Analysis und Use of Data (1): Reporting and Dashboards
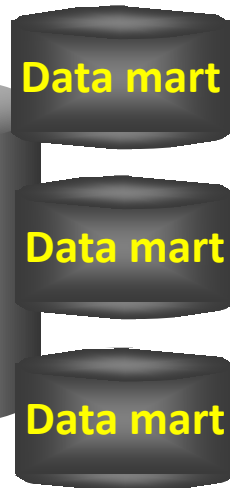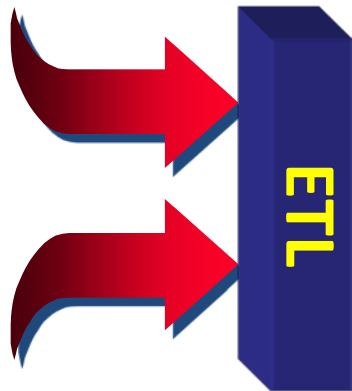
Knut Hinkelmann

Business Intelligence

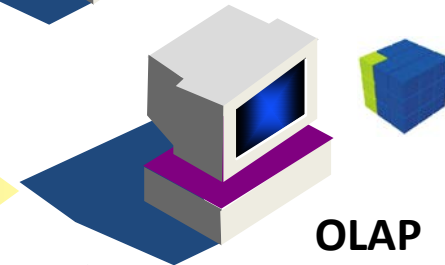**Data Sources**

Data Management

Analysis and Use

Operational data

ETL

Data Warehouse

Data mart
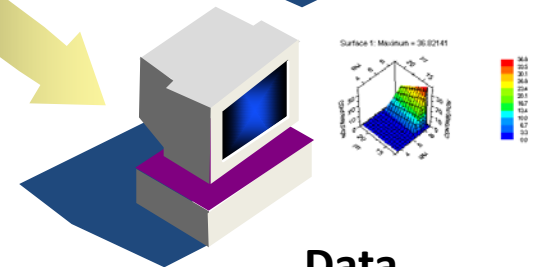
Data mart

Data mart

External Data

Query & Reporting

OLAP

Data Mining

Analysis: BI tools – front-end

1. **strategic:**
   - ♦ support definition of KPIs and their connection to data
   - ♦ offer possibilities to monitor status of indicators
   - ♦ offer a possibility for drill-down, e.g. when indicators are off-target, to understand cause for deviation

   BSC tools

   dashboards, reports

   OLAP

2. **operative:**
   - ♦ support ad-hoc aggregation of numbers e.g. to make decisions about a particular product, customer, supplier or sales rep
   - ♦ support queries for particular facts, needed to make decisions in core business processes
   - ♦ predict (mainly) customer behaviour to optimise sales and marketing strategies, find patterns
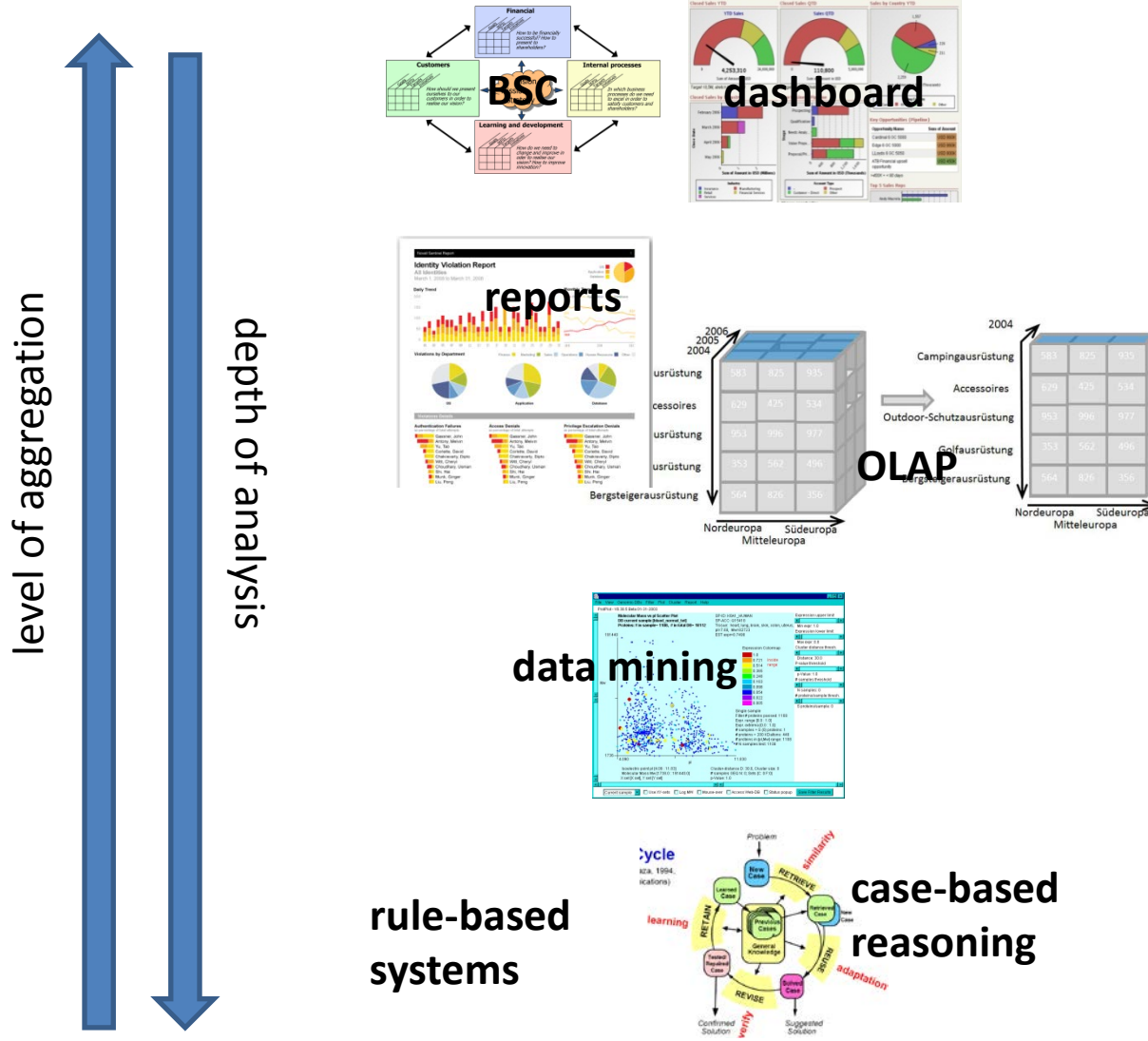
   OLAP

   query tools CBR

   data mining tools

BI front-ends and the questions they answer

BSC

dashboard

reports

OLAP

data mining

rule-based systems

case-based reasoning

level of aggregation

depth of analysis

Set goals and measure...
1. definition of KPIs
2. KPI measurement

Understand why...
3. group by ...
4. filter by ...
5. drill-down

Find new patterns
6. predict ...
7. find patterns ...
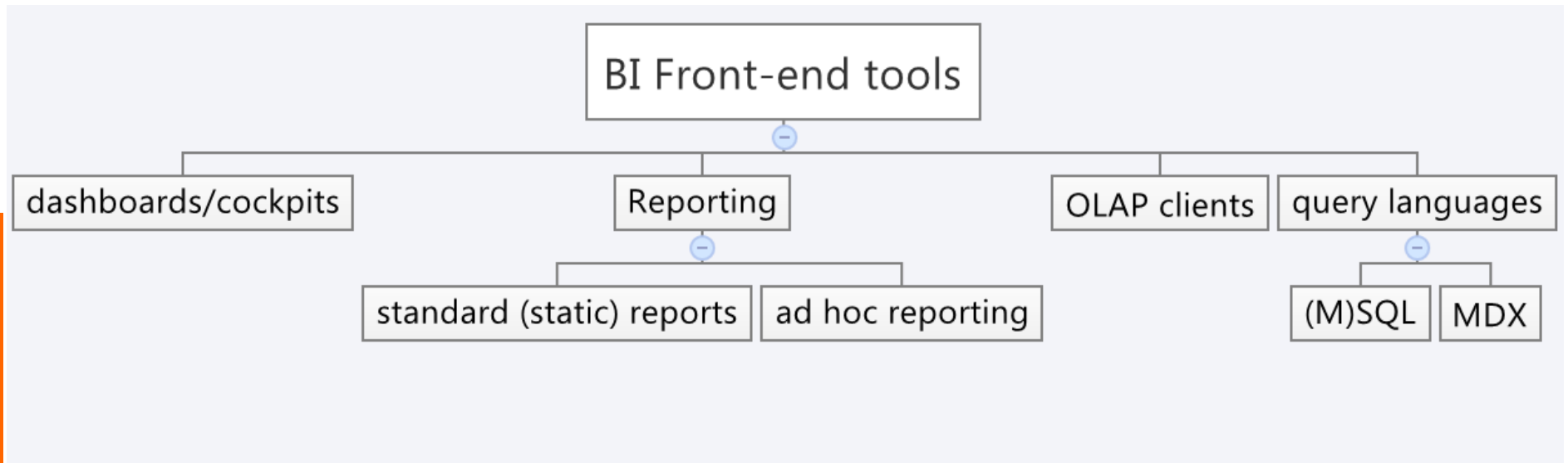
Make decision
8. apply rules
9. reuse cases

Characteristics of front-end tools

■ Monitoring vs. exploring = push vs. pull:

♦ Dashboarding and reporting – as part of performance management – help **monitor**, i.e. to measure goal achievement, make aware of problems
→ *push principle, "what is happening?"*

♦ Analysis tools such as ad-hoc reports, OLAP and query languages help to answer questions to make decisions (strategic or operative), i.e. to **explore** the data, e.g. drill-down for analyzing root causes for deviation from KPI targets, find patterns and/or trends in data
→ *pull principle, "why/how is something happening?"*

BI front-ends overview

BI Front-end tools

dashboards/cockpits — Reporting — OLAP clients — query languages

standard (static) reports — ad hoc reporting

(M)SQL — MDX

push-principle
easy to use/understand
static

pull-principle
complex
flexible/interactive/adaptive

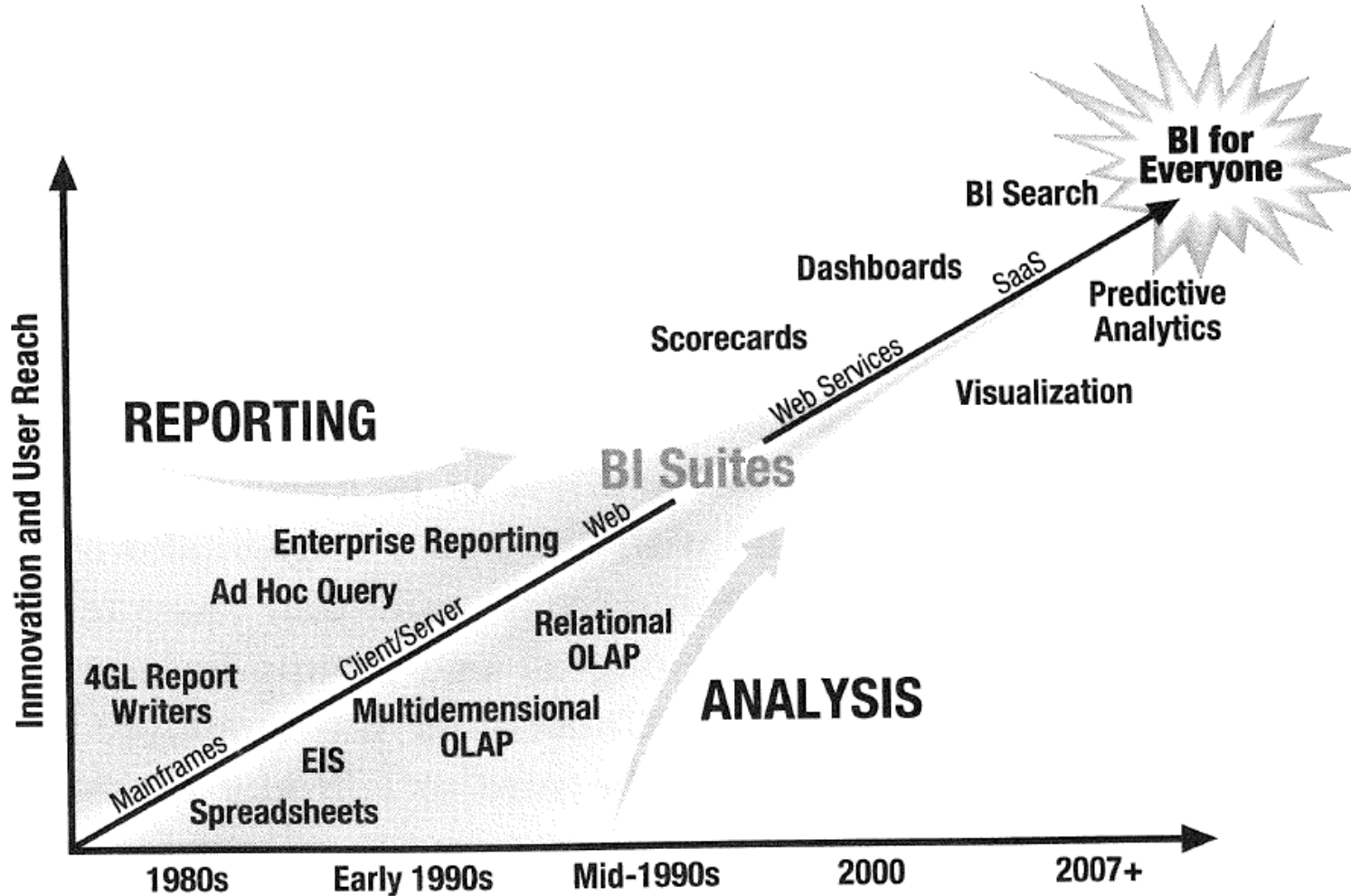# Historical evolution of front-ends

Figure 1-1   Evolution of BI tools.[13]

from: C. Howson. Successful Business Intelligence

Requirements for BI tools – front-end

1. **indicator-driven:**
   - ♦ support definition of KPIs and their connection to data
   - ♦ offer possibilities to monitor status of indicators

     BSC tools dashboards, reports

   - ♦ offer a possibility for drill-down, e.g. when indicators are off-target, to understand cause for deviation

     OLAP

2. **explorative:**
   - ♦ support queries for particular facts, needed to make decisions in core business processes

     OLAP

   - ♦ support ad-hoc aggregation of numbers e.g. to make decisions about a particular product, customer, supplier or sales rep

   - ♦ making prediction, e.g. to optimise sales and marketing strategies

     data mining tools

Blurring distinctions

- when doing OLAP analyses, users want to create reports from what they discover (e.g. to share with others)

- when looking at reports, users want to drill-down immediately to understand

→ modern tools cover both functionality at the same time

Definitions: Dashboards and Reports

A dashboard is a visual display of the most important information needed to achieve one or more objectives; consolidated and arranged on a single screen so the information can be monitored at a glance.[2]

from: C. Howson. Successful Business Intelligence

- **Dashboards** usually contain actual vs. targeted values of KPIs and thus…
  - ♦ … are often closely related to strategic goals defined e.g. in a Balanced Scorecard
  - ♦ … are used by management to visualise goal achievement
  - ♦ … contain highly aggregated data

- A **report** is a summary of business data, typically in the form of tables and/or diagrams

Distinctions

- Dashboards vs. reports: differ regarding the level of detail/aggregation
  - Dashboards are highly aggregated, represent mostly single KPIs
  - Reports are more detailed, smaller level of aggregation

- Fixed vs. ad hoc reports
  - ad hoc reports are created for answering a specific question at a certain time (i.e. reporting tools are sometimes used to formulate ad hoc queries)
  - fixed reports are useful for questions that need to be answered often and regularly; they remind business users that the questions are relevant!
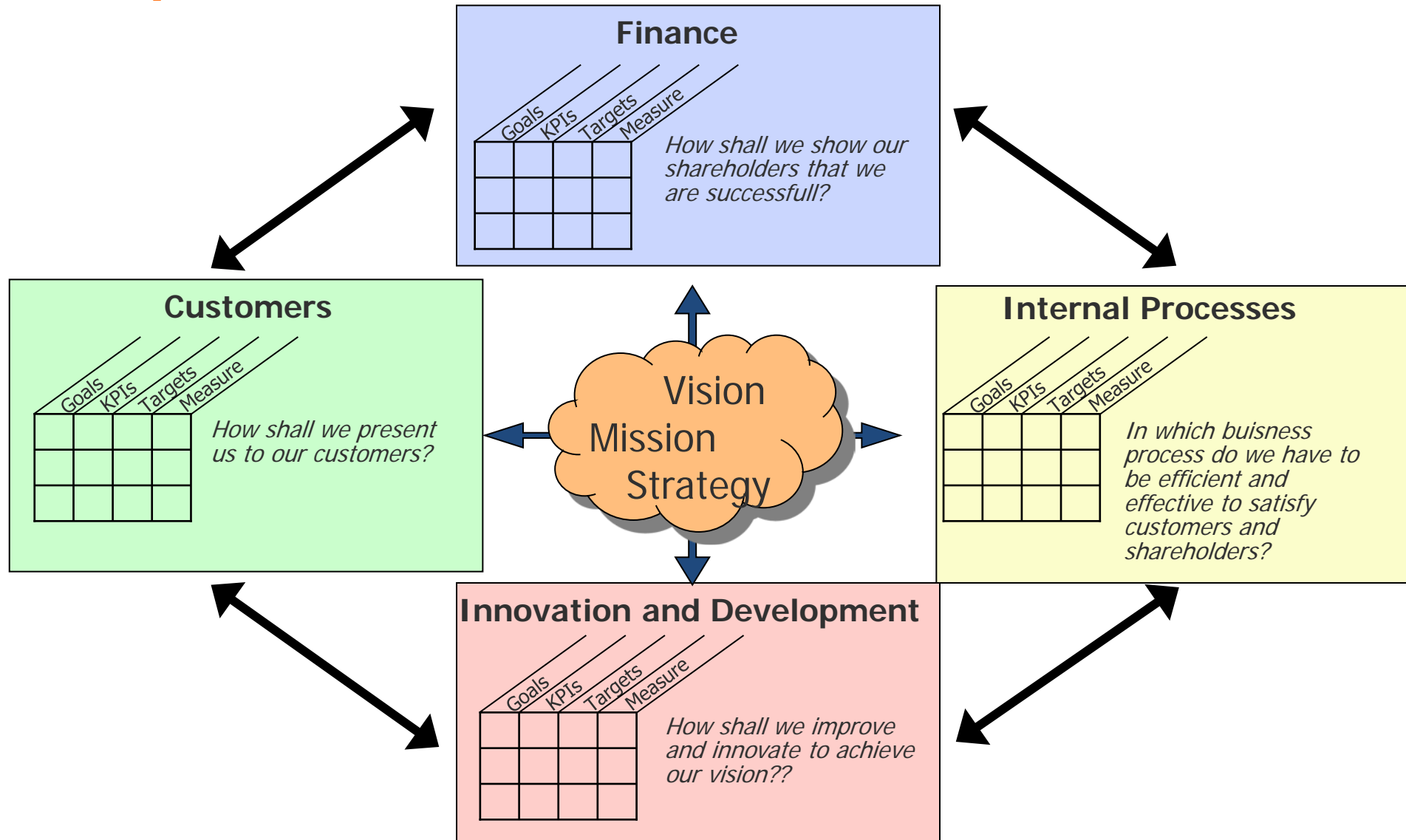
DEFINITION OF KPIS
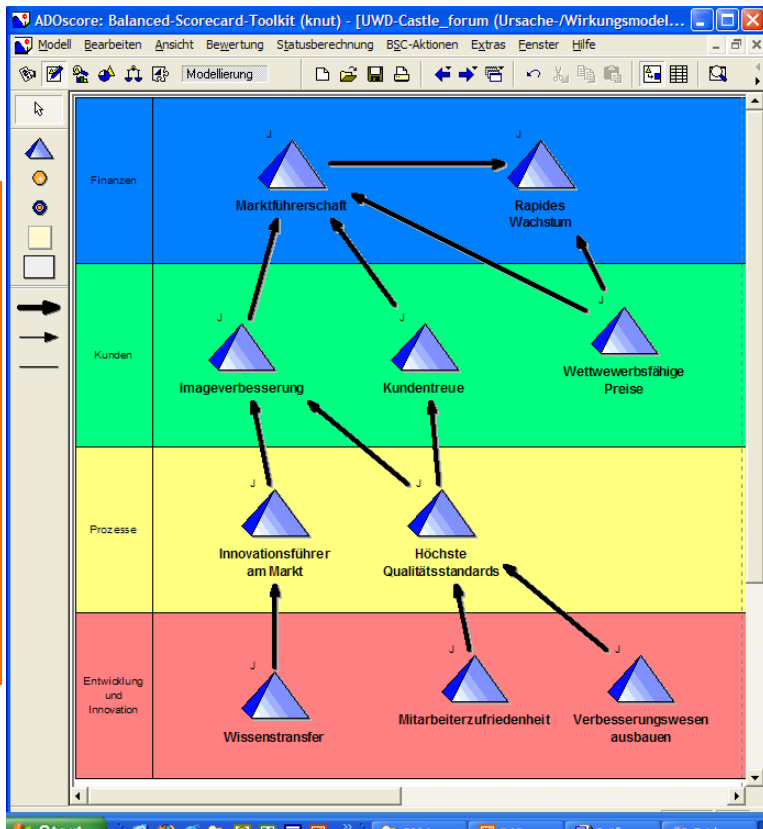
Definition of KPIs starts with the Goals

- KPIs (Key Performance Indicators) help to measure the achievement of goals.

- This means, KPIs only make sense, of the goals are known

- Steps for KPI definition:
  1. Define goals
  2. Determine KPIs for the goals
  3. Determin target values for the KPIs
  4. Measure the KPIs periodically
  5. Show KPIs and their values in a dashboard or report

Example: Balanced Scorecard

Finance

Goals | KPIs | Targets | Measure

How shall we show our shareholders that we are successfull?

Customers

Goals | KPIs | Targets | Measure

How shall we present us to our customers?

Vision Mission Strategy

Internal Processes

Goals | KPIs | Targets | Measure

In which buisness process do we have to be efficient and effective to satisfy customers and shareholders?

Innovation and Development

Goals | KPIs | Targets | Measure

How shall we improve and innovate to achieve our vision??

# 1. Defining Goals

Example: ADOscore [1]

- ■ Determine goals based on strategy and success factors

- ■ Assign goals to perpectives

- ■ Cause-effect relationship can help to determine means of a goal is not achieved:
  - ♦ Which other goals have an influence on goal X?

[1] ADOscore is a tool from BOC to graphically support the development of scorecards
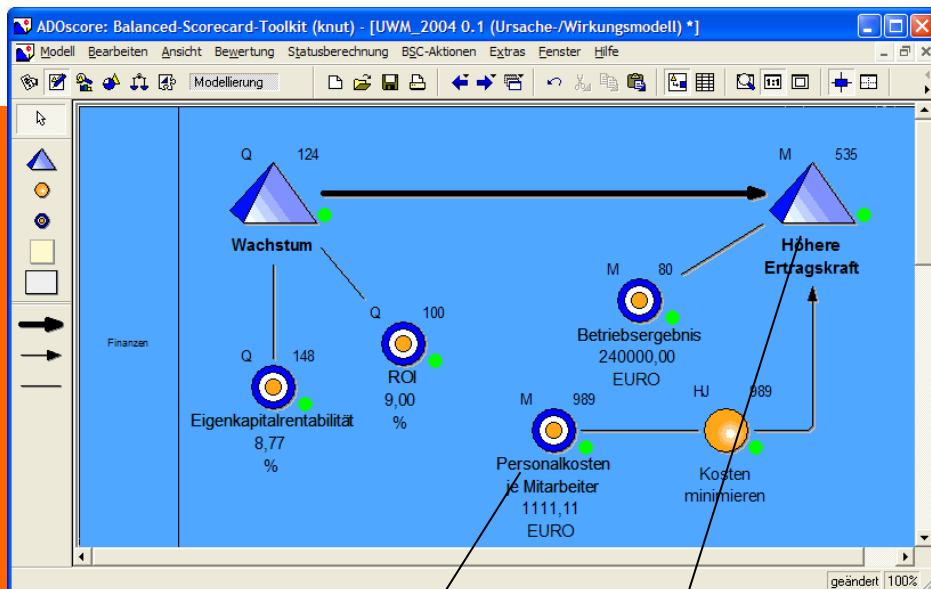
Principle: Cause-Effects are directed towards Success of the Enterprise

Finances

Custon ers

Processes/ Products

Innovation/ Development
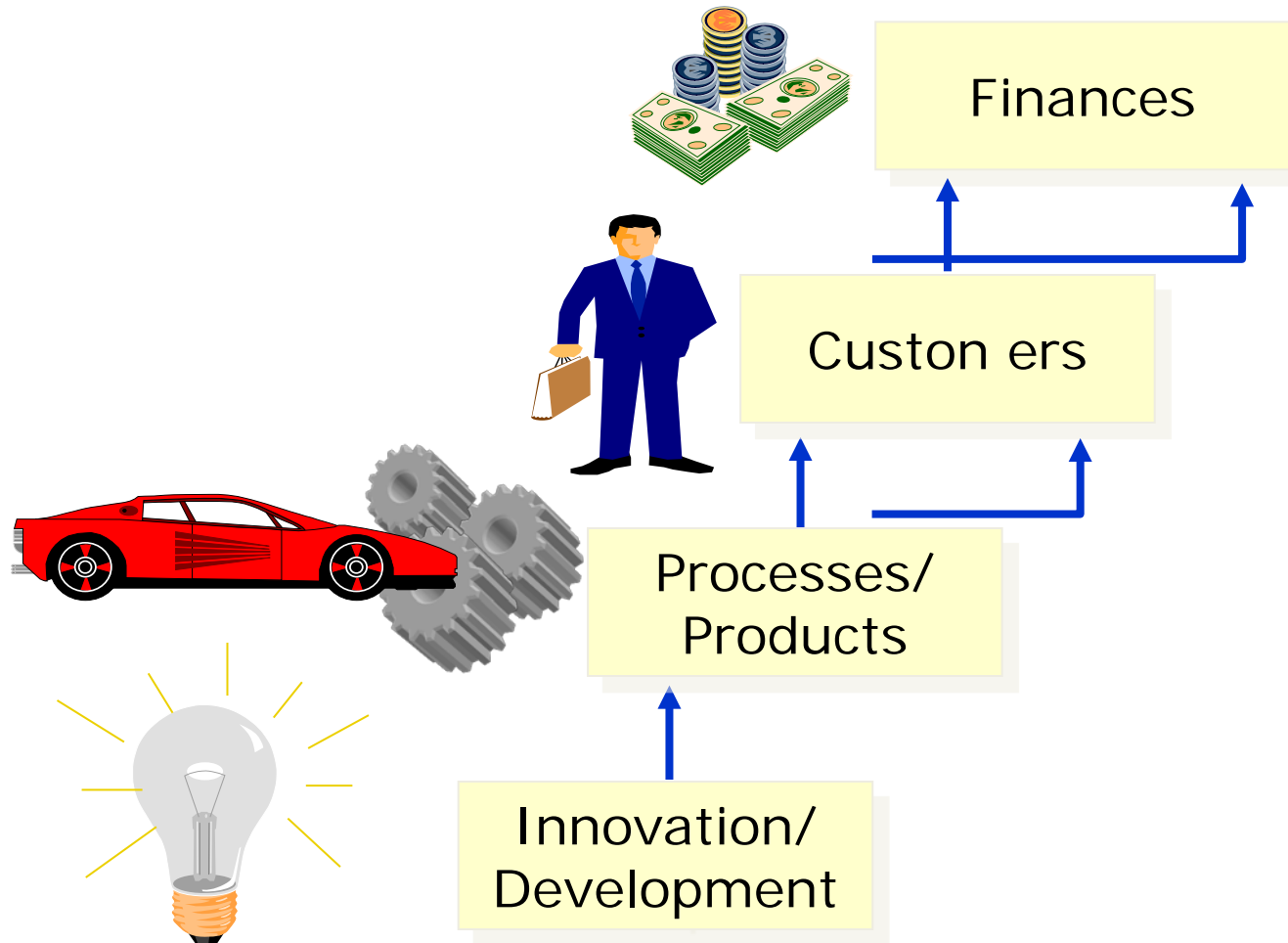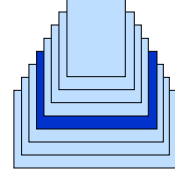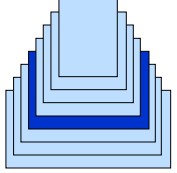
2. Determine KPIs

Example: ADOscore

KPI

goal

- For each goal appropriate indicators are determined

- KPIs are indicators to measure, whether a goal is achieved

- Specify indicators such that
  - … the achievement of the goal can be recognized from the indicator
 - … the behaviour of involved peoples in directed toward the goal achievement

3. Specify Target Values for KPIs

- Specify target values for the indicators
  - Types of targets:
    - minimal value (if a high value is expected)
      - e.g. ROI, revenue, number of customer
    - maximal value (if low value is benefical)
      - e.g. costs, time
    - interval (if value should be in a specific range)
      - e.g. number of employees

Choosing the right KPIs – example 1
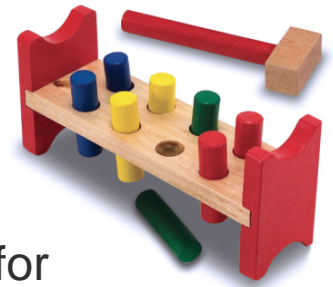
The company WoodToy Inc. designs and produces funny wooden toys for children and adults. An important goal in their strategy is to increase innovation, i.e. to have more innovative products. Recently, they have introduced an idea management system where employees from the R/D department can place ideas for new innovative products. The following two KPIs have been proposed for measuring the achievement of their strategic goal "*increase innovation*":

♦ KPI 1: Number of ideas in the idea management system

♦ KPI 2: Percentage of sales revenue attributable to new products that came out of the idea management system

Which KPI do you consider more suitable in order to measure achievement of the strategic goal?

Choosing the right KPIs – example 2

The company YourERP sells licences for ERP software that they develop. In all licences, technical support is included at no additional cost. YourERP has learned that the satisfaction of their customers with their products depends to a large degree on how fast support issues are solved. They have created a Balanced Scorecard and included the goal "*solve support issues faster*". The YourERP management has discussed about indicators that would measure achievement of that goal and has come up with the following two alternatives:

♦ KPI 1: average time (number of days) to first response

♦ KPI 2: average time (number of days) to final ticket resolution

♦ KPI 3: first contact resolution (= number of tickets resolved with the first response)

Which KPI do you consider more suitable in order to measure achievement of the strategic goal?

Choosing the right KPIs – example 3

A telecommunications company sells many contracts to new and existing customers through telesales campaigns. The goal is to *maximise the profit that results from the campaigns* by optimising the allocation of leads to campaigns. The company has the ability to create predictive models of customer behaviour. Two indicators have been discussed for measuring the achievement of the goal:

♦ KPI 1: revenue from all contracts sold through campaigns

♦ KPI 2: the net present value (over the next 5 years) of all contracts sold through campaigns

Which behaviour will each of these KPIs trigger?
Which one is better suited for measuring achievement of the goal?

Choosing the right KPIs – example 4

A public administration serves citizens with various services. The underlying business processes are complex and knowledge-intensive, i.e. many exceptional situations can arise. In order to be able to measure more accurately the time needed for case completion, the management has introduced a workflow management system through which all cases should be handled. They are planning to measure the following KPI
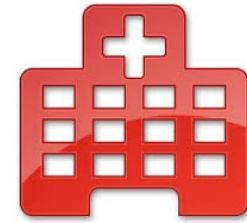
♦ KPI: number of cases completed within a month
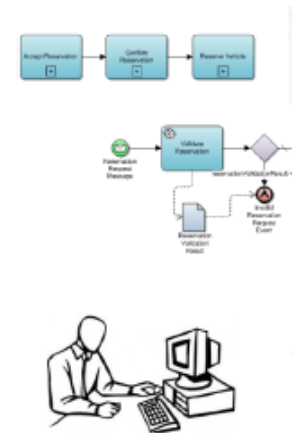
Do you foresee any problems with this KPI?
Which? What do you propose to avoid them?

Choosing the right KPIs – example 5

In Switzerland, physicians' activities are billed using so-called «tax points» that are proportional to the (assumed) difficulty of the activity and that are defined by the law for each activity. However, in some areas – e.g. psychosomatic medicine – tax points are systematically lower for almost all activities.
A hospital wishes to assess the achievement of the strategic goal «increase efficiency of physicians» via the KPI

♦ KPI: number of hours per tax point.

Do you foresee any problems with this KPI? Which? What do you propose to avoid them?

4. Dashboard: Show Goal Achievement

Comparing values of KPIs with their target values

Example: ADOscore

DASHBOARDS

Dashboards – purpose

■ **Monitor performance of an organisation**

When you want to know how your car is doing, the dashboard tells you, at a glance, whether your car is healthy and progressing at the right speed toward your destination.

A well-designed business dashboard helps you understand how healthy your organization is, and whether it's progressing at a fast enough pace toward its destination.

cited from «Dashboards at Eden, Inc.» case

≈
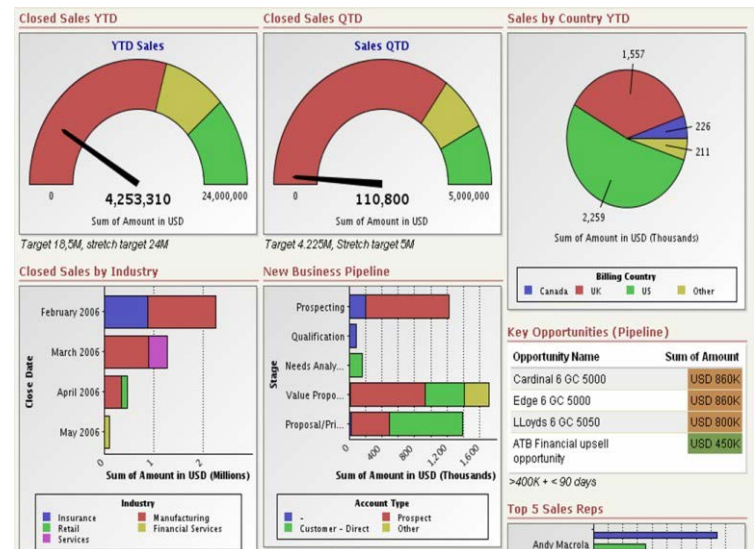
Common dashboard elements (1)

■ **KPI visualisation**: (usually) needs to highlight

 ♦ the target value

 ♦ the actual value

 ♦ the ranges of «red (poor), yellow (satisfactory), green (good)», if defined
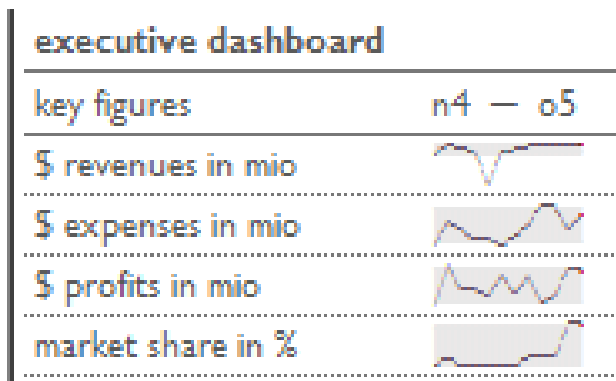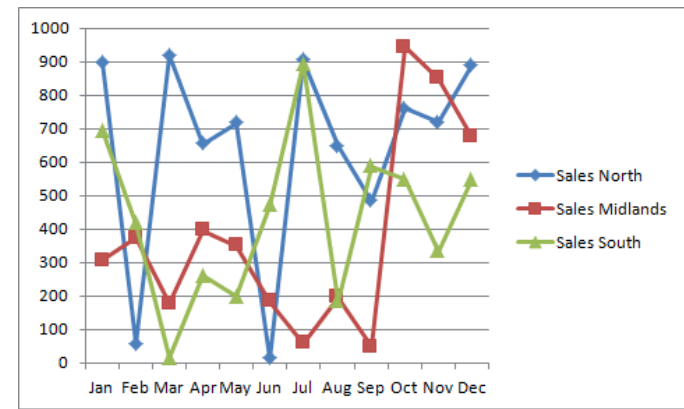

thermometer

dial chart

*bullet graph
(for color-blind!)*

Common dashboard elements (2)

■ Date dimension: visualisation of **values over time**

♦ usually displays time-line horizontally and values of a KPI vertically

spark lines
no coordinates
for general trend only

line charts
with coordinates, details
use different lines for different categories

Common dashboard elements (3)

■ Place dimension: visualisation of **values by region**

regional heat map
encodes sales values with colors on a map

REPORTING

Reporting

■ **Reporting** = gathering, presenting and formatting certain data in a meaningful way.

identify recipients	define content	define layout	implement process
▪ *who needs the information?* ▪ *what decisions do they need to take?*	▪ *select relevant KPIs* ▪ *define aggregation and drill-down levels* ▪ *define reporting frequency and up-to-dateness*	▪ *how to turn data into information?* ▪ *define general way of presentation* ▪ *select visualisation paradigms* ▪ *(define interaction)*	▪ *define distribution channel(s)* ▪ *implement service*

Reporting – kinds and purpose

- **fixed reports:** help in monitoring important key figures and relationships on a regular basis

- **ad hoc reports:** help in making strategic and operative decisions by answering questions

- production reports: reports drawn from operational (transactional) systems or operational data stores (e.g. a list of open orders), used for operative decision-making only

Ad hoc vs. fixed reports

Fixed Report	Purpose	Related Ad Hoc Query
Inventory by Product	To determine if an order can be fulfilled today by the primary warehouse	If I'm short at my main warehouse, can I supply the product from elsewhere?
Top 10 Customers By Quarter and Product	To understand which customers generate the most revenue	Who fell off this quarter's list? Are there certain products we can cross-sell?
Raw Material Receipts and Delivery Times	To determine how long it takes to acquire raw materials and which supplier can fulfill purchase orders fastest	Are there other suppliers who can respond faster?
Patients Per Hour	To understand busy periods and wait times	Do staffing levels correspond to busy times?

Table 3-1   Sample Fixed and Ad Hoc Reports

taken from C. Howson. Successful Business Intelligence

Report components

- A report consists of two parts:
    1. **content:** the data to be displayed
    2. **layout:** the way the data is presented and arranged

- Workflow for creating a report (template)
    1. define a **query** that specifies the report content, i.e. fetches the data to be displayed
    2. apply (aggregation) **functions** to the data, including creation of charts and figures
    3. **position** report elements on page
    4. «run» report to fill with data