



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**



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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.**

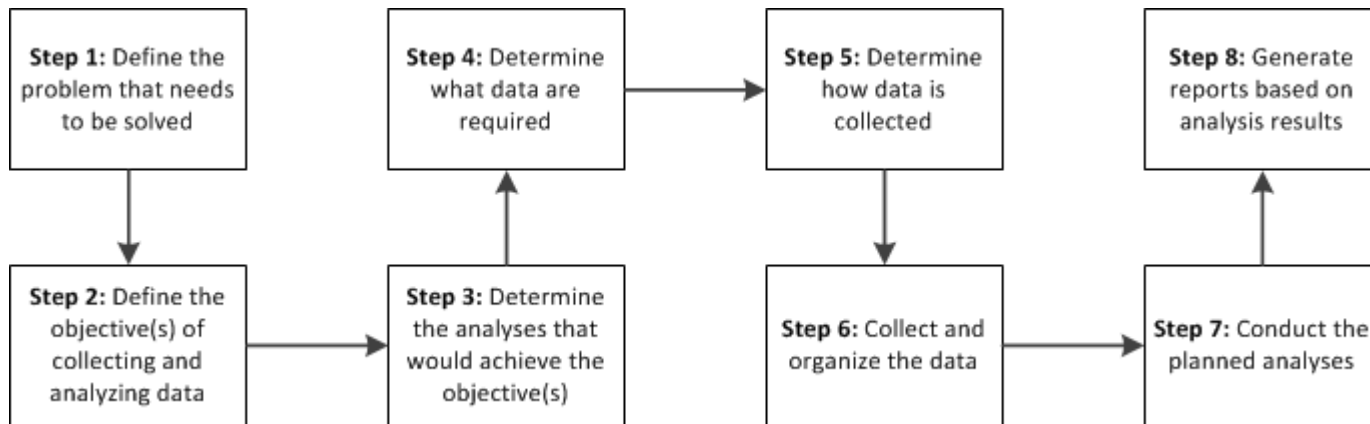


Requirements of Data-driven Decision Making

- **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.**

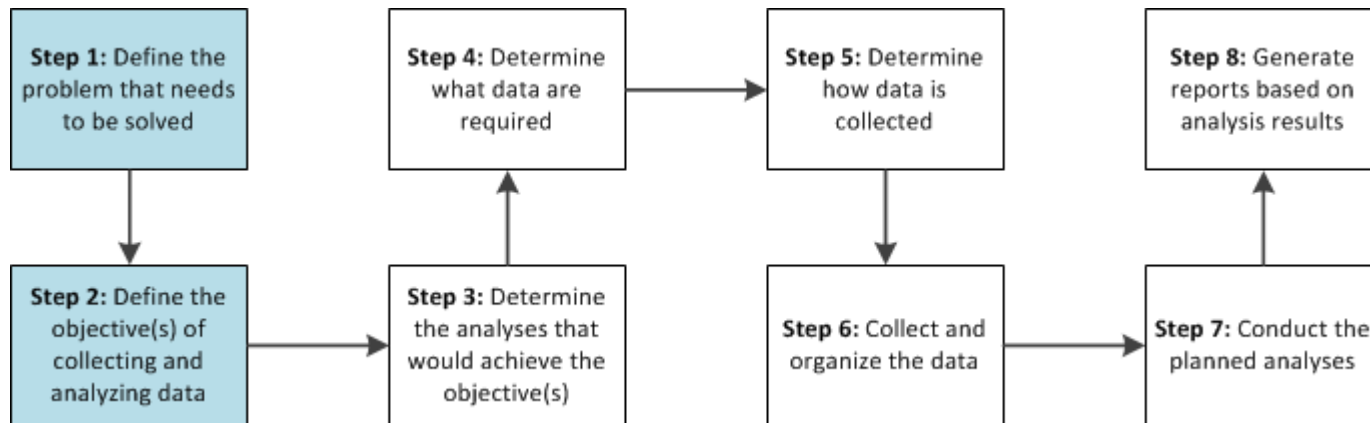
The Process for Collecting and Analyzing Data

- 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?**

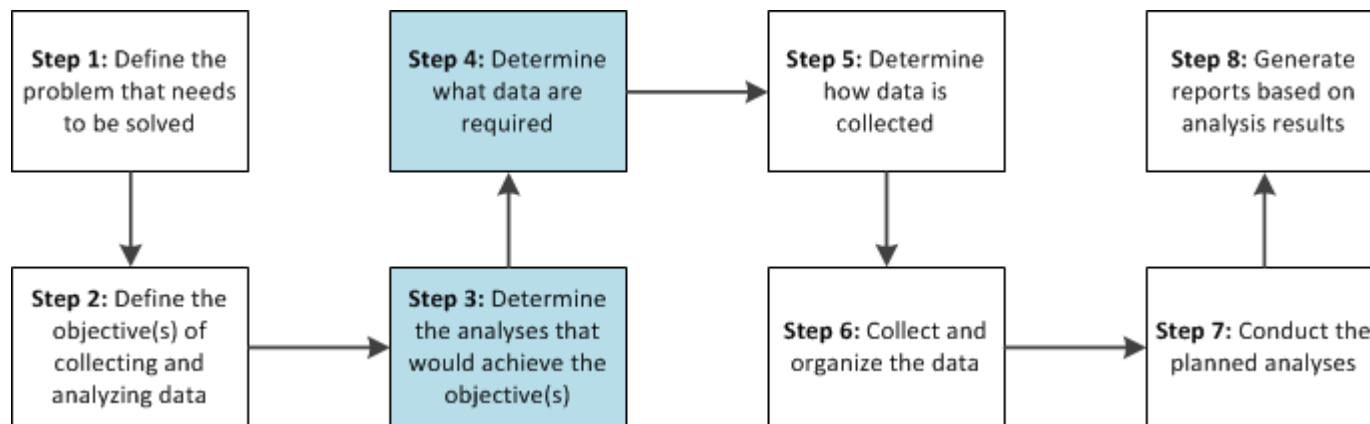


Developing Objectives

- **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 and connections may exist among variables.**
- **They can also tell you how much you can trust the answers you're getting.**

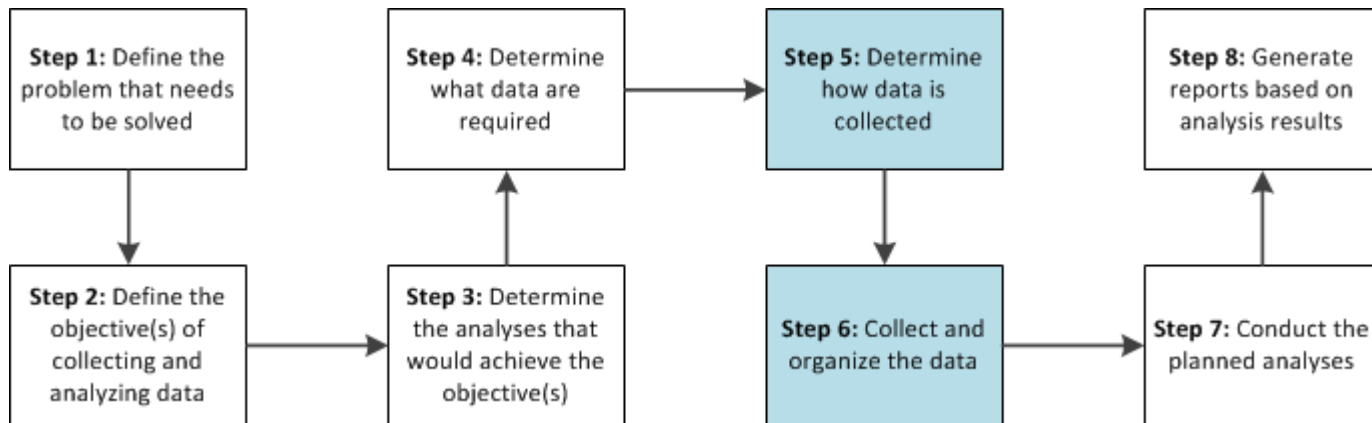


Determining the Analyses (cont'd)

- **Through statistical techniques, you can compare your information to other groups (i.e. a control or comparison group) to help draw conclusions from the data.**
- **The point is to get an accurate understanding of the overall situation.**

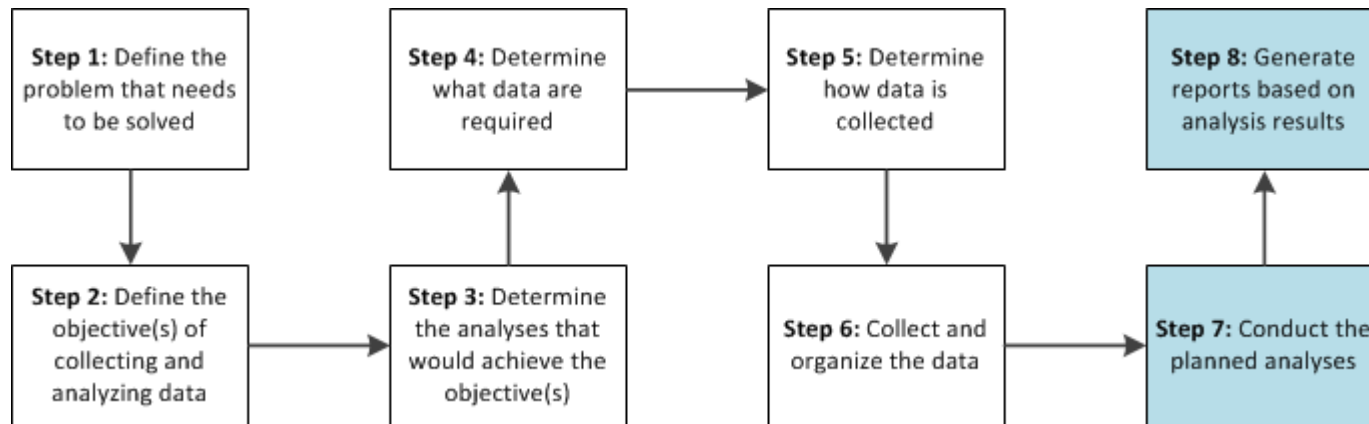
The Process for Collecting and Analyzing Data

- 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 3 and 4.





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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

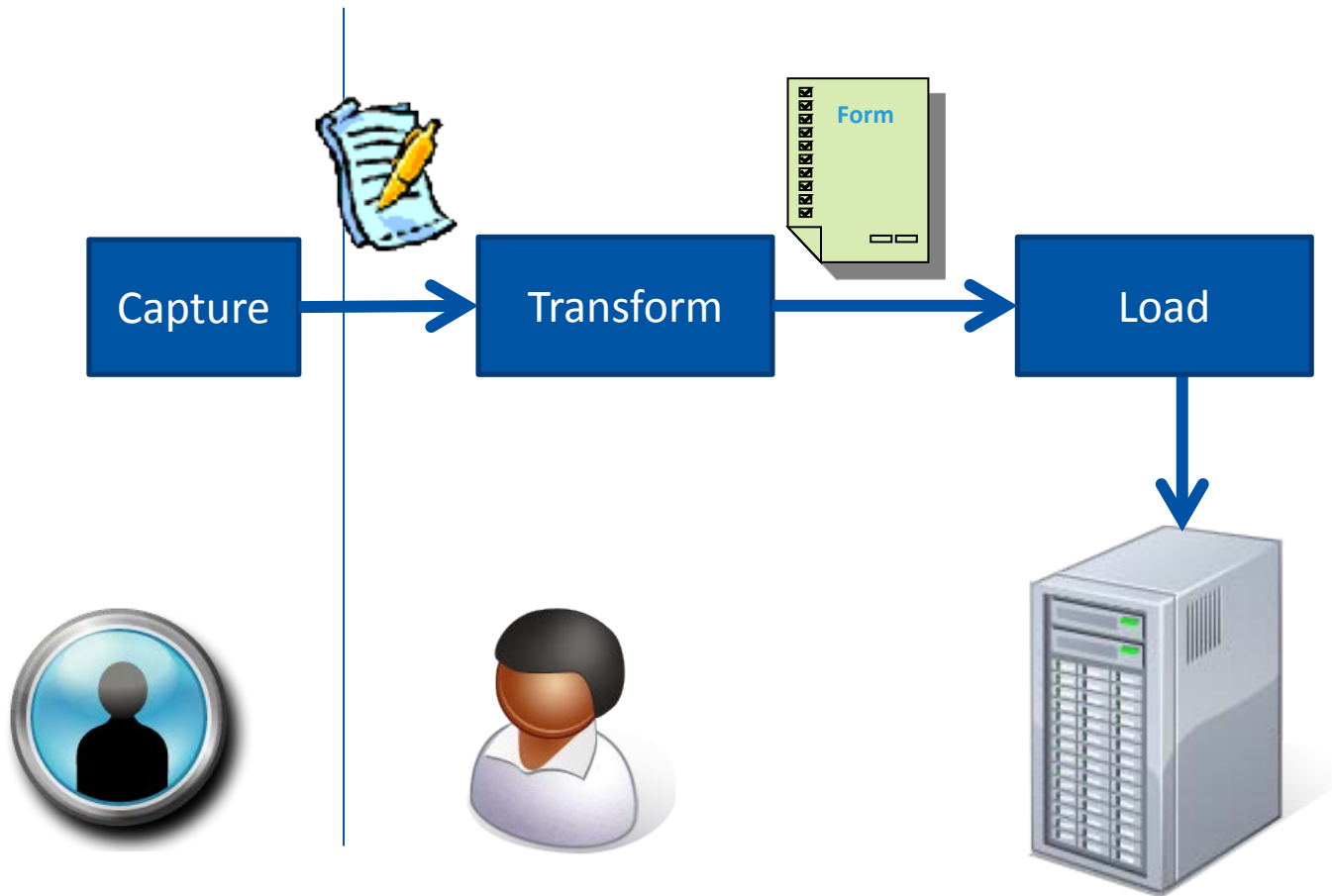
- **Our need for information and the quantity of information available to us are expanding rapidly.**
- **Managers and experts need to collect the right quantity and quality of information as a basis for sound decision making.**



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



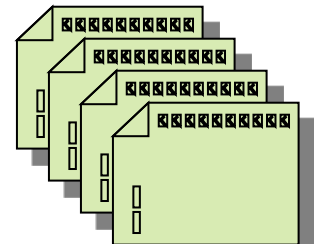
Airline



Database

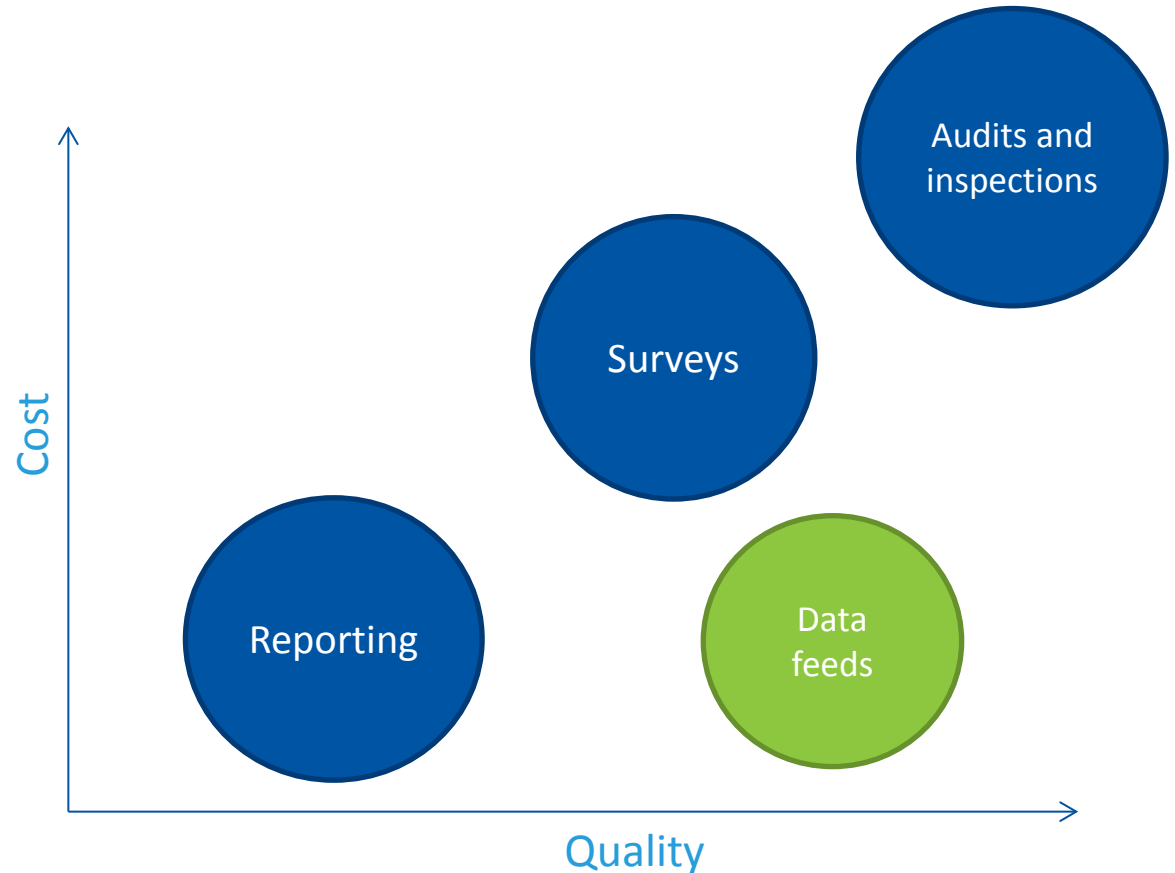


Entity records



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%):

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

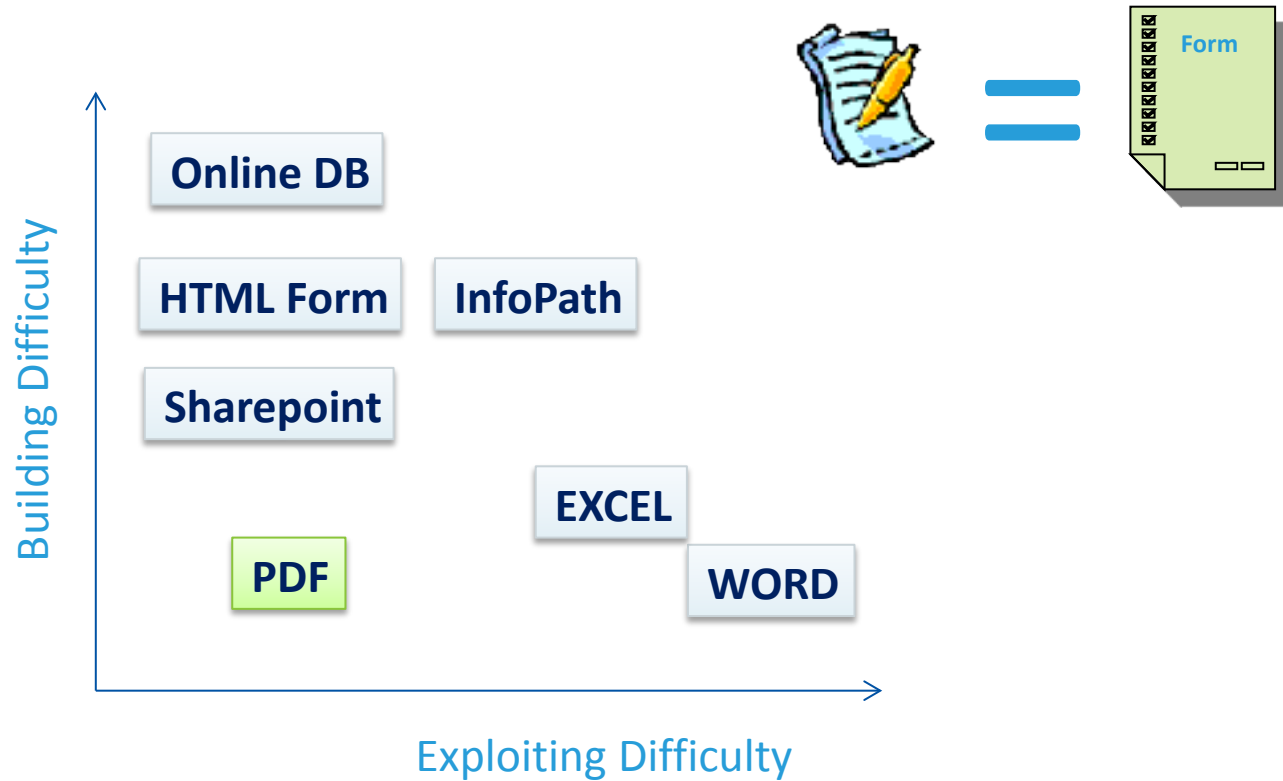
Examples

- **USOAP Protocol Questions**
- **SSP Gap Analysis Questions**

Data Feed Sources

- **Accidents and incidents**
 - Aviation Safety Network
 - Aviation Herald
 - ASCEND
 - iSTARS ADREP
- **Traffic**
 - FlightStats
 - iSTARS State Traffic
- **ADS-B Positions**
 - FlightStats
- **Flight Schedules**
 - FlightStats
- **Airport Information**
 - iSTARS Airports
 - iSTARS PBN
- **Fleet Information**
 - iSTARS Fleet
 - ASCEND / FlightGlobal
- **Terrain Data**
 - NOAA GLOBE
- **METARS**
 - NOAA

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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