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IT393
Business Intelligence

Lecture 1



An Overview of Business Intelligence, Analytics, and Decision Support

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Learning Objectives:

- 1.1 Understand the need for computerized support of managerial decision making
- 1.2 Recognize the evolution of such computerized support to the current state—analytics/data science
- 1.3 Describe the business intelligence (BI) methodology and concepts
- 1.4 Understand the various types of analytics, and see selected applications
- 1.5 Understand the nature of data as it relates to business intelligence (BI) and analytics

02

Changing Business Environments and Evolving Needs for Decision Support and Analytics:

- The business environment is constantly changing, and it is becoming more and more complex.
- Organizations, private and public, are under pressures that force them to respond quickly to changing conditions and to be innovative in the way they operate.
- Making such decisions may require considerable amounts of relevant data, information, and knowledge. Processing these, in the framework of the needed decisions, must be done quickly, frequently in real time, and usually requires some computerized support.
- This course is about using business analytics as computerized support for managerial decision making.

02

Changing Business Environments and Evolving Needs for Decision Support and Analytics:

Some developments have clearly contributed to facilitating growth of decision support and analytics in a number of ways, including the following:

- Group communication and collaboration: **Assembling a group of decision makers, especially experts, in one place can be costly.** Information systems can improve the collaboration process of a group and enable its members to be at different locations .
- Improved data management : The data may include text,sound, graphics, and video, and they can be in different languages. **Systems today can search, store, and transmit needed data quickly, economically, securely, and transparently.**

02

Changing Business Environments and Evolving Needs for Decision Support and Analytics:

Some developments have clearly contributed to facilitating growth of decision support and analytics in a number of ways, including the following:

- Anywhere, anytime support: Using wireless technology, managers can access information anytime and from any place, analyze and interpret it, and communicate with those involved. This perhaps is the biggest change that has occurred in the last few years. **The speed at which information needs to be processed and converted into decisions has truly changed expectations for both consumers and businesses.**

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Evolution of Computerized Decision Support to Analytics/Data Science:

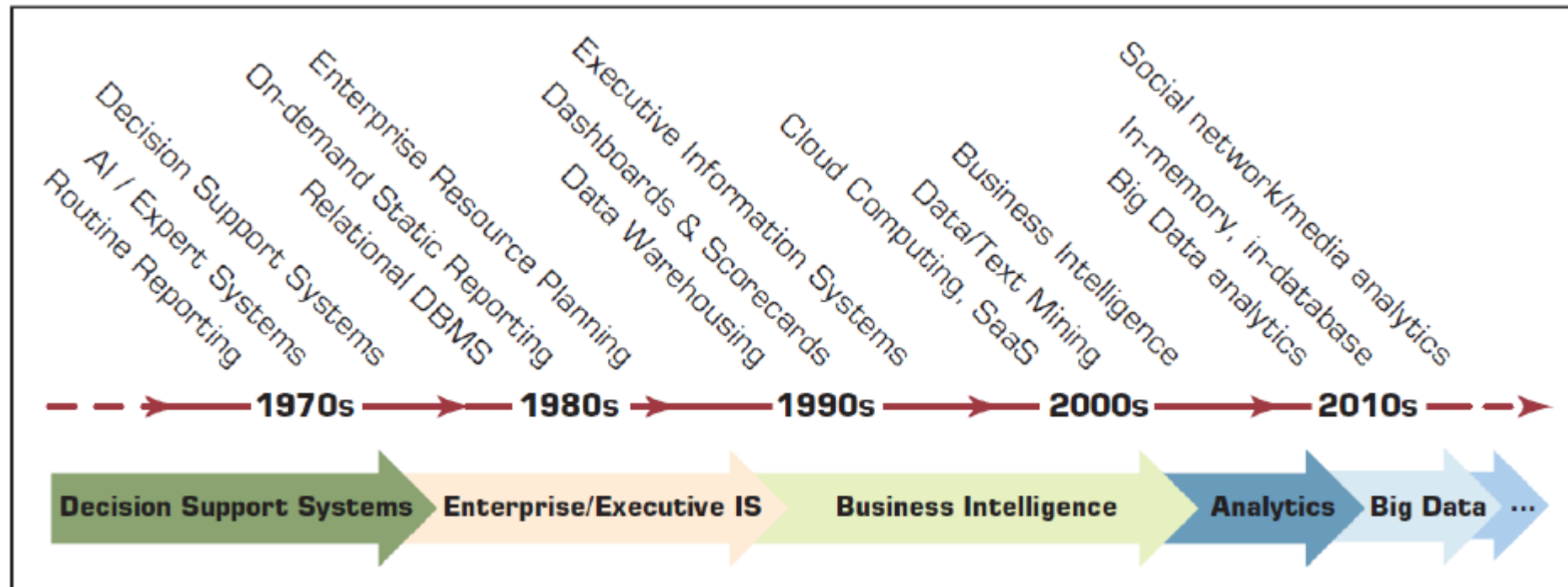


Figure 1.1 Evolution of Decision Support, Business Intelligence, and Analytics

04

DSS (Decision Support Systems):

- DSS defined
- Decision making process
- Decision support framework
- Components

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The Concept of DSS:

- DSS -interactive computer-based systems, which help decision makers utilize data and models to solve unstructured problems. (Gorry and Scott-Morton, 1971)
- Decision support systems couple the intellectual resources of individuals with the capabilities of the computer to improve the quality of decisions.
- DS as an Umbrella Term to describe any computerized system that supports decision making in an organization.
- **BI is an evolution of decision support concepts over time.**

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Phases of Decision-Making Process:

Humans consciously or subconsciously follow a systematic decision-making process -Simon (1977)

- 1) **Intelligence**(Define the problem or opportunity)
- 2) **Design**(Construct a model that describes the real-world problem and Identify possible solutions)
- 3) **Choice**(Compare, choose, and recommend a potential solution to the problem)
- 4) **Implementation**(putting a recommended solution to work)
- 5) **Monitoring** (a part of intelligence?)

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An Early Decision Support Framework (by Gory and Scott-Morten, 1971):

Degree of Structuredness: decision-making processes fall along a continuum that ranges from highly structured (sometimes called programmed) to highly unstructured (i.e., nonprogrammed) decisions.

Structured processes are routine and typically repetitive problems for which standard solution methods exist.

Unstructured processes are fuzzy, complex problems for which there are no cut-and-dried solution methods. In a structured problem, the procedures for obtaining the best solution are known. The objectives are clearly defined. Common objectives are cost minimization and profit maximization.

Semistructured problems fall between structured and unstructured problems, having some structured elements and some unstructured elements.

An Early Decision Support Framework (by Gory and Scott-Morten, 1971):

Type of Decision	Type of Control		
	Operational Control	Managerial Control	Strategic Planning
Structured	Accounts receivable Accounts payable Order entry 1	Budget analysis Short-term forecasting Personnel reports Make-or-buy 2	Financial management Investment portfolio Warehouse location Distribution systems 3
Semistructured	Production scheduling Inventory control 4	Credit evaluation Budget preparation Plant layout Project scheduling Reward system design Inventory categorization 5	Building a new plant Mergers & acquisitions New product planning Compensation planning Quality assurance HR policies Inventory planning 6
Unstructured	Buying software Approving loans Operating a help desk Selecting a cover for a magazine 7	Negotiating Recruiting an executive Buying hardware Lobbying 8	R & D planning New tech. development Social responsibility planning 9

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A Framework for Business Intelligence :

DSS→ BI

Definition of Business Intelligence :An umbrella term that combines architectures, tools, databases, analytical tools, applications, and methodologies.

- BI's major objective is to enable easy access to data (and models) to provide business managers with the ability to conduct analysis. By analyzing historical and current data, situations, and performances, **decision makers get valuable insights that enable them to make more informed and better decisions.**
- The process of BI is based on the **transformation of data to information, then to decisions, and finally to actions.**

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A Framework for Business Intelligence :

The Architecture of BI

A BI system has four major components: a **data warehouse**, with its source data; **business analytics**, a collection of tools for manipulating, mining, and analyzing the data in the data warehouse; **business performance management (BPM)** for monitoring and analyzing performance; and a **user interface** (e.g., a dashboard). The relationship among these components is illustrated in Figure 1.2.

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A Framework for Business Intelligence :

1.Data Warehouse

Function: It consolidates data from different formats and systems (e.g., databases, spreadsheets, CRM/ERP systems) into a unified format for easy access and analysis.

Example: A retail company's data warehouse might store data from its sales database, customer database, and supplier database.

2. Business Analytics

Definition and Function : A collection of tools and techniques used to manipulate, mine, and analyze data stored in the data warehouse.

Example: Using a data visualization tool like Tableau to create a sales trend dashboard.

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A Framework for Business Intelligence :

3. Business Performance Management (BPM)

Definition: A set of processes and tools for monitoring, analyzing, and optimizing organizational performance.

Example: A company might use BPM to track KPIs like customer lifetime value (CLV) and adjust strategies based on performance.

4. User Interface (UI)

Definition: Provides an intuitive interface for users to access analytics, generate reports, and visualize data. It ensures that insights are easily understandable and actionable.

Example: A manager using a dashboard to monitor real-time sales data and KPIs.

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A Framework for Business Intelligence :

The Architecture of BI:

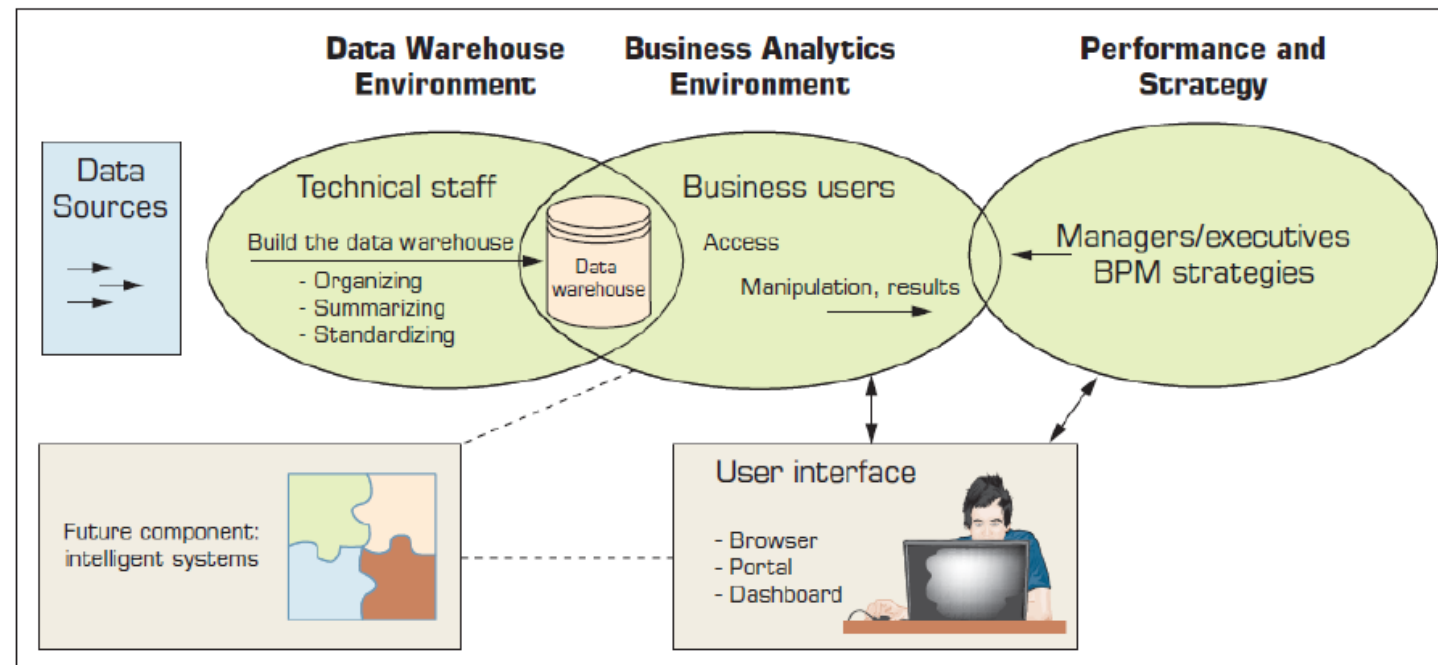


Figure 1.2 A High-Level Architecture of BI

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BI Analytical Applications:

Examples of many applications of BI are provided in Figure 1.3.

Analytic Application	Business Question	Business Value
Customer segmentation	What market segments do my customers fall into, and what are their characteristics?	Personalize customer relationships for higher satisfaction and retention.
Propensity to buy	Which customers are most likely to respond to my promotion?	Target customers based on their need to increase their loyalty to your product line. Also, increase campaign profitability by focusing on the most likely to buy.
Customer profitability	What is the lifetime profitability of my customer?	Make individual business interaction decisions based on the overall profitability of customers.
Fraud detection	How can I tell which transactions are likely to be fraudulent?	Quickly determine fraud and take immediate action to minimize cost.
Customer attrition	Which customer is at risk of leaving?	Prevent loss of high-value customers and let go of lower-value customers.
Channel optimization	What is the best channel to reach my customer in each segment?	Interact with customers based on their preference and your need to manage cost.

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DSS-BI Connections:

Similarities and differences?

First, their architectures are very similar because BI evolved from DSS. However, BI implies the use of a data warehouse, whereas DSS may or may not have such a feature. BI is, therefore, more appropriate for large organizations (because data warehouses are expensive to build and maintain), but DSS can be appropriate to any type of organization.

Second, most DSS are constructed to directly support specific decision making. BI systems, in general, are geared to provide accurate and timely information, and they support decision support indirectly.

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DSS-BI Connections:

Third, most BI systems are constructed with commercially available tools and components that are fitted to the needs of organizations. In building DSS, the interest may be in constructing solutions to very unstructured problems. In such situations, more programming (e.g., using tools such as Excel) may be needed to customize the solutions.

Fourth, many of the tools that BI uses are also considered DSS tools. For example, data mining and predictive analysis are core tools in both areas.

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Analytics Overview:

- Analytics...a relatively new term/buzz-word
- **Analytics**...the process of developing actionable decisions or recommendations for actions based on insights generated from historical data
- According to the Institute for Operations Research and Management Science (INFORMS): Analytics represents the **combination of computer technology, management science techniques, and statistics to solve real problems.**

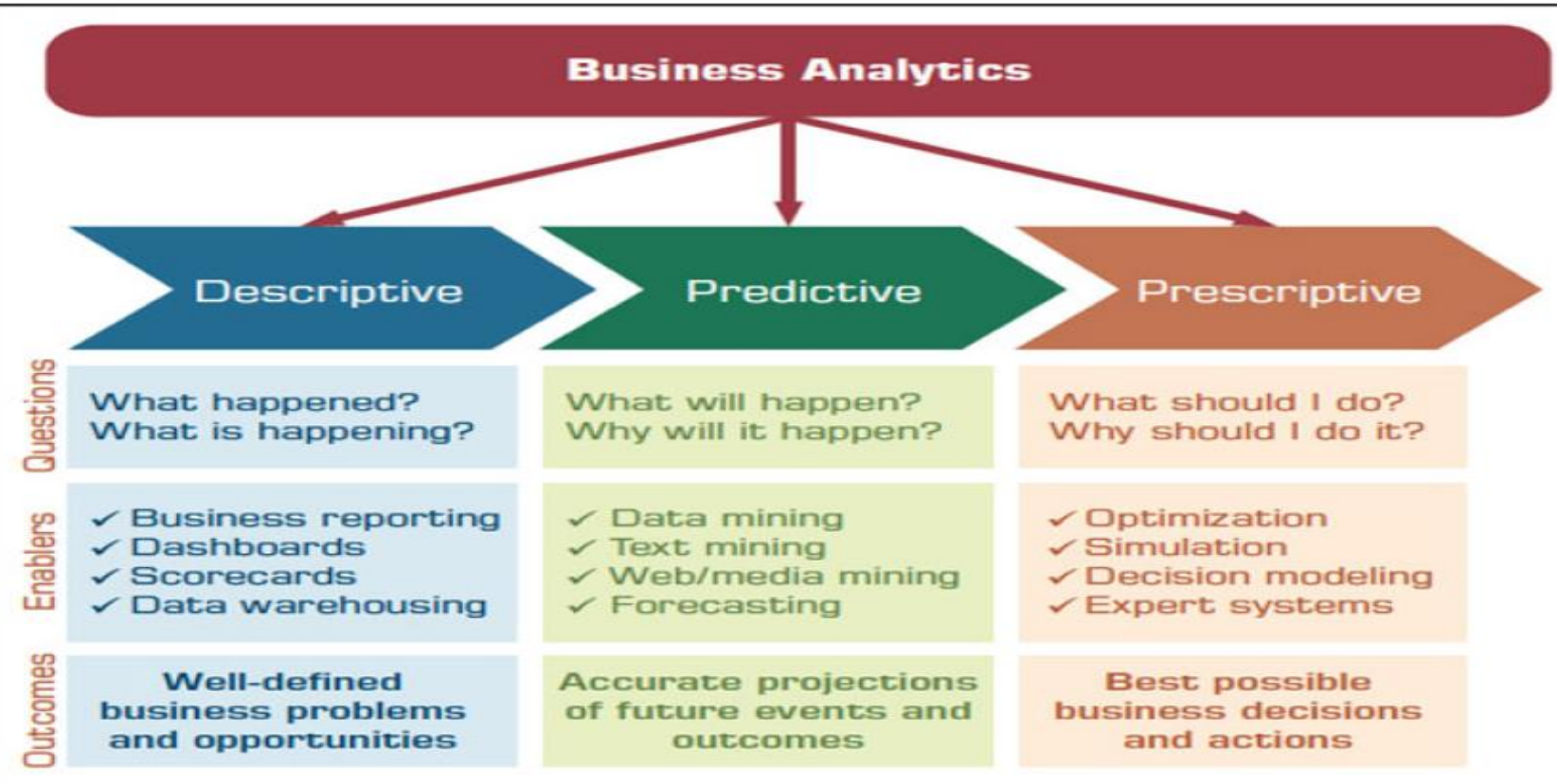


Figure 1.3 Three Types of Analytics

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Business Analytics:

- Descriptive or reporting analytics: refers to knowing what is happening in the organization and understanding some underlying trends and causes of such occurrences.
- This involves, first of all, consolidation of data sources and availability of all relevant data in a form that enables appropriate reporting and analysis. From this data infrastructure we can develop appropriate reports, queries, alerts, and trends using various reporting tools and techniques.
- A significant technology that has become a key player in this area is visualization. Using the latest visualization tools in the marketplace, we can now develop powerful insights into the operations of our organization.
- Application Cases 1.1 and 1.2 highlight some such applications in the healthcare domain.

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Application Case 1:

Eliminating Inefficiencies at Seattle Children's Hospital

Seattle Children's was the **seventh highest ranked children's hospital in 2011**, according to U.S. News & World Report. For any organization that is committed to saving lives, identifying and removing the inefficiencies from systems and processes so that more resources become available to cater to patient care become very important. At Seattle Children's, management is continuously **looking for new ways to improve the quality, safety, and processes from the time a patient is admitted to the time they are discharged**. To this end, they spend a lot of time in **analyzing the data associated with the patient visits**. To quickly turn patient and hospital data into insights, Seattle Children's implemented **Tableau Software's business intelligence application**. It provides a browser based on **easy-to-use analytics to the stakeholders**; this makes it intuitive for individuals to **create visualizations and to understand what the data has to offer**.

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Application Case 1:

Eliminating Inefficiencies at Seattle Children's Hospital

The data analysts, business managers, and financial analysts as well as clinicians, doctors, and researchers are all using descriptive analytics to solve different problems in a much faster way. They are developing visual systems on their own, resulting in dashboards and scorecards that help in defining the standards, the current performance achieved measured against the standards, and how these systems will grow into the future. Through the use of monthly and daily dashboards, day-to-day decision making at Seattle Children's has improved significantly. Seattle Children's measures patient wait-times and analyzes them with the help of visualizations to discover the root causes and contributing factors for patient waiting. They found that early delays cascaded during the day. They focused on on-time appointments of patient services as one of the solutions to improving patient overall waiting time and increasing the availability of beds.

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Application Case 1:

Eliminating Inefficiencies at Seattle Children's Hospital

Seattle Children's saved about \$3 million from the supply chain, and with the help of tools like Tableau, they are finding new ways to increase savings while treating as many patients as possible by making the existing processes more efficient.

Questions for Discussion

1. Who are the users of the tool?
2. What is a dashboard?
3. How does visualization help in decision making?
4. What are the significant results achieved by the use of Tableau?

Source: Tableausoftware.com,
"Eliminating Waste at Seattle
Children's,"
tableausoftware.com/eliminating-waste-at-seattlechildrens
(accessed February 2013).

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Application Case 1:

Questions for Discussion

1. Who are the users of the tool?

*Answer (data analysts, business managers, and financial analysts as well as clinicians, doctors, and researchers)

2. What is a dashboard?

*Answer (A dashboard is a visual display tool that presents key performance indicators (KPIs), metrics, and data in an intuitive format.)

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Application Case 1:

building, age, and location

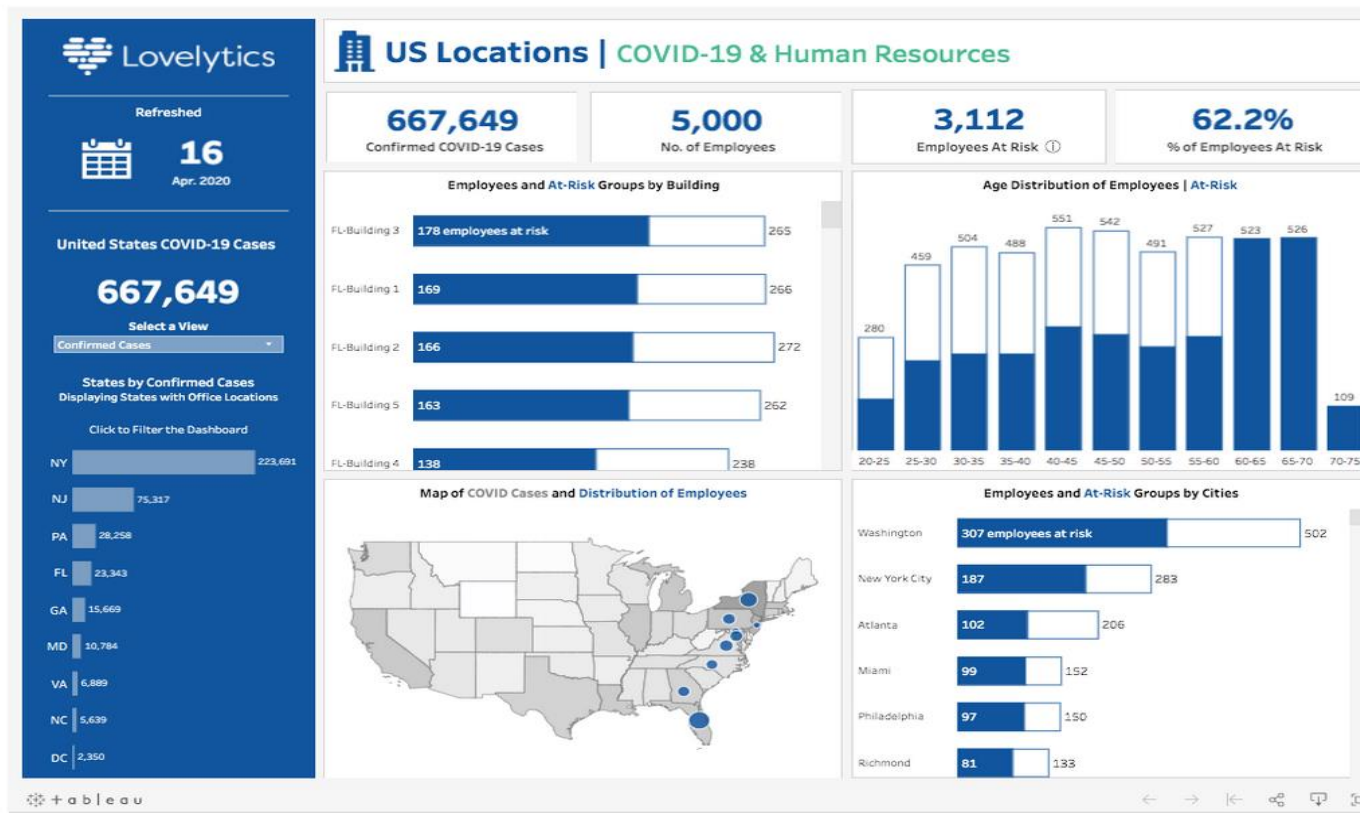


Tableau Dashboard

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Application Case 1:

Questions for Discussion

3. How does visualization help in decision making?

- Simplifying complex data: Presenting data in charts, graphs, and maps makes it easier to understand and interpret.
- Identifying trends and patterns: Visual representations help users quickly spot trends, outliers, and correlations in the data.
- Facilitating communication: Visualizations make it easier to share insights with stakeholders, enhancing collaboration and alignment.
- Supporting rapid decision-making: By providing real-time data, visualizations enable quicker responses to changing conditions.

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Application Case 1:

Questions for Discussion

4. What are the significant results achieved by the use of Tableau?

- Improved patient wait-times: By analyzing wait-time data, the hospital identified early delays as a key issue and implemented measures to improve on-time appointments, thereby reducing overall patient waiting times and increasing bed availability.
- Enhanced day-to-day decision-making: The use of monthly and daily dashboards significantly improved operational decision-making, enabling the hospital to respond more effectively to daily challenges.
- Cost savings: The hospital saved approximately \$3 million in supply chain costs and identified additional ways to increase savings while treating more patients by optimizing existing processes.

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Application Case 1:

Questions for Discussion

4. What are the significant results achieved by the use of Tableau?

- Improved patient wait-times: By analyzing wait-time data, the hospital identified early delays as a key issue and implemented measures to improve on-time appointments, thereby reducing overall patient waiting times and increasing bed availability.
- Enhanced day-to-day decision-making: The use of monthly and daily dashboards significantly improved operational decision-making, enabling the hospital to respond more effectively to daily challenges.
- Cost savings: The hospital saved approximately \$3 million in supply chain costs and identified additional ways to increase savings while treating more patients by optimizing existing processes.

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The Nature of Data:

Data: a collection of facts

– usually obtained as the result of experiences, observations, or experiments

- Data may consist of numbers, words, images, ...
- Data is the source for information and knowledge
- Data quality and data integrity → critical to analytics

The Nature of Data:

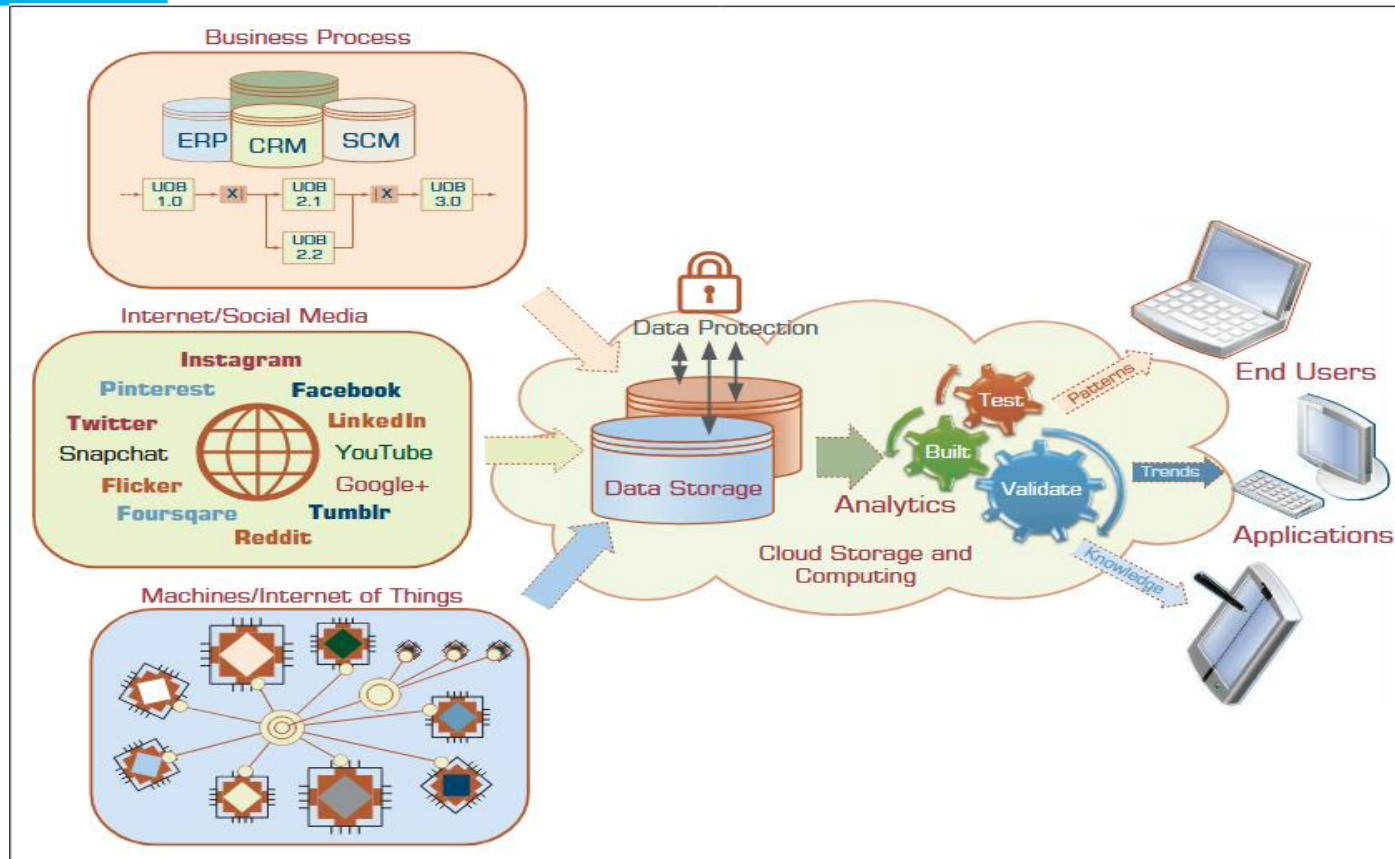


Figure1.4 A Data to Knowledge Continuum.

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A Simple Taxonomy of Data:

Data (datum—singular form of data): facts

- Structured data
 - Targeted for computers to process
 - Numeric versus nominal
- Unstructured/textual data
 - Targeted for humans to process/digest
- Semi-structured data?
 - XML, HTML, Log files, etc.

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A Simple Taxonomy of Data:

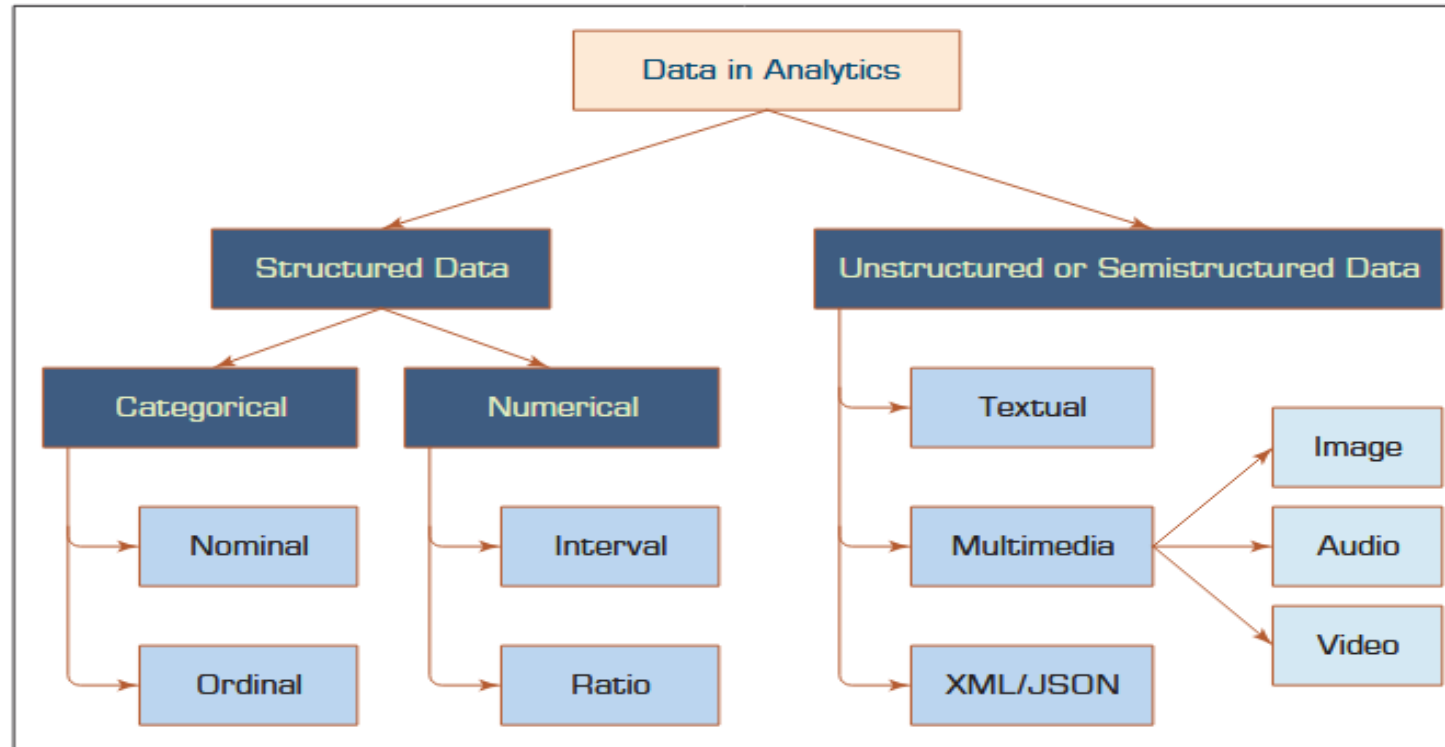


Figure 1.5 shows a simple data taxonomy

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A Simple Taxonomy of Data:

- Categorical data represent the labels of multiple classes used to divide a variable into specific groups.
- Examples of categorical variables include race, sex, age group, and educational level.
- The categorical data may also be called discrete data, implying that it represents a finite number of values with no continuum between them. Even if the values used for the categorical (or discrete) variables are numeric, these numbers are nothing more than symbols and do not imply the possibility of calculating fractional values.

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A Simple Taxonomy of Data:

- Nominal data contain measurements of simple codes assigned to objects as labels, which are not measurements.
- For example, the variable marital status can be generally categorized as (1) single, (2) married, and (3) divorced.
- Nominal data can be represented with binomial values having two possible values (e.g., yes/no, true/false, good/bad), or multinomial values having three or more possible values (e.g., brown/green/blue, white/black/Latino/Asian, single/married/divorced).

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A Simple Taxonomy of Data:

- Ordinal data contain codes assigned to objects or events as labels that also represent the rank order among them.
- For example, the variable credit score can be generally categorized as (1) low, (2) medium, or (3) high. Similar ordered relationships.
- can be seen in variables such as age group (i.e., child, young, middle-aged, elderly) and educational level (i.e., high school, college, graduate school).

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A Simple Taxonomy of Data:

Attributes

Objects

<i>Tid</i>	Refund	Marital Status	Taxable Income	Cheat
1	Yes	Single	125K	No
2	No	Married	100K	No
3	No	Single	70K	No
4	Yes	Married	120K	No
5	No	Divorced	95K	Yes
6	No	Married	60K	No
7	Yes	Divorced	220K	No
8	No	Single	85K	Yes
9	No	Married	75K	No
10	No	Single	90K	Yes

Figure 1.6 Example of categorical data



Thank You