



Theoretical foundations of business intelligence: from theory to practice

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ABSTRACT

Business intelligence systems combine operational data with analytical tools to present complex and competitive information to planners and decision makers. The objective is to improve the timeliness and quality of inputs to the decision process. Business Intelligence is used to understand the capabilities available in the firm; the state of the art, trends, and future directions in the markets, the technologies, and the regulatory environment in which the firm competes; and the actions of competitors and the implications of these actions. The emergence of the data warehouse as a repository, advances in data cleansing, increased capabilities of hardware and software, and the emergence of the web architecture all combine to create a richer business intelligence environment than was available previously. Although business intelligence systems are widely used in industry, research about them is limited. This paper, in addition to being a tutorial, proposes a BI framework and potential research topics. The framework highlights the importance of unstructured data and discusses the need to develop BI tools for its acquisition, integration, cleanup, search, analysis, and delivery. In addition, this paper explores a matrix for BI data types (structured vs. unstructured) and data sources (internal and external) to guide research.

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Introduction

Socio-economic reality of contemporary organizations has made organizations face some necessity to look for instruments that would facilitate effective acquiring, processing and analyzing vast amounts of data that come from different and dispersed sources and that would serve as some basis for discovering new knowledge.

For long time management information systems (MIS) have been supporting organizations in their different tasks. However, today many IT systems have undergone significant depreciation. Hitherto existing management information systems (i.e. MIS, DSS, ES, EIS) have not always met decision makers' expectations, such as:

- making decisions under time pressure;
- monitoring competition;
- possessing such information on their organizations that includes different points of view; and
- carrying out constant analyses of numerous data and consider different variants of organization performance.

They simply do not handle integration of different, dispersed and heterogenic data well, they cannot interpret such data in any broad contexts effectively and they are not capable of sufficient discovering new data interdependencies (Bui, 2000; Gray, & Watson, 1998).

Reasons are to be found in improper techniques of data acquisition, analysis, discovery and visualization. In order to be able to react quickly to changes that take place on the market, organizations need management information systems that would make it possible to carry out different cause and effect analyses of organizations themselves and their environments (Power, 2001). Business Intelligence (BI) systems provide a proposal that faces needs of contemporary organizations. Main tasks that are to be faced by the BI systems include intelligent exploration, integration, aggregation and a multidimensional analysis of data

originating from various information resources. Systems of a BI standard combine data from internal information systems of an organization. and they integrate data coming from the particular environment e.g. statistics, financial and investment portals and miscellaneous databases. Such systems are meant to provide adequate and reliable up-to-date information on different aspects of enterprise activities. As the first research results show, the BI systems in question contribute to improvement and transparency of information flows and knowledge management and they also enable organizations to (Kalakota, & Robinson, 1999; Liautaud, & Hammond, 2002; Moss, & Alert, 2003):

- follow profitability of their products sold;
- analyse expenditures;
- monitor corporate environments; and
- discover business anomalies and frauds.

Recent years have witnessed numerous discussions on the Business Intelligence issues including OLAP techniques, data mining or data warehouses. However, little attention has been paid so far to questions of creating and implementing BI in organizations. Such questions are rarely analyzed in categories of solutions that would facilitate effective decision making and strategic thinking.

There is no a sufficient number of guidelines informing how to create systems that might be used as examples of authentic symbiosis of IT and management processes.

With reference to the above formulated research problem, the article has been assumed to aim at suggesting methodology of creating and implementing BI Systems. Realisation of this objective in different companies, in authors' humble opinion, will largely contribute to diminishing some gap in supporting processes of decision making by means of BI.

Defining Business Intelligence

This essay examines the evolution of Business Intelligence and its links with Strategic Foresight and futures studies

techniques in pragmatic applications. Scholars distinguish between four key intelligence categories.

- Competitor Intelligence focuses on inter-firm rivalries and battles for brand and strategic positioning.

- Competitive Intelligence (CI) is defined by Ian Gordon as a method 'to develop strategies to transfer market share profitably.' John McGonagle Jr. and Carolyn Vella believe that CI orientates managers to 'fine tuning your business planning process.' Leonard Fuld defines CI as 'highly specific and timely information about a corporation.'

- Business Intelligence (BI) uses information systems and transaction databases to provide decision-making support and transform data into intelligence within a rational management framework. Herbert Mayer, vice chairman of the Central Intelligence Agency's National Intelligence Council, defines BI as the 'radar for business.'

- Social Intelligence (SI), spearheaded by University of Lund professor Stevan Dedijer, tracks the diffusion of these capabilities into broader social contexts and across longer timeframes.

BI and CI writings dominate popular writings on business management. Companies use these techniques as a form of market intelligence that 'focuses on monitoring trends in the market to identify future problems and opportunities, and provides a company with the information necessary to maneuver in advance of the change in the market.' Defensive intelligence targets blind-spots by 'analyzing your own business's activities as your competitors and others see them.' Convergent technologies including e-mail, pagers and cell phones have been used by one-to-one marketers as proactive intelligence. Company executives also have growing awareness of the need for counterintelligence against competitors and industrial espionage. Global companies use risk analysis to assess the 'general background that a company needs to know to operate securely in an unfamiliar environment.' McGonagle Jr. and Vella link CI to parallel business processes including strategic intelligence (STEEP factors and trends), crisis management, competitive benchmarking and reverse engineering. Companies now merge BI into inter-departmental synergies and cross-functional roles. The knowledge management company Lexis Nexis, for example, integrates BI metrics, CI analysis, market research, benchmarking and strategy into its research cycle. This integration suggests that BI will cross-bond with related frameworks and tools over the next decade.

Many analysts trace BI's development to writings on military strategy by Sun Tzu, Miyamoto Musashi, Niccolo Machiavelli and Karl von Clausewitz. However this emphasis predated the 1980s fascination with Oriental exemplars. Gordon notes that during World War II both Allied and Axis strategists 'monitored the enemy and tracked the history of the battles fought by key commanders'. The intelligence gained from this leadership profiling was then used 'to determine the likely outcome of various moves' (notably during the D-Day landings and the Manhattan Project).

Forecasting underpinned North America's economic growth throughout the 1950s and 1960s as strategists focused on new markets and portfolio management. However this 'economic miracle' was shattered by the OPEC oil crisis in 1973, soaring energy prices, and stagflation. By the early 1980s North America's competitive advantage was being challenged by trade liberalization, globalization, and technological change. This perceived threat provided the stimulus for exemplars and gurus to popularize business management theories. However its dark undercurrent was an integration propaganda that fed on

resurgent nationalism and xenophobic fears of geo-economic domination by foreign nations.

This integration propaganda was explicit in the United States' response to 'Japan Inc'. In 1986 Japan became 'the world's leading creditor nation' whilst 'the United States became a debtor nation.' Two geo-economic debates concerned the declining market share of Detroit's Big Three car manufacturers and the commercialization of artificial intelligence technologies. Japan's trading companies (sogo shosha) viewed 'intelligence as organized information' and focused on prices, competitors and political developments.

Japan's most famous CI organization during this period was the Ministry of International Trade and Industry that 'tracks the international marketplace and acts as an information provider.' US analysts claimed that MITI spearheaded industrial espionage operations and had 'negative attitudes toward free trade and capital liberalization.' United States analysts also became concerned about patent filings, plant tours and trade shows. Antitrust laws prevented competitors from exchanging information that would create price-fixing or oligopolies. For Japan these tactics were natural because America was their 'biggest market and chief manufacturing competitor.'

Chun Wei Choo notes that this response to Japan 'focused on the alleged superiority of their social intelligence skills' and that the companies targeted included 'Mitsubishi, the Mitsui Knowledge Industry Corporation and Nichimen Corporation.' 'The Mitsubishi intelligence staff in New York,' Meyer reveals, 'takes up two entire floors of a Manhattan skyscraper.'

This economic warfare became global in the early 1990s as the nation-state morphed into the network society. The 'internationalization of capital', the reunification of Germany and the creation of the European Union refocused analysts on geo-economic imperatives. In this climate American companies shifted their focus outwards and interest in CI grew and its techniques were adopted by investment banks, law and Many analysts trace BI's development to writings on military strategy by Sun Tzu, Miyamoto Musashi, Niccolo Machiavelli and Karl von Clausewitz. However this emphasis predated the 1980s fascination with Oriental exemplars. Gordon notes that during World War II both Allied and Axis strategists 'monitored the enemy and tracked the history of the battles fought by key commanders'. The intelligence gained from this leadership profiling was then used 'to determine the likely outcome of various moves' (notably during the D-Day landings and the Manhattan Project).

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The Intelligence Cycle

Herring's most important contribution was his summary of the intelligence cycle which divided the BI process into five stages. The BI practitioner conducts a needs assessment that establishes the business and market context. Herring used the term Key Intelligence Topics (other writers have used the term Critical Intelligence Needs instead of KIT). Some companies use a Likert scale to rank their KITs. Kirk Tyson prefers a 'reliability index' that distinguishes between rumor, confirmed rumor, fact and hard fact. Brett Breeding sorts information according to its attributes (shallowness, credibility, timeliness and focus) and whom to send the resulting intelligence to.

This scope enables the practitioner to plan the research tools and diagnostic scorecards, and to identify 'data requirements and sources.' F.W. Rustman Jr. contends that 'Evaluating the sources of information is one of the most important tasks of the analyst.' The practitioner then collects the data from published and non-published sources. The data is evaluated for sufficiency, 'chunked' into 'information building blocks' and categorized. The crucial ability at this point is 'to recognize what factors will influence the specific subject or issue.' Then the data is analyzed to create 'timely, accurate, and reliable' information. Business Objects founder Bernard Lietaud distinguishes here that 'data is raw and unadorned' whilst 'information is data endowed with some degree of business context and meaning.' Analysts must also 'never be afraid to include dissenting judgments along with their own.'

Finally this information is presented to decision-makers and strategists to produce actionable intelligence. Information transforms into intelligence when it meets 'one consumer's unique needs. Here the analyst may use Neuro-Linguistic Programming and other techniques to present the material since policymakers absorb information through different sensory modalities. Lietaud emphasizes that 'intelligence elevates

information to a higher level within an organization', that it is 'organic' and that 'it contributes to an organizational state that may be characterized as collective intelligence.' This definition hints at how the study of emergence and 'swarm intelligence' may transform BI in the near future.

Meyer sums up the intelligence cycle used by government security agencies and subsequently adopted by first generation CI units. Companies:

1. 'study raw material'
2. 'argue and debate what it means'
3. 'check and recheck facts'
4. 'resolve the inevitable inconsistencies in data'
5. 'question original assumptions'
6. 'interview experts'
7. 'develop theses'
8. 'test and retest'.

Other practitioners have amended this generic process with insights from operations research and the scientific method. Ben Gilad's criterion for data evaluation considers its relevance, truth-value, understandability, sufficiency, significance and timeliness. Chun Wei Choo divides the process into collection, evaluation/filtering, storage, analysis and dissemination phases. Michael O'Guin and Timothy Ogilvie's process involves forming hypotheses, looking for signals and sources, and then using data collection to hunt for confirming evidence. Adrian Slywotzky perceives BI-oriented strategy as a form of pattern recognition, which uses 'a different lens through which to see a complex reality', and enables the analyst to 'understand more of the picture. Intelligence analysis is firmly rooted in epistemological and ontological concerns; a viewpoint frequently obscured by business strategists.

Key Considerations in Deciding on a BI Offering

Business decision makers must evaluate both the breadth and depth of a BI offering in order to make an appropriate decision on a BI offering. The breadth of a BI offering is a measure of how well the BI offering supports the different requirements of the BI stakeholders. The depth of a BI offering is a measure of its vertical integration, i.e., how well the BI offering enables a business to take raw data from a production system and transform it into relevant and useful information and then deliver this information to business users in the proper context.

There are many steps required to generate consumable BI from raw data and there are various BI stakeholders within an enterprise that have a vested interest in the process. IT professionals, application developers, and business users (who are also the consumers of BI) all play a role in the development of a BI solution. Business users define the business rules that determine how the raw data must be transformed. Application developers develop the processes for acquiring, consolidating, and presenting the raw data based on the business rules. IT professionals manage the processes, ensure availability, and enforce security.

Requirements of Business Users

Different types of business users have different requirements of a BI offering.

- Analysts – Analysts support managers with performance management analysis. Analysts require a powerful and interactive environment that allows them to create metrics and navigate the data in an ad-hoc setting. This type of user requires tools for analytics, statistics, predictive modeling, and advanced visualization.

- Managers – Managers at all levels need BI to assist them in making informed business decisions. This type of business

user requires a friendly query environment that also supports the ability to generate ad hoc reports and delivery mechanisms that enable managers to disseminate information up and down the chain of command.

- **Operations workers** – Operations workers use BI as part of solving a larger issue. For example, as part of servicing a customer, a retail clerk might recommend other related products to a customer. This type of worker requires BI that is embedded in a production application, rather consuming BI as part of a BI application.

Business users of all types want to reduce their dependence on IT, but still have confidence in the numbers, have advanced analytics, superior query performance, and access to timely information in the format and delivery mechanism of their choice, whether through a portal, a spreadsheet, or email. Satisfaction of these business user requirements enables BI to truly become mission critical, fulfilling the promise of BI, and providing businesses with competitive advantage in the global marketplace.

Requirements of Application Developers

Application developers must be able to develop the variety of BI application types required by business users that are essential to enable enterprises to obtain competitive advantage in the global marketplace. The range of capabilities that a BI offering needs to support is as varied as the BI applications required by enterprise business users. BI applications such as sales analysis need to be able to handle large data sets (terabyte) with very long lists of dimension members (in the millions). Other BI applications must support complex calculations for the derivation of key performance indicators or financial reporting modeling. Other BI applications merge BI analytics with data collection for budgeting, planning, and forecasting. Still other BI applications require very low data latencies for use in business activity monitoring applications to create real time BI. The BI applications developer requires a BI offering that is capable of supporting this entire range of BI applications.

In an enterprise today, BI is frequently embedded in business processes that support operations workers and needs to be seamlessly integrated into existing applications, and then easily extended as new BI needs are discovered. Application developers must be able to use existing Evaluating Business Intelligence Offerings skill sets, reuse code and components, and leverage existing applications and infrastructure to be able to meet the increasing need for BI that can be easily maintained and extended without requiring new skill sets. A crucial factor for the productivity of application developers is having a single development environment that allows them to work on all aspects of BI, from the data to the analytics to the user interface using a single development language, and that supports team development.

Further, application developers must be able to easily extend BI applications using third party tools and technologies where necessary. These third party products must integrate existing BI applications, rather than operate parallel to the platform. This requirement is an acceptance of the fact that there is no perfect product in the market. A BI offering might fulfill most of an enterprise's needs, but there are always a few cases where requirements cannot be met with the existing offering. Extensibility offers a safety valve in such cases.

Requirements of IT Professionals

IT professionals require a BI offering that enables them to deliver mission critical BI; namely a BI solution that is highly available, reliable, and secure. IT professionals require a back-end solution that is fault-tolerant and scalable; that supports

change control and scriptable deployment; and that enables them to leverage their existing resources and skill sets while building on the current IT platform and infrastructure. Furthermore, IT professionals must be able to deliver real time or near real time data to business users with minimal degradation in query performance.

Creating a BI Unit in Organizations

Prescott and Gibbons define the BI function in an organizational setting as 'a formalized, yet continuously evolving process by which a management team assesses the evolution of its industry and capabilities and behavior of its current and potential competitors to assist in maintaining or developing a competitive advantage.' Gilad notes that 'the development of a business intelligence function will be an evolutionary process and the function may end up anywhere within the organization'

Tyson found that the BI unit often begins as a 'quiet, private network.' A project convener establishes the organization's collection channels including 'an 800-number, a CI e-mailbox, and systematic sales and marketing briefings.' Usually the convener is driven by curiosity and 'making inquiries on the borderline of his or her official job description.' In their initial phase BI units are often clearinghouses for ad hoc queries and cross-departmental requests. The new BI analyst usually tracks demographics and socioeconomic indicators, investment analyst reports and public-entity filings and searches news and journal articles.

Gordon suggests that the BI function may encompass objectives, beyond a narrow-focused CI emphasis, as the organization evolves: 'such as identifying and analyzing acquisition targets, retaining high market share levels, finding approaches to increase overall industry profitability, gathering 'nice-to-know' information as a security blanket or developing tactical competitor and customer information.' Liautaud found a range of structures, from departmental and complex BI to a centralized-decentralized spectrum and a 'help desk' support approach.

The most effective BI units, Liautaud found, embodied the 'information democracy' ideal rather than the extremes of 'information anarchy' versus 'information dictatorship'. Herring demands that an effective unit meets four quantitative criteria: time savings, cost savings, cost avoidance and revenue enhancement. This is because the intelligence cycle can be a trade-off between efficiency and effectiveness.

Business Intelligence Failures

Perhaps reflecting on the rise-and-fall of strategic planning, writers on Business and Competitive Intelligence have paid attention to how implementations can fail.

Meyer summarizes a range of BI failures that can occur between the analyst and the executive decision-makers. Policymakers can interfere with the intelligence process by ignoring the intelligence reports (passive) or not acting on the intelligence they receive (active). Planned leaks or political implementation can skew the interpretation of intelligence to normative ends. Intelligence analysts can sabotage their own work by withholding 'judgments and projections from their policymakers because of their own distaste for what they know or believe these policymakers will do.' They can become addicted to secrets or focus on secrets and miss relevant information from public sources. Finally, policymakers very rarely share public credit for intelligence breakthroughs. Instead they find that the secretiveness of these operations means 'intelligence outfits make excellent scapegoats.'

For Pollard, most BI failures 'have not been failures in collection but failures of organization and evaluation, which is why epistemological concerns are so important.' Epistemological concerns, the management's ontology and blind-spots also influence the design of a BI template. Pollard advises that a back casting exercise with considers the processes of information gathering, scope and weighting is crucial. Tyson and Swanson also suggest 'a mission statement be developed for the intelligence process' to ensure that the CI function remains aligned with 'the business objective.' Albrecht warns explicitly that market language may conceal 'inhumane' assumptions.

Tyson and Swanson warn that senior management in a BI unit can become over-fascinated with new technology. They witnessed some common errors in ERP-oriented implementations: the system was 'built for Data instead of Information', the staff had 'unrealistic expectations', there was 'insufficient user buy-in' and 'no senior management commitment.' Seeking patterns in industry dynamics and the information technology that monitors them can be a dead end. Slywotzky reminds us that BI maps 'patterns of internal organizational behavior' that 'are rooted in human nature . . .

Suggested Methodology of Building BI Systems

Building and implementing BI systems require organizations to have some culture of working with information and information technologies, which is related to:

- thorough and ongoing research into organizations' informational needs (present and future);
- authentic co-operation of the users involved (i.e. decision makers and operational personnel) with organizations' IT departments and knowledge management centers;
- information sharing; and
- abilities to interpret analyses and use such analyses in management properly.

Suggesting the methodology of building and implementing BI systems, the authors have benefited from sound business practices set by enterprises that succeed in building BI systems. Any general model to be suggested may be a set of guidelines and some kind of a pattern for organizations that want to use any BI system. The model in question pays particular attention to the role of end users in the whole life cycle of the BI systems including the phase of the BI usage in particular.

Parameterization of the BI system carried out by its user is required for its correct performance.

Such parameterization involves providing repositories with knowledge (employees, customers, suppliers or co-operators). Using BI systems will succeed in business only when their users keep:

- identifying and modelling knowledge;
- monitoring and modifying data repositories;
- creating their own analyses and reports;
- learning how to interpret results and ask sophisticated questions; and
- improving business and decision making on the on going basis.

All the above has to be manifested in the system performance. Taking into account significant influence users have on the BI system performance allows for suggesting two major iterative stages in the approach to building and creating the systems in question, i.e. (compare: Dresner, Buytendijk, Linden, Friedman, Strange, Knox, & Camn, 2002):

- creation of BI; and
- use ("consumption") of BI.

BI creation is the most time consuming and this stage requires the greatest part of financial and manpower resources in the

whole BI life cycle. BI creation consists of numerous stages including in particular:

- definition of the BI undertaking, i.e. determination of the BI system development strategies;
- identification and preparation of source data;
- selection of BI tools;
- designing and implementing of BI; and
- discovering and exploring new informational needs and other business applications and practices.

The BI "consumption" stage is predominantly associated with end user application. The stage

shows its major role in popularizing and promoting practices that are related to data analyses and BI systems. This stage may be divided into several different steps to be taken at the discretion of users and according to their needs or tasks to be faced. The steps mainly include the following:

- logistic analyses that enable to identify partners of supply chain quickly;
- access, monitoring and analyses of facts;
- development of alternative decisions;
- division and co-operation; and
- change in the effect of company performance.

Strategy of the BI System Development

Undertaking realization of BI systems in organizations, it is first necessary to determine a general vision of such systems. The systems also have to be related to business objectives. This stage involves specifying informational needs of organizations, simultaneously paying attention to key IT decision makers and specialists. Ranking of informational needs (carried out on the basis of their importance) allows for highlighting e.g. indexes that are important while realizing business strategies (Chaudhary, 2004).

It is necessary to remember that applying of BI systems in organizations makes sense when companies involved are not interested in passive recording of different events only. Such companies ought to focus their attention on interpretation of different events in different wider contexts, e.g. when it is more important to understand customers' expectations and preferences than to find out the amount of income obtained. BI systems should closely correspond to business objectives of enterprises. Therefore, the most important motives that support implementation of BI systems in enterprises may include the following (Kalakota, & Robinson, 1999; Liautaud, & Hammond, 2002; Rasmussen, Goldy, & Solli, 2002):

- transitioning from instinct and intuition decision making to objectivism that is based on the analysis of facts, indexes, balanced score cards, managerial cockpits, etc.;
- forecasting enterprise development along with customers' and suppliers' behaviour;
- matching operational activities with realisation of strategic objectives (measuring development in the realisation of strategies, monitoring of business process effectiveness, matching budgets and investments with corporate strategies);
- implementing standards that are used as the basis for repetitive, regular and cyclical business processes within organizations;
- unifying informational transfers in order to make them more transparent and unifying roles of individuals who participate in decision making processes;
- rapid detecting of information that deviates from commonly accepted standards and procedures and that suggests some possibilities that new threats will emerge (dishonest customers, inflated material or energy usage, etc.);

- shortening time that is necessary to analyse information, and decreasing a number of participants who are involved in analysing and processing of information; and
- automatic and rapid reporting and preparing of plans and forecasts.

At this stage, it is necessary to find areas and business processes that will first undergo different analyses and explorations. Analysing this process in enterprises that have already implemented BI systems, it is possible to note that it was natural for the enterprises in question to start with finance.

Then, marketing, customer relations management and logistics followed. As far as sectors are concerned, enterprises that pioneered BI implementation mainly include banks and insurance institutions that were subsequently followed by telecommunications, power engineering, transportation, trade companies and production enterprises.

Observing general trends in companies that show BI initiatives, it is possible to assume that the development of the majority of BI is characterized by a top-down approach, i.e. firstly, decision making by the board and top management is supported and then lower levels of management are involved. At this stage, it is necessary to decide whether a particular BI solution is planned to be implemented in one department and if it is supposed to cover a selected scope of enterprise functioning or whether a potential solution is to be of complex nature, thus integrating different aspects of activities undertaken by enterprises. Translating this situation into the data warehouse context may provide an answer to the question if a particular enterprise is going to create individual data marts (that are subsequently going to be integrated in a corporate data warehouse), or whether the enterprise in question will immediately take up building an integrated data warehouse that would cover the enterprise's different departments. The data marts oriented approach is supported by a less demanding scope of a project and - as a result - by faster effects to be obtained.

However, it is possible to observe some future difficulties while integrating different individual data marts in one corporate data warehouse.

Formulating general requirements for potential BI systems, it is also worth considering whether, for instance, such systems should work online, whether they ought to be directed at symmetric exploration of Internet websites or at advanced forecasting analyses, etc. At this stage, available sources of information are not taken into consideration. The objective is rather to identify general business needs, even if it turns out that supporting such needs might be difficult or hardly possible.

Identification and Preparation of Data for the BI System

At the stage of identifying and preparing data, it is necessary to specify sources of data that may be used to support business needs. Such specification requires finding internal sources (intellectual resources, information technology resources, paper files, etc.) and external ones (concentrated on customers, suppliers, shareholders, etc) along with verifying reliability of the sources and a form of transformations that the sources in question will have to undergo so that they could be subject to further analyses. Realisation of this stage calls for remarkable help provided by decision makers, operational workers, IT departments, departments of knowledge management and strategic customers.

At this stage, it is necessary to diagnose all information systems and databases used in a given enterprise (simple applications that are based on dbf files, Access or sophisticated ERP systems). While carrying out such a diagnosis, it is worth

following several important instructions (Błotnicki, & Wawrzynek, 2006):

- find data that are to be found in the IS and that are not important from the perspective of the analyses carried out; find relations between data in different information systems;
- describe the logical structure of data that are to be found in the system: much attention should be paid not only to their structure in the base but also to the relation with business processes described;
- find places that allow for generating errors in data (a possibility that data are inconsistent); and
- find limits of IS applicability (which data cannot be reported out of IS, e.g. due to erroneous logic of source bases).

At this stage, it may turn out that a lot of data are hidden or just inaccessible, and that it is necessary to use numerous informal sources. A huge amount of valuable data that are necessary for analytic reports may be hidden, e.g. in the Internet resources. While searching for such data, it is suggested to take advantage of the following methods:

- manual searching: documents are directly downloaded by a particular system user;
- automatic searching and downloading of HTML documents by means of appropriate software; and
- queries: using browsers that search through indexes.

Contents mined this way may provide interesting information. Processes of mining depend on the data obtained. When data get filtered and are made homogenous, they may be directly transferred to databases. ETL techniques are responsible for this process to the large extent. In order to mine information from semistructured and unstructured sources, techniques of the so-called 'wrappers' along with text processing methods may prove useful (Poul, Gautman, & Balint, 2003). Apart from text identification, it is recommended to carry out reliability, up-to-datedness, precision and consistency assessments. It is also necessary to find out whether data of the BI system should be provided systematically or with some minimal delay or periodically.

Conclusions

Business Intelligence (BI) and Competitive Intelligence (CI) are two rarely understood methods relevant to pragmatic Strategic Foresight™. BI was methodologically influenced by the Central Intelligence Agency's (CIA) collections and analysis techniques, and ideologically shaped by the 1980s specter of Japan, Inc. BI has evolved into a collection of sophisticated techniques that merge insights from business strategy, risk analysis, cognitive psychology, organizational behavior and political science. Jan Herring's model of the CIA's intelligence cycle is outlined.

Information technology to deliver actionable information for decision makers, are essential for managing today's global businesses. BI uses both structured and semi-structured data. The former is much easier to search but the latter contains the information needed for analysis and decision making.

Each methodology of information system designing and implementing should be characterized by certain canons. In case of BI systems particular attention ought to be paid to the following issues:

- BI systems should be rapidly implemented, which is quite difficult because such systems are specific for each enterprise. Although basing on standard components shortens time required to build BI, each implementation necessitates adjusting of a particular system to specific requirements of an enterprise.

While choosing ready to use BI solutions, it is necessary to be very careful;

- BI solutions ought to be flexible. As soon as business changes, organisations should adjust their BI systems to new conditions;
- BI systems ought to be independent of their hardware and software platforms. Hence, it is recommended that a system of multidimensional analyses should co-operate with different bases (e.g. DB/2, Oracle, MS SQL Server or Informix) and work in already tested and commonly applied operation systems (e.g. Windows NT, Unix or OS/400). Such solutions will allow for better adjusting the system in question to information technology related infrastructure of an enterprise;
- While creating BI systems, it should be necessary to pay some attention to the fact that there are different information technology systems in organisations (e.g. transaction systems, MRP II, ERP, etc.);
- BI solutions have to be scaleable. Flexibility and open architecture allow for easy expansion of the system. It is necessary in a situation when there are new informational needs or when an amount of information to be processed remarkably increases); and
- BI systems should be based on modern technologies. It is necessary to pay much attention to solutions provided by household names of the computer industry. Only then, it is possible to expect stability and reliability of purchased technologies.

BI systems pose a chance for the effective management of an enterprise. However, they require analysts', designers' and users' high business, information and organisational culture. Skills to identify, model (in the processes and organisation structures) and share knowledge constitute only some factors that determine a correct development of the BI systems.

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