



Data-Driven Decision Making

A Practical Guide

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Are you looking for solutions that help **your company** make **better business decisions** by using data and analytics?

Many companies constantly produce a huge amount of data, but the data is not utilized in an optimal way – understanding the data can make decision-making easier.

Carefully considered reports and dashboards promote and enhance decision-making. By tracking a variety of metrics or key performance indicators, companies can analyze the performance of their operations and identify which functions in particular need fine-tuning or larger investments. »

Case: Drones as a Service – Coffee Delivery

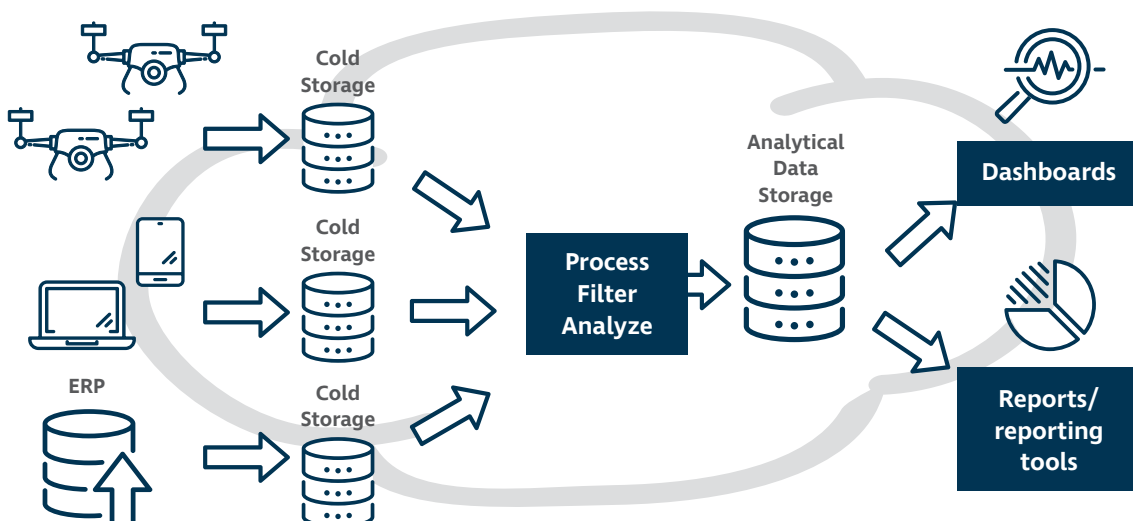
Let's look at an imaginary example case. A coffee shop sells coffee and other beverages delivered by drones. Ordering a cup of coffee is easy – the customer orders the desired beverage with a mobile or web app.

When the delivery starts, the customer receives an estimate of the delivery schedule and can follow the drone on the map. The time estimate is based on information when the next drone is free or a drone with a suitable delivery route is leaving. If multiple orders are leaving at the same time with a similar route, orders are packed into the same drone.

Employees have their own application for order processing. The application contains information related to the loading of the drones and other necessary functions. When the coffee order is packed, the employee is directed to a suitable drone with the mobile app. RFID or QR tags help employees to identify the drones. The drone takes off when the order is finished.

The figure below (see Figure 1) shows how data is collected from the drone company's system, customer and employee applications, and the coffee shop ERP system into separate cold storages.

Figure 1. Coffee shop data architecture: collecting and combining data from different sources



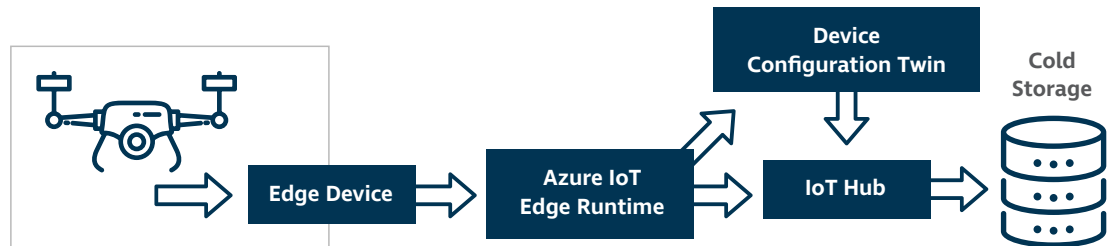
Customers are able to follow the drone route in the mobile app. They also receive a notification when the coffee is delivered. To receive the order, the customer opens the container with an application or code. The drone either returns to the coffee shop or makes the next delivery on its route. »

Monitoring Data

The coffee shop itself doesn't have the knowledge and skills to operate the drones – the drones are bought as Drones as a Service from a special drone company. The drones come with an Azure IoT Edge capable device that sends data to the IoT Hub.

The most obvious data collection point is, of course, the drone itself. In addition, data can be collected from the drone's digital twin, sales, and the mobile app used by customers. Collecting data from the drone and combining it with the digital twin is presented in Figure 2.

Figure 2. Combining drone data with digital twin



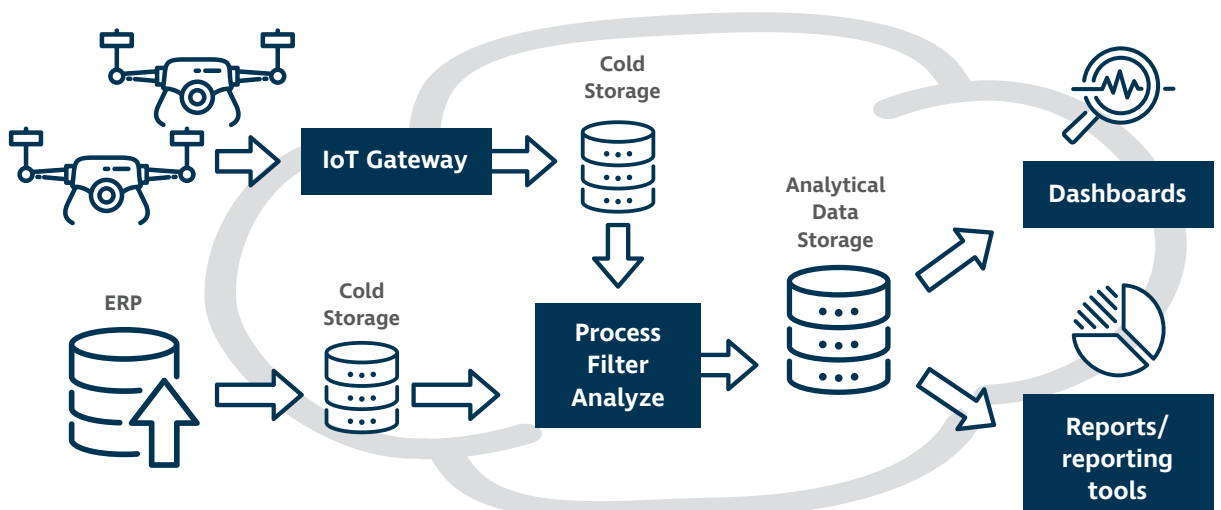
Both customers and coffee shop employees have their own mobile applications tailored to their needs. Through the mobile apps, data can be filtered for many different uses: coffee shop customers can order and give feedback, coffee shop workers can pack the orders and send the drone on the go, and management and marketing will benefit from the report views.

The coffee shop can monitor deliveries and customer satisfaction by using data. For example, they can analyze delivery times and optimize the number of drones used.

Drone flight time and battery consumption are valuable information for the drone company. These metrics can be used to plan the right number of drones for the coffee shop. The drone company can analyze the usage data to determine if the drones are constantly flown in bad conditions, such as low battery, too high altitude or constant bad weather.

As Figure 3 shows, the environmental and drive data is collected from drones through IoT components into cold storage. ERP data is collected into separate cold storage and processed (filtered and formatted) with IoT data into Analytical Data Storage.

Figure 3. Drone company data architecture: collecting and combining data from different sources



Key Performance Indicators for the Coffee Shop

Key Performance Indicator (KPI)

is a measurable value that shows how effectively a company can achieve key business goals. KPIs are usually not direct monetary quantities, although there is a high correlation to a company's profitability. KPIs also allow results to be monitored continuously without the need to first produce financial statements.

When the coffee shop starts cooperation with the drone company, it needs to determine how many drones are needed to keep everything running smoothly and costs to an optimal level. If the number of drones is too large, the costs will become too high. If, on the other hand, there are not enough drones, customers will have to wait too long for their coffees.

How should the coffee shop optimize the use of time? Does the coffee shop actually spend more time waiting for a free drone or making coffee? The problem could be solved, for example, by the mobile application indicating the time left to wait for a drone.

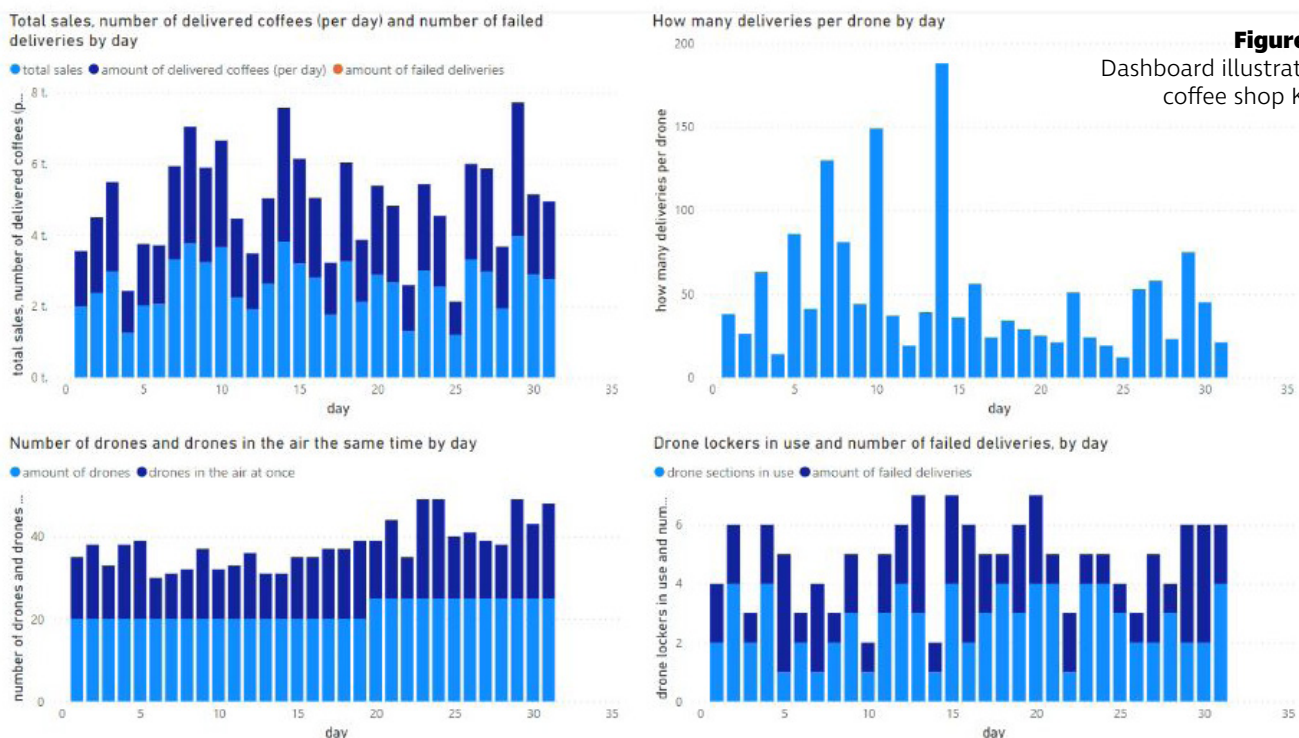
One of the most important KPIs for the coffee shop is **the number of delivered coffees per day**. In addition,

failed deliveries must also be considered. For example, the delivery may fail because the waiting time is too long – hot coffee has cooled down or the customer is no longer available.

It is also important to monitor **how many deliveries one drone can make at once** and **how many drones there are in the air at the same time**. The coffee shop needs to find out how many beverages it makes sense to carry in one delivery. Delivering more than one beverage requires careful monitoring of temperatures and delivery times. In order for multiple deliveries to be delivered on a single drone, the drone must have multiple code-lockable lockers.

How far can the drone fly so that the coffee is still warm and drinkable? This means that **the number of lockers on a drone** must be considered. If the measurements show that coffee stays warm during delivery, then more lockers can be used in one drone. Based on the collected data, it is possible to estimate how many deliveries can be made in one trip.

The charts (see Figure 4) illustrate key performance indicators.



Key Performance Indicators for the Drone Company

In order for everything to work smoothly, drones also need regular maintenance. The digital twin of a drone has the drone's current state and service history. The coffee shop receives information from the drone company when the drones require maintenance. They are either picked up or flown to the maintenance shop when needed.

Effective and preventive maintenance requires accurate indicators of the drone's condition. In this case, the maintenance of the drones can be anticipated and the necessary

maintenance can be done at the right time. Important KPIs for the drone company are **the number of drones needing maintenance** and **when they actually need maintenance service**.

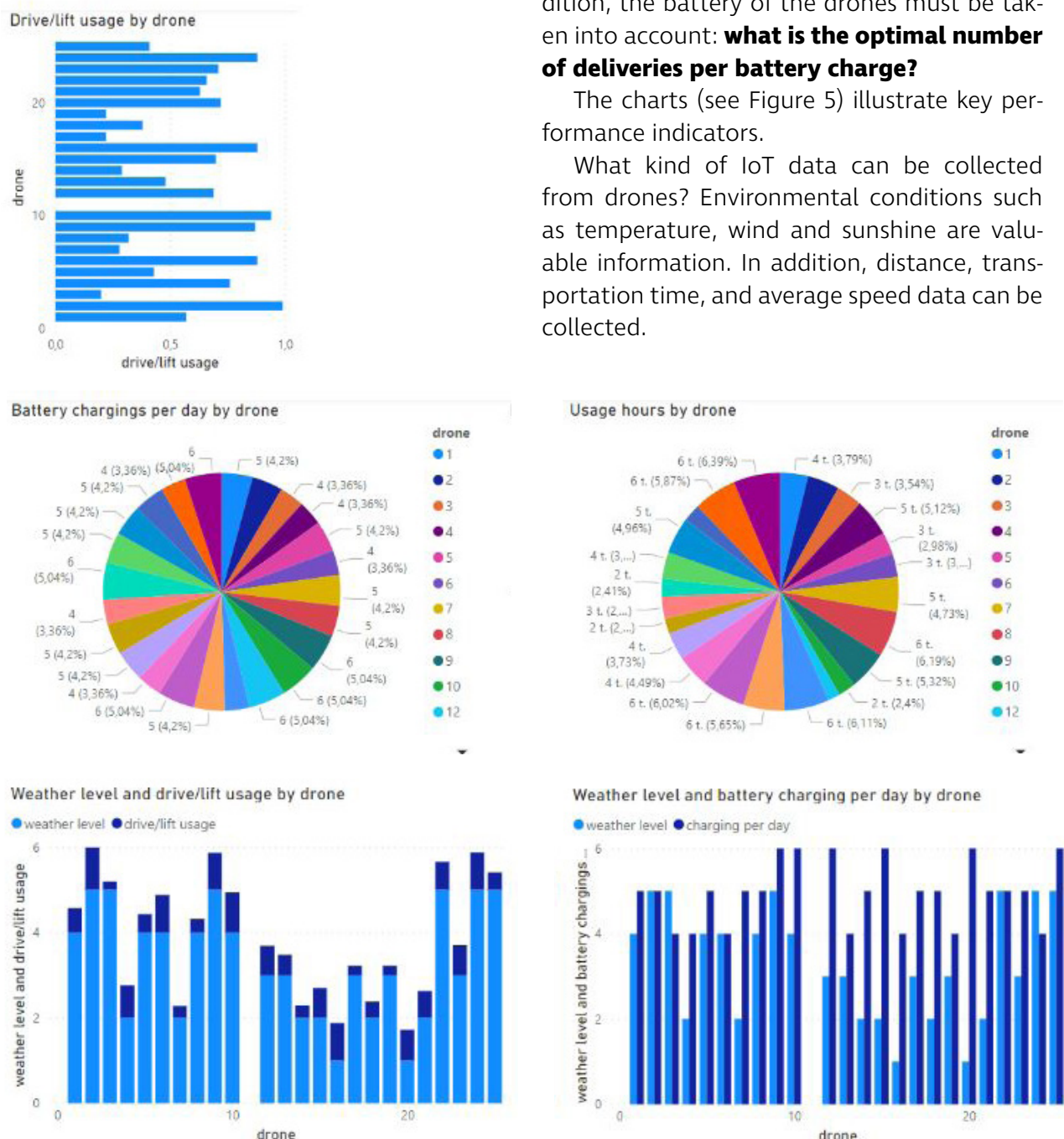
Drones that have flown full hours in bad conditions or the load has been too heavy will probably need maintenance earlier. Therefore, **the load factor of the drones** should be taken into account.

It is a good idea to find out **the percentage between occupied drones and idling drones**. Important KPIs for drones are **usage hours** and **load balance over the drone fleet**. In addition, the battery of the drones must be taken into account: **what is the optimal number of deliveries per battery charge?**

The charts (see Figure 5) illustrate key performance indicators.

What kind of IoT data can be collected from drones? Environmental conditions such as temperature, wind and sunshine are valuable information. In addition, distance, transportation time, and average speed data can be collected.

Figure 5. Dashboard illustrating drone company KPIs





Practical **Guidelines**

In the following we give a few practical guidelines for establishing an efficient data-driven enterprise architecture.

Practical **Guidelines**

1. Collect Data into One Place

The main principle is to collect all data from different sources into one place. This allows analysts to access all operational data in one location. If analysts always needed to start with connecting to multiple data sources based on different technologies, their jobs would become too difficult and producing new reports and dashboards would take much longer.

First, data is collected from different sources to separate cold storages. Existing storages may be used if data retention is not a problem. All relevant data should then be copied into a single Analytical Data Storage by filtering the necessary data for reporting and decision-making. Formatting can be done by using the same units and scales.

2. Include Your KPIs in Reporting

A KPI is a measurable value that shows how effectively a company can achieve key business goals, but usually not a direct monetary quantity (such as revenue).

To make data-based decisions easier, it is a good idea to focus on KPIs and include them in your dashboards and reports. In our examples, both the coffee shop and the drone company have included KPIs in the reporting view and dashboards.

3. Make User-friendly Dashboards

Make your dashboards and reporting systems user-friendly for the target end users. Use visualization techniques such as charts, make comparisons with relevant reference data easy, etc.

Seeing and understanding the gathered information makes it possible to build machine learning models and intelligent systems. If the information remains only in the source system, it is difficult to analyze and can even be impossible to convert into relevant business information. »

4. Include Stakeholders in the Reporting Design Process

It is important to involve business decision-makers in the design of dashboards and reports. Such a user-centered design process is the only way to ensure that analytics produces something that serves their needs and will actually be of use.

New roles and responsibilities may also emerge as information is collected and processed on a regular basis. For example, business-critical information requires a report manager, whose task is to monitor the accuracy of the information being reported.

5. IAM and Permission Control

Identity and Access Management (IAM) and permission control determine what kind of information the companies and employees are allowed to see. For example, the coffee shop doesn't need to access all the technical flight data. However, the technical flight data helps the drone company to assess the need for drone maintenance.

On the other hand, all relevant information needs to be easily accessible to those who need it. Too strict a policy can easily prevent the development of useful dashboards and reports. Instead of creating a separate solution for data collection and presentation, integrate it with the organization's existing infrastructure.

6. Create Architecture for Analysts

This guideline actually summarizes all of the above guidelines 1–5. Many organizations start doing data analytics by just starting to produce the first dashboard they come up with, skipping the architectural design part. This will almost certainly lead to a situation where each new report or dashboard always needs a considerable amount of work and IT expertise. However, in a well-designed analytics architecture, and with the right tools, even business decision-makers themselves could eventually craft new reports for their needs.



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