

Produced by:

Dr. Brenda Mullally

bmullally@wit.ie

Ruth Barry

rbarry@wit.ie

Department Computing Maths and Physics

Waterford Institute of Technology

www.wit.ie

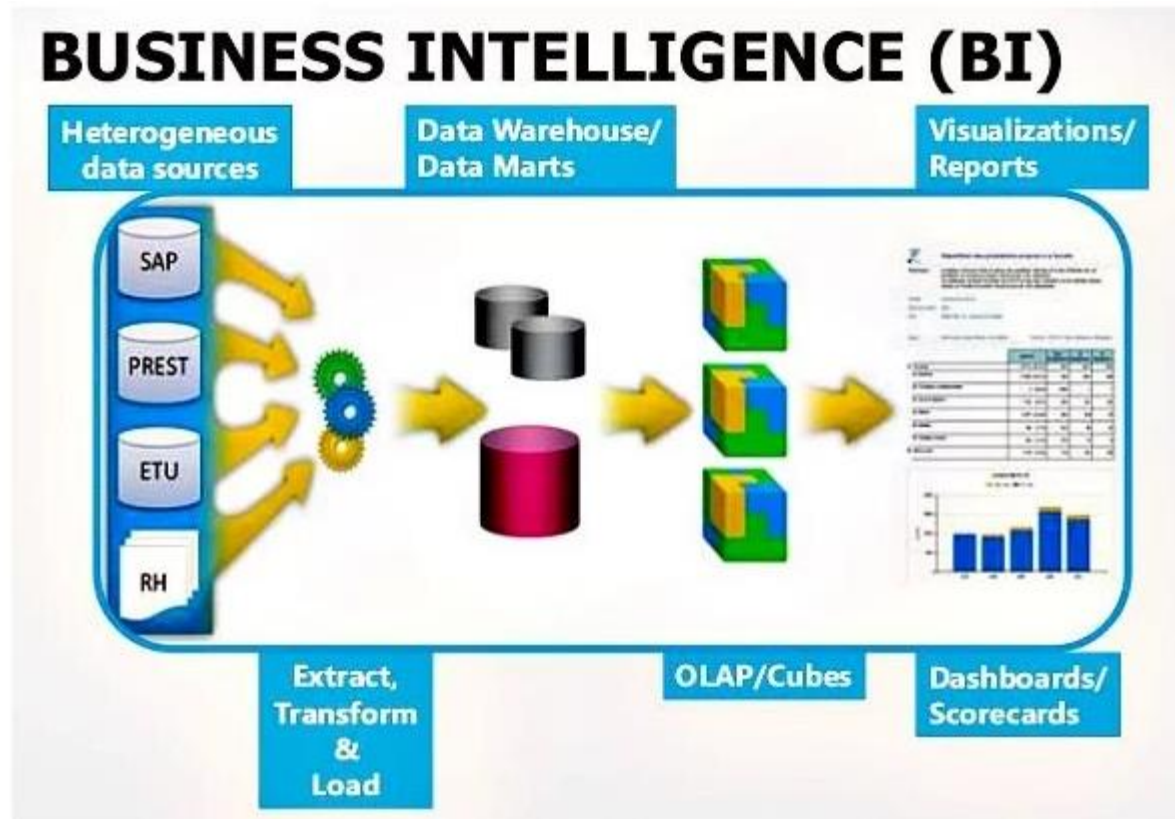
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MSc Enterprise Software Systems Business Intelligence

- Information Presentation

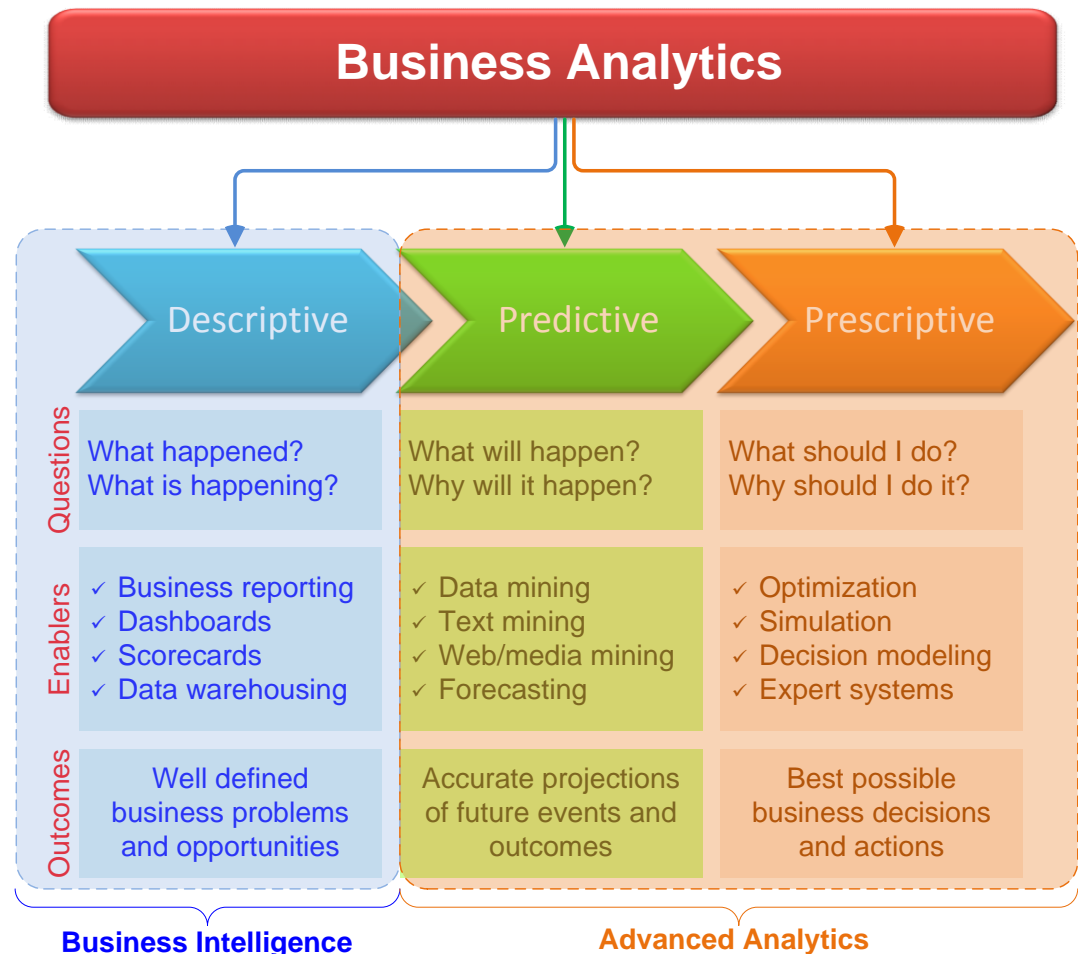
(Sharda et. al. (2018) Business Intelligence, Analytics and Data Science: A Managerial Perspective. Pearson, New York. ISBN 0134633288)

Business Intelligence



Business Intelligence and Analytics

- BI used to be everything related to use of data for managerial decision support
- Now, it is a part of Business Analytics
 - BI = Descriptive Analytics



Data and Information Visualization

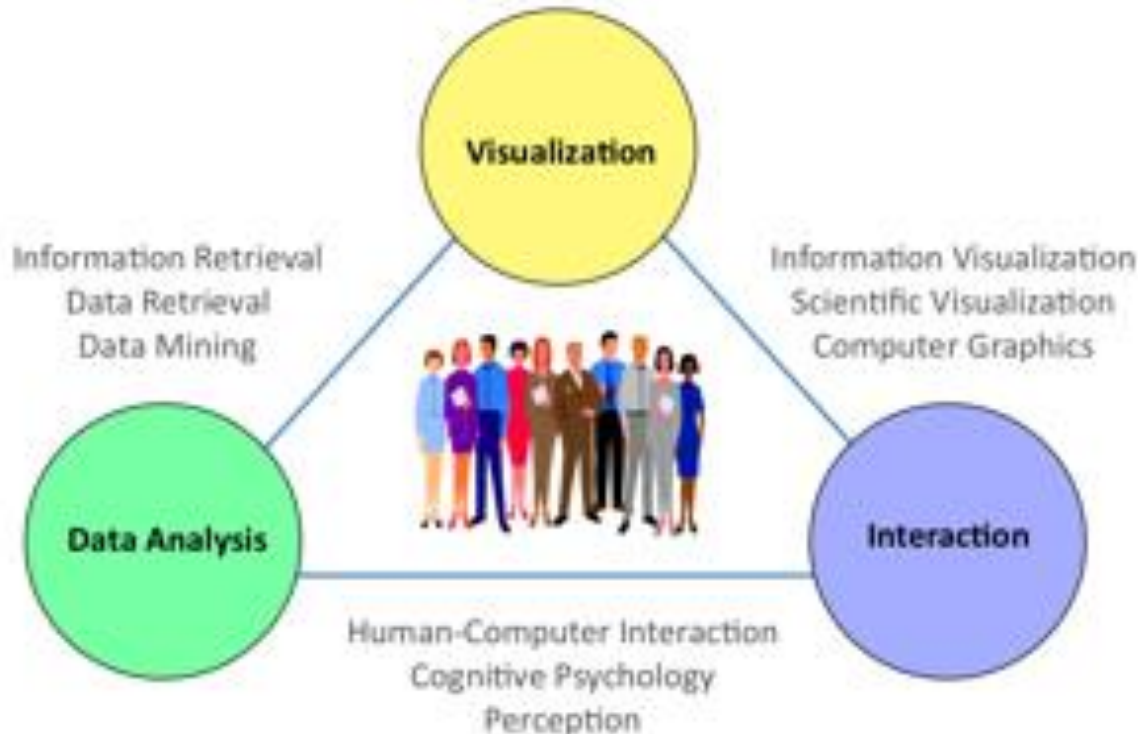
“The use of visual representations to explore, make sense of, and communicate data.”

- ▶ Data visualization vs. Information visualization
- ▶ Information = aggregation, summarization, and contextualization of data
- ▶ Related to information graphics, scientific visualization, and statistical graphics
- ▶ Often includes charts, graphs, illustrations, ...



Visual Analytics

- ▶ Visual analytics refers to the use of computer graphics to create a visual representation of large collections of information
- ▶ Purpose of visualization is to enable knowledge discovery
- ▶ Importance: visualization helps users see patterns



Visual Analytics

- ▶ A recently coined term
 - ▶ Information visualization + predictive analytics
- ▶ Information visualization
 - ▶ Descriptive, backward focused
 - ▶ “what happened” “what is happening”
- ▶ Predictive analytics
 - ▶ Predictive, future focused
 - ▶ “what will happen” “why will it happen”
- ▶ There is a strong move toward **visual analytics**



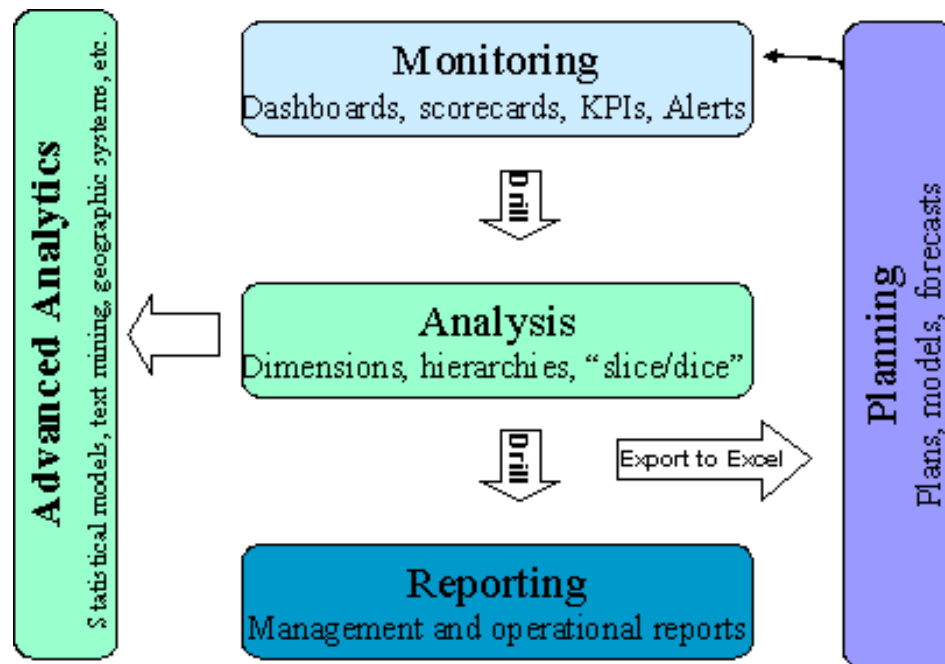
The Emergence of Data Visualization and Visual Analytics

- ▶ **Emergence of new companies**
 - ▶ Tableau, Spotfire, QlikView, ...
- ▶ **Increased focus by the big players**
 - ▶ MicroStrategy improved Visual Insight
 - ▶ SAP launched Visual Intelligence
 - ▶ SAS launched Visual Analytics
 - ▶ Microsoft bolstered PowerPivot with Power View
 - ▶ IBM launched Cognos Insight
 - ▶ Oracle acquired Endeca



How BI has evolved

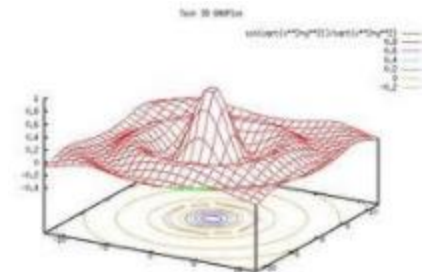
The five dimensions of BI by Wayne Eckerson



Data/Information Visualisation

- ▶ Descriptive analytics – what has occurred?
 - ▶ Business reporting
 - ▶ OLAP
 - ▶ Dashboards
 - ▶ Data visualization

Year 2000				
Line Items	Audio Division		Video Division	
	Budget	Actual	Budget	Actual
Cost of Goods Sold	\$6,851,006.48	\$7,132,961.30	\$4,322,514.74	\$4,526,954.71
Marketing Expense	\$750,179.20	\$756,596.17	\$455,048.05	\$462,615.40
Research and Development Expense	\$536,243.39	\$536,014.73	\$329,890.95	\$336,606.13
Selling Expense	\$1,632,921.64	\$1,579,790.18	\$986,887.49	\$927,970.90
Taxes	\$314,659.05	\$319,390.19	\$202,636.67	\$200,205.01
Year 2001				
Line Items	Audio Division		Video Division	
	Budget	Actual	Budget	Actual
Cost of Goods Sold	\$2,564,556.31	\$2,700,773.16	\$1,726,031.18	\$1,773,448.08
Marketing Expense	\$294,766.22	\$290,696.70	\$167,757.29	\$176,778.55
Research and Development Expense	\$200,719.90	\$193,236.83	\$134,270.95	\$125,725.88
Selling Expense	\$600,427.30	\$611,649.47	\$405,092.93	\$400,181.91
Taxes	\$130,926.70	\$122,526.31	\$82,450.78	\$80,671.87



Business Reporting Definitions and Concepts



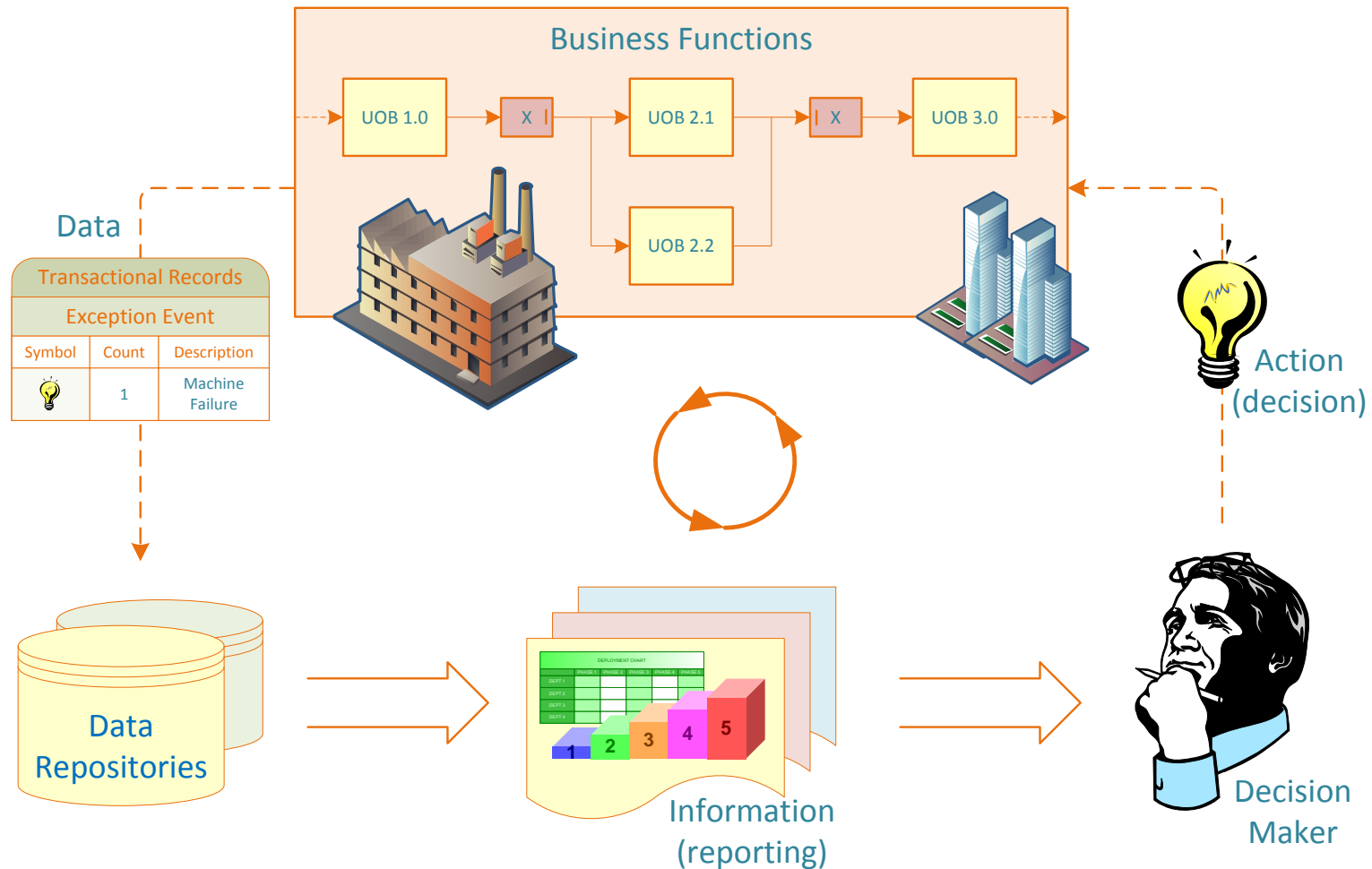
- ▶ Report = Information → Decision
- ▶ Report?
 - ▶ Any communication artifact prepared to convey specific information
- ▶ A report can fulfill many functions
 - ▶ To ensure proper departmental functioning
 - ▶ To provide information
 - ▶ To provide the results of an analysis
 - ▶ To persuade others to act
 - ▶ To create an organizational memory...

What is a Business Report?

- ▶ A written document that contains information regarding business matters.
- ▶ **Purpose:** to improve managerial decisions
- ▶ **Source:** data from inside and outside the organization (via the use of ETL)
- ▶ **Format:** text + tables + graphs/charts
- ▶ **Distribution:** in-print, email, portal/intranet

Data acquisition → Information generation →
Decision making → Process management

Business Reporting



Key to Any Successful Report

- ▶ Clarity ...
- ▶ Brevity ...
- ▶ Completeness ...
- ▶ Correctness ...
- ▶ Report types (in terms of content and format)
 - ▶ Informal – a single letter or a memo
 - ▶ Formal – 10-100 pages; cover + summary + text
 - ▶ Short report – periodic, informative, investigative



Types of Business Reports

▶ Metric Management Reports

- ▶ Help manage business performance through metrics (SLAs for externals; KPIs for internals)
- ▶ Can be used as part of Six Sigma and/or TQM

▶ Dashboard-Type Reports

- ▶ Graphical presentation of several performance indicators in a single page using dials/gauges

▶ Balanced Scorecard-Type Reports

- ▶ Include financial, customer, business process, and learning & growth indicators

Components of Business Reporting Systems

▶ Common characteristics

- ▶ OLTP (online transaction processing)
 - ▶ ERP, POS, SCM, RFID, Sensors, Web, ...
- ▶ Data supply (volume, variety, velocity, ...)
- ▶ ETL
- ▶ Data storage
- ▶ Business logic
- ▶ Publication medium
- ▶ Assurance



Online Analytical Processing

- ▶ Transactional databases are accessed by online transaction processing (OLTP) applications
- ▶ OLAP was coined by Edgar Codd [1970]
- ▶ OLAP is used essentially to query the DW
- ▶ OLAP supports the presentation of data in a multi-dimensional format called a cube
- ▶ The numeric facts in the DW known as the measures

OLTP vs OLAP

Why would an organization need an OLAP?



Ask me what's happening

OLTP
On-Line Transaction Processing



Ask me what will happen

OLAP
On-Line Analytical Processing



(Sharda et. al. (2018) **Business Intelligence, Analytics and Data Science: A Managerial Perspective.** Pearson, New York. ISBN 0134633288)

Analysis of Data Stored in DW

OLTP vs. OLAP

- ▶ **OLTP (online transaction processing)**
 - ▶ A system that is primarily responsible for capturing and storing data related to day-to-day business functions such as ERP, CRM, SCM, POS,
 - ▶ The main focus is on efficiency of routine tasks
- ▶ **OLAP (online analytic processing)**
 - ▶ A system is designed to address the need of information extraction by providing effectively and efficiently ad hoc analysis of organizational data
 - ▶ The main focus is on effectiveness

OLAP vs. OLTP

TABLE 3.5 A Comparison between OLTP and OLAP

Criteria	OLTP	OLAP
Purpose	To carry out day-to-day business functions	To support decision making and provide answers to business and management queries
Data source	Transaction database (a normalized data repository primarily focused on efficiency and consistency)	Data warehouse or DM (a nonnormalized data repository primarily focused on accuracy and completeness)
Reporting	Routine, periodic, narrowly focused reports	Ad hoc, multidimensional, broadly focused reports and queries
Resource requirements	Ordinary relational databases	Multiprocessor, large-capacity, specialized databases
Execution speed	Fast (recording of business transactions and routine reports)	Slow (resource intensive, complex, large-scale queries)

Analysis of Data in DW

- ▶ **Online analytical processing (OLAP)**

- ▶ Data driven activities performed by end users to query the online system and to conduct analyses
- ▶ Data cubes, drill-down / rollup, slice & dice, ...

- ▶ **OLAP Activities**

- ▶ Generating queries (query tools)
- ▶ Requesting ad hoc reports
- ▶ Conducting statistical and other analyses

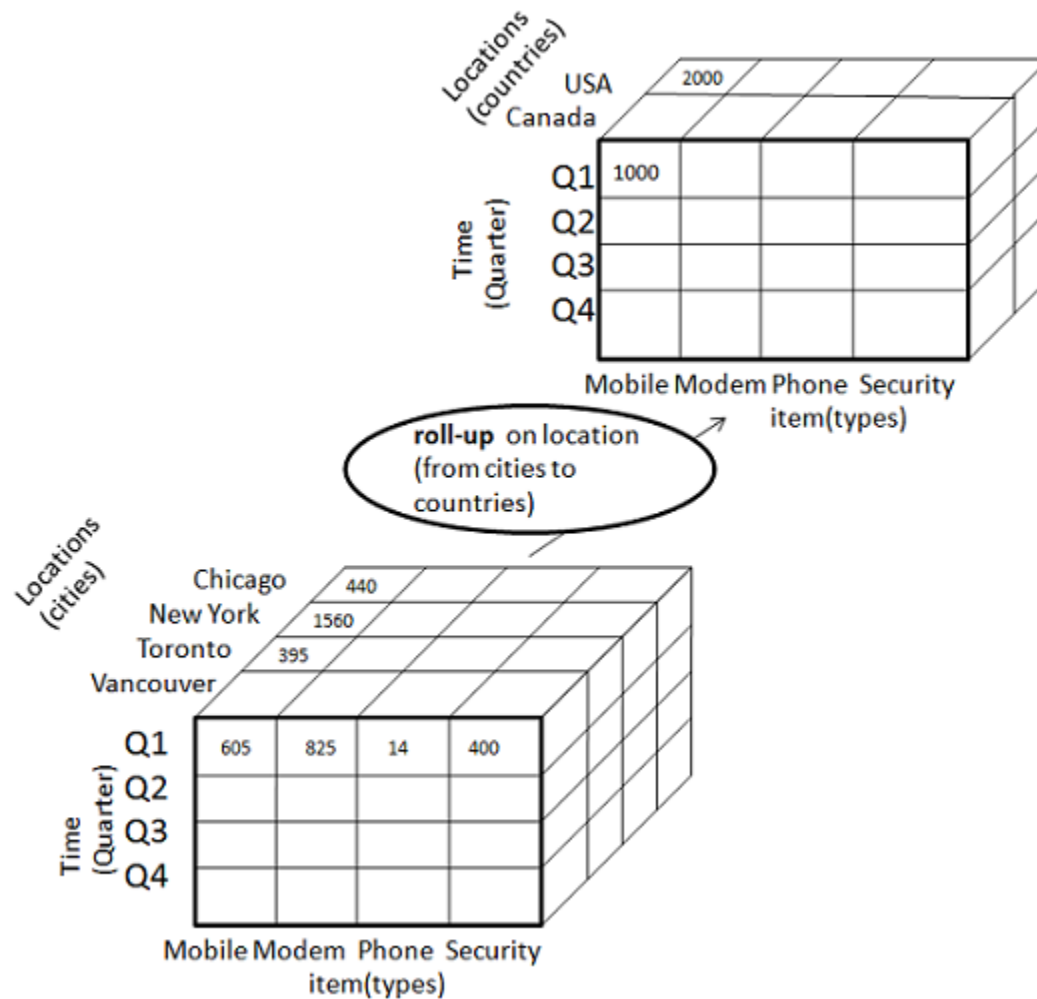


OLAP Operations

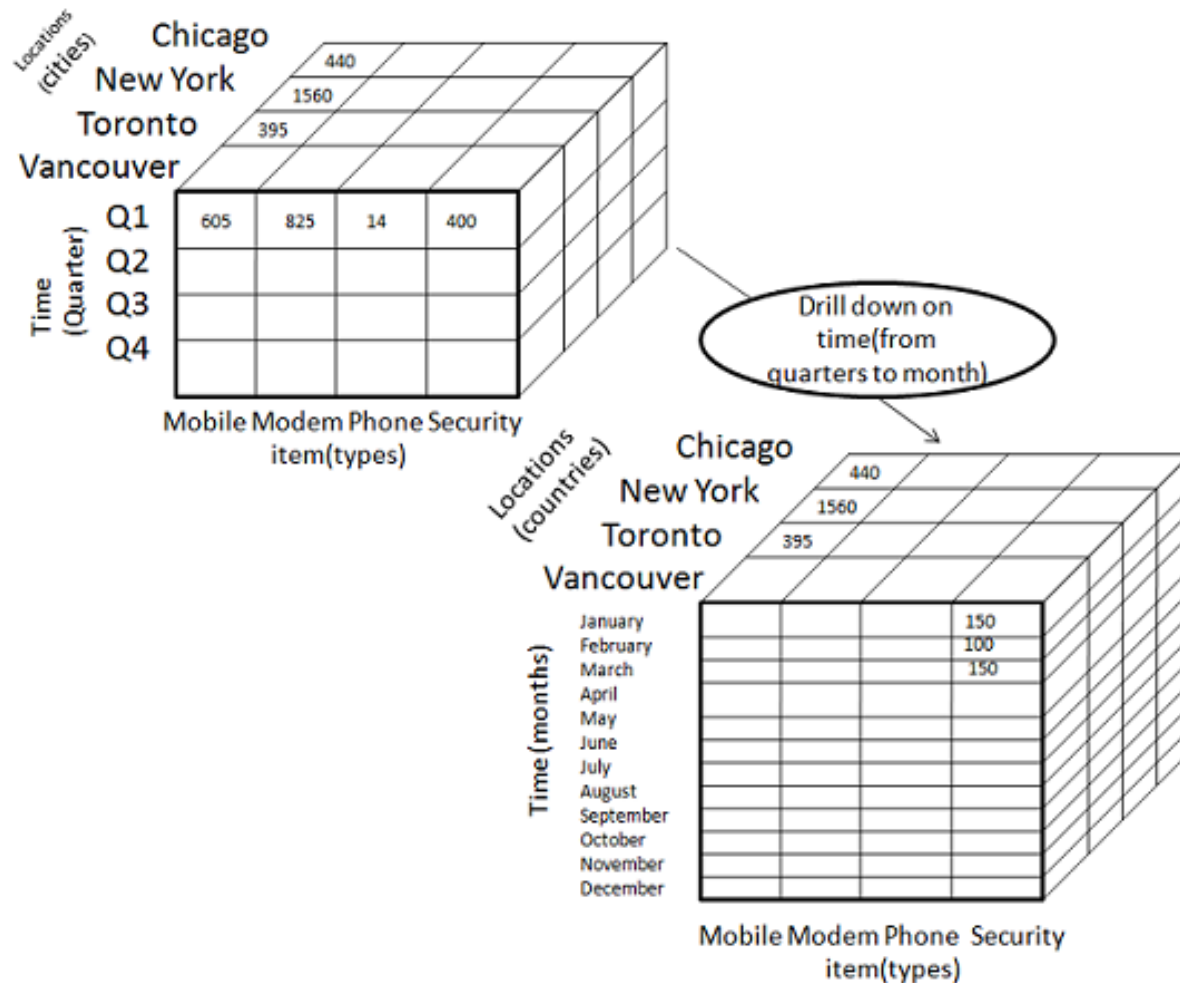
- ▶ **Slice** – a subset of a multidimensional array
- ▶ **Dice** – a slice on more than two dimensions
- ▶ **Drill Down/Up** – navigating among levels of data ranging from the most summarized (up) to the most detailed (down)
- ▶ **Roll Up** – computing all of the data relationships for one or more dimensions
- ▶ **Pivot** – used to change the dimensional orientation of a report or an ad hoc query-page display



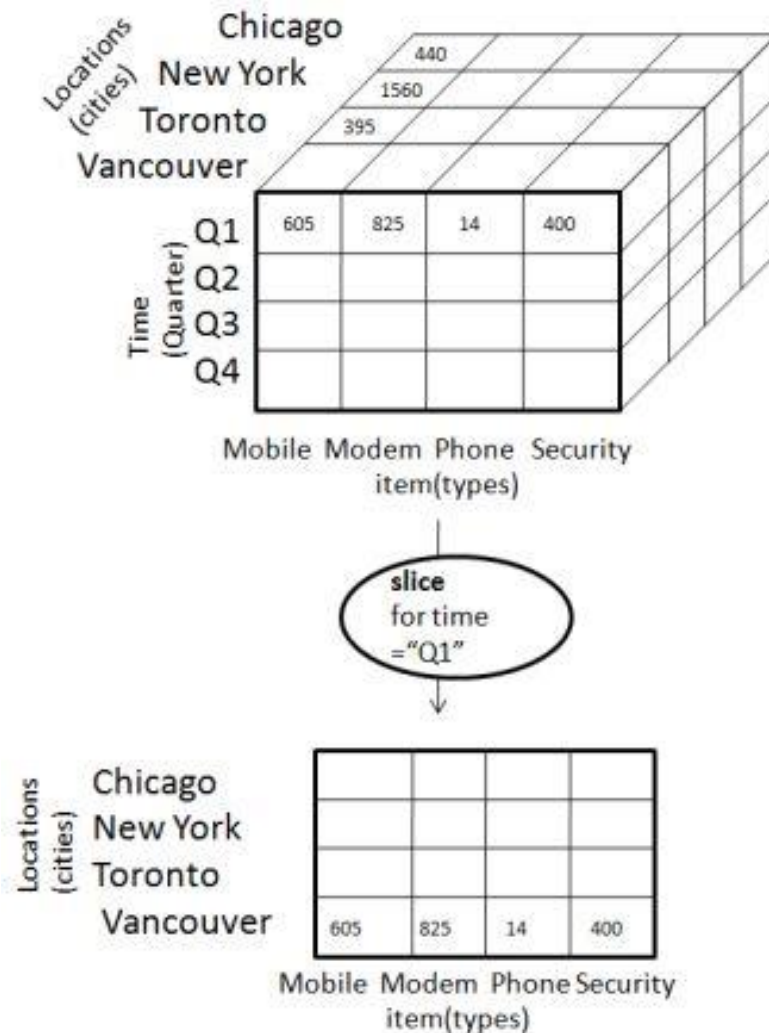
OLAP – roll-up



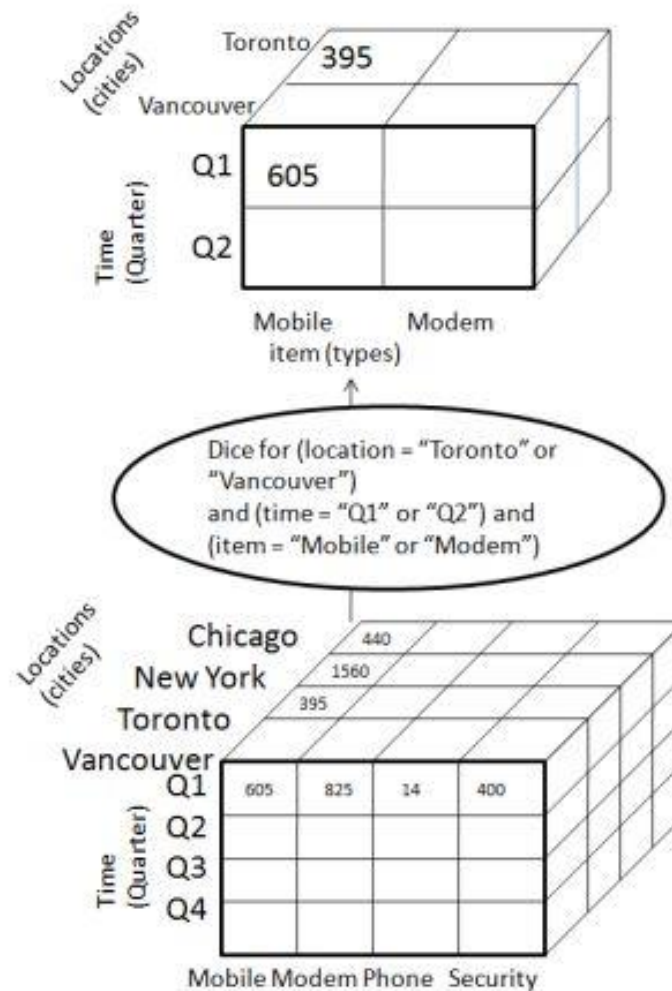
OLAP – drill-down



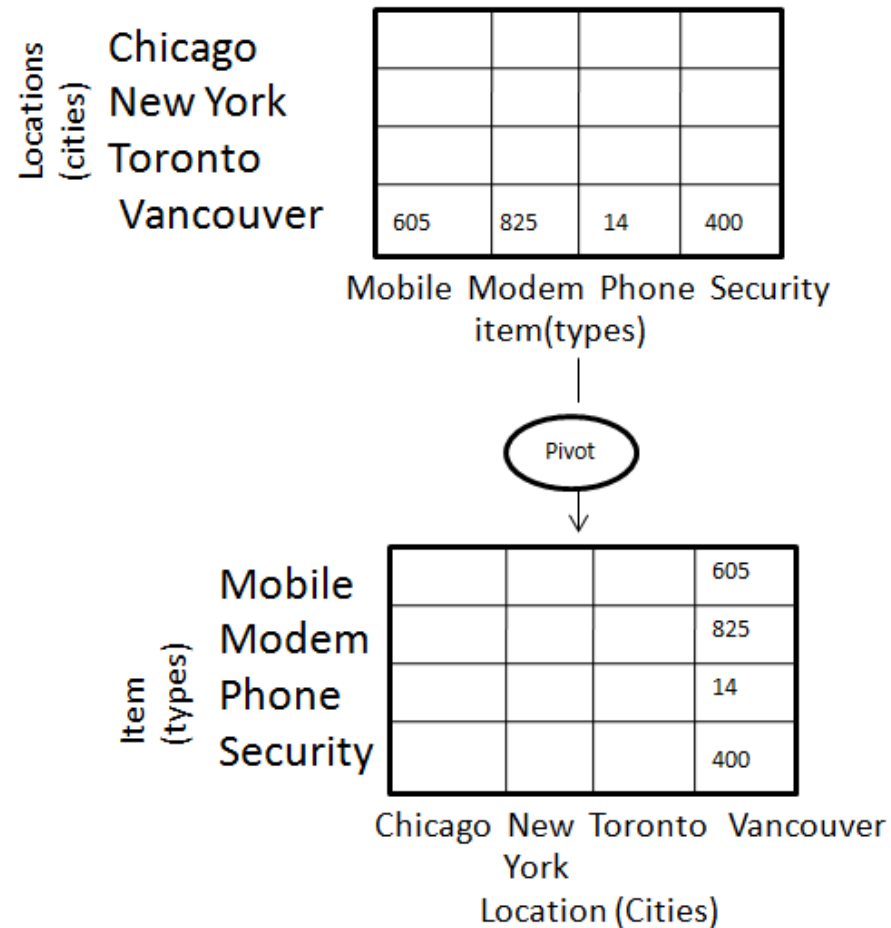
OLAP - slice



OLAP - dice



OLAP - pivot



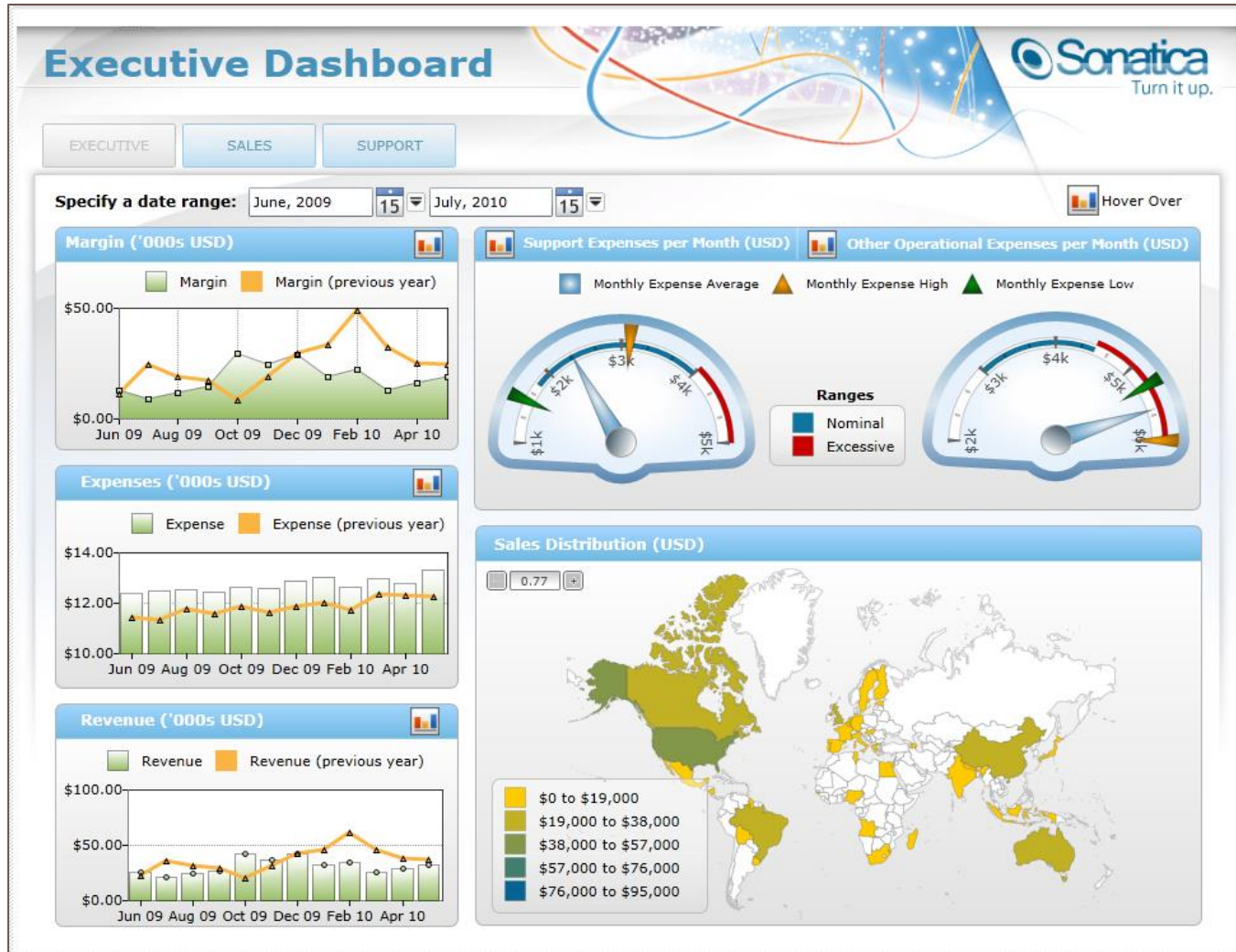
Performance Dashboards

- ▶ Performance dashboards are commonly used in Business Performance Management (BPM) software suites and BI platforms for data visualization.
- ▶ Dashboards provide visual displays of important information that is consolidated and arranged on a single screen so that information can be digested at a single glance and easily drilled in and further explored

Performance Dashboards

- ▶ Performance dashboards are designed to be similar to a car dashboard
- ▶ Performance dashboards serve as an “organization magnifying glass”
- ▶ Measure performance, reward positive contributions and align efforts
- ▶ Used for forecasting, inventory, production and sales

Performance Dashboards



Performance Dashboards

► Dashboard design

- The fundamental challenge of dashboard design is to display all the required information on a single screen, clearly and without distraction, in a manner that can be assimilated quickly
- Organizational performance- “Three Threes”

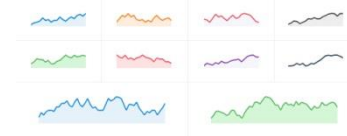
3 Applications	3 Layers	3 Types
Monitoring	Graphical	Operational
Analysis	Summarised	Tactical
Collaboration	Detail	Strategic

Performance Dashboards

▶ What to look for in a dashboard



- ▶ Use of visual components (e.g., charts, performance bars, sparklines, gauges, meters, stoplights) to highlight, at a glance, the data and exceptions that require action



- ▶ Transparent to the user, meaning that it requires minimal training and is extremely easy to use
- ▶ Combines data from a variety of systems into a single, summarized, unified view of the business
- ▶ Enables drill-down or drill-through to underlying data sources or reports
- ▶ Presents a dynamic, real-world view with timely data updates
- ▶ Requires little, if any, customized coding to implement, deploy, and maintain



Best Practices in Dashboard Design

- ▶ Benchmark KPIs with Industry Standards
- ▶ Wrap the Metrics with Contextual Metadata
- ▶ Validate the Design by a Usability Specialist
- ▶ Prioritize and Rank Alerts and Exceptions
- ▶ Enrich Dashboard with Business-User Comments
- ▶ Present Information in Three Different Levels
- ▶ Pick the Right Visual Constructs
- ▶ Provide for Guided Analytics

Business Performance Management (BPM) Overview

- ▶ Many data warehouse implementations end up with the development of a BPM system.
- ▶ Business Performance Management (BPM) is...
A real-time integrated system that alert managers to potential opportunities, impending problems, and threats, and then empowers them to react through models and collaboration.
- ▶ Previously independent of everything else and known as Executive information system (EIS)
- ▶ Also called, corporate performance management (CPM by Gartner Group), enterprise performance management (EPM by Oracle), strategic enterprise management (SEM by SAP)

BPM Definition

“A framework for organising, automating and analysing business methodologies, metrics, processes and systems to drive the overall performance of the enterprise. It helps organisations translate a unified set of objectives into plans, monitor execution and deliver critical insight to improve financial and operational performance.”

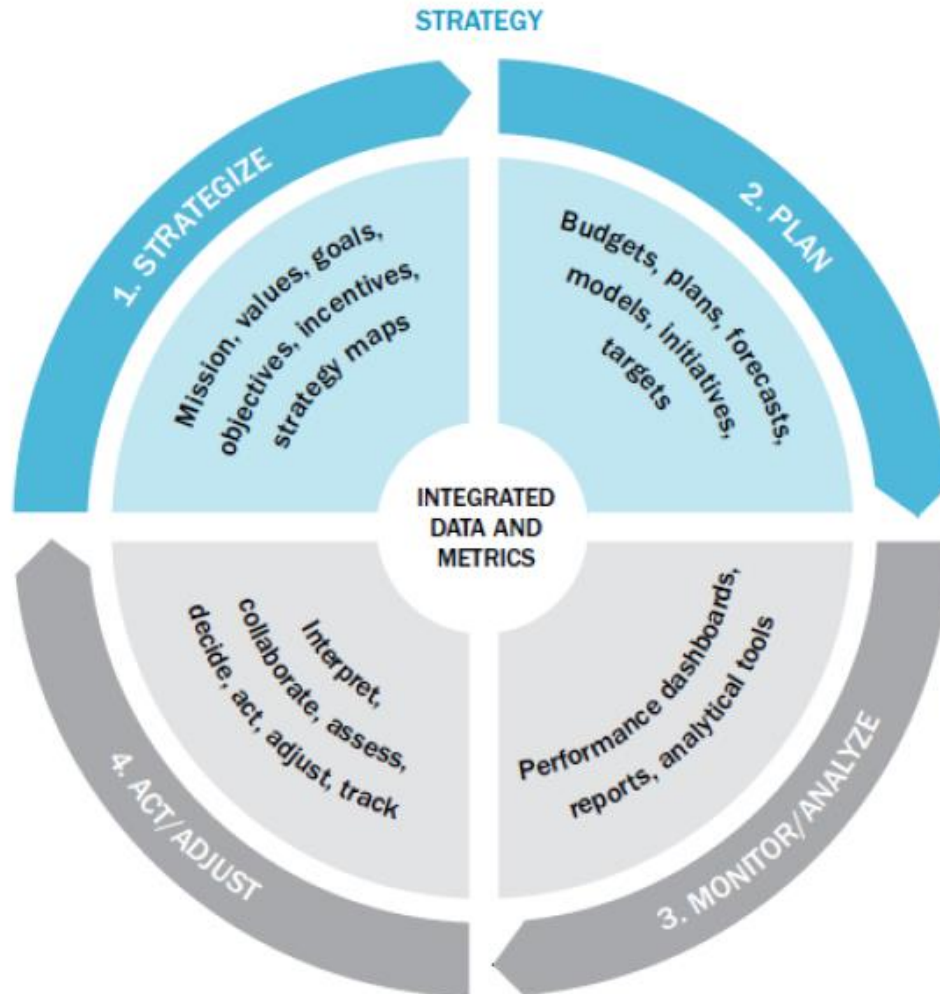


Business Performance Management (BPM) Overview

- ▶ **BPM encompasses three key components**
 - ▶ A set of integrated, closed-loop management and analytic processes, supported by technology
 - ▶ Tools for businesses to define strategic goals and then measure/manage performance against them
 - ▶ Methods and tools for monitoring key performance indicators (KPIs), linked to organizational strategy

- ▶ <http://www.ap-institute.com/>

A Closed-Loop Process to Optimize Business Performance



► Process Steps

1. Strategize
2. Plan
3. Monitor/analyze
4. Act/adjust

Each with its own sub-process steps

1 - Strategize: Where Do We Want to Go?



► Strategic planning

► Common tasks for the strategic planning process:

1. Conduct a current situation analysis
2. Determine the planning horizon
3. Conduct an environment scan
4. Identify critical success factors
5. Complete a gap analysis
6. Create a strategic vision
7. Develop a business strategy
8. Identify strategic objectives and goals

2 - Plan: How Do We Get There?

▶ **Operational planning**

- ▶ **Operational plan:** plan that translates an organization's strategic objectives and goals into a set of well-defined tactics and initiatives, resource requirements, and expected results for some future time period (usually a year).

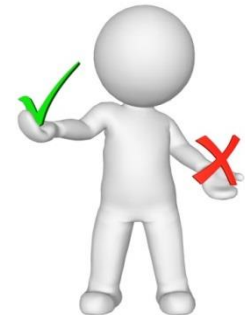
▶ **Operational planning can be**

- ▶ Tactic-centric (operationally focused)
- ▶ Budget-centric plan (financially focused)



3 - Monitor/Analyze: How Are We Doing?

- ▶ A comprehensive framework for monitoring performance should address two key issues:
 - ▶ What to monitor
 - ▶ Critical success factors – “What”
 - ▶ Strategic goals and targets
 - ▶ How to monitor – if a company plans to introduce a new product every qtr for next 2 years, the org needs to track new prod introduction over this time.



4 - Act and Adjust:

What Do We Need to Do Differently?

- ▶ Success (or mere survival) depends on new projects: creating new products, entering new markets, acquiring new customers (or businesses), or streamlining some process.
- ▶ Many new projects and ventures fail!
- ▶ What is the chance of failure?
 - ▶ 60% of Hollywood movies fail
 - ▶ 70% of large IT projects fail, ...

Performance Measurement

► **Performance measurement system**

A system that assists managers in tracking the implementations of business strategy by comparing actual results against strategic goals and objectives

- Comprises systematic comparative methods that indicate progress (or lack thereof) against goals



Performance Measurement KPIs and Operational Metrics

▶ Key performance indicator (KPI)

A KPI represents a strategic objective and metric that measures performance against a goal

► Distinguishing features of KPIs

- Strategy
- Targets
- Ranges
- Encodings
- Time frames
- Benchmarks



Read: Understanding KPI's by Wayne Eckerson

Performance Measurement

▶ **Key performance indicator (KPI)**

Outcome KPIs vs.

(lagging indicators
e.g., revenues)

Driver KPIs

(leading indicators
e.g., sales leads)



▶ **Operational areas covered by driver KPIs**

- ▶ Customer performance
- ▶ Service performance
- ▶ Sales operations
- ▶ Sales plan/forecast

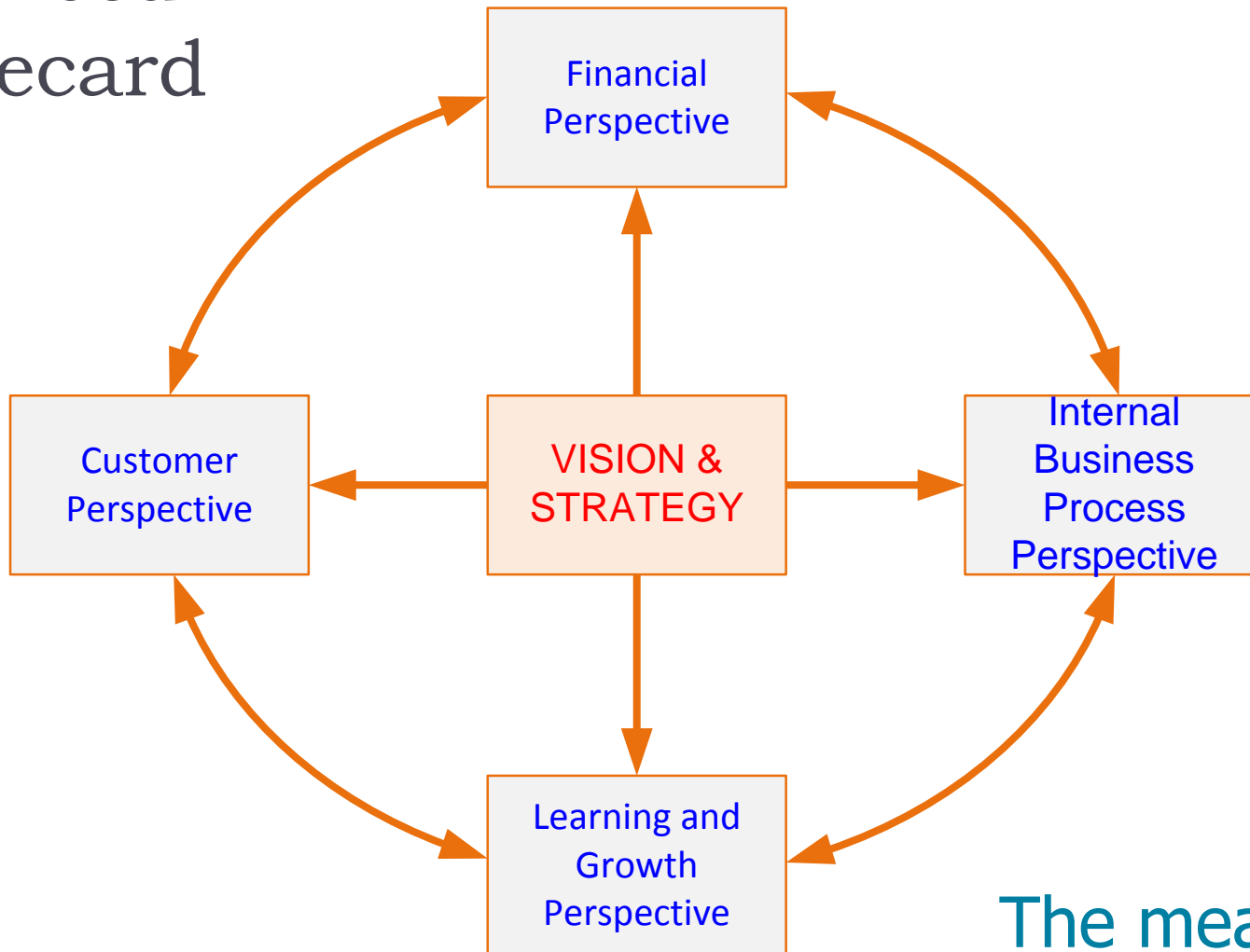
Performance Measurement System

▶ **Balanced Scorecard (BSC)**

A performance measurement and management methodology that helps translate an organization's financial, customer, internal process, and learning and growth objectives and targets into a set of actionable initiatives

“The Balanced Scorecard: Measures That Drive Performance”
(HBR, 1992)

Balanced Scorecard



The meaning of
"balance" ?

Six Sigma as a Performance Measurement System

▶ **Six Sigma**

A performance management methodology aimed at reducing the number of defects in a business process to as close to zero defects per million opportunities (DPMO) as possible

Six Sigma as a Performance Measurement System

► Six Sigma

► The DMAIC performance model

A closed-loop business improvement model that encompasses the steps of **defining**, **measuring**, **analyzing**, **improving**, and **controlling** a process

► Lean Six Sigma

- Lean manufacturing / lean production
- Lean production versus Six Sigma



Effective Performance Measurement Should

- ▶ Measures should focus on key factors.
- ▶ Measures should be a mix of past, present, and future.
- ▶ Measures should balance the needs of shareholders, employees, partners, suppliers, and other stakeholders.
- ▶ Measures should start at the top and flow down to the bottom.
- ▶ Measures need to have targets that are based on research and reality rather than arbitrary.

