



2. DATA VISUALIZATION METHODS

The chapter discusses data visualization and its use for more effective and accurate data analysis. The most important issues of this chapter include:



- the needs for using data visualization and its benefits,
- types of data visualization – when and what visualizations to use,
- comparison of charts with respect to their properties,
- describing dashboards,
- describing the concept of building dashboards.

2.1. Introduction

Nowadays, it is impossible to imagine the functioning of the world without data analysis. With the abundance of information available, data visualization is one of the most important tools that help understand it, make conclusions and, as a result, make business decisions (Buono, 2016). Visualization methods help analyse data and transform it into information and knowledge about business. Thanks to data visualization, it is easier to make business decisions based on about facts, not just a feeling (Graudina & Grundspenkis, 2005). The data visualization methods themselves develop with the development of technology, mainly BI tools. It was the development of BI that popularized Dashboards, which allow users to analyse and monitor data in real time (Tezel et al., 2009).

This chapter covers the selection of different types of charts and discusses the process of creating dashboards. There are many types of charts, including column charts, bar charts, line charts, pie charts, area charts, stock charts, surface charts, radar charts, donut charts, point charts, funnel charts, scatter charts, but also histograms, heat maps and tree maps. The choice of chart should be adapted to the type of data being analysed and should be conditioned by the need for the analysis being performed.



All kinds of data visualizations allow for better understanding. Visualizations allow you to pay attention to the most important things, deviations and trends. Additionally, presenting data on charts, maps and dashboards converts data into information, which may result in getting closer to the knowledge needed to make business decisions (Hansoti, 2010).

2.2. Data Visualization methods

Column charts

Column charts (vertical layout) and bar charts (horizontal layout) are some of the most famous and used charts. They use bars to show the value of category data, where the length of the bars represents the value of the data. The higher the value, the higher the bar. Thanks to column charts, you can compare the size of categories and, above all, compare the differences between them. The categories may be time, measurement (e.g. sales, costs, margin), place, location. Charts can be stacked, where several categories will be in one bar per time, or grouped, where all categories will be next to each other. Individual categories can be grouped together (www_2.1).

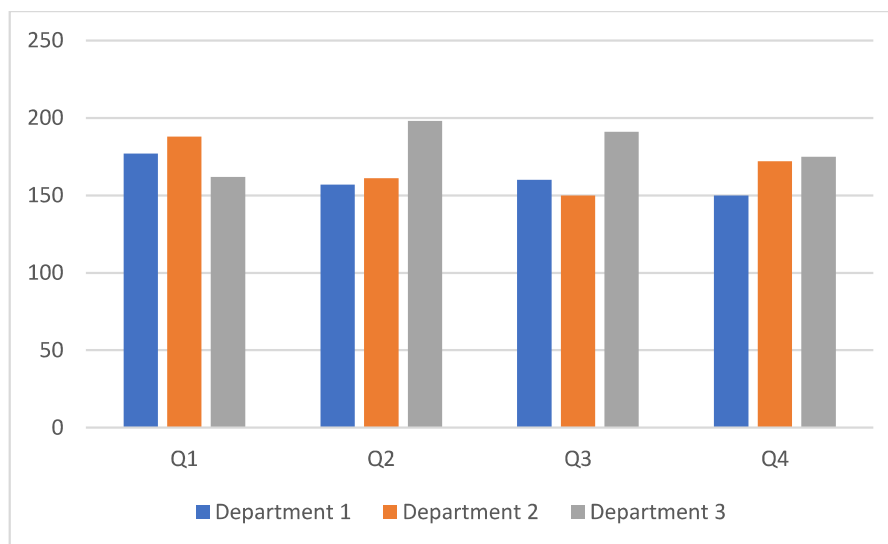


Figure 2.1. Clustered column chart

Source: own study



In the indicated Figures 2.1 and 2.2 you can notice the differences between the stacked and grouped chart. Charts can be grouped together in various ways, so we can look at the same data from different perspectives. Bar charts are often used to present sales results, margins per district, or to present support for political parties during elections.

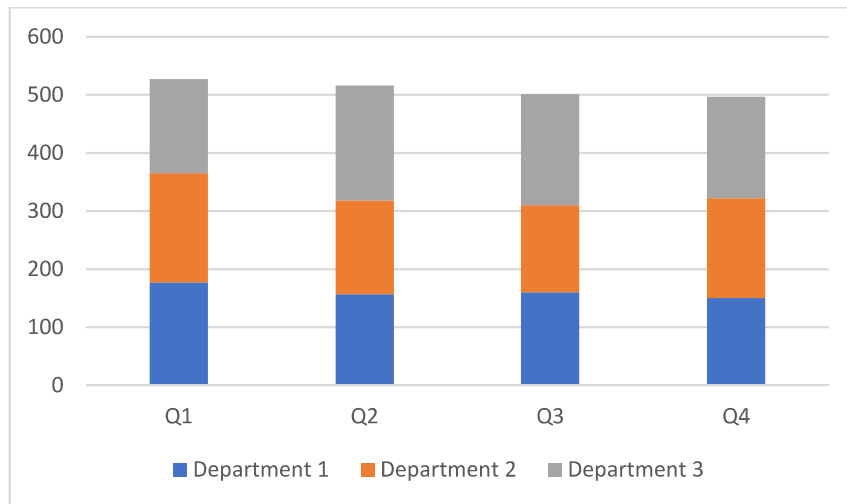


Figure 2.2. Stacked column chart

Source: own study

Pie charts

Pie charts are another popular chart that shows the contribution of different categories to the overall metric. The chart should not be used for time-sensitive data, but is valid for aggregate analysis (year, quarter, month). The chart highlights the dominant category in terms of e.g. sales value (www_2.1).

Figure 2.3 above shows the distribution of sales in a pie chart. The larger the share of the value of the examined category in the whole is, the larger the sector of the circle. The chart can be successfully used when presenting the budget structure or showing the sales structure per division or branch (www_2.2).

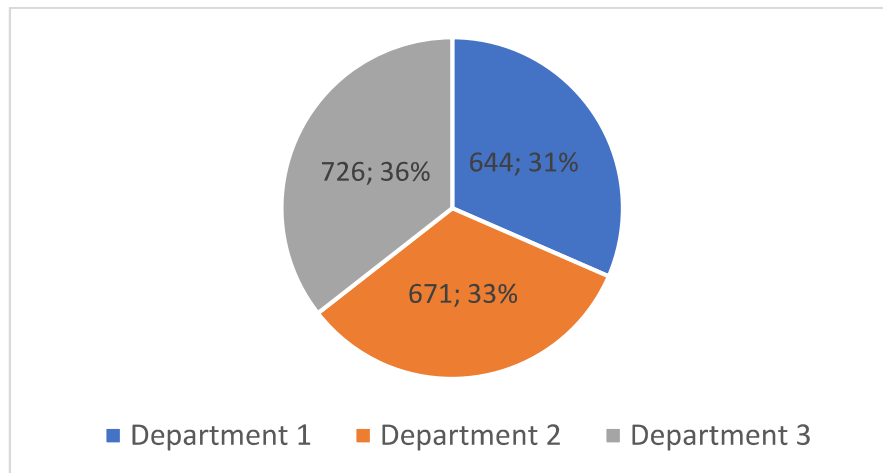


Figure 2.3. Pie chart

Source: own study

Line charts

Line charts are charts that can be used to present data over time. Thanks to this approach, we can easily analyse the trend, trend dynamics, or even forecast values in the future (www_2.3).

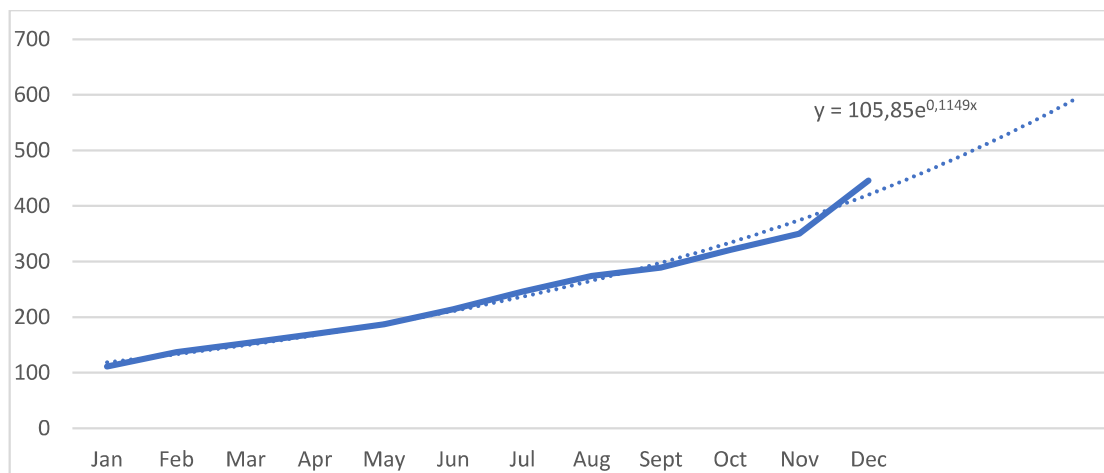


Figure 2.4. Line chart

Source: own study



Figure 2.4 above shows sales per month, demonstrating the exponential trend in those sales. A line chart is a combination of points showing the size of a given category over time. Charts can be used to present currency rates or show the sales trend of a given product (www_2.1).

Stock charts

Stock charts are used to represent stock prices on the stock exchange. The chart is able to show the opening price, closing price and minimum and maximum values at a specific time (www_2.4).

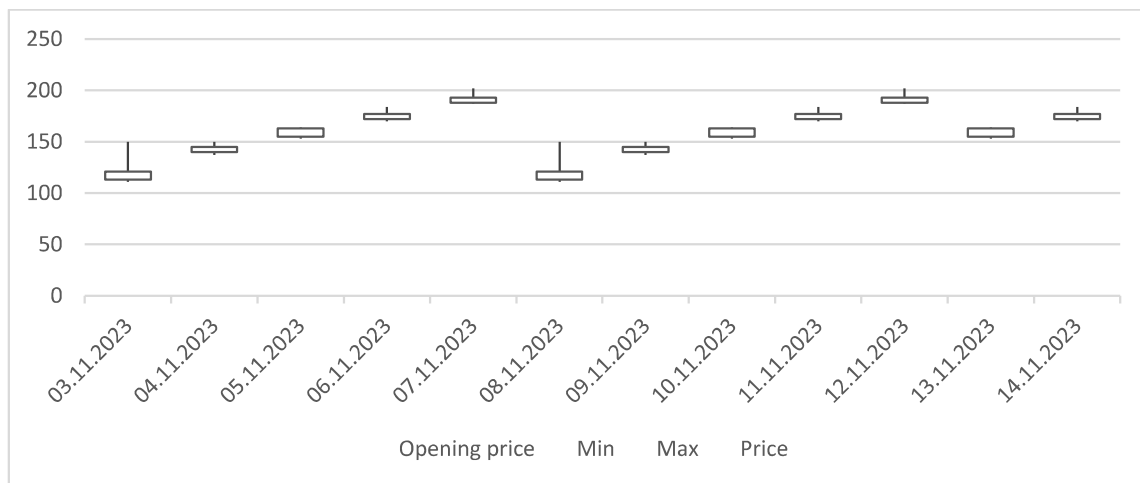


Figure 2.5. Stock chart

Source: own study

Figure 2.5 below shows the opening and closing price of the stock from November 3 to November 14, 2023, along with the maximum and minimum values in this range. The chart is used to present stock prices and currencies (www_2.2).

Surface charts

Surface charts give you the ability to present three-dimensional data on a two-dimensional graph. They allow you to show two independent variables with one dependent variable. The dependent variable is shown using different colours or heights. The chart can be used, for example, to model the topography of a terrain (www_2.5).



Radar charts

Radar charts are used to show multiple variables for selected categories. The chart is not used in a time perspective, but is used to assess a given category, e.g. to assess the skills of a sports player and his skills, but also to assess whether the service provider meets the criteria (www_2.4).



Figure 2.6. Radar chart

Source: own study

Figure 2.6 above shows a radar chart that evaluates the individual features of each supplier. The chart allows you to compare them with each other in order to choose the supplier best suited to the needs of the analysing entity.

Histograms

Histograms can be used to present the distribution of numerical data, which improves understanding of the distribution around the mean value and allows the identification of group sizes. Histograms are used for statistical research, including examining distributions in a given population (www_2.2).

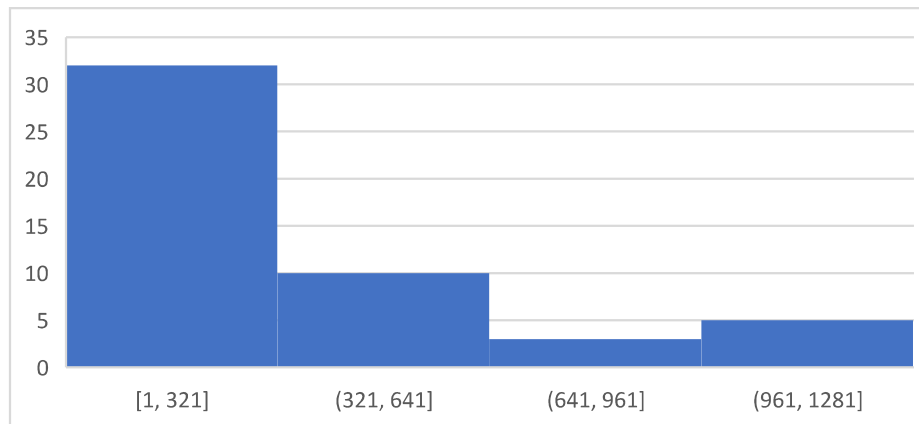


Figure 2.7. Histogram

Source: own study

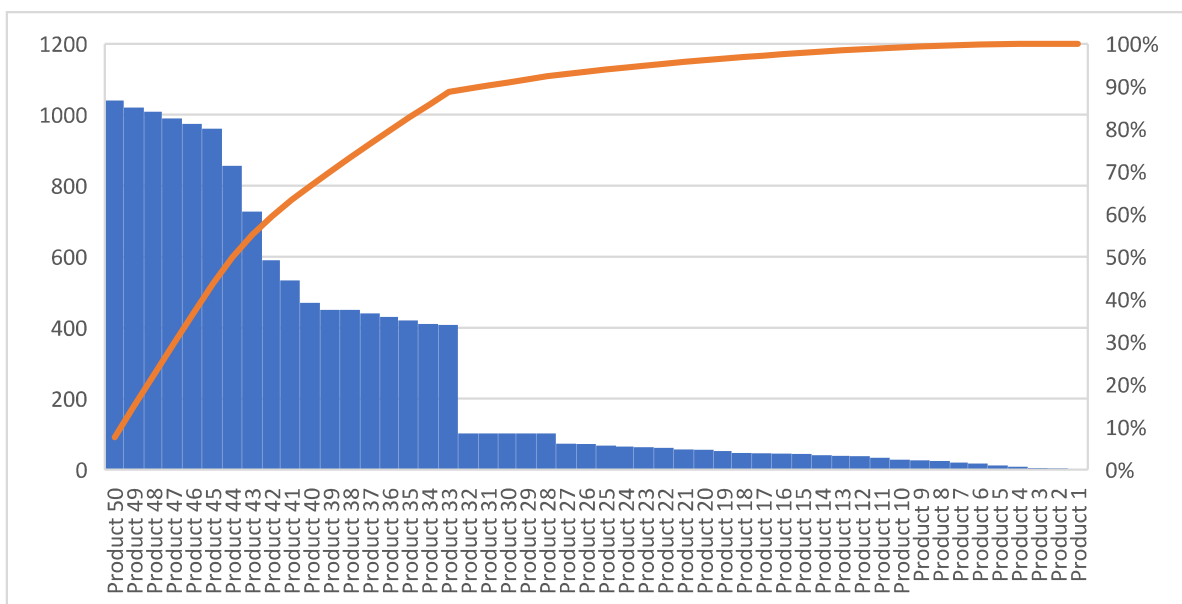


Figure 2.8. Pareto chart

Source: own study

Figures 2.7 and 2.8 above show the sales distribution using a histogram, Pareto and Lorenz curve. There are 4 distribution groups visible, where the largest pool consists of the smallest customers. Using Pareto chart you can pay attention to how many first customers are responsible for what percentage of sales.



Heat maps

Maps are used to visualize data taking into account geolocation or territorial units. The marked areas become increasingly darker in colour with higher values. Maps can also contain various types of charts. You can also plot a time axis on maps, so you can observe changes in values for a selected location (www_2.4).

Figure 2.9 above shows a heat map highlighting sales per region. It can be seen that the highest sales are in the Lubuskie Voivodeship in Poland.

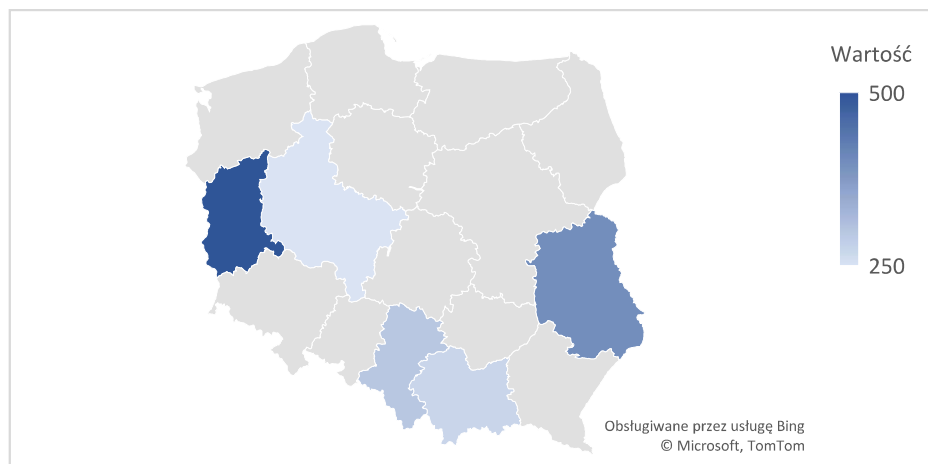


Figure 2.9. Heat map

Source: own study

Combo chart

Combo charts are a combination of several of the charts listed above. They can be used to visualize various data. In such charts, you can use an auxiliary data axis for more convenient data visualization. Such a chart can be used to analyse, for example, sales and profitability (www_2.2).

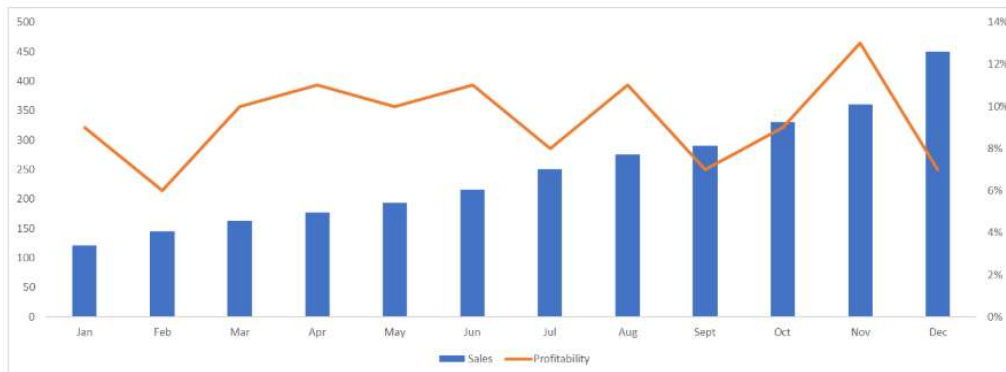


Figure 2.10. Combo chart

Source: own study

Figure 2.10 above shows sales with profitability using a secondary axis. The chart can be used for many analyses where there is a need to use different charts.

Dashboards

Dashboards are a collection of many charts, maps and tables that enable you to monitor and analyse data, KPIs and operational and financial results. Dashboards can present results in real time and can be fully flexible and cascading. The interactivity of dashboards allows you to deepen your analyses and move from general to specific. The purpose of Dashboards is to support business management, i.e. the data must provide information needed to make business decisions (www_2.2).

Dashboards can be compared, as the name suggests, to a car's dashboard, which contains the most important information, indicators, meters and trends regarding the data being examined (www_2.6). Interactivity, i.e. data filtering, the ability to go from general to specific, is the distinguishing feature of dashboards. Any type of interactive buttons/filters should be user-friendly and easy to work with on a daily basis (www_2.6).

Dashboards enable quick and effective decision-making for executives, analysts and managers by providing information on process performance, so that all dashboard recipients can better understand the business. An additional benefit is tracking the achievement of goals and focusing on the most important information. Another advantage is that you can easily



isolate the least effective process stages or the largest deviations from goals, which allows you to introduce corrective actions much faster. Dashboards have an advantage over traditional reports in that they present data in practice in real time (www_2.7).

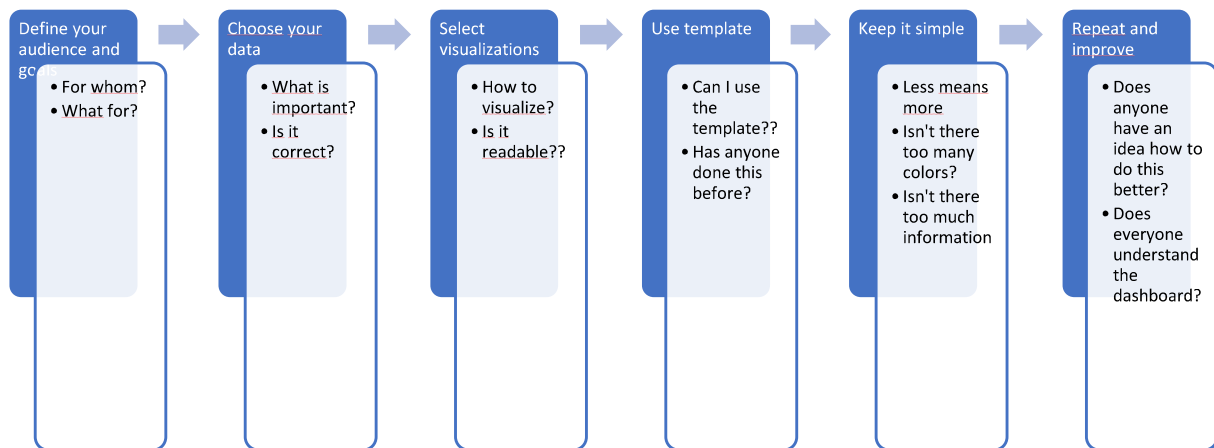


Figure 2.11. How to create a Dashboard

Source: own study based on: (www_2.8)

Figure 2.11 shows step by step how to approach creating a dashboard. The most important thing is to know the reason for creating the report, who it is supposed to help do their job better and what we want to achieve. The next step is to know what data to use and make sure it is correct. The next step is to appropriately adjust the visualization to the data or use available templates. The last steps are the most important, because when creating a dashboard, we must remember that less is more and that the dashboard should be useful to the recipient. This means that it has to be legible, transparent, pleasing to the eye, and that the creator of the dashboard should modify it if the recipient requires it (www_2.8).

Figure 2.12 shows an example of a sales dashboard, showing sales to the largest customers and comparing them to last year. The achievement of sales targets and the division of sales into regions were also taken into account. Sales dashboards allow you to track sales and intervene quickly in the event of unexpected drops or failure to meet the budget.



Sales Performance Dashboard Template 1 of 2



Figure 2.12. Sales dashboard example

Source: (www_2.9)



Figure 2.13. Use of dashboards

Source: own study based on: (www_2.8)



Figure 2.13 shows possible uses of dashboards. There is practically no field in which dashboards cannot be used to improve processes and make the right business decisions. Data visualization using dashboards builds employee awareness of operations in every possible process.

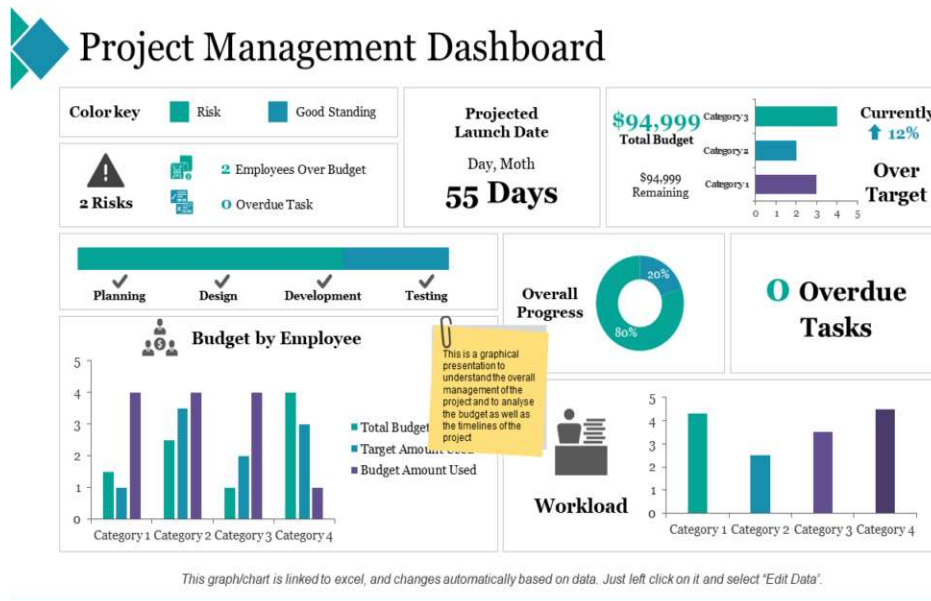


Figure 2.14. Example of an operational dashboard

Source: (www_2.10)

Figure 2.14 shows an example of a dashboard supporting project management. The visualization supports the preview of work progress and indicates at-risk stages. The visualization uses several types of charts that are graphically consistent with each other.

Dashboards are easiest to create using programmes such as Power BI, Qlik, Tableau, Google Data Studio and other Business Intelligence tools. Additionally, an alternative option is to use the most popular "spreadsheet", i.e. MS Excel.

2.3. Comparison chart types

Data visualization is the ability to get to know data and extract knowledge from it that supports running a business. The appropriate selection of charts, maps or comprehensively



created dashboards can build a competitive advantage. The tools should make it possible to go into the details of the analysis, so that the recipient of the visualization is able to draw interesting conclusions.

Table 2.1 compares the properties of chart types that can be used for data analysis. Based on the table, you can select the appropriate type of chart for your needs.

Table 2.1. A table comparing chart types according to their properties

Chart Type	Suitable for trend analysis	Correctly shows the measure of time	Perfect for comparing category sizes	Effective in showing percentage data	Good for presenting relationships between variables	Accessible to the general community
Column	No	Yes	Yes	Yes	No	Yes
Line	Yes	Yes	No	No	Yes	Yes
Pie	No	No	Yes	Yes	No	Yes
Area	No	No	Yes	Yes	No	Yes
Stock	Yes	Yes	No	No	Yes	Yes
Surface	No	No	No	No	Yes	Yes
Radar	No	No	Yes	No	Yes	No
Scatter plot	No	No	No	No	Yes	Yes
Histogram	No	No	Yes	No	No	Yes
Heat map	No	No	Yes	Yes	No	Yes
Combo	Yes	Yes	Yes	Yes	Yes	Yes

Source: own study



Chapter Questions

1. What are some of the challenges that can arise when creating dashboards?
2. Does the choice of chart type affect data interpretation and decision-making? Explain your answer.

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