



Munich Personal RePEc Archive

Business Intelligence Approach In A Business Performance Context

Muntean, Mihaela and Cabau, Liviu Gabriel

West University from Timisoara (Romania), Faculty of Economics
and Business Administration, Department of Economic Informatics
and Statistics

25 March 2011

Online at <https://mpra.ub.uni-muenchen.de/29914/>
MPRA Paper No. 29914, posted 05 Apr 2011 17:53 UTC

BUSINESS INTELLIGENCE APPROACH IN A BUSINESS PERFORMANCE CONTEXT

Prof. Mihaela I. Muntean, Ph.D
Liviu Gabriel Cabău, Ph. D Candidate¹)

Abstract

Subordinated to performance management, Business Intelligence approaches help firms to optimize business performance. Key performance indicators will be added to the multidimensional model grounding the performance perspectives. With respect to the Business Intelligence value chain, a theoretical approach was introduced and a practice example, based on Microsoft SQL Server specific services, for the customer perspective was implemented.

1. Business Intelligence for Business Performance

1.1 Theoretical approach

Business Intelligence (BI) is unanimously considered the art of gaining business advantage from data; therefore BI systems and infrastructures must integrate disparate data sources into a single coherent framework for real-time reporting and detailed analysis within the extended enterprise. Gaining into the business/organization by understanding the company's information assets, like customer's information, supply chain information, personnel data, manufacturing data, sales and marketing activity data as well as any other source of critical information [Negash, S., Gray, P., 2003], BI tools have the power to make informed decisions more effectively. Including aggregation, analysis, and reporting capabilities, BI solutions transform data into the high-value insight that allows managers to make more timely and informed decisions. Without any doubts, business decisions are only as good as the information on which they are based.

Looking inside the business and at the environment in which they operate, managers are able to fundament the most productive and profitable decisions. Only optimizing performance, an enterprise can survive and remain an important competitor in the changing market, constantly taking advantage of the raising opportunities, risking and being flexible at new multiple demands. Having as a main goal productivity and profitability, BI initiatives help decidents in solving business problems for maximizing the business value [Muntean, M., Târnavăanu, D., Paul, A., 2010]. Also the solution to a business problem is a process that includes business intelligence, BI, by itself, is rarely the complete solution to the problem [Pentaho Corporation, 2008]. Therefore, BI tools must understand the process and how to be part of it.

Subordinated to performance management, BI approaches help firms to optimize business performance [Mukhles, Z., 2009]. Benefit will be realized when the company manages to optimize

¹ Faculty of Economics and Business Administration, West University of Timisoara, Romania

the business processes that affect the key performance indicators (KPI) metrics (*Figure 1*). When integrating KPIs into a company's performance evaluation system, it is crucial that relevant indicators be identified by managers. A KPI should be specific, measurable, achievable, result-oriented, and time-bound. KPIs are used to assess or measure certain aspects of business operations that may otherwise be difficult to assign a quantitative value to, like employee or customer satisfaction, leadership development, or service quality. *Integrated into a company's strategic plan as part of the management techniques, like the Balanced Scorecard approaches, they sustain performance management.*

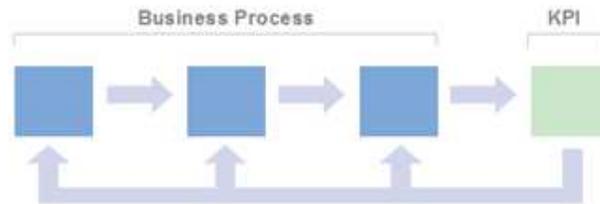


Fig. 1 Business intelligence & Performance management [Pentaho Corporation, 2008]

Business intelligence systems vendors are preoccupied to offer suitable solutions for managers, *BI solutions that are capable to deploy Balanced Scorecards* [Kaplan, R., Norton, D., 1996], performance dashboards, and enterprise reports; they offer support for managing initiatives, risks, all kind of operations, benchmarking, and resources.

The Balanced Scorecard is a powerful and innovative tool to measure performance, to measure if a firm's activities help it achieve its objectives related to its vision and strategies. It is a management system and strategic planning tool, offering a global image of a firm, transforming the strategy and firm mission into tangible and measurable objectives. The term "scorecard" signifies quantified performance measures and "balanced" signifies that the system is balanced between: short-term objectives and long-term objectives; financial measures and non-financial measures; lagging indicators and leading indicators; internal performance and external performance perspectives [Muntean, M., Târnavăanu, D., Anca, P., 2010].

Linking Balanced Scorecard measures to strategy is vital; strategic measures, those that define the strategy designed for competitive excellence, will ground the collaborative decision processes among senior and mid-level managers. *Any Balanced Scorecard Management Program can be developed based on a business intelligence approach.*

1.2 Practice example for customer perspective

The four main perspectives (Finance, Internal Business Processes, Education and Growth, Customers) [16] provide relevant feedback for the managers' initiatives [Kaplan, R., Norton, D., 1996]. *By organizing the customer perspective as a Balanced (Sub-) scorecard, we can define the next four approach perspectives: ❶ Market Invasion (MI), ❷ Customer Quality (CQ), ❸ Customer Segmentation (CS) and ❹ Damage and Recovery Manager (DRM) (Figure 2).*

For **MI** analysis, measures like I_{11} - **Accession Rate** (the percentage of new customers), I_{12} - **Diminution Rate** (the percentage of lost customers), I_{13} - **Market Penetration Rate** (a measure of the amount of sales or adoption of a product or service compared to the total theoretical market for that product or service) and I_{14} - **Retention Rate** (the percentage of retained customers from those who approached for cancellation) are recommended.

CQ specific measurable objectives can be expressed by I_{21} - **Customer Loyalty Rate** (tendency of a customer to choose a business or product over other businesses), I_{22} - **Customer Value** (the profit brought by the customer into the business), I_{23} - **Customer Long Term Value** (the net present value of the cash flows attributed to the relationship with a customer) and I_{24} - **Customer Life**

Span (the period of a relationship with a customer - usually years).

For the **CS** perspective we propose to introduce measures like I_{31} – **Happy Customers** (the number of customers that often and on a large scale use some services or products and are completely satisfied with them), I_{32} – **Satisfied Customers** (the number of customers that are satisfied with the provided services/products, however they don't have an active, constantly developing relationship with the business), I_{33} – **Dissatisfied Customers** (the number of customers that aren't satisfied with the provided services/products) and I_{34} – **Customer Potential** (the value brought by the customer into the business during the life span).



Fig. 2 Customer relationship scorecard

And finally, but not at least, **DRM** is based on I_{41} – **Risk Factor** (the number of high loyalty customers who are at risk of breaking their relationship with the business or are going to become passive ones), I_{42} – **Dissatisfaction Management** (the number of dissatisfied, unhappy customers turned into satisfied ones), I_{43} – **Damage Control** (costs generated by dysfunctions/damages of services/products), I_{44} – **Customer Recovery** (the number of customers recovered from the passive ones or from those who had broken their relationship with the business) and I_{45} – **Service Quality** (the quality of products/services).

As indicated in *Figure 3*, the performance will be expressed at indicator level (I_{11} – I_{45}), at perspective level (I_{MI} , I_{CQ} , I_{CS} and I_{DRM}) and at global level (I_{CRM}). By introducing weights at indicator level, the total performance for each perspective will be determined as a weighted average of the individual performances; similar proceeding for the total performance in the customer relationship scorecard (I_{CRM}).

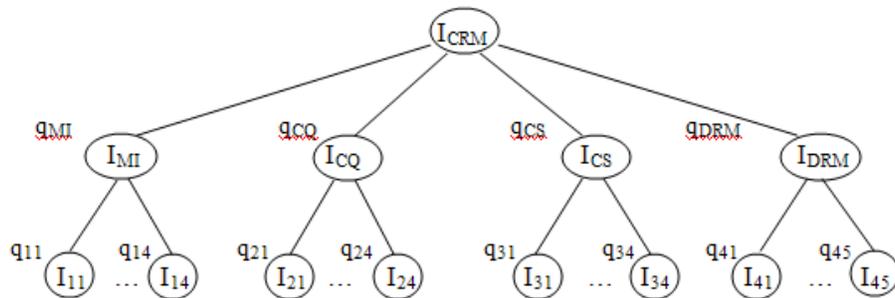


Fig. 3 KPIs for the customer relationship scorecard

Strategy initiatives will be formulate taking into account the desired targets and should imply the correction of business aspects and customer management strategy approaches.

2. Business Intelligence Value Chain

2.1 From Data to Profit

According to Gartner Group, business users are challenged by enterprise resource planning (ERP) applications' data access and analytic capabilities [4]. As a strategic business initiative, META Group said that, *Business Intelligence projects for ERP* “stand to offer ‘breakaway’ competitive advantage” [13]. There have been identified important business drivers for adopting BI for ERP, after 2007 a major consolidation of BI vendors with ERP vendors being registered [14]. This new approach contributes to: identify performance issues; monitor business activities to ensure optimal execution; provide macro view of customer (supplier, employee, partner) information; enable business partners and suppliers to access critical information to integrate business process decision-making within the supply chain; improve responsiveness to events and activities that impact the business.

BI solutions should grow the visibility over business performance and support that in *Figure 4* indicated value chain.

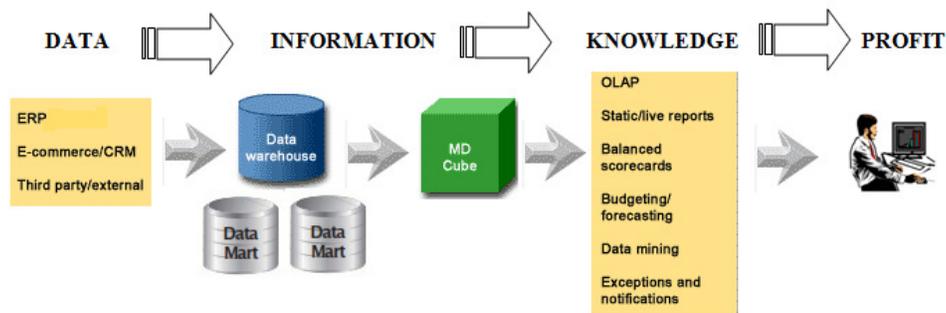


Fig. 4 BI value chain (adapted from [www.businessobjects.com])

The „From DATA To PROFIT” previously defined BI value chain needs a unitary value management approach [Bitici, Martinez, Albores, Parung, 2004]. According to experts, Business Intelligence enhances the business value of „nuts-and-bolts” transactional data in ERPs and other applications by enabling users to gain insights through analysis and reporting [14].

2.2 Data Warehouses for supporting the BI value chain

According to McKnight, W., *establishing the proper enterprise data warehouse (EDW) architecture is a good start for any the BI approach* [6]. The efficacy of having a centralized data store with quality, integrated, accessible, high performance and scalable data can't be denied, but short term business needs can conduct to a data marts oriented BI solution (*Figure 5*). The enterprise data warehouse/department data marts must content items/objects of importance to the business as customer, product, time, geography, sales hierarchy and market (referred to as ‘dimensions’ since they define the context of the business transactions). Practically, the data warehouse/data mart is a database in which atomic level data from disparate sources is brought together in a structured way creating one multi-subject oriented version of the corporate/department truth, designed to enable timely, accurate decision making in support of strategic and tactical business initiatives.

According to Cope, D. (2007) “data warehouses (DW) are not a once off implementation; they are a medium/long term investment” [3]. One essential step in the deployment and consolidation of data warehouses and data marts is the elaboration of the DW data model.

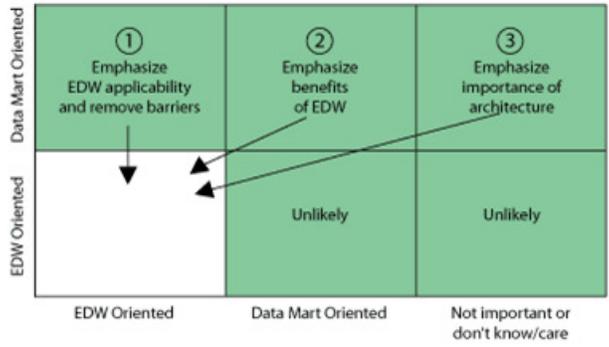


Fig. 5 Data warehouse architecture [McKnights, W., 2004]

With regards to the business requirements and as a result of a complex data analysis, the data model will ground the logical design of the data warehouse. Facts and dimensions, building a multidimensional approach (Figure 6), will be established.

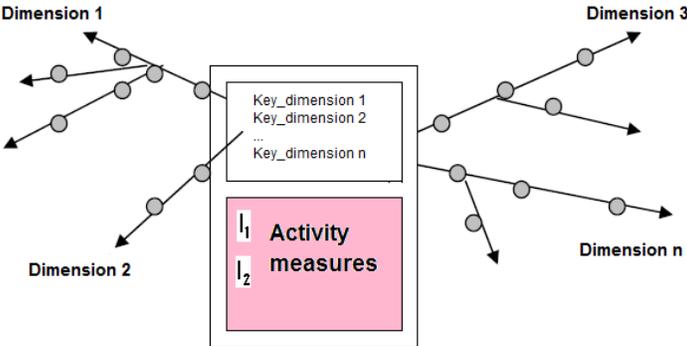


Fig. 6 DW multidimensional model

The data model obtained through a query oriented or a data sources oriented approach [Ballards,C., Herrman, D., Schau, D., 1998] is the result of a conceptual multidimensional design process. Data analysis and business requirements analysis will ground the initial multidimensional data model. Through customizing (introducing granularity, aggregation types, sparsity) the initial data model will be suitable to support the BI value chain [8]. *The query oriented approach starts with the identification of the key performance indicators, these being candidate measures for the conceptual multidimensional model* [8]. A star/snowflake schema, consisting of facts and dimensional tables, will be generated for the data warehouse, grounding the MultiDimensional (MD) cube deployment process. Using drill-up and drill-down operations on the MD cube, detailed views of the dimensional hierarchies can be displayed, obtaining a real valuable knowledge.

3. A BI approach with Microsoft SQL Server

Successful implementation of performance management relies on technology platforms that facilitate the rapid creation of planning, analysis and monitoring capabilities which provide critical insight in the form of forward - looking and historical indicators and solutions that enable people to turn data into insight, ideas into action and turn change into opportunity. Microsoft SQLServer provides a scalable Business Intelligence platform optimized for data integration, reporting and analysis, enabling organizations to deliver knowledge where users want it [15]. Grounded on the DW schema, the MD cube will be deployed. After processing the cube, the KPIs can be added to the MD cube (Figure 7). KPIs are meant to enable decision makers to monitor the

key aspects of the organization’s operations at single glance, being frequently evaluated over time.

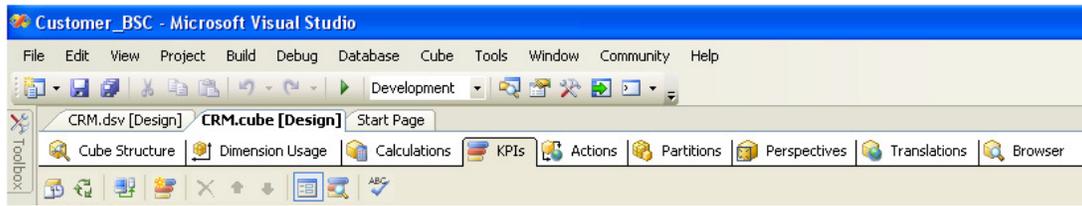


Fig. 7 Adding KPIs to the MD cube

Defining a KPI means to establish the following components: ❶ the Value Expression (a MultiDimensional eXpressions – MDX that returns the KPI’s actual value), ❷ the Goal Expression (a MDX expression that returns the KPI’s target value), ❸ the Status Expression (a MDX expression that returns the KPI’s state at a specific point in time) and ❹ the Trend Expression (a MDX expression that returns the KPI’s value over time). Some KPIs return absolute values, others express rates, a unifying approach being necessary.

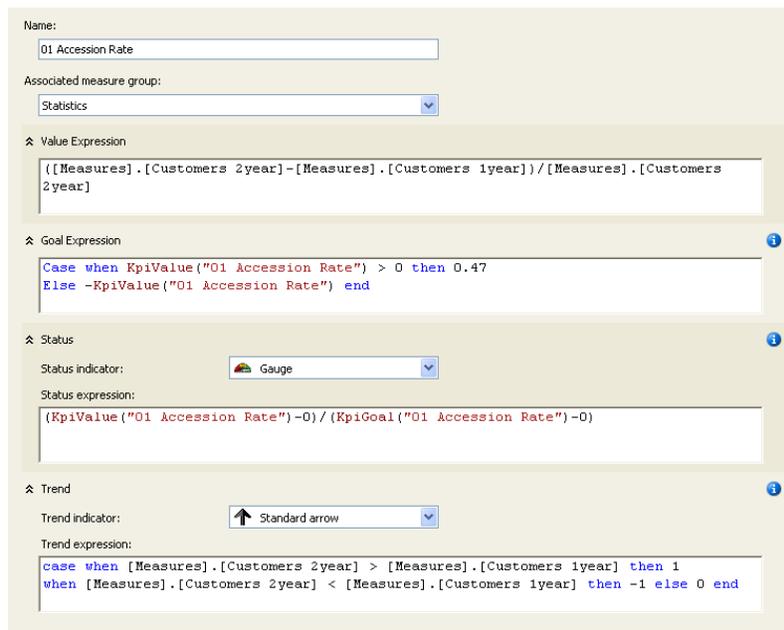


Fig. 8 SQL Server. Defining KPIs

According to the *Status expression* formulation, beyond the *KPI_Value* and the *KPI_Goal* a *KPI_Minimum*, based on the business reality and the meaning of the KPI, is necessary to be considered.

$$KPI_status = \begin{cases} \frac{(KPI_Value - KPI_Minimum)}{(KPI_Goal - KPI_Minimum)}; \forall KPI \text{ with a positive connotation} \\ \frac{(KPI_Value - KPI_Goal)}{(KPI_Minimum - KPI_Goal)}; \forall KPI \text{ with a negative connotation.} \end{cases}$$

For KPIs with negative connotation, *KPI_Goal* represents an undesired goal, the *KPI_Minimum* being in fact the real target. After adding the Status Expression, the Status Indicator will be setup (for example the Gauge – Figure 8).

For the Trend Expression the formulation indicated in *Figure 8* has been chosen. A Trend Indicator can also be setup in form of an arrow (*Figure 8*) or as the smiley face. In some cases, for defining KPIs calculated members are needed [Shelton, R., 2010].

As stipulated in paragraph 1.2, the total performance for each perspective, like *Market Invasion*, *Customer Loyalty*, *Customer Segmentation* and *Damage and Recovery Manager* will be established as a weighted average of the individual performances (*Figure 9*). Practically, a weighted average of the KPI_status values will be calculated. After defining all KPIs, the result can be viewed (*Figure 9*).

Dimension	Hierarchy	Operator	Filter Expression
Periods	Period	Equal	{ 2009-2010 }
<Select dimension>			

Display Structure	Value	Goal	Status	Trend	Weight
I MARKET INVASION					
01 Accession Rate	0.37	0.47		↑	5
02 Diminution Rate	0	-0.2		↓	1
03 Market Penetration Rate	0.61	0.85		↑	3
04 Retention Rate	1.59	0.85		↑	1
05 MARKET INVASION	0.9				3
II CUSTOMER QUALITY					
06 Customer Loyalty Rate	0.4	0.8		↓	6
07 Customer Value	78	100		↑	1
08 Customer Longterm Value	156	300		↑	2
09 Customer Life Span	2	3		↑	1
10 CUSTOMER QUALITY	0.55				3
III CUSTOMER SEGMENTATION					
11 Happy Customers	6887	8673		→	2
12 Satisfied Customers	13266	13266		↑	1
13 Dissatisfied Customers	3207	2538		↑	6
14 Customer potential	200	338		↑	1
15 CUSTOMER SEGMENTATION	0.16				2
IV DAMAGE AND RECOVERY MANAGER					
16 Risk Factor	2354	2241		→	2
17 Dissatisfaction Management	780	652		↑	5
18 Damage Control	13	17		↑	1
19 Customer Recovery	2335	1659		↓	1
20 Service Quality	342	569		↑	1
21 DAMAGE AND RECOVERY MANAGER	0.8				2
TOTAL PERFORMANCE IN CRM SCORECARD					
22 TOTAL PERFORMANCE	0.62				

Fig. 9 Customer perspective specific KPIs

As this practice example demonstrates, a KPI can be an effective way to get a quick read on the organization's performance. Concluding, Microsoft SQL Server, through its Analysis Services component, provides all features to define KPIs based on the deployed MD cube. The KPIs values are calculated for the entire data set, or filters can be defined (*Figure 9*) to establish what data the KPIs will use.

4. Conclusions

The customer balanced scorecard represents a useful basement for customer relationship management within the global business strategy. "How should we appear to our customers?" – is a question that constantly preoccupies business managers in their desire to increase customer loyalty. Beyond customer satisfaction, the customers must feel themselves as part of the business. Referring

to the Service Profit Chain, the Accession Rate will be increased, if the Customer Loyalty Rate obtains higher values.

The four proposed perspectives ❶ - *Market Invasion*, ❷ - *Customer Quality*, ❸ - *Customer Segmentation* and ❹ - *Damage and Recovery Manager*, together with their subordinated child KPIs, form the customer balanced scorecard and are grounding a BI approach for performance management. Referring directly to the considered practice example, the deployed BI solution proved its efficiency in optimizing business performance.

Managers should invest in Business Intelligence solutions; they provide the answer to critical business challenges.

5. References

[1] BALLARDS, C., HERRMAN, D., SCHAU, D., Data Modeling Techniques for Data Warehousing, 1998

[2] BITICI, U.S., MARTINEZ, V., ALBORES, P., PARUNG, J., Creating and Managing Value in Collaborative Networks, International Journal of Physical Distribution & Logistic Management, vol. 43, no.3/4, 2004

[3] COPE, D., Business Intelligence Architecture. Components Overview, IBM Corporation, 2007

[4] DRESNER, H., "Gartner's 2002 BI Market Study: How Do You Stack Up?", Gartner AV_18_5277, November 2002

[5] KAPLAN, R., NORTON, D., Translating Strategy Into Action. The Balanced Scorecard, Harvard Business School Press Boston, 1996

[6] McKNIGHTS, W., The New Business Intelligence Architecture Discussion, Information Management Magazine, September 2004

[7] MUKLES, Z., Business Intelligence: Its Ins and Outs, Technology Evaluation Centers, April 29th, 2009, <http://www.technologyevaluation.com/research/articles/business-intelligence-its-ins-and-outs-19503/>

[8] MUNTEAN, M., A Framework for Designing and Developing OLAP Systems, Electronic Computation and Economic Cybernetics Studies and Research, vol. 36, no 1-4, 2003

[9] MUNTEAN, M., TARNĂVEANU, D., PAUL, A., BI Approach for Business Performance, Proceedings of the 5th WSEAS Conference on Economy and Management Transformation, 2010

[10] NEGASH, S., GRAY, P., Business Intelligence, Proceedings of the Americas Conference on Information Systems, 2003

[11] POPA, GH., UDRICA, M., MANOLE, A., VASILIU, B.G., GÂRBA, M., Microsoft SQL Server, Editura Economica, București, 2006

[12] SHELTON, R., Adding a KPI to an SQL Server Analysis Services Cube, www.SimpleTalk.com, 2010

[13] ***, META Group - "Best Practices for ERP Business Intelligence Strategies: 2003/04"

[14] ***, Business Objects. SAP and Business Intelligence – www.businessobjects.com

[15] <http://www.microsoft.com>

[16] http://www.valuebasedmanagement.net/methods_balancedscorecard.htm

ACKNOWLEDGEMENT

This work was partially supported by **ANCS-CNMP Project PNII – 92-100/2008-2011** „Sisteme colaborative suport pentru managementul proiectelor economice“ for **Prof. Mihaela I. Muntean, Ph.D**

and

partially supported by the strategic grant **POSDRU/CPP107/DMI1.5/S/78421, Project ID 78421 (2010)**, co-financed by the European Social Fund – Investing in People, within the Sectoral Operational Programme Human Resources Development 2007 – 2013” for **Liviu Gabriel Cabău, Ph. D Candidate**