Business Intelligence
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Introduction

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History of BI

- **Origin of the term Business Intelligence:**
- 1958: H. P. Luhn (IBM): „The ability to apprehend the interrelationships of presented facts in such way as to guide action towards a desired goal

  …

  „A collection of activities carried on for whatever purpose, be it science, technology, commerce, industry, law, government, defense, et cetera.“

History of BI

- Business Intelligence in the tradition of Decision Support Sytems, close connection to Operations Research
- Methods applicable in many fields
- Focus on methods, similar to BI

History of BI

- Change in focus due to availability of data
- 1989: H. Dresner (Gartner Group): „An ***umbrella term*** to describe concepts and methods to improve business decision making by using ***fact-based support systems“***

History of BI

- Data Warehouse becomes the main topic of BI
- OLAP und reporting are the dominant tools for decision support
- Development of new methods for data analysis in computer science and statistics (Data Mining)

History of BI

- **(Grothe/Gensch, 2000)**

  Der analytische Prozess zur Überwachung, Steuerung und Optimierung der Geschäftsprozesse eines Unternehmens

  BI umfasst Verfahren, Methoden und Werkzeuge, um entscheidungs- und analyserelevante Daten aus unternehmensinternen und -externen Quellen zusammenzufassen und für Analyseprozesse optimiert aufzubereiten

History of BI

2004 Negash:

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.

……

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.

History of BI

- **2008: Davenport:**

  Business intelligence should be divided into **Querying, Reporting, OLAP and Business Analytics**

  In this definition, business analytics is the subset of BI based on statistics, prediction, and optimization.

Characteristics of BI

- **Features of BI**

  Task of BI: The main task of BI is providing decision support for specific goals defined in the context of business activities in different domain areas taking into account the organizational and institutional framework

  Foundation of BI: BI decision support mainly relies on empirical information based on data. Besides this empirical background, BI uses also different types of knowledge and theories for information generation

Charakteristika von BI

- **Features of BI**

  Realization of BI: The decision support has to be realized as a system using the actual capabilities in information and communication technologies (ICT)

  Delivery of BI: A BI-system has to deliver information at the right time to the right people in an appropriate form

Actual Challenges

- Integration of improved process understanding, workflow considerations and process mining
- Applications to new organizational structures
- New data sources (Web data, semi structured data text data)
- New methods for new data types (text mining, opinion mining)
- Using actual IT facilities: SaaS, Big Data (cloud)
- New devices: mobile devices, real time decision support

Topics Related to BI

- ***Business Analytics***: Finding new insights and understanding of the business
- ***CRM Analytics***: Focus on customers in order to improve relationship to customers
- ***Predictive Analytics***: Main emphasis is on prediction of future business events by using statistically oriented models
- ***Data mining***: Extracting information about the business from large data sets

Topics Related to BI

- ***Machine Learning***: Computer programs with the ability to learn to solve a task (AI); in its origin not so much oriented towards many data instance
- ***Data Warehousing***: Organize all relevant data from operative systems and external systems under a unified view which supports information retrieval
  Process Mining: Finding structure in instances of business processes (more production oriented)

Putting BI in Context – Basic Definitions

- **Business** can be understood as any kind of activities of an organization for delivering goods or services to consumers
  - Size of business: Size of the enterprise, possible generalizations to similar enterprises or larger units
  - Scope of business: Complexity of the activities

Putting BI in Context – Basic Definitions

- **Business Strategy** describes how the organization intends to succeed Depends on size of organization, scope of activities
- **Businesss model** reflects the strategy of an enterprise to create value
  - There are many other definitions of a business model

Putting BI in Context – Basic Definitions

- Execution of strategy at different levels

Putting BI in Context – Basic Definitions

- Strategies may refer to different business tasks

Putting BI in Context – BI Scenarios

- Roles of BI within a strategy and a business models
  - BI separated from strategic management
  - BI supports monitoring of strategy performance
  - BI as feedback on strategy formulation
  - BI as strategic resource

Putting BI in Context – BI Perspectives

- Business activities are frequently structured by formulating a business process
- ***Business process***: A collection of related and structured activities necessary for delivering a certain good or service to customers together with possible response activities of customers
- ***Process instances***: observable realization of the business process

Putting BI in Context – BI Perspectives

- Three different perspectives of business processes:
  - ***Production perspective:*** What should be offered to customers? How should the offer be produced?
  - ***Customer perspective:*** How perceive customers the product? How react customers?
  - ***Organizational perspective:*** What organizational structure is behind production? What organizational structure is behind customers?

Putting BI in Context – BI Perspectives

- In connection with the organizational perspective it is often important to identify roles of involved parties:
  - ***Process owner:*** Responsible for setting up the rules behind the process
  - ***Process subjects:*** Identifiers for the process instances
  - ***Process actors:*** Other persons or organizational units involved in the process execution

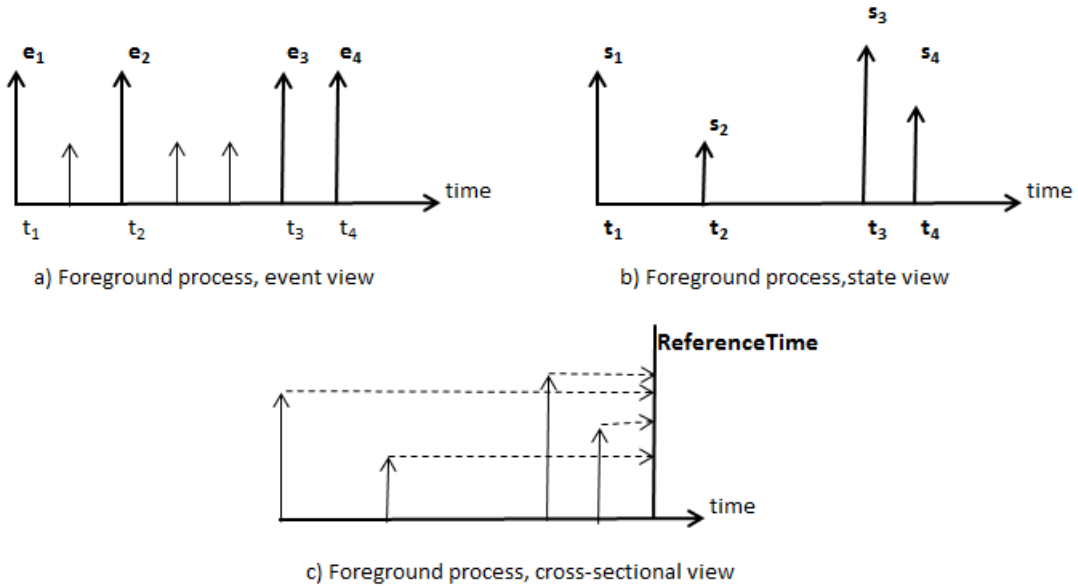
Putting BI in Context – BI-Views

- The business process can be viewed from different angles
  - ***Event view***: Main emphasis is on the events in the business process
    - ***Activities*** are characterized by a start event, an end event, and possibly interruption and resuming events
  - ***State view***: In connection with events frequently attributes are measured which characterize the state of the process at a certain time

Putting BI in Context – BI-Views

- ***Cross-sectional view***: Look at the history of many process instances at a certain time

- Schematic representation of the views:



Putting BI in Context – BI-Goals

- Main goal of BI is to give information about the performance and to improve the performance of a business process
- Measurement of performance by ***Key Performance Indicators (KPI)***
- ***Influential factors***: Attributes of the process that influence the performance

Putting BI in Context – BI-Goals

- Example of KPIs in the customer view

Kundenbeziehungs-kenngrößen	Marketingkommunikations-kenngrößen	Preismanagement-Kenngrößen
Kundenzugangsquote	Medienreichweite	Gewinnspanne
Kundenabgangsquote	Click Through Rate (CTR)	Handelsspanne
Dauer der Kundenbeziehung	Tausenderkontaktpreis (TKP)	absoluter/relativer Deckungsbeitrag
Reklamationsquote	Markenbekanntheitsgrad	Preiselastizität der Nachfrage

Putting BI in Context – BI-Goals

- KPIs are designed for information about the business process
- If we are interested in improvement of the business process we need reformulation of the relation between KPIs and influential factors in terms of ***Analytical Goals***

Putting BI in Context – BI-Goals

- Typology of Analytical Goals
  - ***Descriptive goals***
    - Reporting (KPIs)
    - Segmentation (Clustering)
    - Detecting interesting behavior
  - ***Predictive goals***
    - Regression: Find a model for the relationship between KPI and influential factors
    - Classification: Find rules which allow assignment of observed process instances to one of the possible classes

Putting BI in Context – BI-Goals

- Typology of Analytical Goals
  - ***Understanding goals***
    - Process identification: Finding rules which determine the relationships between the events of the process
    - Process analysis: investigate the conformance of process instance with a defined process

BI Tasks and Analysis Formats

- For achievement of the analytical goals we must execute a number of analysis tasks
  - ***Data Task***: Organization of the available information about the business and its environment
    - The data task is based on data modeling techniques (ER-models, UML, semi-structured data,…)
    - Main challenge is integration of data from different sources and data quality

BI Tasks and Analysis Formats

– ***Business and Data Understanding Task***: Looking at the business from the intended goals (KPIs) point of view

The following activities are of importance

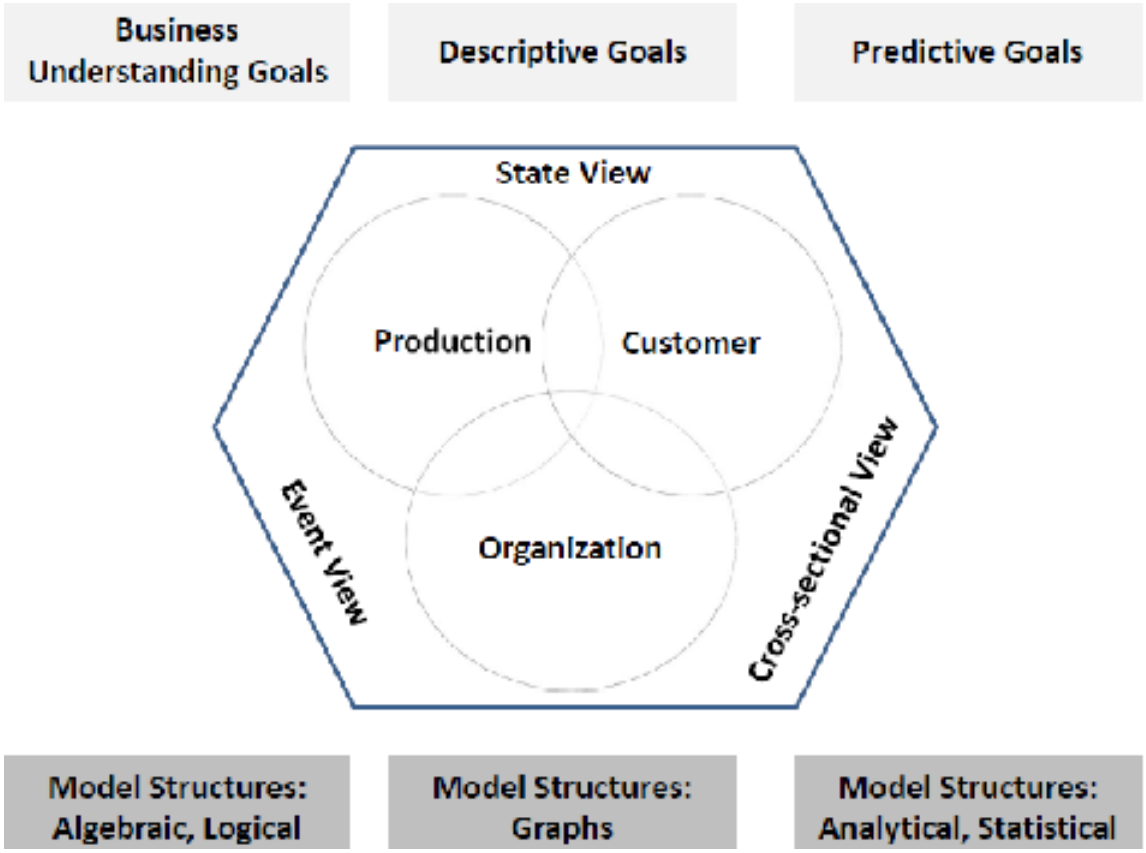
- Explore application environment (size and scope of business, BI strategy, resources for and time horizon of the BI-project)
- Which business perspective is of main interest?
- Which view on the process is supported by data
- How can KPIs and analytical goals be formulated?
- Assessment of data

BI Tasks and Analysis Formats

- ***Modeling Task***: Define an analytical model, which allows formulation of the analytical goals in terms of certain properties of the model
  - Usually different models have to be explored
  - Choice of models have to take into account
    - The analytical goal
    - The business perspective we are interested in
    - The view on the business defined by the data
  - The more techniques one knows the better one can fit these criteria

BI Tasks and Analysis Formats

– Overview of modeling activities

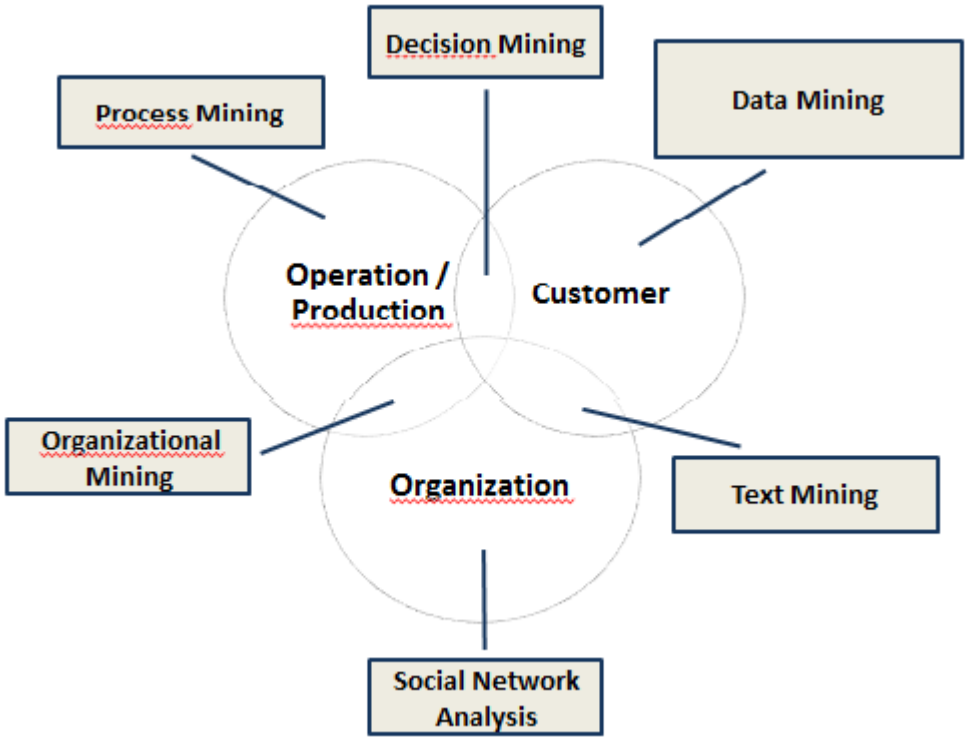


BI Tasks and Analysis Formats

- ***Analysis Task***: Apply analytical (algorithmic) techniques which answer the questions of the analytical goals in the framework of the model
  - In context of BI applications these analytical techniques are usually called "mining"
  - Different mining techniques have been established in connection with the different business perspectives

BI Tasks and Analysis Formats

– Overview about mining techniques and business perspectives



BI Tasks and Analysis Formats

- ***Evaluation and Reporting Task***: Present the results of the analysis in context of the business
  - Evaluation and reporting has to be done under consideration of the intended audience
  - Focus on the main points
  - Use visualization techniques

BI Tasks and Analysis Formats

- ***Analysis Formats*** put the different analysis tasks into a coherent framework
- Some examples of analysis formats:
  - Software engineering projects: cascade models or cyclic models
  - Data mining projects: Cross Industry Standard Process for Data Mining (CRISP): Focus on analysis of data in the cross-sectional view
  - L*-Format: Focus on process mining applications for data in the event view
  - iMine: Combining ideas of CRISP and L*

BI Tasks and Analysis Formats

iMine Format