Module 1
Fundamentals of Data-Driven Decision Making

Module 1

- **Section 1 – Introduction**
  - Define data-driven decision making
  - Describe the benefits of using this approach
  - Define the process for collecting and analyzing data

- **Section 2 – Data collection**
  - Define data
  - Identify data sources
  - Determine methods of collecting data

End of Module Objective

- Recognize the advantages of data-driven decision making and prioritization
- Identify data analysis needs
- Decide about the appropriate way of collecting data in order to apply statistical techniques

Section 1

Introduction

Data-driven Decision Making

- Effective and informed decisions are based on the analysis of data and information.
- Using valid and relevant data helps place the “problem” in the right context.
- It allows us to identify risks and opportunities.

Data-driven Decision Making (cont'd)

- It mitigates human error.
- Relying on data also helps us determine a best-fit solution.
- Data-driven decision making provides credible evidence to stakeholders and management regarding strengths, weaknesses, opportunities, limitations and risks.

Data-driven Decision Making (cont'd)

- Managers and experts in all fields must base their decisions on the right quantity and quality of information.
- They must also use information that is relevant to their needs.

Benefits of Data-driven Decision Making

Decision making based on the right data and information enables managers to focus on strategy and policy issues such as:

- changes that can be expected in statutory and regulatory requirements, emerging technologies, markets or resources which may affect the organization;
- risks that need to be identified, managed or minimized;
- various priorities that need to be established and managed, e.g. strategic, operational, resources;

Benefits of Data-driven Decision Making (cont'd)

- potential changes in the needs and expectations of interested parties in the long term;
- existing services, products and processes that currently provide the most value for interested parties;
- new services, products and processes needed to meet the changing needs and expectations of interested parties;

Benefits of Data-driven Decision Making (cont'd)

- the evolving demands for the organization's services and products in the long term;
- the impact of emerging technologies on the organization; and
- new competencies that may be needed.

Other Benefits of Data-driven Decision Making

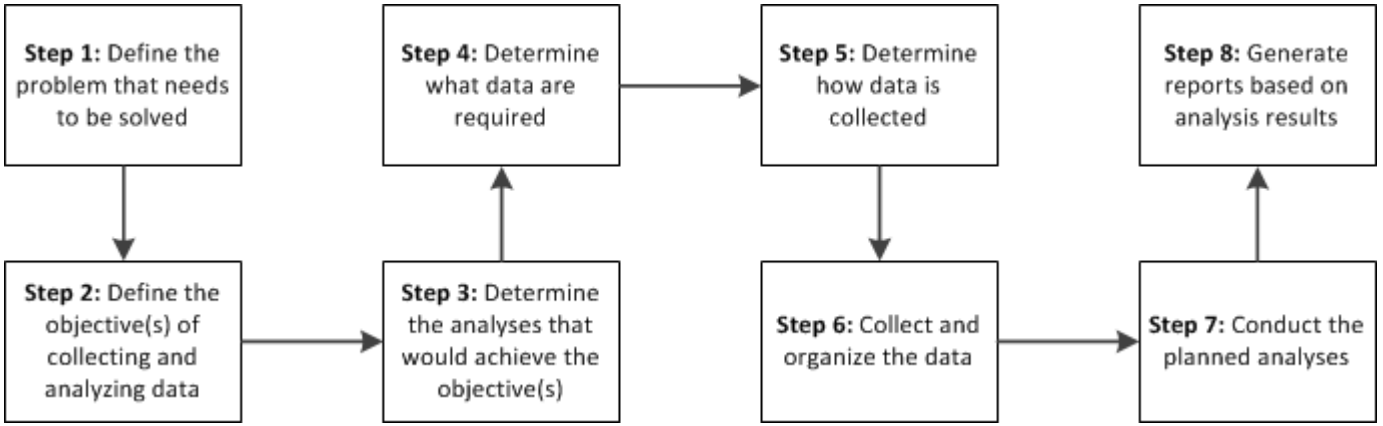
- By using data and facts, we can determine the effectiveness of our past decisions. We can do so by referencing factual records.
- We also become more able to review, evaluate, challenge and change opinions and decisions.

Requirements of Data-driven Decision Making

- Managers and experts who adopt a factual approach to decision making need to:
- ensure that data and information are accurate and reliable;
- make data accessible to those who need it;
- analyze data and information using valid methods; and
- balance their decisions with experience and intuition.

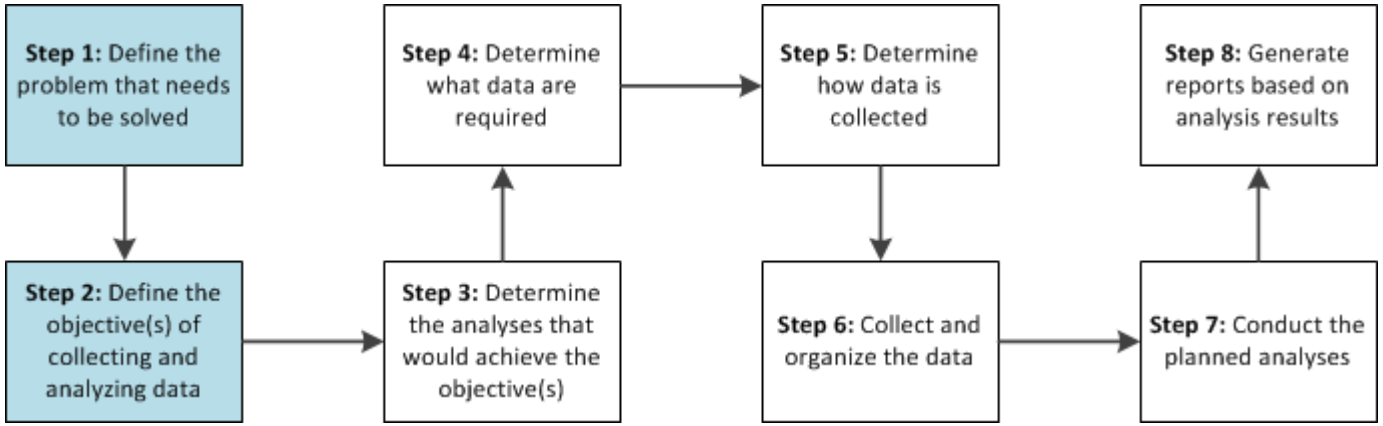
The Process for Collecting and Analyzing Data

- **The diagram below shows the process for collecting and analyzing data.**



The Process for Collecting and Analyzing Data

- **The first step is to define the problem that needs to be solved by collecting and analyzing data.**
- **The organization also needs to set clear and relevant objectives.**



Defining the Problem

- **The first step in planning and establishing a data-driven decision making process is to define what the problem statement is:**

- **What is the question that needs to be answered?**
- **What decision does management need to make?**
- **What is the objective of collecting and analyzing data?**

Defining the Problem (cont'd)

- In the process of defining the problem, management need to also answer the following questions:

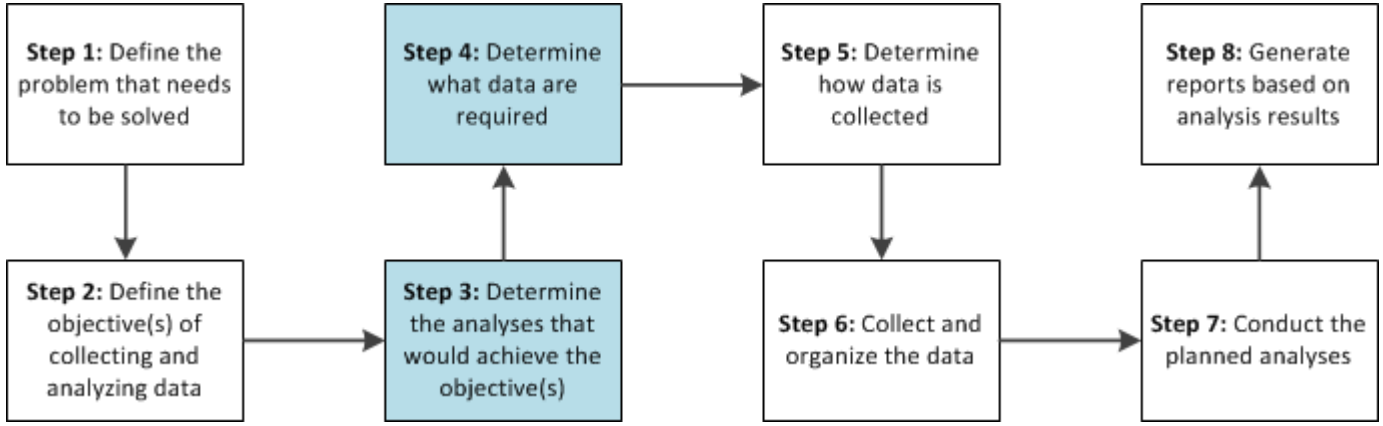
- Does the collection and analysis of data support and relate to the organization's objectives?
- Is it practical and feasible to collect and analyze the data?
- Are the required data available? Or can they be obtained in a reasonable manner?
- Are the required resources (people, equipment, software, funds) available?

Developing Objectives

- In the planning phase, the organization also needs to define a clear set of objectives, showing:
- Why the organization needs to address the identified problem.
- How and where management will use the results of data collection and analysis.

The Process for Collecting and Analyzing Data

- **The next steps involve determining the analyses that would achieve the defined objectives and the data that would be required.**



Data Analysis

- Data Analysis is the process of applying statistical or other analytical techniques to check, describe, transform, condense, evaluate and visualize data.
- The goal of data analysis is to discover useful information, suggest conclusions and support decision making.

Data Analysis

Analysis of data shows:

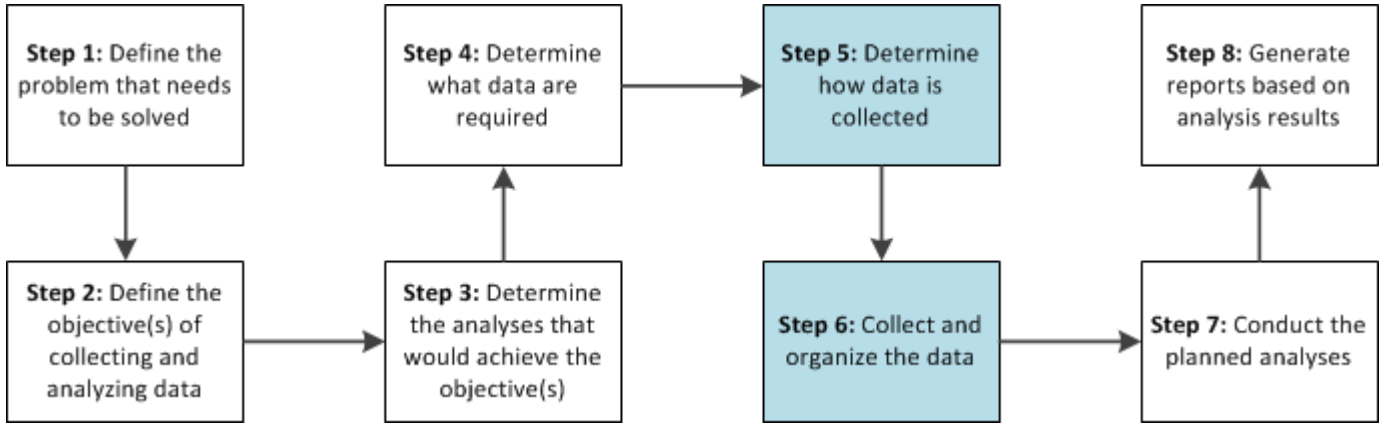
- whether the organization, system or process is improving;
- factors that cause change;
- connections or “correlations” between or among various factors.

Determining the Analyses

- Analyzing data involves examining it in ways that reveal the relationships, patterns and trends that can be found within it.
- Statistical techniques can show what kinds of relationships, connections and comparisons may exist among variables.

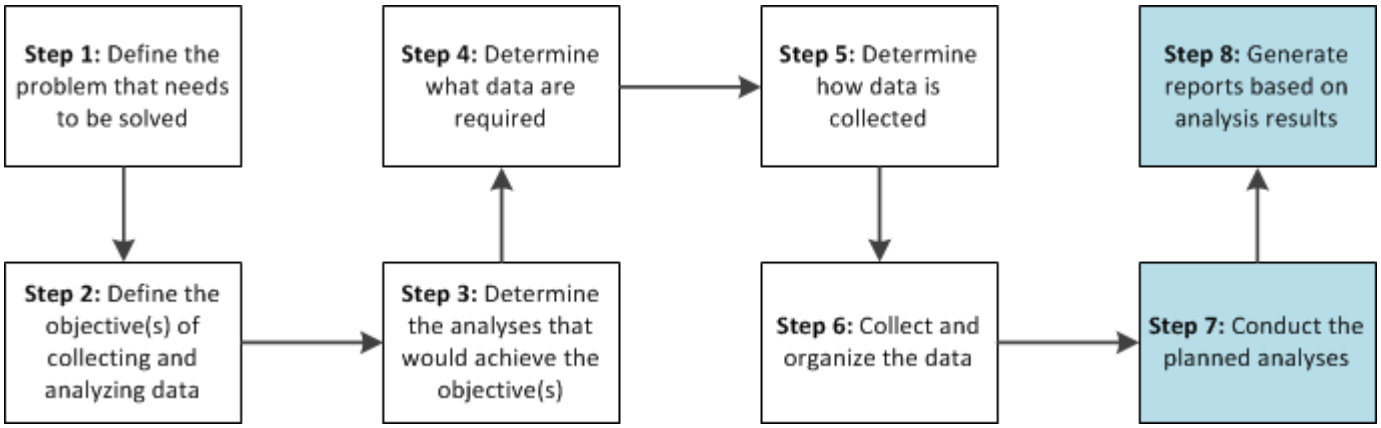
The Process for Collecting and Analyzing Data

- **In section 2 of this module, we will discuss data collection.**



The Process for Collecting and Analyzing Data

- **We will discuss examples of data analyses and reporting in modules 2 and 3.**



Section 2

Data Collection

What is Data?

- Data is a variable piece of information in raw or unorganized form (such as alphabets, numbers, or symbols) that refers to, or represents, a condition, idea or object.
- Data is limitless and present everywhere in the universe.
- Each piece of data conveys an individual piece of information.

What is Data?

- ***Raw*** **or** ***unprocessed*** **data needs to be "processed".**
- **Therefore it needs to be collected, measured, analyzed and reported.**
- **"Processed data" from one stage of a process may be considered "raw data" for the next.**

Types of Data

- There are two kinds of data:
  - 1) Quantitative data – information that is collected as, or can be translated into, numbers and which can be displayed and analyzed mathematically.
  - 2) Qualitative data – collected as descriptions, anecdotes, opinions, interpretations, etc. and generally cannot be reduced to numbers and left as narratives.
- This workshop mainly focuses on quantitative data.

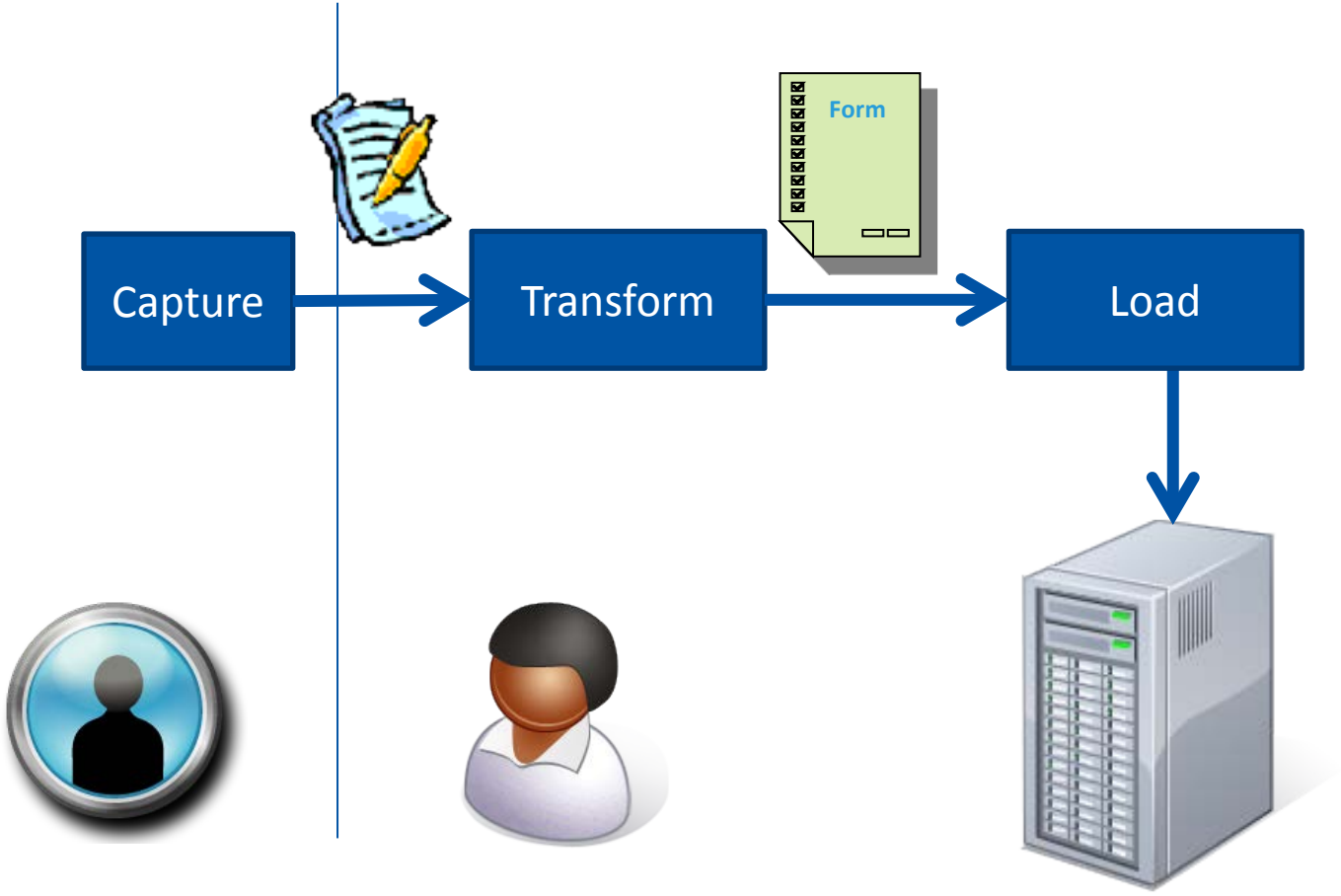
Collecting Data for Decision Making

- Our need for information and the quantity of information available to us are expanding rapidly.
- Managers and experts need to collect the right quantity and quality of information as a basis for sound decision making.

Collecting Data for Decision Making

- A sound method for collecting and managing data needs to be:
- objective;
- logical; and
- a well-planned system.

Collection Process



Where Does Data Come from?

- Much of the information that is the basis of decision making for an organization comes from its routine, everyday operations.
- However, routinely available information is not always enough for important decisions.
- In that case, the organization needs to get the information from other sources or through additional research and observation.

Where Does Data Come from?

- To determine the source of data, we need to identify the “object of interest”: what is it that we are interested in?
- In the world of aviation, the object of interest is related to an “aviation entity” or where aviation activities are conducted.

Aviation Entities

- Organizations: airlines, maintenance organizations, training organizations
- People: licensed personnel, qualified inspectors
- Physical entities: airports, aircrafts
- Virtual entities: airspace

Digitization

Event

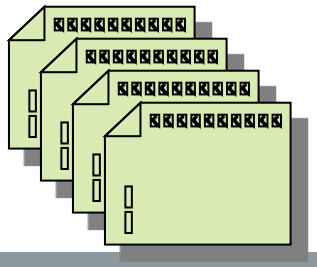
Airport

Airline

Collect characteristics about entities

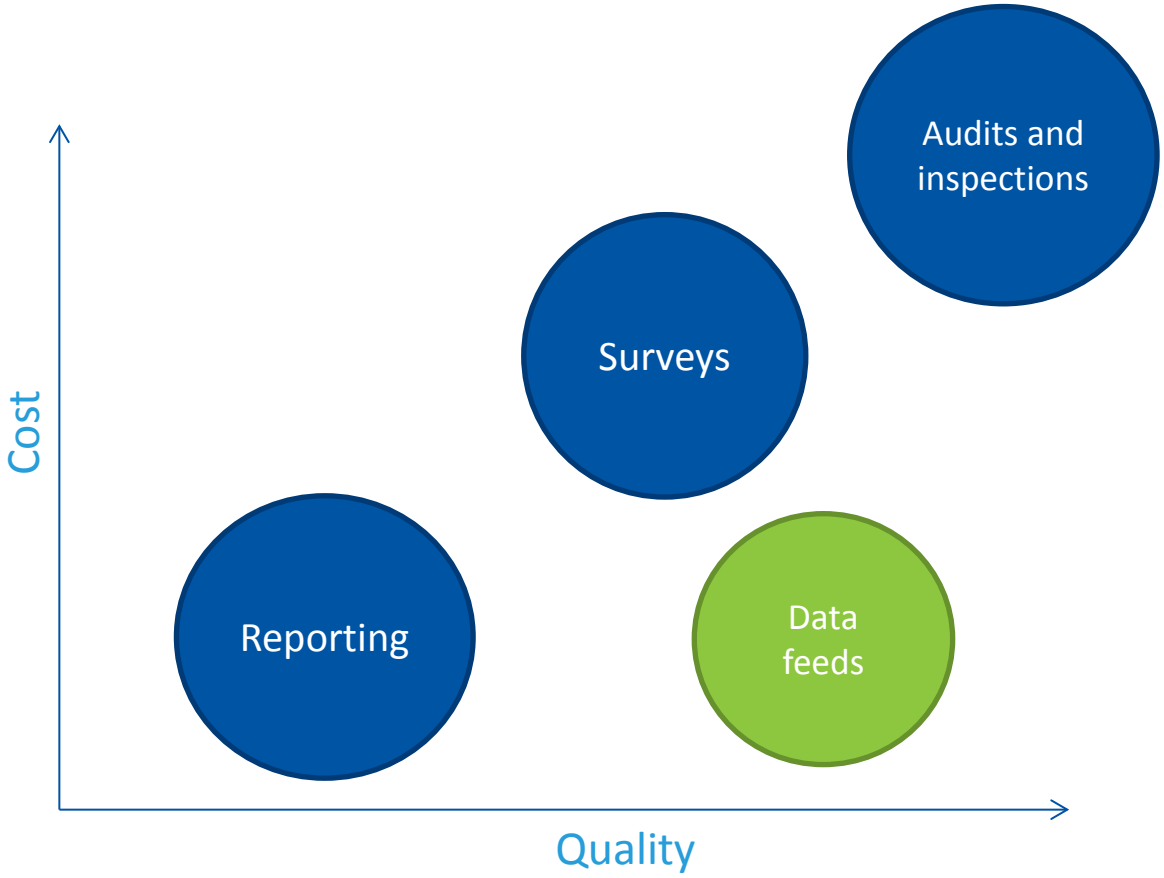
Database

Entity records



Collection Methods

- **Proactive**
  - Surveys
  - Audits
  - Inspections
- **Reactive**
  - Reports
- **Automated**
  - Data feeds



Data Feeds

- Data feed is a mechanism for users to receive updated data from data sources.
- It is commonly used by real-time applications in point-to-point settings (from a source to a destination), as well as on the World Wide Web. The latter is also called web feed. News feed is a popular form of web feed.

Audits and Inspections

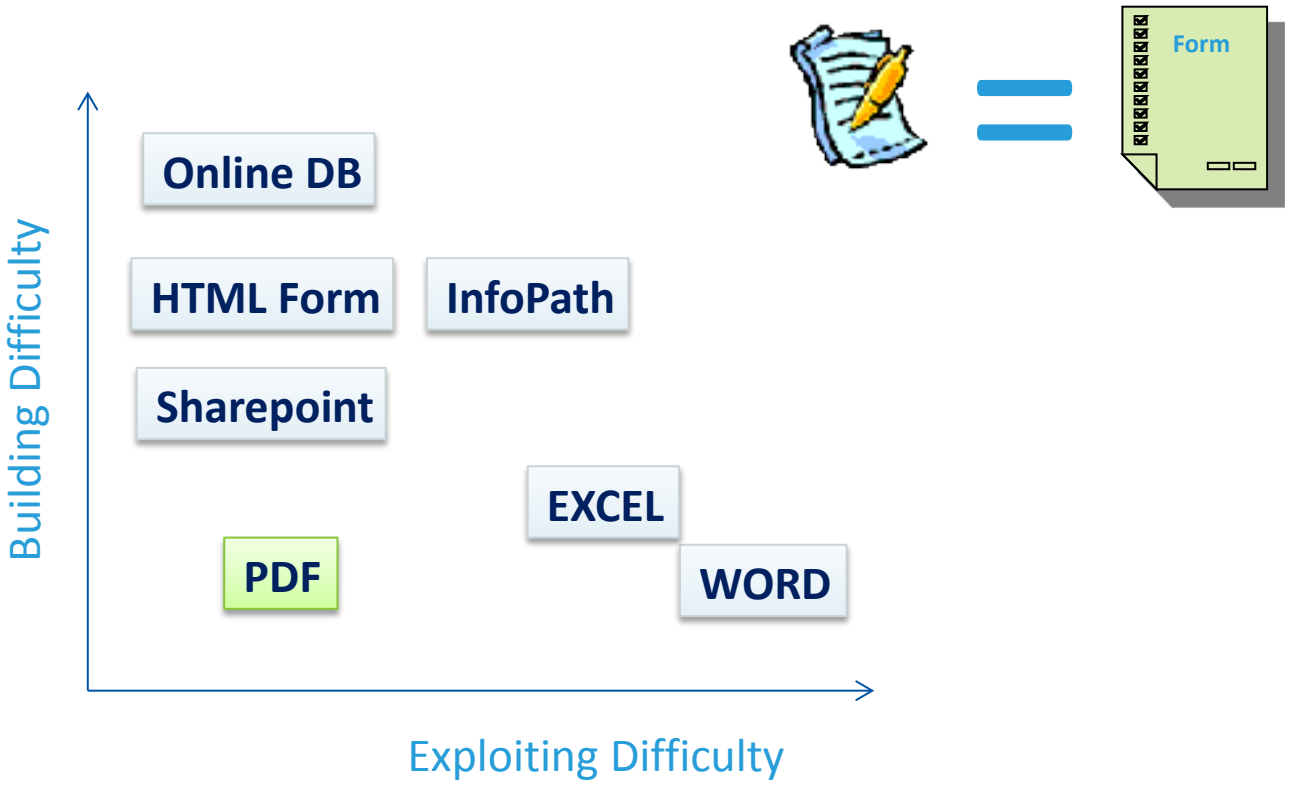
- An audit or inspection needs a checklist with questions.
- Each question must be either "Yes/Satisfactory/Good", "No/Unsatisfactory/Bad" or "Not Applicable/Not asked".
- There can only be one finding per question.
- A score can be calculated for each audit or inspections and expressed as a percentage (from 0% to 100%):

$$\text{Score} = \frac{\sum Yes}{\sum Yes + \sum No}$$

Examples

- USOAP Protocol Questions
- SSP Gap Analysis Questions

Electronic Forms



Form Design Principles

- Only ask for data you really need to generate information.
- Avoid multiple value fields (e.g. occurrence category).
- Allow multiple ways to submit (print, email, online).
- Support multiple IT systems (Mac, MS, iPad, etc.).
- Do not ask for subjective information.
- Keep the value lists limited (less than 8).

The Right Quantity of Data

- How much data is the right amount?
- The quantity of data can be determined based on “width” and “depth”.
- These depend on the object of interest and the needs of the organization.

Data Width

- The width of the data is the number of information fields in it.
- For example, a person's data may include: name, age, gender, place of birth.
- The same person's data collected for another purpose may include: name, age, gender, place of birth, education, profession, contact information.

Data Depth

- The depth of the data is the amount of the information being collected.
- For example, do we need data for 100 people or for a 1,000 or for 10,000?
- Or do we need data for the last 6 months, 5 years or 20 years ?

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THANK YOU