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INVITED PAPER

Service-oriented architecture is a driver for daily decision support

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Abstract

Purpose – This paper aims to explain why service-oriented business intelligence (SOBI) happened, the new development and how to make a strategy to introduce daily decision support in the retail trade.

Design/methodology/approach – The diffusion of business intelligence (BI) tools is operationalized on Rogers' innovation theory.

Findings – The article answered the question: How to draft a BI strategy for all parts of the retail enterprise? By excellent data warehouse quality; choosing an area for common decision support; starting simply, with metrics (sale, gross margin, number of customers) to get users started and then continue the iterative process of practicing more comparing and personalized BI.

Practical implications – Retailers meet a changeable world around where business decisions must be taken daily. In the retail industry, the customer's current demands control the supply of commodities, inventories and crew. Retailers have enterprise applications designed for their business processes, but also daily want to measure the performance. It is a question of from existing enterprise applications and databases design new decision processes and business flows that currently request BI data to be presented directly to operative responsible staff.

Originality/value – Explains why there are attempts to combine the two broad architectural paradigms BI and service orientation. Service-oriented architecture, BI, on line analytical processing, extract, transform and load, SOBI are discussed in detail.

Keywords Business improvement, Cybernetics, Management theory

Paper type Case study

1. Introduction

Why should retailers invest in analyzing tools for business intelligence (BI)? Gather materials for reporting from various systems and let the report generator operate on different data sources, is difficult and expensive. Separate excel sheets with their own formulas are the "walk-around" solution bringing person dependencies and expensive maintenance over time. Inadequate or biased aggregated information silos turns decision-making for pricing goods, launching a new product or service, etc. into gambling. The principles and practice of service-oriented architecture (SOA) is to break through the barriers of business integration and help enterprises get their information resources in better order. SOA facilitates the design, the implementation, and re-use of multi-dimensional on line analytical processing (OLAP) databases, but above all SOA increases the availability by presentating services to new categories of BI users. According to the BI managers interviewed in this case study most retailers conduct some sort of customer survey to find out, how customers say they act. In the consumer market surveys can be problematic because customers are unable to articulate their future needs (Tidd *et al.*, 2005, p. 279). BI gives customer relationship management (CRM) information on how customers really act and forecasts how they will act in

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the future. The BI manager from the case company experiences how customers demand for BI assistance increases. The BI market is among the fastest growing worldwide. This is confirmed by IDC, Gartner Group, the Standish Group and other analysis institute's reports of market intelligence for the information and technology markets (IDC: "Worldwide Business Intelligence Tools 2005 Vendor Shares," July 2006, Appendix 2). Some reasons for this are that the BI tools have improved, the costs for disc storage decreased, and in addition new large user categories are joining. BI systems ease the understanding of enterprises and markets by mirroring the reality with tools for operative and directive purposes. The common failure of enterprise applications to support business agility (Strohmaier and Rollett, 2005; Verstraete, 2004), the dead-end integration situation experienced by the case company, and the fact that major software vendors like IBM, SAP, Oracle, and Microsoft are fundamentally re-developing their monolithic products into autonomous services accessible over the internet, all this indicates that enterprises will – to various extents – take advantage of SOA to fulfill customers' changing demands of goods and services. It is not enough to cover the capabilities of business processes like enterprise resource planning (ERP) systems do. ERP systems are not fit to give basic data for decision-making. Business needs to evaluate each activity in terms of how important it is to the organization's results, how well it needs to perform versus how well it actually does perform, and if differentiating or outsourcing help. The focus in this paper is on SOA being a decision support driver due to the increasing importance of the data warehouse (DW). First, we define BI, then SOA and finally the reasons why SOA is an OLAP driver are presented.

2. Method and theoretical background

This case is a study of the diffusion of the innovative BI support in the retail industry. The case company AB Retail Business System is a retail software provider that offers consulting in customized BI and DW. The empiric in our recent research and for this paper (especially Chapter 5) comes from the documentation that was made available for the researchers by the case company, interviews with one of the BI managers at the case company, and participating observations in customer projects of the retail system vendor. The case company is introducing their new service oriented store solution: RetailCenter (RC) (Figure 1). The new RC concept is run on a communication platform which opens for integration with any point of sale system, local or central back office systems, central RP systems BI products and BI services with regard to finance management and analysis, etc. This paper is based upon a case study. The use of case studies is preferable in situations where processes and changes are in focus. It is common to gather information in different ways when using case studies (Patel and Davidsson, 2003). Yin (2003) recommends three principles to be followed to maximize the benefit of data collection. The first principle is that multiple sources of evidence should be used. This case study uses participant-observation, semi-structured interviews conducted with BI managers, study of documentation created during customer projects (business documents, project plans, evaluation reports, audits, specifications, mail correspondence) ranging from 2004 to 2007. The second principle is to create a case study database. We have done this by collecting information in binders. The third principle is to maintain a chain of evidence to ensure quality control. Here the information is sorted in chronological order. The study contains elements of action research where the role of the researcher lies between the role of researcher and

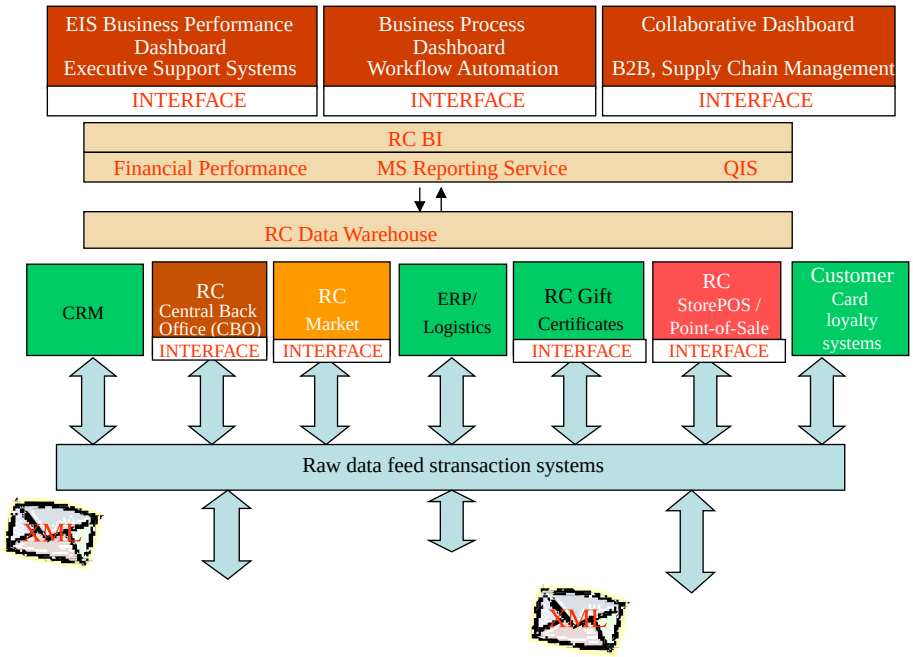

Figure 1.
The RC solution with the DW supporting BI to be the potential nerve center of managing the enterprise. DW with OLAP cubes, SQL, views, queries from BI tools vendors like Cognos, SAS, and Business Objects

Source: Case Company (2006)

consultant (Avison *et al.*, 2001; Gummesson, 1998). By performing a case study, a theory can be both developed and tested. The selection of units that are to be investigated can be made in different ways and both qualitative and quantitative information can be used. Deductive researchers hope to find data to match a theory, and inductive researchers hope to find a theory that explains their data (Merriam, 1998). The issue of objectivity is important like the choice regarding selection of information (Holme and Solvang, 1997). In management control systems theory, the concept of diffusion is relevant, e.g. Ax and Bjornenak (2000), Xu and Quaddus (2005), and Rogers (2003). For this paper, primary and secondary data are operationalised on Rogers' (2003, p. 207) innovation theory with five adoption characteristics applied on the long-term process of establishing BI. Innovation is here defined as the difference between having a DW and BI compared to not using BI in the retail industry. The *Relative advantage* is expressed as economic profitability in establishing BI to increase business value at a reasonable cost. The *Compatibility* issues, i.e. consistent with existing values (customers integrity, culture), past experience (of retail industry) and needs (knowing the customer's businesses). Strategies to manage BI *Complexity* according tools and methods. *Trialability* is defined as all potential users possibility to try the retailers' BI efforts. *Observability* of if BI results are generally accessible.

3. Knowledge management and business intelligence

Herbert A. Simon (1916-2001) in 1978 won the Nobel Prize in Economics for his research on decision making in organizations. Simon was Professor at Carnegie Mellon,

Pittsburg University, USA, and one of the founders of Artificial Intelligence (AI). Simon (1965, 1969) identifies threes stages in a sequential decision-making process:

(1) intelligence finding occasions for making a decision;

(2) design finding, inventing, developing, and analyzing alternative courses of action; and

(3) choice – selecting a course of action.

The most known contribution of Professor Simon (1965) is probably the data chess.

In 1956, Simon and Newell produced the AI program – The Logic Theorist – proving many of the theorems of symbolic logic in Whitehead and Russell's Principia Mathematica (Russell and Norvig, 1995; Whitehead and Russell, 1910). Can the IS theory approach BI help management in making better business decisions? Models/theories are useful and can automate knowledge to be operationalized down in the hierarchy/organization. The term BI is less fantasy oriented but with substance when it comes to decision making. Automated decision-making systems are becoming increasingly more common. Researchers are discussing and studying whether expert systems achieve better results than human experts (Davenport and Harris, 2005). Corporate performance management aims to provide different scorecards (dashboards, scorecard, balanced scorecard). Automated decision making and guarding the enterprise with vigilant systems, e.g. "health check" of the factory performance or of the entire enterprise, come of use with not only support of decisions but also decision making with automated alerts to initiate actions. At Western Digital a dozen dashboards with their own OLAP cube that includes metrics and ratios, help staff accelerate their Observe-Orient-Decide-Act loops of the processes monitored (Houghton *et al.*, 2004).

Sveiby (2001) argues that there are two separate tracks in KM; the IT-track where knowledge is viewed as objects and the people-track where knowledge is equivalent to processes. Dividing activities according to "urgent" and "important" in a four field figure presuppose that focusing on the urgent but sacrificing the important have unwanted consequences (Covey and Merrill, 1994). Quadrant I which is urgent-important is generally rewarded by organizations. Quadrant II is not urgent-important and needs reflection and dealing with, to avoid future crisis; e.g. planning and managing relations. Not important-urgent (Q III) and not important-not urgent (Q IV) are what we should avoid doing. The metrics and ratios should bring business value to the retailers and benefit the individual customer. Storing more and more information is not the key, but discovering patterns and making templates. Discover what is important by shrinking and reduction helps to create clarity in our information overloaded world. Data warehousing support BI by gathering, consolidating, and storing data. The components of successful DW can be summarized as data collection, cleansing, consolidation, and data storage. BI is the delivery of information to support the decision-making needs of the business. It can be described as the process of enhancing data into information and then into knowledge (Gordon *et al.*, 2005). BI is granular information about the business and its supply chain that line-of-business managers seek when they are analyzing key performance metrics of their enterprise (Houghton *et al.*, 2004). Having valuable data in a DW has no value at all if it is not accessible. Powerful report- and analysis software (like Claudia Win 2005, SAP NetWeaver BI (Appendix 1), MS BI) are flexible and versatile reporting and

data analysis tools that combine powerful OLAP functionality (data cubes for BI presentation) with ease of use and user-friendliness.

4. Service Oriented Architecture

SOA is a way of thinking and making it possible to use existing IT/IS investment for new demands. Business people are realizing that SOA provide potential for their companies. SOA views everything as a service provider, from applications, to databases, companies, and devices. Microsoft, Apple, Google, SAP, and IBM all have the strategy to both open and offer their applications as services delivered by the internet and paid for by advertisement and subscriptions. The change to loosely coupled, standards-based integration opens up the opportunity for using many pre-built services and being able to integrate with professional business applications on the market (e.g. ERP systems, CRM systems, accounts systems, billing systems, web systems). SOA's possibility to bridge between modern service-oriented solutions (see case company's RC communication platform) and integrate existing component-oriented ERP system like SAP or Axapta, and in-house main frame systems. The idea of SOA is to create a palette of these different business services from different enterprise applications that can then be orchestrated back together again into a logical order and managed using. This degree of independent components (services) protects the flexibility. To meet the needs of the agile enterprise, the practice of SOA has following core principles:

- The business drives the services, and the services drive the technology. In essence, services act as layer of abstraction between the business and the technology.
- Business agility is a fundamental business requirement. The requirements from business must reach the next level of abstraction "meta-requirement." (Granebring and Révay, 2007).

5. BI at case company

Retailers have indicated that knowledge of the individual customer is needed in key business segments of retail (Granebring *et al.*, 2006). Case company realizes the need to support personalized customer offers and support following-up on promotional activities to build competitive advantages for retailers. Two people work with BI at case company. Case company's store systems are today in use in more than 2,500 stores. About 17 of the 20 biggest grocery stores in Sweden use the whole or parts of case company's store solutions. Most of those customers analyze and make decisions with the help of case company's customized RC BI products for analysis and finance management.

5.1 RC business intelligence analysis

RBI and RetailCenter Business Intelligence (RC BI) are the case company's solutions for BI management and DW. DW is central storage of data from numerous sources. Relevant information areas within retailing are customers, suppliers, articles, and stores. Data warehousing demands powerful servers and large storage capacity. BI analysis – put together and organizing data to metric data and ratios serving as basic data used to identify bottlenecks in the enterprise and provide the business with data to support strategic business initiatives. BI analysis demands advanced reports, high

level of visualization, and powerful analysis tools. Case company's platform is Microsoft SQL Server e.g.:

- MS SQL Server 2005 = RDMS, Report Builder, Business Scorecard Manager.
- Microsoft Data Transformation Services (DTS) = Microsoft's ETL tool.
- Analysis Services = OLAP database.
- MS Reporting Services.

Several retailers have installed case company's analysis support RC BI. RC BI is case company's solution for presenting statistics, business information and renders possible analysis of primary the store operation. The solution is based on that the collection of sales data from case company's back office products StoreOffice (local) or RC CBO (central) is daily transformed to a central database (data layer). From the stores there are information collected each day concerning article statistics, category statistics, frequency, recycling statistics, cash discount, receipts, assortment data, and sales representatives. The presentation is preference in ProClarity or Excel but also other presentation tools are used. Information can be collected from other systems like central ERP, customer card loyalty systems, etc. as well as from local store systems (Figure 1). Multi dimensional OLAP-cubes are used to optimize basic data for reports and analysis's. RC BI is used among others to analyze sales-, frequencies-, discount-, and wastage data. RC BI gives each store access to a clear picture of the own customers and their buying patterns. The information can be used for actions to increase the turnover, analysis of different marketing efforts, and also increased precision concerning optimal purchase volumes. As these type of business information and analysis demand changeability and development to conform to the enterprise and its changes this RC BI solution underlie in close and continuing cooperation with the customer to develop and change data content as well as information in the shape of reports, ratios, and investigations. (Interviews with BI Manager at case company).

In the central back-office there are a server, databases, monitors for supervision and control, DTS package for "cleaning" of source date, OLAP-cubes for multi-dimensional compilation of data, report generators and analysis applications. The case company's way of working with business information is characterized by:

- pre-study to identify the customers requirements and needs;
- the assignments are performed as consultancy project;
- customer unique database design of data layer;
- customer unique ETL-process;
- customer unique OLAP-cubes; and
- customer unique reports and analysis are developed in cooperation with the customer.

5.2 Analysis – an innovation theory perspective on the BI building process

According to Rogers (2003) the perceived attributes of innovations consist of five different characteristics that have systematic effect of diffusion and assimilation: Relative advantages, compatibility, complexity, trialability, and observability.

5.2.1 Relative advantage. A more effective handling of customers, suppliers, articles, and stores combined with increased quality regarding the information due to formal

logging of errors, which opens up for statistics over incoming complaints which makes them more noticeable. Professional handling increases efficiency, availability, flexibility, and quality. It was impossible to get this BI information earlier – it took hours to put together. Decision supports for market departments by campaign following-ups, like double points, buy three for two. Evaluate ad items and campaigns items. Bench marketing between similar stores located in similar residential areas (LPA = lokal prisanpassning), etc. regarding pricing, exposure of commodities. ICA[1] do not bench mark (individual retailers own the shops) but Coop do. Support in the negotiations for a contract (prices, new articles) with suppliers by presenting business information like margins, prices, demands. BI get away from the criticized "smearing same offers like cheep ketchup to all." More precise marketing with improved customer clustering. For grocery commodities personalization is not a practical viability yet. The case company's customer mobile phone network provider TRE, being sale oriented, uses RC BI to manage commission to sellers.

5.2.2 Compatibility. RC Central back office (CBO) makes BI easier compared to local back office (StoreOffice) since data is already centrally collected. Industry experience and BI knowledge are required to interpret and understand BI. Drowning in BI information is a disease that has struck also retailers. Most users are at head office in marketing and purchasing areas. The collaboration with BI manager support from case company is the basis of authority when starting with BI at customer site.

5.2.3 Complexibility. Common solutions on the market offer different kinds of OLAP cubes, a tool for following-up, analysis and decision support. An OLAP-user is obliged to be familiar with common data and underlying structures, making BI difficult to decentralize.

The BI working method to accomplish "one-version-of-the-truth" from various data sources increases complexity. Data is redundantly stored in many systems under separate concepts. The BI managers have awareness of that some data is biased, needing correction to produce a correct data base for decision support. What is important for the customer is always the starting point. Customer unique designs complicate re-use of ratios, affordance in interfaces, etc.

5.2.4 Triability. Increased availability and flexibility for all users and not the traditional target group CEO and controllers is one of the introductory goals of the new common BI. BI do not act real time and is therefore not operational critical. BI for all presupposes resources for a large operative mass of end-users with BI tools, methods and skills. Users at customer sites expect support from skilled BI managers. BI management consultants at case company have technical skills, social skills, and retail business process experienced. The user-friendly BI tools in Office 2007 open for BI for an increasing amount of end-users. Excel 2007 and excel services in the browser makes it possible to build advanced analysis solutions and publish in SharePoint 2007 and visualize in dashboards. One of Bill Gates early mottos for the goals of Microsoft is "IAYF" (Information At Your Fingertips) and their new enabling BI tools are a way to achieve that.

5.2.5 Observability. Web interfaces simplify distribution and accessibility of BI. Stores get better margins and profits with BI support. Customers and the public are now familiar with the fact that different actors collect data about them.

6. Service-oriented business intelligence

The concept of synergy in this case means the combined action of discrete entities or conditions such that the total effect is greater than the sum of their individual effects (Gordon *et al.*, 2005). As shown in Table I SOBI Synergy is the idea of SOA + BI = business improvement. In any complex environment, there are a number of data sources which contain information which must be consumed by the solution. Some data sources are likely to be held in semi-structured or unstructured formats, such as spreadsheets (mostly excel), Google, home pages, and document management systems. With these kinds of systems it is important to structure the information prior to integration into the DW. This will be achieved in one of the following ways:

- *Apply structure to the data store.* Available structured and change controlled templates for spreadsheets and documents, such that the information can be accurately and reliably extracted from the document. This will involve business process change.
- *Impose structure on the data read from the store.* This is inherently difficult as it relies on making assumptions about the semantics of the existing structure of the data source and relying on this never changing. If this assumption holds, programmatic extraction can be achieved (Gordon *et al.*, 2005).

The number and variety of data sources interested for BI purpose increases with the adoption of SOA and SOA associated enabling technologies. SOA apply application-to-application integration with low volume and high frequency. SOA encapsulation, high abstract formality, and re-use of components are helpful also in the business decision support and data transformation world of BI. BI solutions are tightly coupled to the data sources that feed the DW.

SOA exhibit loose coupling between their services. Real enough time vs online. SO: s event driven integration might even improve traditional ETL (Extract, Transform and Load) mechanism. All data do not have to be physically moved to the BI platform. Operational data can be accessed from the SOBI framework platform. There are advantages like:

- brings interface abstract patterns to BI;
- aggregation as a service (i.e. known queries re-useable at month level); and
- calculations (i.e. business logic for sales and forecast, etc. available for the whole organization).

There are business and organizational issues that need to be solved like:

- governance:
- enterprise data and SOA strategy; and
- operational versus management reporting

7. Conclusions and future work

SOBI is the mixing of approaches from SOA and BI. A SOBI architectural framework attempts to solve problems of integration in an enterprise of disparate "stove piped" systems. It attempts to provide a common data transformation mechanism for operational

Table I.
SOA and BI are separate but they also overlap and can support each other

Dimension	SOA	BI	SOBI
Tenets of architecture	Separation of interface and implementation by 1) Boundaries are explicit 2) Services are autonomous 3) Services share schema and contract – not classes 4) Policy-based service compatibility with consumers	Handling analytical capabilities Batch-driven ETL during business downtime Current data quality improvement Specific set of data-manipulation tools, e.g. expensive client licences	Delivers data event-driven + better foundation for the future + easy to update/change + standard + platform independent still traditional ETL techniques for large-scale data transfer
Strategic information analysis and data ownership	Entity services owns record data. A cornerstone of SOA internal vs external	DW is not the data owner. DW owns BI and reference data One version of the truth	Publications collective information to be shared
Integration	Event-driven loose coupling between services Application-to-application integration subscribe to a service	Tightly coupled to the data sources that feed the DW. Data-to-data-integration with large data volumes, e.g. traditional ETL mechanism	+ data-to data ETL and SOA loose coupling
Availability reporting/ information	Support operational reporting	OLAP databases with MIS data. An OLAP-user is obliged to be familiar with common data and underlying structures, making BI difficult to decentralize. Gather materials for reporting from various systems and let the report generator operate on different data sources is difficult and expensive	SOBI provide presentation services for operational and MIS data

(*continued*)

Dimension	SOA	BI	SOBI
Re-use	Re-use of generic capabilities. Re-use of object oriented components. Re-use of services trough information analysis, e.g. Identify System of Record Re-use of business rules	Metrics (sale, gross margin, number of customers) are of interest for several customers (in same trade). Ratios (sales/customer, changes compared to previous period, efficiency measurements, etc.) must be defined customer unique	Mapping, e.g. transformation logic where ever possible
Users	Operational staff	Executives	Wider audience Right solution for each user
Data sources	In orderly manner. Accessed by SOA associated techniques. Non-record data is solved with the concept of publications and subscriptions in SOA	Difficult to manage various data sources It is not unusual with hundreds of systems having for instance their own customer data	Opens for unstructured data; excel, Google, home pages; presupposes Content Management (CM-software)
Tools		OLAP applications – powerful but not user-friendly MIS questions EIS-dashboards	Cheaper and more user-friendly clients (like MS excel 2007)
Questions	Operative question: What packagings are available for article X?	Has the article been sold the last three months and what is the forecast for next month?	Identify profitable customers and products. Buying patterns for improved forecasts

Sources: Gordon *et al.* (2005), interviews with BI Manager at Case Company (2006) and Granebring *et al.* (2006)

Table I.

and management information both. It sets out guidance in the form of principles and patterns. Publications are the SOA term for data warehousing data. Information areas like orders, catalogs, web sites, and price lists have different demands for versioning schemas, internal vs external use, reference data vs operative data, etc. At what periodicity is updating required? At the event when change or new data is available or batch wise each night, for instance. There is a price to pay for online data and often older data can be accepted. By deciding the level of current interest a strategy can be made. The responsibility for the publications should be on the enterprise architect/enterprise information area manager. Orderliness is important and less volatile data is more suitable to manage as publications. Consumer and provider have specific roles. Providers must know their consumers and be sure to send publications to them. In point-to-point links the layers are one-way directed. With SOBI there is no rank between the organizational levels – they are all equal. More and more end-users will demand access to relevant BI information and flexible BI tools in the future. Business systems and non-enterprise data sources will be refined with orderliness among all information sources to meet constantly growing needs to support all kinds of offered services, including SOBI services. Access to relevant and dispose of irrelevant BI information are key issues. And above all – after knowing comes deciding and acting – otherwise the knowledge industry is of no value. There are new driving forces making companies having to make business decisions each day. Every BI system has a specific business goal. By improved reporting and data analysis processes retailers can gain new insights about customers, suppliers and the market, e.g. explain and discover long-term methods for strategic purposes like fusions or which products are to be provided in ten years. SOBI can accomplish daily decision support. The case company gives some clues for right solution for each receiver. Introducing continuous decision support in a big chain of stores is a process. Experience of the retail industry is a condition for success. How to draft a BI strategy for all parts of the enterprise?

- excellent DW quality;
- choose an area for daily decision support; and
- start simple with metrics (sale, gross margin, number of customers) to get users started and then continue the iterative process of practicing more comparing and personalized BI.

Note

1. ICA, Coop and Axfood are the three dominating Swedish grocery wholesaling and retailing organizations: These three accounted for approximately 72 percent of Swedish grocery sales in 2004.

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Appendix 1. Description of the SAP NetWeaver BI

Source: SAP Netweaver BI, available at: www.sap.com/platform/netweaver/components/bi/index.epx (accessed December 19, 2006).

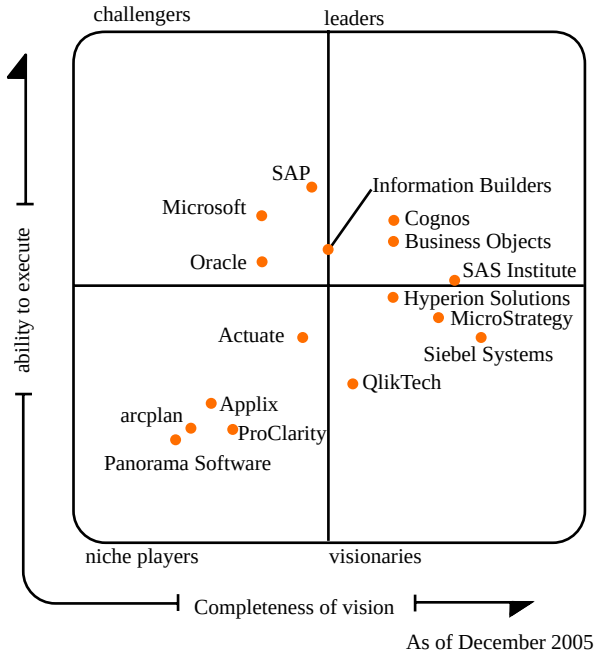
SAP NetWeaver BI offers tools and processes of bringing and refining business information for:

- *Data warehousing.* DW management, business modeling, and extraction, transformation, and loading (ETL) enable you to build DWs, model information architecture according to business structure, and manage data from multiple sources.
- *Business intelligence.* OLAP, data mining, and alerts provide a foundation for accessing and presenting data, searching for patterns, and identifying exceptions.
- *Business insights.* Query design, reporting and analysis, and web application design allow you to create analysis reports, support decisions at every level, and present BI applications on the web.
- *Measurement and management.* Business-content management, metadata management, and collaborative BI monitor progress, provide reporting templates, ensure consistent data, and help decision-makers work together.
- *Open hub services.* Open hub services features enable the delivery of high-quality, audited enterprise information through web services to applications. Bulk data exchange, change data capture, and modeling features streamline deployment and enable cost-effective operations.
- *Information broadcasting.* Information broadcasting features support the distribution of mass information to large audiences in a personalized and secure manner, e.g. as an offline document, live report through personalized e-mail, according to a schedule or based on key events.
- *High performance analytics.* Based on compressions, parallel in-memory processing, and search technologies, the SAP NetWeaver BI accelerator functionality improves the performance of queries, reduces administration tasks, and shortens batch processes. Developed jointly with Intel Corporation, the accelerator runs on state-of-the-art chips, such as the Intel Xeon 64-bit chip, and can be deployed on affordable blade server technology.

Appendix 2. Magic Quadrant for BI Platforms, 1Q06

The analyst firm Gartner expects the BI market to experience sustained growth as the technology includes more users within an organization. Business Objects, Cognos, Information Builders, and SAS Institute are setting the standards in BI, according to Gartner's "Magic Quadrant for Business Intelligence Platforms, 1Q06." The companies are listed as leaders, with

all four offering a range of capabilities across reporting, analysis, performance management, and data integration, according to the report. Microsoft, Oracle, and SAP are listed as close challengers, while Hyperion, MicroStrategy, QlikTech, and Siebel Systems are listed as visionaries, or those companies with potential to become leaders (Figure A1).



Source: Gartner

Figure A1.
Magic Quadrant for BI Platforms, 1Q06

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