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**Master 2 in Construction Projects Management**
**Course: Data Analysis**
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# Chapter 01 :

# Introduction to Data Analysis



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**Chapter objectives:**

**At the end of the course, the learner will be able to:**

- Recognize the significance of data analysis and its importance for managing construction projects.
- Make a distinction between quantitative and qualitative data
- Learn about the steps involved in data analysis.
- Recognize several examples of data analysis in construction projects management domain.

# Chapter 01: Introduction to Data Analysis

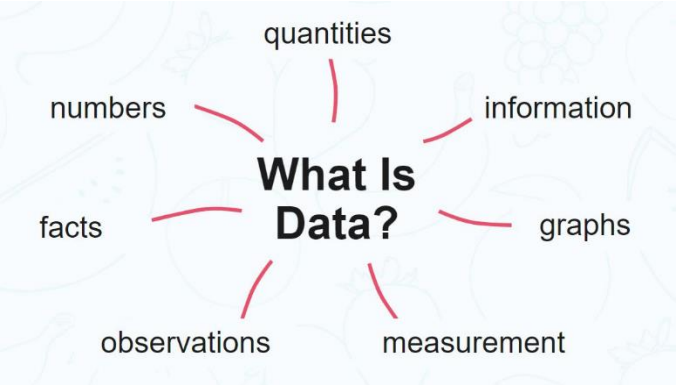
## 1.1 What is data and data analysis?



**DATA** refers to **factual information** that needs to be recorded and analyzed in a form which can be assessed to make a determination or decision about a specific action.

It consists of facts, numbers, text, letters, symbols, images, sounds, and measurements.

Data is gathered from a variety of sources, such as scientific research, government records, commercial transactions, social media, ect. (Richmond. B, 2006)




**DATA ANALYSIS is** a range of specific procedures, specialized techniques and methods that convert the collected data to meaningful information in order to draw conclusion about that information, thus supporting the mechanism of decision-making process. (Manpreet. K. B, 2017)

In other words, Data analysis includes ways of working with information (data) to support the work, goals and plans of your program or agency. (Richmond. B, 2006)

## 1.2 Importance of Data Analysis



Data analysis is the most crucial part of any research. It allows researchers to understand the information gathered, test hypotheses, and draw conclusions. It ensures that research findings are accurate, reliable, and actionable, enabling researchers to draw meaningful conclusions, « data analysis is the crucial part of research which makes the result of the study more effective ». (Dawit, 2020, p25).

## 1.3 Types of Data

Data are organized into two broad categories: **qualitative and quantitative**.

**Qualitative Data:** Qualitative data are mostly non-numerical and usually descriptive or nominal in nature. This means the data collected are in the form of words and sentences. Such data captures feelings, emotions, or subjective perceptions of something. (Kabir, 2016).

**Examples** :

- The supervisor observed that workers were '**well-coordinated**' during the concrete pour.
- Workers reported that the new safety protocols were '**easy to follow**' but '**time-consuming**.'
- The project team identified potential weather disruptions as a '**significant risk**' to the schedule

**Quantitative Data:** Quantitative data refers to numerical data that can be measured and quantified. It is data that represents quantities and is typically used for statistical analysis, often collected through surveys, measurements, and experiments (Kabir, 2016).

**Examples :**

- The project is scheduled to be completed in **12 months.**
- Material costs for the foundation amount to **200,000 DA**.
- There are **150 workers** on-site daily
- Each floor of the building will take **30 days** to construct.

## What is the difference between quantitative and qualitative data ?

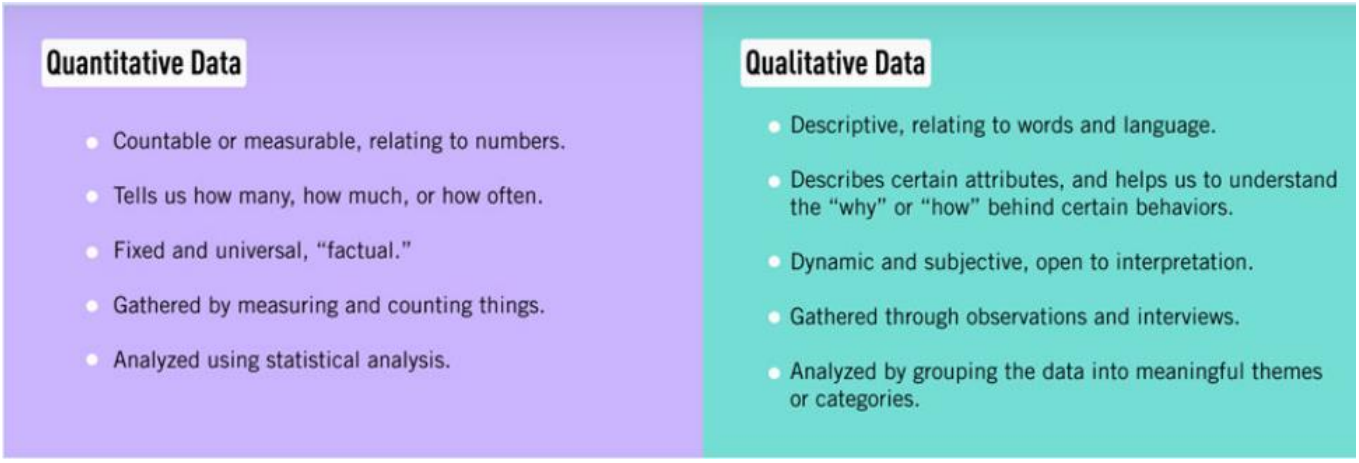



Figure 01 : the difference between quantitative and qualitative data. source : https://careerfoundry.com/en/blog/data-analytics/difference-between-quantitative-and-qualitative-data/

## 1.4 Overview of Data Analysis Process

The data analysis process is a systematic approach to collecting, cleaning, interpreting, and presenting data to extract meaningful insights and support decision-making. Here's an overview of the key steps involved in this process:

1. **Define the objectives/research problem**

First, we need to clear about why we need data analysis and what we will do with it. Clearly outline the goals of the analysis. This step helps determine what questions need to be answered, what decisions need to be supported, or what problems need to be solved.

**Key Questions:**

- What are the objectives of this analysis?
- What outcomes are expected?

**Example**: In a construction project, the objective might be to identify causes of cost overruns.

2. **Data Collection**

Data collection is a process of collecting information from all the relevant sources to find answers to the research problem, test the hypothesis and evaluate the outcome

**Example**: Collect daily progress reports, budget records, and weather data for a construction project.

3. **Data Cleaning and Preparation**

After you collect the data, you must enter it into a computer program such as SAS, SPSS, or Excel. During this process, whether it is done by hand or a computer scanner does it, there will be errors. No matter how carefully the data has been entered, errors are inevitable. This could mean incorrect coding, incorrect reading or written codes, missing data, and so on. **Data cleaning is the process of detecting and correcting these coding errors.** (https://www.researchgate.net/publication/338528149_Data_Analysis_Types_Process_Methods_Techniques_and_Tools)

**Example**: Removing Duplicates: Identifying and eliminating duplicate rows or records in the dataset to prevent redundant analysis results

4. **Data Exploration and Visualization**

Explore the data to understand its structure, patterns, and key characteristics. Visualization tools, such as graphs, charts, or dashboards, are often used to make sense of the data.

**Example**: Create a bar chart to visualize monthly expenses and identify trends in cost overruns.

5. **Data Analysis**

Apply analytical techniques to interpret the data and extract meaningful insights. The specific methods used depend on the type of data (qualitative vs. quantitative) and the objectives of the analysis.

6. **Interpretation of Result**s

Interpret the findings from the data analysis in the context of the objectives. This step involves making sense of the results and determining what actions or decisions can be made based on the insights gained.

- **Questions**:
  - What do the results mean?
  - How do the findings align with the project's goals or hypotheses?

**Example**: Conclude that delays caused by subcontractor inefficiencies are responsible for 20% of project schedule overruns.

7. **Reporting and Communication**

Present the results of the analysis in a clear and actionable format. This could include written reports, visual dashboards, or presentations tailored to different stakeholders.

- **Key Elements**:
  - Summary of key findings.
  - Visual representations (graphs, charts).
  - Recommendations based on the analysis.

**Example**: Prepare a report with charts showing the main causes of cost and schedule delays and suggest mitigation strategies.




Figure 02 : steps of data analysis process. Source: Author

## 1.5 Application of Data Analysis in Construction Project Management Research (example)

**A simpler example of data analysis in a construction project context, focusing on understanding the impact of weather delays on project completion times.**

## 1-Research Objective:

To determine how weather delays impact the total duration of construction projects.

## 2- Data Collection

**Hypothetical Dataset:**

| Project ID | Weather Delays (days) | Total Duration (days) |
|---|---|---|
| 001 | 3 | 150 |
| 002 | 0 | 120 |
| 003 | 5 | 180 |
| 004 | 2 | 140 |
| 005 | 7 | 200 |

## 3- Data Preparation

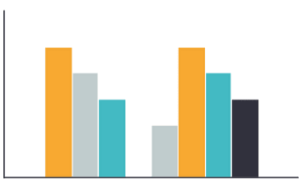
**Data Cleaning**: Ensure all data entries are correct and consistent. In this case, verify that weather delays and total duration are recorded in days.

## 4- Data Exploration and Visualization

1. **Scatter plot**
    - **Purpose**: To visualize the relationship between weather delays and total project duration.
    - **X-axis**: Weather Delays (days)
    - **Y-axis**: Total Duration (days)
    - **Plot**: Each project is represented as a point. The scatter plot will show if there's a visible trend or pattern.



2. **Bar Chart**:
    - **Purpose**: To compare the total duration of projects with different weather delays.
    - **X-axis**: Project ID
    - **Y-axis**: Total Duration (days)
    - **Bars**: Each bar represents the total duration for a specific project, which can be compared visually to the weather delays.



**4- Data Analysis**

Using analytical techniques: to determine if there is a relationship between weather delays and total project duration

**5- Results Interpretation**

- **Findings**:
    - There is a strong positive correlation between weather delays and total project duration.
    - Projects with more weather delays generally have longer total durations.
- **Recommendations**:
    - **Improve Planning**: Factor in potential weather delays during the planning phase to create more realistic project timelines.
    - **Implement Mitigation Strategies**: Develop strategies to minimize the impact of weather on construction activities, such as scheduling critical tasks during favorable weather periods.

**5. Reporting and Communication**

- **Research Report**: Create a brief report summarizing the findings. Include the average weather delays, total durations, and correlation results. Use a scatter plot to visualize the relationship between weather delays and total duration.
- **Presentation**: Present the findings in a simple slide or dashboard to stakeholders, highlighting the key points and recommendations.

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## Webography


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