

# Business Intelligence - Methodologies, Techniques and Applications in Marketing

Yannis Theodoridis

[ytheod@unipi.gr](mailto:ytheod@unipi.gr)

Information Systems Laboratory  
University of Piraeus

Νέες Τεχνολογίες & Marketing, Ιεράπετρα Κρήτης, 24/5/2007

BI ●  
DM ●  
BPM ●

*"Measurements are the key.  
If you cannot measure it, you cannot control it.  
If you cannot control it, you cannot manage it.  
If you cannot manage it, you cannot improve it."*

Harrington, J.H., 1991 (\*)

(\*) Business Process Improvement - The breakthrough strategy for total quality, productivity, and competitiveness. McGraw-Hill

Yannis Theodoridis (2007) BI in Marketing - 2

## Introduction

BI ●  
DM ●  
BPM ●

- Data flood is out there !
- More and more data is generated ...
  - ◆ Bank, telecom, retail ...
  - ◆ Scientific data: astronomy, biology, etc.
  - ◆ Web, text, and e-commerce
- More and more data is captured ...
  - ◆ Storage technology faster and cheaper
  - ◆ DBMS capable of handling larger DB



Yannis Theodoridis (2007) BI in Marketing - 3

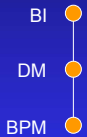
## More and more data ...

BI ●  
DM ●  
BPM ●

- France Telecom has largest decision-support DB, ~**30TB**; AT&T ~ **26 TB** (source: Winter Corp. 2003 Survey)
- Walmart reported to have **24 TB** DB
- UC Berkeley estimated that **5 EB** (5 million TB) of new data was created in 2002.
- **So what?**
  - ◆ A tiny portion of this data will ever be looked at by a human
  - ◆ We need to make sense and use of data!

Yannis Theodoridis (2007) BI in Marketing - 4

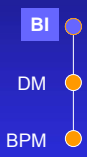
## Outline



- **Business Intelligence (BI)**
  - ◆ Applications
  - ◆ Customer-centric
- **KDD and Data Mining (DM)**
  - ◆ The KDD process
  - ◆ DM techniques
  - ◆ DM in BI
- **Business Performance Management (BPM)**

Yannis Theodoridis (2007) BI in Marketing - 5

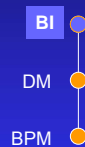
## Business Intelligence



- **Business Intelligence (BI)**
  - ◆ a set of applications and technologies for gathering, storing, analyzing, and providing access to corporate data to aid in decision making
- **BI includes (among others):**
  - ◆ Decision support systems (DSS)
  - ◆ Statistical analysis
  - ◆ Information visualization
  - ◆ Data warehousing (DW) and Online Analytical Processing (OLAP)
  - ◆ Data mining (DM)

Yannis Theodoridis (2007) BI in Marketing - 6

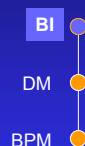
## BI - Applications



- **Market analysis and management**
  - ♦ target marketing, customer relation management, market basket analysis, cross selling, market segmentation
- **Risk analysis and management**
  - ♦ Forecasting, customer retention, improved underwriting, quality control, competitive analysis
- **Fraud detection and management**
- **Other Applications**
  - ♦ Intelligent query answering
  - ♦ Text / Web mining (news group, email, documents)

Yannis Theodoridis (2007) BI in Marketing - 7

## BI - Customer-centric



- **Customer-centric vs product-driven company**
  - ♦ A customer-centric organization defines, markets and sells its products or/and services from the customers' point of view
  - ♦ Data concerning customers' behaviour should be analysed
- **A customer-centric organization knows and understands its customers**
  - ♦ Customer service s/w packages (helpdesk, complaints handling systems, call centers, etc.)
  - ♦ Customer satisfaction evaluation
  - ♦ Surveys using IT applications and Internet
- **BI under Customer-centric approach**
  - ♦ Transforming customer data into actionable information and getting the right information to the right person at the right time

Yannis Theodoridis (2007) BI in Marketing - 8

## Data Mining

---

BI ●

DM ■

BPM ●

- Data mining
  - ◆ Extraction of interesting (i.e. non-trivial, implicit, previously unknown, potentially useful) information, so-called patterns, from data in large databases
- Alternative names:
  - ◆ Knowledge discovery (mining) in databases (KDD), knowledge extraction, data archeology, data dredging, information harvesting, etc.
- What is not data mining?
  - ◆ (Deductive) query processing.
  - ◆ Expert systems or small ML / statistical programs

Yannis Theodoridis (2007) BI in Marketing - 9

## Types of data analyzed, 2006

Source: [www.kdnuggets.com](http://www.kdnuggets.com) (Jul. 2006)

---

BI ●

DM ■

BPM ●

Type of Data	Percentage
table data - fixed # of columns	70.8%
time series	34.0%
text - free-form	33.0%
transactions (association rules)	28.3%
anonymized data	25.5%
spatial data (2D 3-D)	14.2%
email	10.4%
web clickstream	8.5%
links or networks	8.5%
images / video	7.5%
XML data	6.6%
web content	5.7%
music / audio	4.7%

Yannis Theodoridis (2007) BI in Marketing - 10

## DM Process

BI ●

DM ●

BPM ●

- According to CRISP-DM:
  - Business understanding
  - Data understanding
  - Data preparation
  - Modeling
  - Evaluation
  - Deployment

Yannis Theodoridis (2007) BI in Marketing - 11

## DM tasks

BI ●

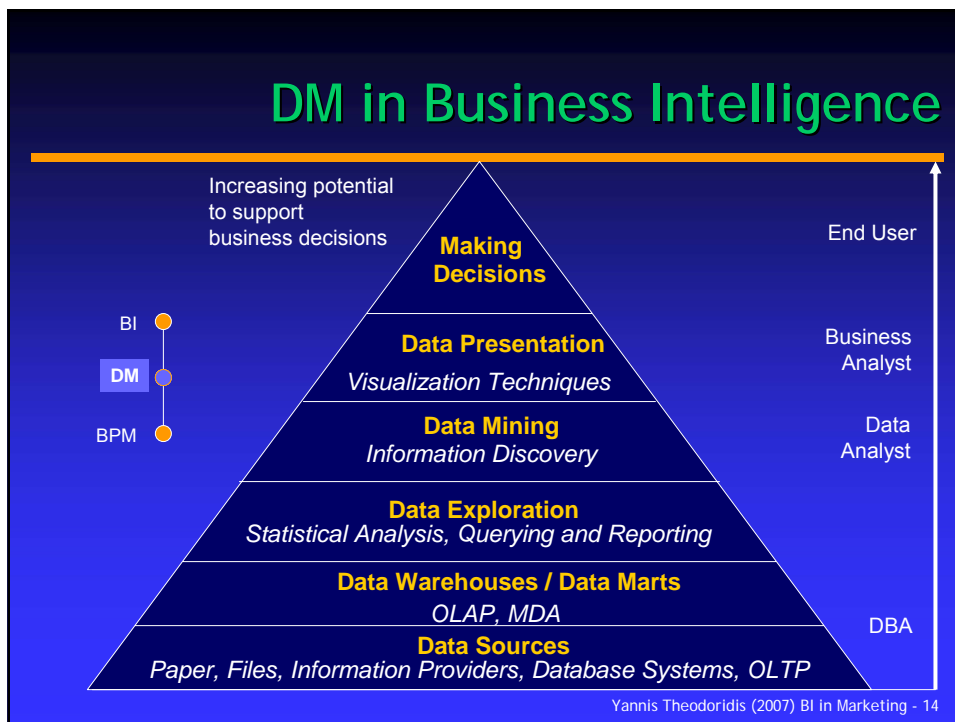
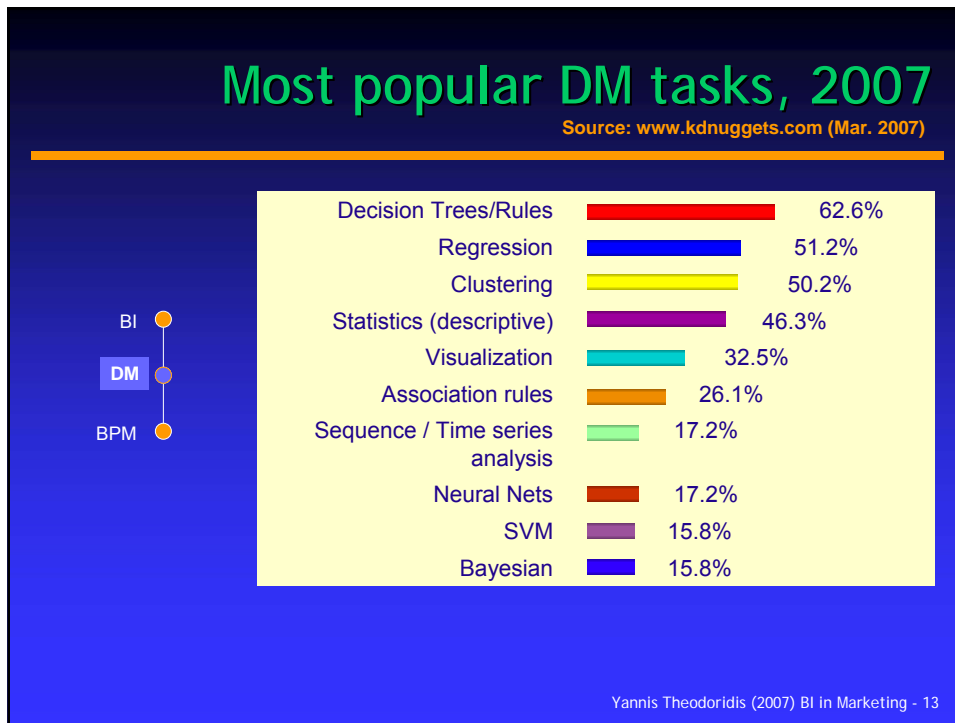
DM ●

BPM ●

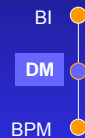
- Association & Sequence mining
  - Market-basket analysis
- Classification & Prediction
  - Decision Trees, Neural Nets, Bayesian classification
- Clustering
  - Hierarchical, partitional, density-based

$X \Rightarrow Y$	$s$	$\alpha$
Bread $\Rightarrow$ PeanutButter	60%	75%
PeanutButter $\Rightarrow$ Bread	60%	100%
Beer $\Rightarrow$ Bread	20%	50%
PeanutButter $\Rightarrow$ Jelly	20%	33.3%
Jelly $\Rightarrow$ PeanutButter	20%	100%
Jelly $\Rightarrow$ Milk	0%	0%

Yannis Theodoridis (2007) BI in Marketing - 12



## DM - Customer-centric



### ■ Analytics

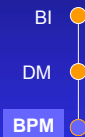
- ♦ **Customer Segmentation** – breaking down the customer base into segments by a number of different metrics
- ♦ **Promotional/Advertising/Campaign Impact** – assessing the effectiveness of advertising and price changes
- ♦ **Loyalty/Account Program Performance** – using data from loyalty/account programs to assess specific customer behavior

### ■ Data Sources

- ♦ **Transactions and Tenders** – point of sale information
- ♦ **Customer Master, Loyalty/Charge Accounts** – specific or general customer information.
- ♦ **Promotions, Advertising, Campaigns** – marketing and pricing information.
- ♦ **CallCenter Data, Surveys, Internet Postings** – real customer feedback

Yannis Theodoridis (2007) BI in Marketing - 15

## BPM - The new BI



- Marketing decisions are based, among others, on market trends, transactional data and customer profiles. However:

- ♦ **modern organizations need something more than analytics based on historical data**

- The next generation of decision making tools:

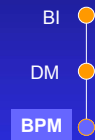
- ♦ (integrated) **performance measurement and management**

- The era of process-oriented organizations raises the need for a **complete management of organizational performance**

Yannis Theodoridis (2007) BI in Marketing - 16



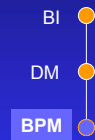
## BPM definition



- **Business Performance Management (BPM)**
  - ◆ A set of processes that assist organizations optimize business performance
- BPM can be used to support operational decision making
- This is a very challenging issue:
  - ◆ **Goals and objectives** against which we measure performance are exponentially increasing
  - ◆ **External unstructured data and events** have to be encompassed
  - ◆ **Acting in a timely and effective manner** on the resulted imperatives is required

Yannis Theodoridis (2007) BI in Marketing - 17

## Measuring BPM ...



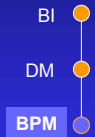
- Not only data but also **workflow logs**, **business rules** (BR) and **key performance indicators** (KPI) can be analyzed in order to discover trends, tradeoffs, hidden patterns
  - ◆ Several measures for business performance (quantitative, qualitative, actionable)

BR	Expression
Waiting time for check out	< 20 min.
Execution time for process type: "Order dairy products"	< 24 hrs.

KPI	Target value
Avg waiting time for check out	5 sec. per item
Avg market basket price	20 € (weekdays) 50 € (weekends)
Avg portion of private-label products in basket	30%
Weekly sales per branch	50K €

Yannis Theodoridis (2007) BI in Marketing - 18

## BI vs. BPM



**Activity**

**Key methodologies**

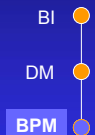
**Workflow**

**Analytics**

Traditional BI	The BPM approach
After transaction	During transaction
Data analysis, OLAP, reporting and query tools, data warehousing	Traditional methodologies plus KPIs, dashboards, business rules engines
Offline, disconnected from business processes	Embedded in operational processes and systems
Summarize past performance, group behavior, trends	Continuously measuring and managing performance

Yannis Theodoridis (2007) BI in Marketing - 19

## An example ...



**BPM in retailing**

- Business & Customer Intelligence
- Performance measurement

**Technological challenges**

- sequence analysis using RFID
- Indoor positioning systems (IPS) for personalized, real-time offers

Enterprise portal

Business & Customer Intelligence

Performance measurement

Alerts

Cubes

Data mining engine

Activity monitoring

Business Dw

Process Dw

Pattern warehouse

Integration manager

Operational DBs

Workflow logs

Other (data) streams

Yannis Theodoridis (2007) BI in Marketing - 20

## Concluding ...

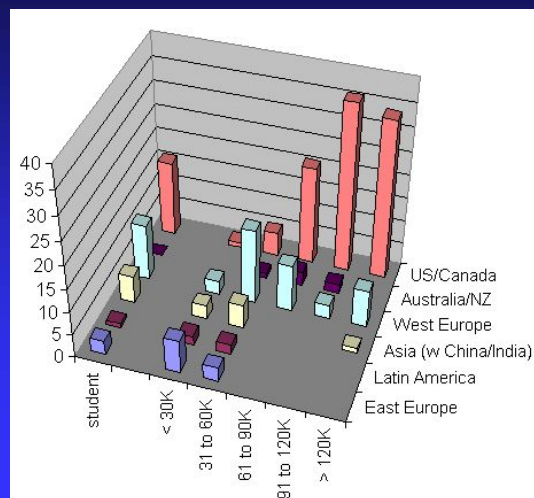


- Data mining is a 'hot' science and business
- BI using DM is one of the keys to success for organizations
- BPM is a future 'must'
- Junior scientists and students should take a look at the following figure ...

Yannis Theodoridis (2007) BI in Marketing - 21

## Data Miners' annual income in US\$

Source: [www.kdnuggets.com](http://www.kdnuggets.com) (Jan. 2007)



Yannis Theodoridis (2007) BI in Marketing - 22

## Acknowledgements

### ■ Research on BI/DM/BPM funded by

- ♦ Grants and scholarships under the EPEAEK II Programme of the Greek Ministry of National Education



### ■ Students contributed

- ♦ Evangelos Kotsifakos, Gerasimos Marketos, Irene Ntoutsis

For more info about our activities, please visit  
URL: <http://isl.cs.unipi.gr/db>