales of used cars are analyzed in periods (Date) according to the brand of car (Product) and sales regions (Region). A corresponding multidimensional model is shown in Figure 3.1. The model in Figure 3.1 could be hard to interpret for a business user who is inexperienced in data modeling, and thus for OLAP the information is displayed as a multidimensional cube (see Figure 3.2).

In this model, cubes represent facts concerning sales (e.g., the measure is sales quantity) in the following dimensions: Region, Product, and Date. Usually, the multidimensional cube is an aggregate⁷ of data registered on the level of the fact table, and its overall character is determined by all dimensions.

3.1.4. Basic Operations of Multidimensional Data Analysis

The basic operations of multidimensional data analysis are



Figure 3.1. The multidimensional model for a chain of used car dealers.

Source: author.

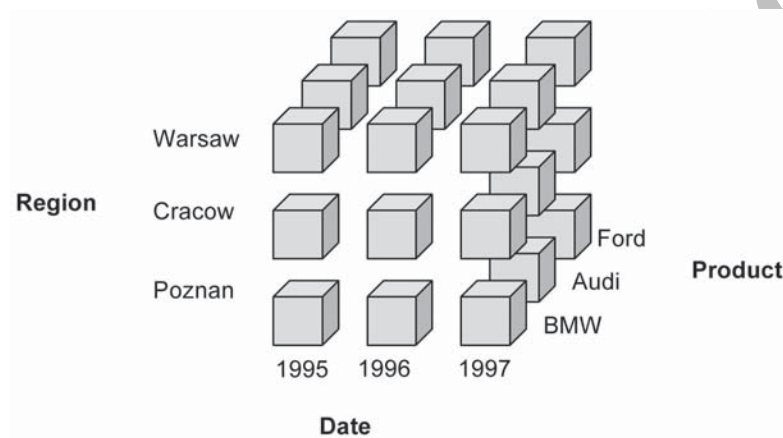


Figure 3.2. The multidimensional cube for sales in used car dealers.

Source: Wrembel, Bebel, and Zadrozna (2004).

- specification of the scope of analysis,
- drill down,
- roll up,
- slice and cube (selection),
- rotation,
- operations on measures.

3.1.4.1. Specification of the Scope of Analysis

The specification of the scope of analysis consists of determining what measures will be reported and in what dimensions they will be reported. Usually, the first operation specifies facts and dimensions for subsequent operations. Still, these settings can be modified during the analysis. For the cube from Figure 3.2, the Sales quantity and dimensions, Region, and Date in a correct report would look like the ones in Table 3.1 or in Table 3.2.

3.1.4.2. Drill Down

Drill down is one of the most common analytical operations that allows for the expansion of existing information. In the example in Figure 3.3, the sales analysis on the level of a calendar year is expanded to the level of a month in 1997. Such an effect can be achieved if a hierarchy is defined within the Date dimension,⁸ for example, Year-Month-Day.

Table 3.1. Demonstration Sales Report for Used Car Dealers (Version 1)

Date	Region	Sales quantity
1995	Warsaw	1,000
	Cracow	500
	Poznan	1,000
1996	Warsaw	1,500
	Cracow	500
	Poznan	900
1997	Warsaw	2,000
	Cracow	500
	Poznan	800

Source: author.

Table 3.2. Demonstration Sales Report for Used Car Dealers (Version 2)

Sales quantity for			
Date	Region		
	Warsaw	Cracow	Poznan
1995	1,000	500	1,000
1996	1500	500	900
1997	2000	500	800

Source: author.

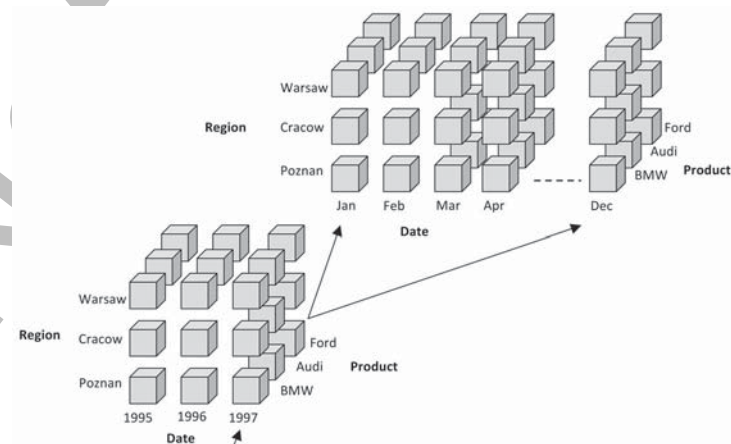


Figure 3.3. Drill-down in the dimension Date.

Source: Wrembel, Bebel, and Zadrozna (2004).

By drilling down this hierarchy, the sales analysis may be expanded to the level of 1 day. As long as it is semantically justified, you can formulate hierarchies within any dimension. For the Product dimension, it can be a car brand model. The lowest level in the hierarchy is connected with the level of granularity, which was discussed in chapter 2. For the cube in Figure 3.3, the report (for the measure Sales quantity and Region and Date dimensions) would look like the one in Table 3.3.

3.1.4.3. Roll Up

Roll up is the opposite operation of drill down, where for a given dimension, upward “navigation” in the hierarchy takes place to present more general aggregates.

3.1.4.4. Slice and Cube

In the slice-and-cube operation, facts are presented for a selected set of dimensions with specific values (either a concrete value or a set of values) for other dimensions. In Figure 3.4a, the Date dimension is sliced, while the cube in two other dimensions is limited to the year 1997. Analogically, in Figure 3.4b, the

Table 3.3. Demonstration Sales Report for Used Car Dealers After Drill Down in dimension Date

Sales quantity for			
Date	Region		
	Warsaw	Cracow	Poznan
01/1997	100	30	30
02/1997	120	20	20
03/1997	150	20	20
04/1997	200	30	30
05/1997	100	40	90
06/1997	190	50	100
07/1997	230	60	120
08/1997	200	70	100
09/1997	220	70	120
10/1997	220	30	60
11/1997	180	40	70
12/1997	90	40	40

Source: author.

slice of the Region dimension means that the presentation displays the sales values in all Dates and for all Products, but only for the Poznan region.

For the cube in Figure 3.4a, after the slice of the dimension “Date = 1997,” the report (Sales quantity and Region, Product, and Date dimensions) would look like Table 3.4.

For the cube in Figure 3.4b after the slice in the “region = Poznan” dimension, the report (for the measure Sales quantity and Region, Product, and Date dimensions) would look like Table 3.5.

Table 3.4. Demonstration Sales Report for Used Car Dealers After the Slice in the dimension Date

Sales quantity for Date = 1997			
Product	Region		
	Warsaw	Cracow	Poznan
BMW	1000	150	300
Audi	500	250	300
Ford	500	100	200

Source: author.

Table 3.5. Demonstration Sales Report for Used Car Dealers After the Slice in the dimension Region

Sales quantity for Region = Poznan			
Product	Date		
	1995	1996	1997
BMW	200	300	300
Audi	300	300	300
Ford	500	300	200

Source: author.

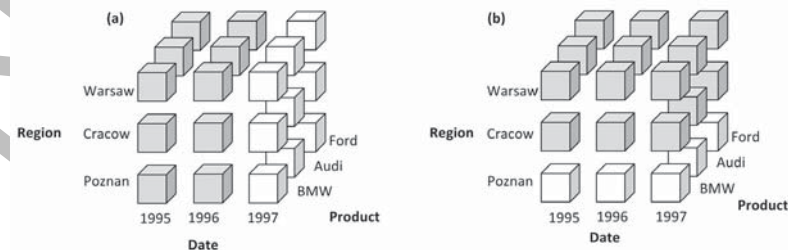


Figure 3.4. The operation of slice (a) dimension Date = 1997 and (b) dimension Region = Poznan.

Source: Wrembel, Bebel, and Zadrozna (2004).

3.1.4.5. Rotating

Rotating facilitates the presentation of data in the report. For the cube in Figure 3.5 (first phase), the start of the report (Sales quantity and Region and Date dimensions) would look like Table 3.6.

For the cube in Figure 3.5 (second phase), rotation by 90° vertically (with the Sales quantity and Region and Product dimensions) would look like Table 3.7. For the cube in Figure 3.5 (third phase) rotation by 90° horizontally (with the Sales quantity fact and Region and Product dimensions) would look like Table 3.8.

3.1.4.6. Operations on Measures

Operations on measures (numerical data) are a wide range of operations that are based on the numerical character of facts. The most common operations are as follows:

Table 3.6. Demonstration Sales Report for Used Car Dealers in the First Phase in the Operation of Rotating

Sales quantity			
Date	Region		
	Warsaw	Cracow	Poznan
1995	1,000	500	1,000
1996	1500	500	900
1997	2000	500	800

Source: author.

Table 3.7. Demonstration Sales Report for Used Car Dealers in the Second Phase in the Operation of Rotating

Sales quantity			
Product	Region		
	Warsaw	Cracow	Poznan
BMW	1,000	500	800
Audi	1,500	500	900
Ford	2,000	500	1000

Source: author.

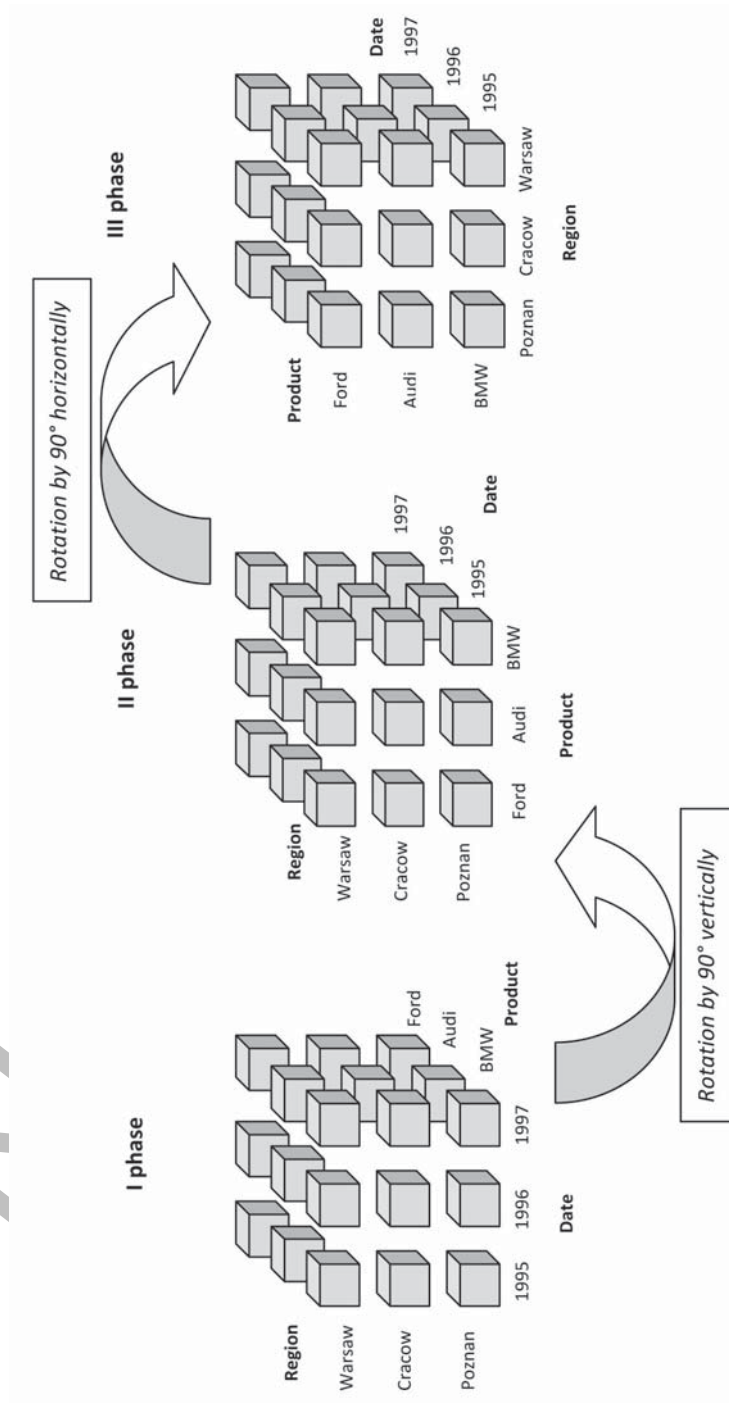


Figure 3.5. The rotation of the multidimensional cube.

Source: Wrembel, Bebel, and Zadrozna (2004).

Table 3.8. Demonstration Sales Report for Used Car Dealers in the Third Phase in the Operation of Rotating

Sales quantity			
Region	Product		
	BMW	Audi	Ford
Warsaw	1,000	1,500	2,000
Cracow	500	500	500
Poznan	800	900	1000

Source: author.

- Mathematical operations and functions, such as addition, the highest and the lowest value, the mean, and so on
- Ranking and sorting into groups
- Selection
- Calculation of new measures, for example (e.g., profitability; see Table 2.1)
- Basic statistical calculations

Case Study 3.1 shows a basic example of the OLAP analysis.

Case Study 3.1

To demonstrate operations, here is a further development of the previous case study (see Case Study 2):

- *Area:* Sales
- *Provided information or analysis:* Quantity (volume) and amount of sales analysis divided into time period, sales region, product category, and so on

The sales analyst was asked to check whether the expected (due to promotion activities) 20% growth in sales took place in May compared with April in stores located in Boston in the juices product category. During this period, the prices of juices were constant. Thanks to the newly implemented tool, the sales report (April compared with May) for the Category = "Juice"; Store City = "Boston"; and Calendar Year = "2007" was generated (see Table 3.9).

Table 3.9. Report: sales amount comparing April to May in 2007

Calendar month		
April	May	Grand total
Sales amount (\$US)	Sales amount (\$US)	Sales amount (\$US)
954	1072	2026

The analyst saw that juice sales in May increased slightly, but the results were substantially lower than expected. He decided to carry on the analysis and, through drill down, see how the sales of each juice (Product Name) looked for the Category = "Juice"; Store City = "Boston"; and Calendar Year = "2007" (see Case Study 3.2).

Table 3.10. Report: sales amount in category Juice in April and May 2007

	Calendar Month		
	April	May	Grand Total
Product Name	Sales Amount USD	Sales Amount USD	Sales Amount USD
Qubus Big	295	230	525
Qubus Small	659	842	1501
Grand Total	954	1072	2026

To his amazement, he noticed that the sales of Qubus Big had dropped in May. In order to find the reason for this, the analyst limited the analysis exclusively to Qubus Big by selection and rotation. The sales of this product in April and May for different stores (Store Name) were as shown in Case Study 3.3 (Store City = "Boston"; Calendar Year = "2007").

Table 3.11. Report: sales amount in Boston stores in April and May 2007

	Calendar month		
	April	May	Grand total
Store Name	Sales amount (\$US)	Sales amount (\$US)	Sales amount (\$US)
ALFA_10	98	128	226
ALFA_11	116	0	116
ALFA_12	81	102	183
Grand total	295	230	525

The report gave a surprising answer. It turned out that the sales of Qubus Big increased in two locations in Boston, while in the store ALFA_11, it amounted to zero (they didn't sell one single bottle of Qubus Big). Therefore, the low sales of juices in Boston resulted from a slump in sales of Qubus Big in ALFA_11. Finally, the analyst found the name of the manager (Store Manager) of this particular store in the report shown in Table 3.12.

Table 3.12. Report: Managers of stores in Boston

	Store city
	Boston
Store name	Store manager
ALFA_10	Scott Pippen
ALFA_11	John Paxson
ALFA_12	Michel Jordan

The analyst decided to show the result of his analysis to the regional sales director and suggested that he should contact John Paxson (the manager of the store ALFA_11). He also carried out a thorough analysis of sales and orders in the store ALFA_11 as compared with other stores in Boston.

3.2. Information Management

3.2.1. Introduction

The technological background of business intelligence (BI) has already been presented (the data warehouse, modes of presentation and data analysis by means of OLAP tools, etc.). Now the time has come to look at the business application of these technologies. Let us begin with an explanation of key terms, such as “data” and “information.”

In his classic book about management, James Stoner⁹ informally defined “data” as raw, unanalyzed numbers or facts—for instance, the volume of sales of the book *Witness to Hope* in May 2008. According to Stoner, information is organized and analyzed—for example, a sales analyst might compare the volume of sales of *Witness to Hope* in May and in April of 2008.

A formal definition of information is given by Bogdan Stefanowicz:¹⁰ “Information describes meaning (content) which with suitable interpretation is given to a message M,”

$$\text{Message } M = \langle O, X, x, t \rangle,$$

where *O* is a described object, *X* is an attribute of the object, *x* is a value of the attribute *X*, and *t* is time, in which the attribute *X* of the object *O* has the value *x*. In this definition, message *M* in the context of a specific semantic interpretation belongs to information, while as an object of processing

and storage, it is data. It complies with the etymology of the word “information,” which in Latin means “to shape” or “to give a form.”¹¹

All in all, technically speaking, data warehousing is about data storage and processing. However, in the context of a recipient (user), where data are provided by means of OLAP tools, you are likely to call it “information.” According to the formal definition of information, the message <Book *Witness to Hope*, volume of sales, 44, 05/2008> is information about the fact that in May 2008, 44 copies of the book *Witness to Hope* were sold (although it is not information as understood in Stoner’s informal definition). In fact, the result of the analysis of the sales trend—that is, the comparison between sales in May and April—is also information. You can have good insight into the relationship between data and information by looking at Figure 3.6, which also shows the final aim of information management, that is, supporting decisions.

As mentioned before, the subject (i.e., the recipient) of any information is always human. Given that fact and taking into account various possible functions of a person in an organization, you can single out two relevant kinds of information: managerial information and strategic information (see Table 3.9).

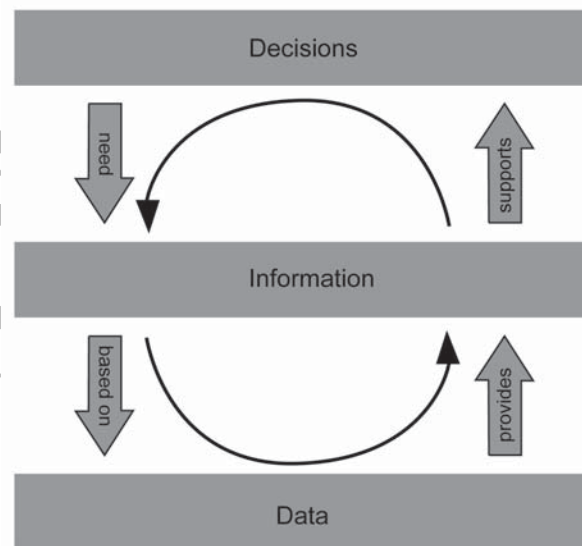


Figure 3.6. Relationship: data-information-decision.

Source: Reinschmidt, Gottschalk, Kim, and Zweitering (1999).

Table 3.13. Type of Received Information Depending on Its Analysis and Recipient

Type of received information	Recipient	Analysis and supplementary information
Managerial	Heads, directors, board of directors	Detailed OLAP analyses, access to selected source data
Strategic	Board of directors, president, CEO	OLAP analysis, additional reports and explanatory analysis, study about competitors

Source: author.

This division complies with the development tendencies in BI, which are aimed at

- business processes management and realization (implementation) of a strategy (managerial information),
- strategic analysis and support for a planned strategy¹² (strategic information).

Illustrative of this is Table 3.14, which describes information at both levels:

- *Managerial information* tends to be provided mainly at the tactical and operational level of management but also at a strategic level.
- *Strategic information* is provided at a strategic level of management.

Table 3.14. Information in Managerial Decisions

Level of management	Period, time horizon	Frequency of update	Source	Credibility	Range	Level of granularity
Tactical and operational	Short, present	Big	Internal	Big	Narrow: inside the company	Big: analysis
Strategic	Long, future	Small	External	Small	Wide: environment, the world	Small: synthesis

Source: Based on Stoner, Freeman, and Gilbert (1995).

3.2.2. Managerial Information

3.2.2.1. Basics

Managerial information is information that is used in the management of a company.¹³ In this chapter, this is limited to the analysis of the internal activities of an enterprise. To review the basic possibilities of providing decision makers with managerial information, Porter's value chain will be employed.¹⁴ Michael E. Porter introduced the concept of the value chain as a tool to extensively explore the most important functions of an enterprise and the effectiveness of interactions that occur among them.

Porter's approach can be directly reflected in the process paradigm,¹⁵ which defines an internal company process as follows: In a company, a process is a series of activities (tasks) designed to produce a product or a service.¹⁶ According to the classic model, there are the following kinds of processes (see Figure 3.7):

- *Main processes.* They create and deliver products, services, or both offered on the market to external customers.
- *Supporting processes.* Products of these processes are invisible to external customers. They support main processes: resources or infrastructure management, among others.
- *Controlling (managerial) processes.* They ensure effective functioning of a company—for example, planning and budgeting, finance and strategic controlling, and monitoring the

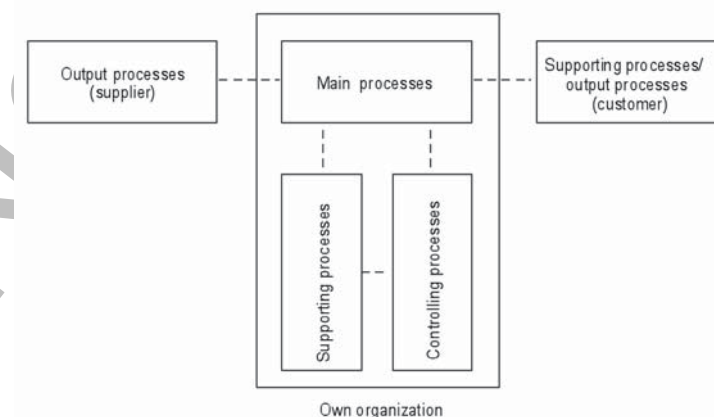


Figure 3.7. Typology of business processes.

Source: PROMET (1997).

realization of the strategy. Controlling processes are metaprocesses, as it were, because they support the management of other processes. For instance, controlling of production costs is used to streamline the production process and its management.

3.2.2.2. Review of Selected BI Applications

If you want to provide managerial information professionally, it will usually require creating a data warehouse, but in some applications it is possible to base your analysis on flat files with source data. Moreover, data processing can also be more complex than simple OLAP; it can be extended by various econometric models, operational research, or to be more general, by data-mining methods. Here only the basic applications will be presented—that is, applications of OLAP tools with some elements of basic statistical analyses. Applications that employ data-mining methods will be discussed in chapter 4.

Selected BI applications will be presented and divided into three process groups:

1. Main processes
 - Sales, marketing, and service (see Table 3.15)
 - Logistics (both internal and external; see Table 3.16)
 - Operations and production (see Table 3.16)
2. Supporting processes
 - Human resource management (see Table 3.17)
 - Supply chain management (see Table 3.17)
3. Controlling (managerial) processes
 - Finance (see Table 3.18)

BI systems in managerial processes should be of particular interest to readers of this book. Using source data from the integrated enterprise resource planning (ERP) systems, complex tools have been devised, which allow the following, among others things:

- Planning and budgeting
- Financial consolidation
- Stakeholder relationship management in terms of developing a suitable public relations policy in a company

Table 3.15. Review of Selected BI Applications (Managerial Information) on Main Processes in Sales, Marketing, and Service

Name	Description	Tool
Lifetime value analysis	Analytical model that describes the profitability of individual customers or groups of customers at specific time on the basis of the analysis of their activities (e.g., their shopping)	OLAP
Analysis of the deviation of sales of products of various assortments	Analysis of the influence of the amount of sold products, prices, and changes of assortment on the change of sales over time	OLAP
Price optimization (income management)	Analysis of the response of demand on the market to changes of prices, research into the impact of one's own and competitors' promotions, and the detection of optimal prices in certain distribution channels	OLAP with basic statistical functions (regression model for demand curve)
Analysis of sales profitability	Ratio analysis including the following: • Sales profitability indicator • Net profitability indicator • Cost indicator	OLAP

Source: Based on Davenport and Harris (2007).

Table 3.16. Review of Selected BI Applications (Managerial Information) on Main Processes in Logistics—Supply Chain Management and Production

Area	Name	Description	Tool
Logistics	Stocks analysis	The analysis of product rotation (seasonal character taken into account) to optimize warehouse management	OLAP with basic statistical functions
Logistics	Delivery analysis	Analysis of delivery in terms of its promptness and consistency with the order	OLAP
Production	Production effectiveness analysis	Analysis of productivity over time and in comparison with norms in terms of production line, machinery, shifts, and workers	OLAP
Production	Quality analysis	Analysis of the relationship between the quality of products and production lines or half-finished products depending on suppliers	OLAP with basic statistical functions

Source: author.

Table 3.17. Review of Selected BI Applications (Managerial Information) on the Supporting Processes in HR and Procurement

Area	Name	Description	Tool
HR	Training planning	Analysis of the profile of workers in comparison with formal requirements for a given position	OLAP
Procurement management	Ranking of suppliers	Ranking of suppliers depending on their promptness and the quality of supply	OLAP

Source: author.

Table 3.18. Review of Selected BI Applications (Managerial Information) on Controlling Processes in Finance

Name	Description	Tool
Analysis of financial reports (balance, profit and loss account, and cash flow account) and threat detection (early warning systems)	Evaluation of the financial situation and the results of the given enterprise by the analysis of its reports regarding the analysis of structure, dynamics, ratio analysis, cause analysis, regression and correlation analysis, and multidimensional comparison analyses	OLAP with basic statistical functions
Analysis of assets	Activity analyses based on inventory turnover, average collection period, and total assets turnover	OLAP
Costs analysis	Activity-based costing	OLAP with basic statistical functions
Profitability analysis	Identification of basic factors for sales profit and their influence on change of volume of sales, profitability ratios, gross profit margin, profit margin on sales, return on assets, return on equity	OLAP
Liquidity analysis	Liquidity analyses including the following: • Current ratio • Quick ratio • Cash ratio	OLAP
DuPont analysis	Measure of financial performance based on the two return on investment (ROI) equations: ROI (total assets) and ROI (equity).	OLAP

Source: Based on Schall and Haley (1991).

3.2.2.3. Business Processes Management

The use of BI systems to manage business processes in terms of monitoring and supervision is particularly important. It is based on the objective measurement of these processes by means of indicators (measures) of effectiveness called key performance indicators (KPIs). Standard critical success factors (CSFs) employed to assess the process, such as the completion date, cost, quality, and flexibility, imply a wide spectrum of KPIs, which are universally applied in practice by process specialists (see Figure 3.8).

In general, the performance indicator should have the following traits (according to the SMART¹⁷ model):

- *Specific*. Is the measure clear and focused?
- *Measurable*. Can the measure be quantified and compared to other data?
- *Attainable*. Is the measure achievable, reasonable, and credible under expected conditions?

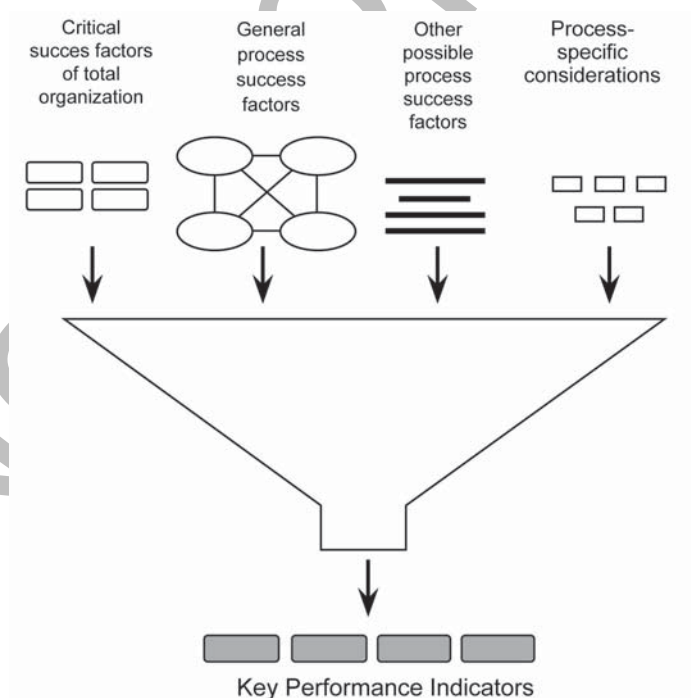


Figure 3.8. Generating KPIs based on CSFs.

Source: PROMET (1997).

- *Realistic*. Does the measure fit into the organization's constraints? Is it cost effective?
- *Timely*. Is the measurement doable within the given time frame?

Effectiveness indicators are implemented by BI systems in the form of a corporate performance management cockpit (management dashboard) and by means of data warehouses and OLAP tools (see Figure 3.9).

In this context, KPIs are described by the following parameters:

- Name of the process being monitored
- Name, definition, and formula describing the calculations
- Unit of measurement
- Frequency of update
- Measured period
- Specification of the forecast values, trends, or both at specific intervals
- Specification of the data sources
- Method of explanation for the value of the indicator by reports and operations (i.e., drill down)

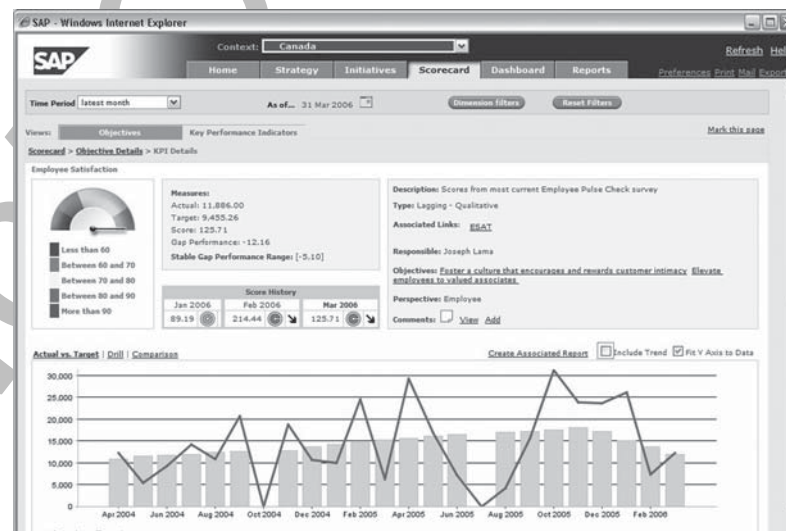


Figure 3.9. Management dashboard (visualization of KPI and adequate OLAP reports) on the example of SAP Business Objects Strategy Management.

Source: SAP Poland (2009).

- Method of presentation for the end user
- Trade-off (i.e., impact of this indicator on other indicators)
- Connection with strategic goals
- Responsibility (responsible manager, which is usually the process manager)

The ergonomics of the visualization of indicators can even be reflected in the proper organization of the room used for board meetings (a possible solution is presented in Figure 3.10). To illustrate the issue of process management in which KPI monitoring is employed, let us consider order processing. This process is conventionally described by the on time in full (OTIF) indicator, which informs a logistics manager what percentage of orders are realized on time (promptness) and in full in a specific time frame (see Figure 3.11). In this example, OTIF is the KPI, which is directly subject to the processes of the manager's evaluation.

The maturity of BI solutions was one of the decisive factors in their development in business process management. BI can be employed for activities such as the following:



Figure 3.10. Management dashboard as an integral element of company's board meeting room.

Source: Daum (1999).

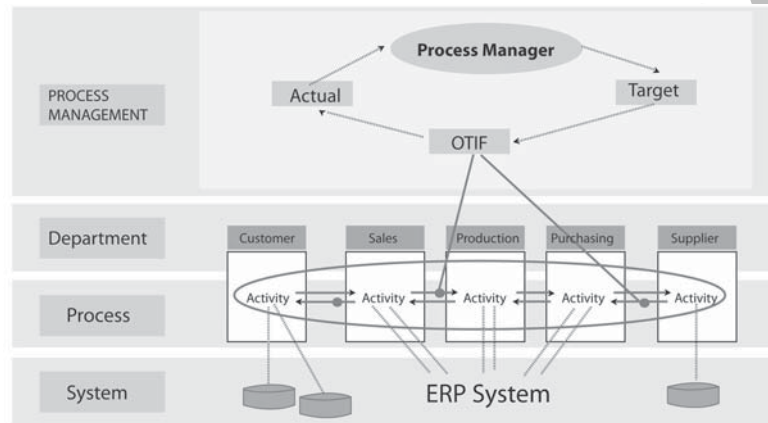


Figure 3.11. OTIF as an example of KPI in the order processing management.

Source: PROMET (1997).

- *Real-time monitoring.* Usually the time interval is not shorter than day, week, or month. Still, there are solutions that can be applied for real-time process monitoring. It is possible if the design of a data warehouse is directly integrated with the transactional system. In this approach, a specific transactional event is stored and aggregated almost immediately in the data warehouse. As a result, the information is pushed to the management dashboard.¹⁸
- *Analysis.* Every KPI as understood by multidimensional data analysis is a measure in the fact table or a calculated measure in the OLAP reporting tool. This means that all analyses discussed in this chapter are definitive for use.
- *Off-line simulations.* Cause-and-effect simulations and “if-then” analyses can be carried out, which enable a process manager to fully understand the process and search for suitable solutions in critical situations.
- *Suggestion of managerial decisions.* It is possible not only to provide managerial information but also to suggest business solutions on the basis of the current situation due to expert systems.¹⁹ Despite being developed in the 1970s, this business application is not mature and universally applied yet.

- *Presentation and distribution of information.* It is universally used by corporate portals, in which the scope of presented data and mode of notification about critical or exceptional situations are defined, confidentiality of access is managed, mode of presentation is defined, and so on (see Figure 3.12).

Such applications of BI allow for comprehensive process management and its continuous improvement.

The development of the implementation of business processes within ERP management systems led to the development of referential models.²⁰ These models reflect the best practices based on experience of many enterprises that participated in the implementation of previous versions of the system. Consequently, it is now possible to construct ready-made models of data warehouses designed to provide concrete and business-oriented managerial information. Extensive ready-made referential data models (metadata repositories) are available for, among other things, concrete applications in telecommunications and the financial sector (e.g., banking).²¹



Figure 3.12. Example of personalized access to the corporate portal based on SAP Portal.

Source: SAP Poland (2009).

3.2.2.4. Balanced Scorecard

Research into the problem of strategy management and measuring a company's performance resulted in the concept of a balanced scorecard. This scorecard was drawn up by Robert Kaplan and Peter Norton as a response to the obvious weakness of the classical description of a company's performance by means of financial measures, in which intangible assets were gaining more and more importance.²² Kaplan and Norton's concept showed its true worth when the scorecard was employed as a system of support for a company's strategy implementation and its rational management. This strategic scorecard is a tool that enables the management board to translate a company's vision and strategy into a set of logically linked KPIs in four perspectives: finance, customers, internal business processes, and learning and growth. The practical application of the balanced scorecard has spread thanks to the development of BI tools, which allow for the accurate calculation of the scorecard indicators at adequate time intervals and their visualization, description, and proper use in the management of a company. The values of all indicators are calculated and displayed for the same moment in time. Usually, this hinders cause-and-effect analysis because real connections between perspectives differ in time. Figure 3.13 shows a possible way to present a demonstration of KPI from selected perspectives.

A properly devised and implemented balanced scorecard is an extremely strong management tool. It can be employed, among others, to²³

- present, clarify, and agree on the strategy inside the company;
- connect strategic aims with yearly budgets and indicators with forecast values;
- connect goals of different organizational units and different employees with the realization of the strategy;
- monitor strategic initiatives (projects);
- analyze the realization of a strategy systematically and periodically;
- gain feedback that allows for the updating and modification of a strategy;
- link the extent to which the strategic aims were achieved to the payroll system.

Case Study 3.2 shows an example of a management dashboard for a chain store.

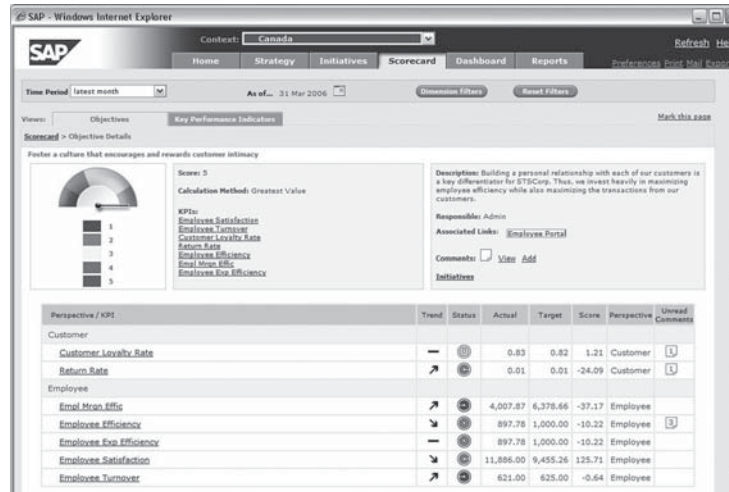


Figure 3.13. Presentation of indicators of customer's perspective and perspective of the development of the balanced scorecard on the example of SAP Business Objects Strategy Management.

Source: SAP Poland (2009).

Case Study 3.2

Thanks to the implementation of the data warehouse and managerial information system, the management dashboard was devised for the president of the ALFA chain. This enables the president to monitor the enterprise's three key strategic initiatives: developing the chain, increasing the market share, and optimizing cost management. The ten KPIs on the management dashboard are shown below in Table 3.19:

Table 3.19. The ALFA chain KPI's

No.	KPI	Reporting period	Responsible
1	Earnings before interest and taxes (EBIT)	Month	Financial director
2	Return on capital employed (ROCE)	Quarter	Financial director
3	Cash conversion cycle (CCC)	Week	Financial director
4	Sales volume (amount & quantity)	Week	Board member responsible for sales
5	Market share	Month	Board member responsible for sales
6	Average store (Point of Sales) profitability	Month	Board member responsible for sales
7	Number of new stores	Month	Vice-president
8	Product turnover in the logistics center	Month	Logistics director
9	Logistics costs	Month	Logistics director
10	Staff turnover	Month	Human resources manager

3.2.3. Strategic Information

3.2.3.1. Introduction

In section 3.2.2, managerial information was intentionally limited to analysis of the internal activities of an enterprise (also in terms of the realization of the strategy; see section 3.2.2 on the balanced score-card). However, here “strategic information” means information that supports the process of devising a strategy, which is mainly based on the analysis of the environment of the enterprise. The strategic analysis is then a series of activities designed to evaluate an enterprise and its environment, which allows for the creation of a strategic plan and its realization. On the whole, strategic management (including the analysis, planning, and realization of the strategy) is defined as making decisions that are supposed to take advantage of the opportunities and strengths of the company, avoid threats in the environment of the enterprise, and take notice of its weaknesses. Strategic managerial decisions, which are fundamental to the future of the company, are usually unique and by their very nature difficult to formalize. They concern activities that²⁴

1. have long-term consequences,
2. build the competitive advantage of the company,
3. effectively exploit the company’s main reserves and capacity,
4. are internally consistent.

And that’s why they are usually

1. ill-structured,
2. performed in times of great uncertainty,
3. costly (because they require clear-cut and often irreversible investment decisions),
4. cascading (i.e., to be effective, they must be followed by a series of consistent tactical and operational decisions).

According to Herbert Simon’s works,²⁵ this kind of decision is labeled as an ill-structured task. Solutions for this task are found using strategic information supported by the use of strategic analysis. A relatively

long-term perspective and dependence on external sources of information are particularly important here (see Table 3.14).

Strategic analysis, including demand for information, encompasses three areas:²⁶

1. *Enterprise itself.* This area is connected with managerial information (see section 3.2.2).
2. *Competitive environment.* This includes external individuals, groups, and companies with which the enterprise has business relations: suppliers, customers, competitors, and so on.
3. *Macroenvironment.* This includes political, technological, legal, demographic, and social conditions.

The competitive and macro environments are connected to the issue of “competition intelligence.” In American specialist literature, this approach to the theory and practice of enterprise environment analysis was originally called “competitor intelligence.”²⁷ However, its semantic range has been extended over time. Nowadays, competitive intelligence (CI) is defined as the activity of monitoring an enterprise’s economic and competitive environment, which is relevant for strategic decision making.²⁸ This terminological digression is extremely important because the term “business intelligence” is mistakenly interpreted as competition intelligence. Although BI and CI are very different in many ways, they do partially overlap. From the point of view of BI, CI is the field (subset) of applications in the context of supporting strategic managerial decisions. From the point of view of CI, BI may be interpreted as a set of tools and technologies for more effectively drawing up and processing strategic information.

3.2.3.2. The Process of Strategic Information Management

The process of strategic information management (see Figure 3.14) is carried out by a panel of experts called information brokers. The recipients of this strategic information are the board of the company.

The process of strategic information management consists of the following stages:²⁹

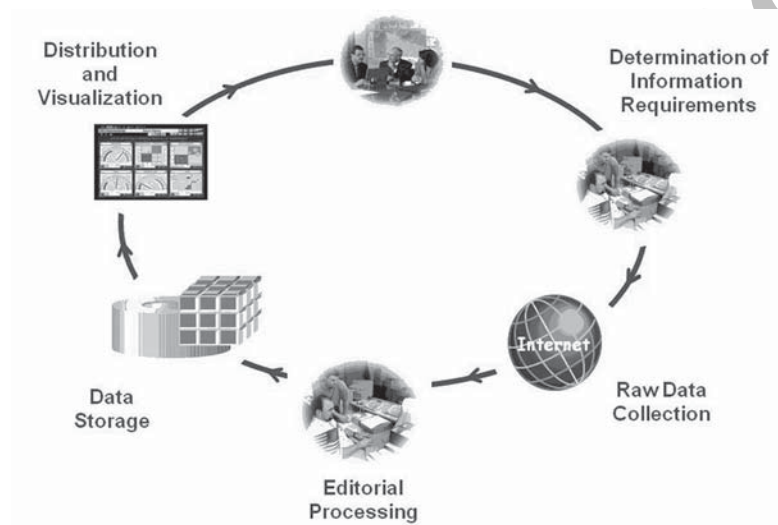


Figure 3.14. *The process of strategic information management.*

Source: Fulleborn and Meier (1999).

1. *Determination of information requirements.* This analysis is made with the board of the company and aims to determine the key intelligence topics and key intelligence questions designed to support (rationalize) strategic decisions.
2. *Raw data collection.* Having determined the information requirements, the sources of information are located and the raw data are collected. As mentioned before, these are usually external sources of unstructured data: They may amount to 95% of all sources, of which the vast majority are published and public sources. Unpublished data, which are collected during interviews with employees, experts, and so on, is also taken into account. When online databases or Internet sources are the source of data, additional opportunities arise connected with making queries, which allow for searching web pages, their constant monitoring, and often the identification of previously unknown sources of information.
3. *Editorial processing and data storage.* This is the key stage of the whole process, which consists of processing the collected raw source data and transforming it into strategic information. The issue of selectiveness plays a vital role at this stage. As was observed by Herbert Simon,³⁰ the problem does not lie in the scarcity of information but in its proper

selection so that decision makers can have access to the most important information.³¹ The key factors here are the broker's very clear understanding of the enterprise board's needs, which should have been determined at the first stage; the wider market context; the ability to select adequate information, and finally their synthesis. It must be stressed that current information technology (IT) allows for only limited support of these activities. Then this stage naturally leads to the storage of data in the data warehouse, which allows for its further processing, analysis, visualization, and distribution.

4. *Distribution and visualization of information.* The final stage is the drawing up of the managerial information and its distribution to the board. The key is the ability to select the essential information and present it clearly. Having more sources of information at their disposal than the rest of the employees, leaders can sometimes lose their sense of direction more easily or follow the wrong track. Extensive knowledge and the proper synthesis of information enable managers to detect implicit relationships and anomalies, and most importantly, they make them more sensitive to things that are strategically vital.

3.2.3.3. The Role of BI in Strategic Information Management

BI systems designed to support strategic decision making are often called strategic information systems. These BI systems start the process by collecting the source information. This collecting takes place on the web, and extract-transform-load (ETL) techniques (see section 2.4) can be employed to integrate various sources of data for further analytical processing.

The most demanding part of the process is connecting sources of information in which the stored data are largely unstructured. The crucial point is to connect text documents with quantitative data—for instance, the financial results of the company with its product strategy report. Technically, it is possible to store data of different types in a data warehouse, but only if they are connected with each other through the primary key or identifier (see Figure 3.15).

If quantitative data describing companies, competing businesses, or both are properly stored, benchmarking can be conducted on the level of key performance indicators. At present, competitive benchmarking is one of the standard management techniques and consists of comparing

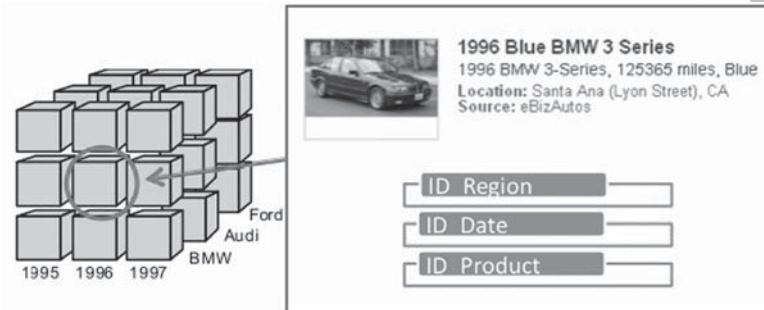


Figure 3.15. Example of connecting text data in the data warehouse.

Source: Based on Fulleborn and Meier (1999).

competing enterprises and their activities. Making comparisons with a company's competitors on the level of KPI is relatively easy. The difficulty lies in the fact that data from external sources are nonnumerical (qualitative) and usually unstructured (i.e., they are in various formats or lack clear-cut and consistent nomenclature, uniqueness, etc.). The classic methods of data processing (see chapter 2) are of no use in such a situation. And that means that most of the work at this stage is performed manually by a team of information brokers. However, at least part of the processing can be initially done by automatic text data processing by means of text mining.³²

Text data exploration consists of mining data from unstructured text data. The following methods can be employed for text mining:

- *Text categorization.* Automatic matching of the document with formerly determined categories (e.g., putting dot-com documents about competitors into one of three categories: new products and technologies, current events, or other).
- *Text clustering.* Automatic identification of sets (groups) of documents that are similar because of one shared feature (e.g., the most frequent identical key word). For each identified group, statistics are quoted (e.g., the most important shared features of each group). In this approach, it is possible to identify duplicate and almost identical documents.
- *Data extraction.* Extracting from a text document some objects that have shared semantic interpretation, such as people, organizations, places, things, events, and also relationships between

identified objects (see Figure 3.16). Here it is also possible to identify the language of the text or interpret abbreviations used, dates, units of measurement, and so on.

- *Editorial processing.* Automatic processing of a document in terms of spellchecking (i.e., correcting spelling and punctuation mistakes) and summarizing (i.e., identifying the most important tasks and putting them together into a consistent text).

The last stage—that is, the visualization and distribution of information if the data are stored in the data warehouse—is processed in the same way as the previously discussed management dashboards. The fundamental difference lies in the necessity of presenting text data.

Our examination of the basics of business analysis concludes with a reflection on the importance of strategic information. In the next chapter, advanced business data analysis methods will be presented.

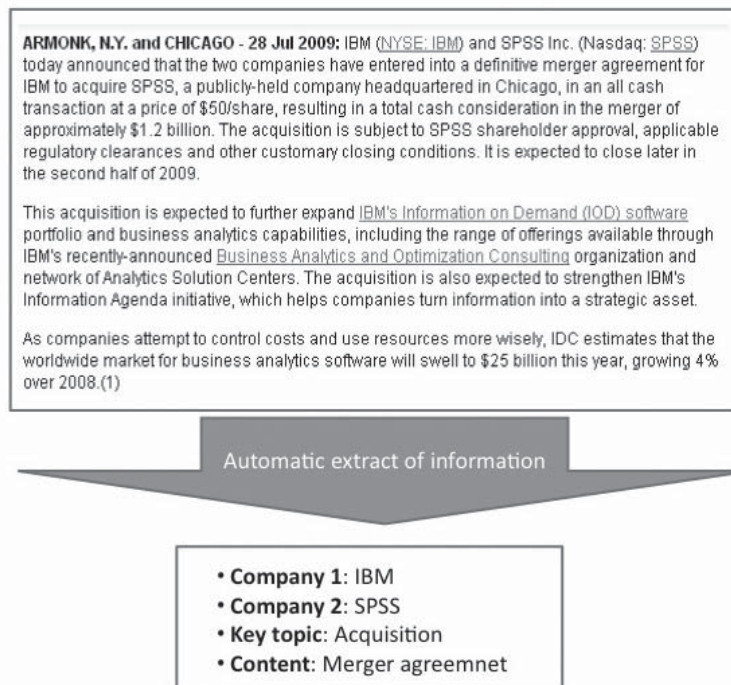


Figure 3.16. Example of automatic extraction of information from the text.

Source: author.

Recommended Literature

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- Markov, Z., & Larose, D. (2007). *Data mining the web: Uncovering patterns in web content, structure, and usage*. New York, NY: Wiley-Interscience.

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- Feldman, R., & Sanger, J. (2006). *Text mining handbook: Advanced approaches in analyzing unstructured data*. Cambridge, UK: Cambridge University Press.
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Internet Resources

OLAP

- Data Warehousing and OLAP. <http://www.daniel-lemire.com/OLAP>
- OLAP Report. <http://www.olapreport.com/>

Information Management

Business Intelligence Journal. <http://www.businessintel.org/>

Business Process Management Initiative. <http://www.bpmi.org/>

Balanced Scorecard Institute. <http://www.balancedscorecard.org/>

Strategic Information

Strategic and Competitive Intelligence Professionals. <http://www.scip.org/>

The CI resource Index. <http://www.bidigital.com/ci>

Open Source Intelligence. <http://www.onstrat.com/osint/>

EUROSINT Forum. <http://www.eurosint.eu/>