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# ICT-TEX course on Digital skills

## Topic 7: Introduction to Analytics

The course is developed under Erasmus+ Program Key Action 2:  
Cooperation for innovation and the exchange of good practices [Knowledge Alliance](#)

**ICT IN TEXTILE AND CLOTHING HIGHER EDUCATION AND BUSINESS**

Project Nr. 612248-EPP-1-2019-1-BG-EPPKA2-KA

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# 7.1. Analytics and Classification Of Analytics



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# Introduction to Analytics

## The Analytics:

- Represents tools and techniques to explore, analyze, and visualize data from different data sources.
- Uses raw unprocessed data (unstructured data and structured data) from different data sources
- Analyzes and Process data to derive valuable insights and extract knowledge



# Introduction to Analytics

## The Analytics:

- Visualizes data results to the user with the help of data visualization techniques
- Provides an informative way of understanding a valuable information
- Human decisions can be made or these tools can make fully automated decisions.



# Introduction to Analytics

Analytics is related to:

- Detecting data
- Analyzing data
- Processing data
- Using data and interpretation
- Visualizing data results



# Introduction to Analytics

- Definition of Analytics

Analytics represents *“the extensive use of data, statistical and quantitative analysis, explanatory and predictive models, and fact-based management to drive decisions and actions”*

- Davenport T H & Harris J G. *Competing on Analytics: The New Science of Winning*. Harvard Business School Press Boston, USA 2007. ISBN: 978-1-422-10332-6 (2007)



# Introduction to Analytics

- Definition of Analytics

*“Analytics is the process of developing actionable insights through problem definition and the application of statistical models and analysis against existing and/or simulated future data”*

- Cooper, A.: *CETIS Analytics Series: What is Analytics? Definition and Essential Characteristics, CETIS Analytics Series Vol 1, No 5., The University of Bolton, UK 2012, ISSN 2051-9214 (2012)*





# Introduction to Analytics

- Definition of Analytics

*“Analytics can be defined as a process that involves the use of statistical techniques (measures of central tendency, graphs, and so on), information system software (data mining, sorting routines), and operations research methodologies (linear programming) to explore, visualize, discover and communicate patterns or trends in data”*

- Schniederjans, M., Schniederjans, D. and Starkey, C.: Business Analytics Principles, Concepts and Applications: What, Why, and How. Pearson FT Press, USA 2014, ISBN: 978-0-13-355218-8 (2014)



# Classification of Analytics

One of the most common classifications and accepted by the scientific community is the one that divides Analytics into the following categories:

- Descriptive Analytics
- Predictive Analytics
- Prescriptive Analytics
- Combination



# Classification of Analytics

## Descriptive Analytics:

- Descriptive Analytics basically describes what happened in the past, without providing context, why an event occurred or if that event is likely to happen again in the future.
- They try to answer the questions:
  - What has happened?
  - What is happening?



# Classification of Analytics

## Descriptive Analytics:

- Their activity is carried out by applying statistical techniques that describe what is the content of a particular piece of data or database.
- Such as:
  - **Standard reporting** - to try to answer the question: What happened?
  - **Query/Drill down** - to try to answer the question: Where exactly is the problem?
  - **Ad hoc reporting** – to try to answer the questions: How often? How many? Where? And many others.



# Classification of Analytics

## Descriptive Analytics:

- The analysis is possible thanks to:
  - Alerts
  - Reports
  - Dashboards
  - Business Intelligence
  - And others examples



# Classification of Analytics

## Predictive Analytics:

- Present models for analyzing the past to predict the future and provide some explanation for the occurrence of an event.
- The purpose is to answer the questions:
  - What can happen?
  - Why will it happen?
  - What has happened?
  - What is happening?



# Classification of Analytics

## Predictive Analytics:

- Try to understand the future by using statistical models and forecasting techniques.
- Such as:
  - Predictive modeling - to answer the question: What will happen next?
  - Forecasting - to answer the question: What if these trends continue?
  - Simulation - to answer the question: What could happen?
  - Alerts - to answer the question: What actions are needed?



# Classification of Analytics

## Predictive Analytics:

- The analysis is possible thanks to:
  - Predictive models
  - Forecasts
  - Statistical analysis
  - Scoring
  - And others examples





# Classification of Analytics

## Prescriptive Analytics :

- Prescriptive Analytics are useful tools in determining what to do next as a result of an event and provide evidence of the most optimal level of key variables to achieve a particular desired and expected outcome.
- The purpose is to answer the questions:
  - What should happen?
  - What must be done?
  - Why should I do it?



# Classification of Analytics

## Prescriptive Analytics :

- Prescriptive Analytics tools mainly use optimization and simulation algorithms to make a recommendation for a possible result.
- Such as:
  - **Optimization** - to try to answer the question: What is the best possible outcome?
  - **Random variable optimization** - to try to answer the question: Given the variability in specific areas, what is the best outcome? And many others.

# Classification of Analytics

## Prescriptive Analytics:

- The analysis is possible thanks to:
  - Business rules
  - Organization models
  - Comparisons
  - Optimization
  - And others examples



# Classification of Analytics

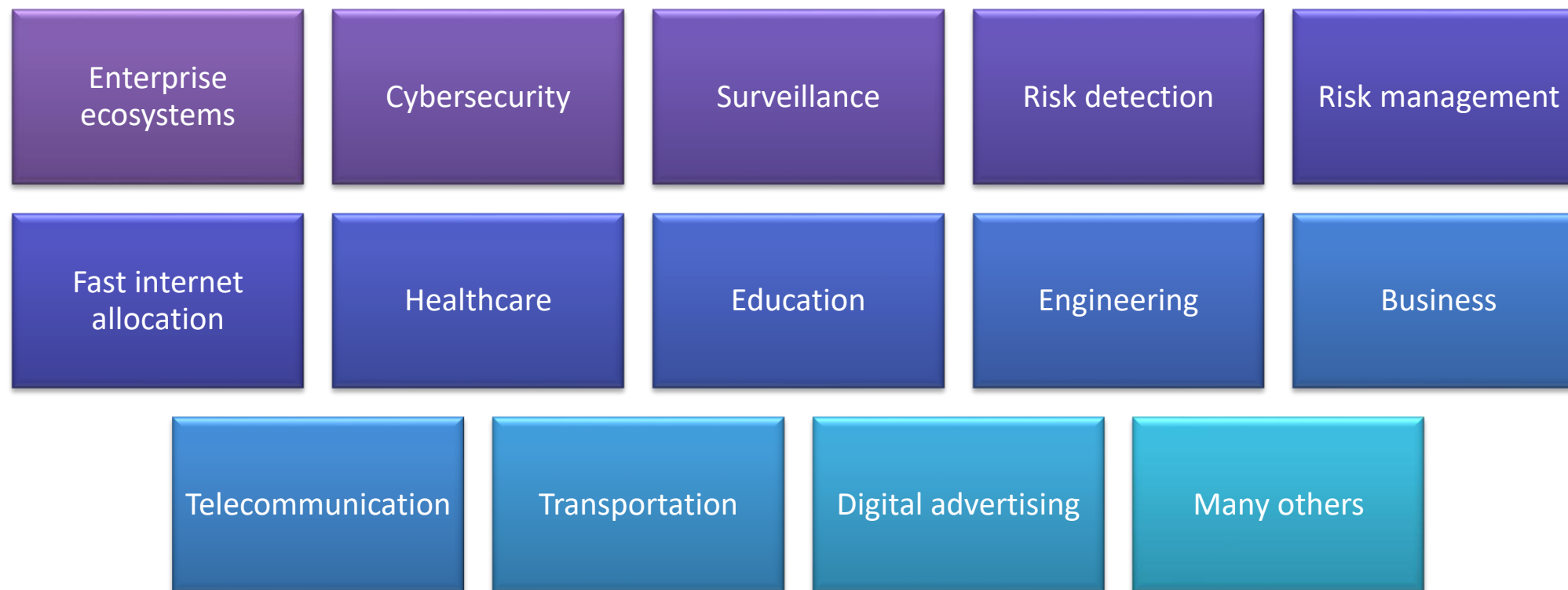
A combination of different types of analytics

- Many Analytics tools combine the functionalities of descriptive, predictive, or prescriptive analytics into their structures.
- There are existing other categories of Analytics tools such as Diagnostic analytics, Cognitive analytics, and many others. The analytics tools are constantly developing, thanks to researchers and practitioners.



# Application of Analytics

- Analytics instruments are applied in different areas, such as:





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## 8.2. Business Analytics



# Business Analytics Definition

*“Business Analytics can be defined as a process beginning with business-related data collection and consisting of sequential application of descriptive, predictive, and prescriptive major analytic components, the outcome of which supports and demonstrates business decision-making and organizational performance”*

- Schniederjans, M., Schniederjans, D. and Starkey, C.: *Business Analytics Principles, Concepts and Applications: What, Why, and How*. Pearson FT Press, USA 2014, ISBN: 978-0-13-355218-8 (2014)



# Business Analytics vs Analytics

- Analytics has many different areas of application. Business Analytics are **applied to business**.
- Business Analytics tools use primarily business data. Analytics tools use a variety of non-business data to generate insightful information.
- Business Analytics helps business organizations to increase their performance by creating measurable business results and increased value. Business Intelligence is not focused on that.





# Business Analytics vs Analytics

- Analytics tools can often represent one type of analytics tool, classified as Descriptive, Predictive, Prescriptive analytics, and so on.
- Business Analytics tools often include all three categories of analytics instruments into their structure (and they can be applied sequentially – descriptive, predictive, and prescriptive analytics) for generating valuable and new information supporting the decision-making processes of the organization.



# Business Analytics vs Business Intelligence

- Business Intelligence *“can be defined as a set of processes and technologies that convert data into meaningful and useful information for business purposes.”*

– Schniederjans, M., Schniederjans, D. and Starkey, C.: *Business Analytics Principles, Concepts and Applications: What, Why, and How*. Pearson FT Press, USA 2014, ISBN: 978-0-13-355218-8 (2014)

- Business Intelligence is focused on historical business data and the data report, storage, and maintenance of that data.
- Business Analytics is not focused on data storage.



# Business Analytics vs Business Intelligence

Business Intelligence uses mainly the analytics capabilities of descriptive analytics to analyze the organization data from the past.

Business Intelligence tries to answer the questions:

- What has happened?
- What is happening?
- What to do (take action) based on the historical data?



# Business Analytics vs Business Intelligence

Business Analytics can combine different types of analytics.

- Business Analytics tools can present models for analyzing past business data to predict the future (Predictive analytics capabilities) and provide some explanation for the occurrence of an event in a business.
- Can answer the business questions:
  - What is happening? What has happened?
  - What can happen? Why will it happen?



# Business Analytics vs Business Intelligence

Business Analytics can combine different types of analytics.

- Business Analytics can determine what to do next as a result of a business event and provide evidence of the most optimal level of key variables to achieve a particular desired and expected business outcome (Prescriptive analytics capabilities), resulting in increased business value and performance.
- Can answer the business questions:
  - What should happen? What must be done?
  - Why should I do it?



# Business Analytics vs Business Intelligence

- Often Business Intelligence cannot use the combination of different types of analytics and their functionalities, such as the capabilities of predictive analytics and prescriptive analytics.
- Business Analytics can use unstructured and structured business data. Business Intelligence is focused on using only structured business data.



# Business Analytics Application

Manufacturing

Finance

Marketing

Human Resources

Customer  
Relationship  
Management  
(CRM)

Medical  
Methodology

Many others



# Importance of Business Analytics

## Business Analytics tools contribute to:

- Extracting useful insights over the processed data
- Gaining valuable business information and knowledge
- Decision-making process of the management
- Improving business performance, value and profit
- Improving business competitiveness





# Business Analytics Data

- Structured, semi-structured, or unstructured data from different data sources, representing collected business data
- This data must be stored in a database to make it usable by Business Analytics.
- Database management systems (DBMS) collect, process, store, and retrieve data from various sources.
- Business Analytics tools analyze the data and provide valuable business information.



# Business Analytics Data

- Database management systems (DBMS)
- Databases
- Data warehouses
- Data marts
- Online analytical processing (OLAP)
- ETL (Extract, Transform, Load)
- Data mining and so on.



# Business Analytics Data Examples

Any data that contains information regarding business such as:

- Accounting and personnel information
- Different business reports and research such as the market, competition, customer satisfaction, customer behavior, demographics, market size, etc.
- Revenues, profit, statistics, etc.
- Different business analysis and trends
- Any other information related to the business.



# Business Analytics Data

- Different metrics on data are applied on data to measure the defined indicators (performance, added business value, and so on)
- *“A metric is a unit of measurement that provides a way to objectively quantify performance. Measurement is the act of obtaining data associated with a metric. Measures are numerical values associated with a metric.”*

– Evans, J.: *Business Analytics: Methods, Models, and Decisions*, (2nd ed.), Pearson Education, USA 2017, ISBN: 9781292095448 (2017)



# Business Analytics Data

- Business Data can be measured by:
  - **Quantity (quantitative metrics)**
  - **Quality (qualitative metrics)**
- Metrics are:
  - **Discrete metrics** refers to counting on a measurement scale
  - **Continuous metrics** refers to the continuous measurement scale



# Business Analytics Data

- Business Data according to measurement scale:
  - **Categorical (nominal) data**
  - **Ordinal data**
  - **Interval data**
  - **Ratio data**
- This classification provides a basis for classifying different business data into the relevant database available for Business Analytics tools.



# Problem Solving with Business Analytics

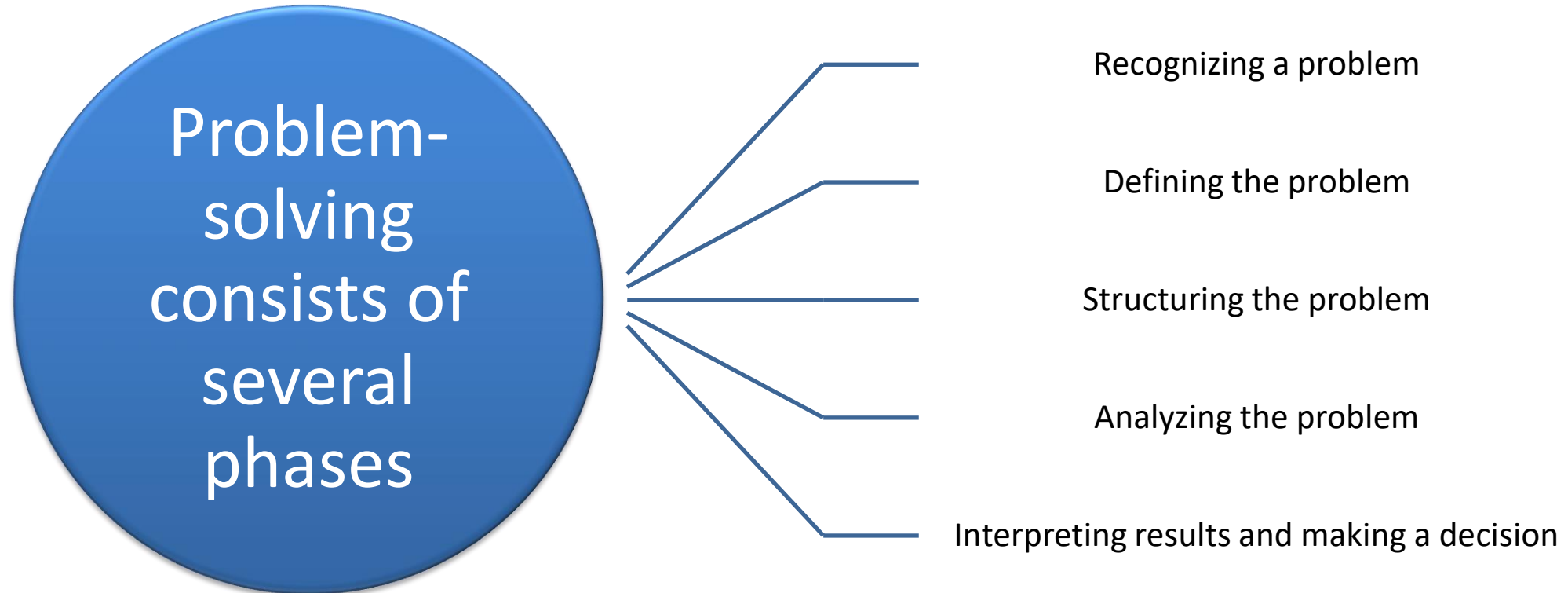
- “Problem-solving is the activity associated with defining, analyzing, and solving a problem and selecting an appropriate solution that solves a problem.”

– *Evans, J.: Business Analytics: Methods, Models, and Decisions, (2nd ed.), Pearson Education, USA 2017, ISBN: 9781292095448 (2017)*

- Business Analytics tools support problem-solving and decision-making processes.



# Problem Solving with Business Analytics



*Based on: Evans, J.: Business Analytics: Methods, Models, and Decisions, (2nd ed.), Pearson Education, USA 2017, ISBN: 9781292095448 (2017)*





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## 8.3. Big Data and Analytics



# Big Data Introduction

- Definition of Big Data

*“Big data is defined as collections of datasets whose volume, velocity or variety is so large that it is difficult to store, manage, process and analyze the data using traditional databases and data processing tools.”*

- Bahga, A., Madisetti, V.: *Big Data Science & Analytics: A Hands-On Approach*. 1st Edition, Arshdeep Bahga & Vijay Madisetti 2019. ISBN: 978-1-949978-00-1 (2019)



# Big Data Introduction

- The term “**Big Data**” also refers to the massive amounts of business data, generated (and in real-time) from any sources of data.
- The data can be of different types of data:
  - **Structured data**
  - **Semi-structured data**
  - **Unstructured data**



# Big Data Introduction

- The business data includes information from different sources of data, collected from companies.
- From an organizational perspective, this data can be:
  - Created **inside** an organization (Internal sources of data)
  - Available **outside** an organization (external sources of data)
- Nowadays companies thrive to collect, store and manage data to make strategic business decisions.



# Big Data Characteristics

- Companies need all the data they can get.
- In particular, the term "Big Data" is often used as the ultimate limit of a company's ability to collect, store, process, and access this big data, for the company's operation and its work, supporting decision-making processes, management risk, customer service and more.



# Big Data Characteristics

- Big Data has many characteristics starting with the letter "V"

## Examples of Big Data characteristics

Volume

Velocity

Variety

Veracity

Value

Viability

Vulnerability

Volatility

Visualization

Others



# Big Data Characteristics

## Big Data Volume:

- Represents the scale of data.
- Represents enormous business data that is constantly generated in real-time
- All the data must be collected, stored, and measured, representing petabytes and exabytes of data, generated from any sources of data.



# Big Data Characteristics

## Big Data Velocity:

- Represents how fast the data is generated, from the different sources of data
- Represents how fast the data is used for the companies
- This characteristic is focused on the analysis of streaming data.
- One of the most common challenges facing organizations is the speed of data (velocity) and the response of companies to process it quickly.





# Big Data Characteristics

## Big Data Variety:

- Represents the diversity of the data.
- This characteristic of Big data represents different types of business data, such as:
  - Structured data
  - Semi-structured data
  - Unstructured data
- Data systems need to have the ability to handle the variety of generated data.



# Big Data Characteristics

## Big Data Veracity:

- Represents the accuracy of the data.
- The control of data quality is one of the key elements to resolve the problem of the large volumes of data, generated from different sources of data, and any form (structured, semi-structured, unstructured)
- To extract valuable information from business data, the reliability (veracity) of big data must be preserved



# Big Data Value

- Represents the usefulness of the data for the specifically defined purpose.
- The value of data is not related to the volume of data, but it is focused on the amount of valuable and reliable data that needs to be processed to extract insights and generate valuable business information and knowledge.
- The value of big data must be related to the generation of economic value to the business



# Big Data Value

Big Data is valuable for example:

Accessibility to Data

Decision Making

Marketing Trends

Performance Improvement

New Business Models/Services



# Big Data Applications

The application of Big data covers a wide range of applications

Manufacturing  
Industry

Retail Industry  
and Wholesale  
trade

Social Media  
Sector

Education  
Industry

Healthcare  
Industry

Banking  
Sector

Government  
Sector



# Big Data Applications

The application of Big data covers a wide range of applications

Ecommerce

Digital  
Marketing

Media and  
Entertainment  
Industry

Cloud  
Computation

Internet of  
Things

Customer  
Oriented  
Services

Securities,  
Insurance  
Industry



# Big Data Applications

The application of Big data covers a wide range of applications

Transportation  
Industry

Digital  
Communications

Airline Industry

Tourism

Energy and  
Utilities

Natural  
Resources

Many others



# Big Data Technologies

## The Big data technologies:

Hadoop Ecosystem

Artificial Intelligence

NoSQL Database

R Programming

Python Programming

Data Lakes

TensorFlow

Beam

Docker

Airflow

Kubernetes

Blockchain and many others





# Big Data Analytics

- Represents a type of Analytics tools and techniques to explore, analyze, and visualize Big data from different data sources.
- Focused on Big Data and Big Data Characteristics
- Uses Big Data technologies and Analytics capabilities to extract valuable insights over the vast amounts of Big data
- Helps the management to make informed business decisions, based on the processed Big Data.

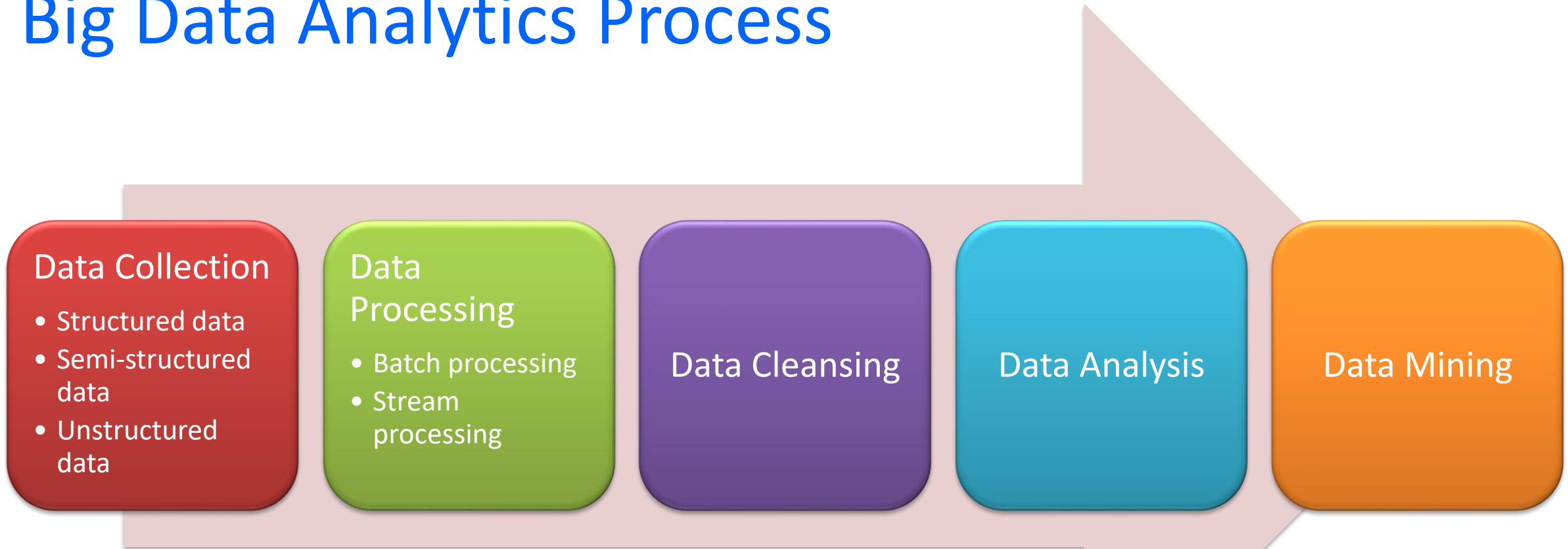


# Big Data Analytics

- Companies need to be prepared to use Big Data in their corporate structures and take advantage of the provided Big Data Analytics capabilities.
- Big Data and Big Data Analytics can improve business performance and other key business factors.
- Companies need to be receptive to new technologies and their integration.



# Big Data Analytics Process





# Benefits of Big Data Analytics

Enterprises are increasingly looking to integrate and use Big Data Analytics into their companies.

Big Data Analytics helps management cope with the characteristics of big data related to the business and the challenges to process it.

Big Data Analytics contribute to finding actionable insights to answer defined business questions.



# Benefits of Big Data Analytics

Big Data Analytics tools are useful instruments for the enterprise and can stimulate key factors for the business as:

- Boost Sales
- Increase Efficiency, Performance, etc.
- Improve Operations, Customer Service, Risk Management

Big Data Analytics contributes to decision-making processes, based on extracted valuable business information and knowledge.



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- Evans, J.: Business Analytics: Methods, Models, and Decisions, (2nd ed.), Pearson Education, USA 2017, ISBN: 9781292095448 (2017)
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