UNLOCKING SUCCESS:
Transforming Business Insights with Visual Financial Analysis and Sustainable Development using Power BI

Edited by ANDRZEJ NIEMIEC

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Introduction

Financial analysis is a research method that aims to describe, understand and solve or just explain the problem or process under study by separating its components and analysing them from different perspectives. It is a process used to discover a complex phenomenon's regularity by dividing it into simple elements, studying their properties and the relationships between them. Therefore, financial analysis is a scientific process involving breaking down the studied object into its components in order to understand complex phenomena and processes by analysing the causal relationships between them (Sierpińska, Jachna, 2004, p. 11). Currently, financial analysis includes not only structural analysis (division into components) but also synthesis, which involves seeking optimal combinations of a new structuring of reality.

With the development of technology, financial analysis encounters new challenges, such as:

- Complexity and data integration: The large amount of data available for financial analysis can lead to increased complexity and difficulties in integrating different data sources.
- Data protection and security: Processing and storing large amounts of financial data entail greater risks of security breaches and confidentiality breaches of such information.
- Big data analytics challenges: Big data analytics requires advanced data analytics tools and techniques to extract meaningful insights.
- Development of the analysts' skills: Visualisation-based financial analysis requires new analytical skills, such as interpreting visual data and utilising data visualisation tools.
- Importance of interpretation and recommendations: Visual financial analysis enables the rapid generation of results, but proper understanding and interpretation of these results and providing accurate recommendations become crucial.
- Changes in the role of financial analysts: Financial analysts are becoming more advanced users of analytical tools and are responsible

for creating and developing financial models, as well as delivering high-quality analyses and recommendations.

In the past, financial analysis relied mainly on financial reporting, which is aggregated data representing a longer period of time. Currently, along with technological development, data is collected in its original form, i.e. as records in accounts, entries from HR systems or records from other databases, which can be combined and aggregated. This is a significant difference compared to the classic financial analysis. Therefore, financial analysis is widely automated thanks to the use of specialised Business Intelligence (BI) software, which enables the collection and combination of data from various sources.

As a result, we are witnessing the birth of a new form of financial analysis – visual analysis. The birth of visual analysis can be associated with the development of information technology and the growing availability of economic data. Visual financial analysis consists in basing the entire analysis on a financial model created in the BI environment. This model reflects the data structure and functioning of the enterprise. Thanks to this, many stages of classic financial analysis, such as division into components of the study or component analysis, can be automatically performed by the system.

In the subject literature, the issue of visual financial analysis has not been examined and described. The process of financial analysis using BI tools requires a broader characterization. Visual analysis breaks the principle of the unity of the analyst's institution and separates the analysis process in time and space. This currently necessitates the redefinition of financial analysis.

The aim of the study was to define visual financial analysis and determine its essence. The realization of this objective was the subject of qualitative research involving interviews and document analysis (Glinka, Czakon, 2021). The research was conducted within a single case study, which involved the implementation of Power BI in the Aesculap Chifa Sp. z o.o. company. The choice of Aesculap Chifa Sp. z o.o. was dictated by the strategy of implementing BI solutions in this company. The selection criteria position the entity as a classic example of digitization processes in Poland, characterized by:

1. The gradual introduction of BI solutions.
2. The issue of assessing the final scale of the digitization process.
3. The challenge of estimating the overall budget for the digitization process.

4. Building competencies concurrently with the introduction of BI solutions.
5. An evolving final outcome of the digitization process. Changes often have an adaptive character in relation to new technological possibilities.

During the literature review, a number of research questions were identified:

1. How did the implementation of solutions change the organization?

In the subject literature, there are many lists of the effects of BI system implementation. However, their large number is not statistically significant (Singla, 2008). Therefore, a revision of the view of the effects of BI system implementation is needed, as well as distinguishing between the causes and effects, mediators, and moderators of this process. For example, achieving strategic benefits from a BI system requires internal and external integration, supported by a high level of business integration and effective resource utilization (Nicolaou, 2004). The effect is therefore not direct.

Among the many issues discussed, the decision-making process appears to be key. Many authors point to the improvement of the decision-making process (Mathrani, Mathrani & Viehland, 2013). This is possible due to quick access to information (Maditinos, Chatzoudes & Tsairidis, 2011, p. 61), increased data detail and accuracy (Otto & Schlager-Weidinger, 2014).

Another change that has been observed is the improvement of coordination between functional departments. In the researchers' opinion, this leads to increased efficiency in conducting operations and reduced operational costs (Wagner, Newell & Piccoli, 2010). The impact on outcomes does not appear to be direct but is confirmed by research results. The effect influencing outcomes is building cost advantage and innovation (Shang and Seddon, 2000). In A.R. Singla's research (2008), this is particularly evident in the areas of inventory and technological cost reduction.

Another element that changes the organization is the improvement and reorganization of communication within the organization (Umble & Umble, 2002; Nah, Zuckweller, Lau, 2003; Sumner, 1999; Singla, 2008). This can lead to a congenial, collaborative, knowledge-sharing culture, and self-motivation (Mathrani, Mathrani & Viehland, 2013). These actions support the organizational learning process.

On the other hand, BI solutions support control processes in the organization. As a result, they contribute to enhanced organizational regulatory compliance (Singla, 2008).

2. In what aspect can BI be considered as an information system?

BI solutions enable the centralization of information from multiple information systems (Otto & Schlager-Weidinger, 2014). Additionally, they integrate information flows and achieve standardization using standard templates that reflect "best practice patterns" (Gosain, 2004). This allows for better control and a more centralized management process. BI solutions facilitate the collection and distribution of data with minimal additional effort, reducing the necessary processing time. They also eliminate previous, more complex solutions in favor of more utilitarian ones (Otto & Schlager-Weidinger, 2014). Through centralization, they allow rapid access to information for decision-making purposes (Maditinos, Chatzoudes & Tsairidis, 2011) and increased detail and accuracy (Otto & Schlager-Weidinger, 2014).

3. In what aspect can BI be considered as an economic model of an entity?

In the literature, BI systems are not mentioned as economic models. However, they do possess certain characteristics because they "present a holistic view of the company, allowing for the sharing of common data and practices in real-time" (Ifinedo and Nahar, 2006, p. 1554).

4. How has the process of financial and economic analysis changed?

This is an unexplored topic. Existing research mainly focuses on the technical aspects of BI system operation (Ibragimov et al., 2015) rather than the actual analysis process.

Visual financial analysis, therefore, appears to have many advantages in this regard. First, the analyst can quickly move from determining the research problem to formulating hypotheses, because the evaluation criterion, measures and reference base are already defined in the financial model.

Secondly, the analysis of the components and the relationships between them can be done quickly through the appropriate selection of data filters and the presentation of the results.

Thirdly, access to data is possible from virtually anywhere using cloud solutions, which means that analysis can be carried out anywhere.

Visual financial analysis focuses analysts' attention on inferences and recommendations. Managers at various levels of management can also use automated analytical solutions, and the role of analysts is to create, maintain and develop financial models, as well as study more advanced management problems.

One of the main effects of visual financial analysis is the shortening of computational elements, which allows analysts to focus on the purpose of the study and on formulating conclusions and recommendations. However, this requires a solid analytical foundation and professional responsibility on the part of the analyst.

5. How do the competencies of analysts and managers change?

It has been observed that BI systems have a positive impact on the skills and knowledge of employees, as well as knowledge and skills in data technology (Mathrani, Mathrani & Viehland, 2013). Especially, digital skills in the enterprise increase the absorption of information in individual departments (Lukman et al., 2011).

An increase in knowledge about one's own business has also been noticed (Otto & Schlager-Weidinger, 2014).

However, the literature lacks mention of analytical competencies and economic knowledge among employees and managers, although L. Fink, N. Yogev, and A. Even (2017) note that analytical skills of employees based on BI are a source of competitive advantage.

6. How does the digitization process lead to the improvement of the organizational learning process?

BI systems enhance employee competencies by fostering a culture of participation and intra-organizational knowledge transfer (Otto & Schlager-Weidinger, 2014). This is possible through the integration of BI infrastructure, such as data warehouses, ETL software platforms, and data visualization and analysis tools, with the knowledge and skills of the BI team. The organizational learning model is based on a shift towards a fact-based decision-making culture, which is related to the use of business analytics and the adoption of BI systems (Davenport & Seely, 2006). The key role of infrastructure is also evident in the creation of new additional knowledge management tools (Otto & Schlager-Weidinger, 2014).

The work consists of an introduction, eleven chapters, and a conclusion. In the first chapter, the process of visual financial analysis is presented. This chapter has a project character. Until now, the procedure of visual financial analysis has not been described and examined. In this part, a broader identification and characterization of this procedure are carried out. Visual analysis breaks the principle of the unity of the analyst's institution and separates the analysis process in time and space. The described procedure is the result of studying the organization of reporting and information flow documentation within the conducted case study. It is an attempt to answer the question of how the process of financial and economic analysis has changed. The verification of the identified procedure was possible through interviews with key analysts. The results constitute the considerations presented in Chapter 11.

The second chapter is methodological and relates to the process of identifying the research problem. While in classical analyses, this stage is carried out intuitively, in visual analysis, it is a significant element of the analyst's toolkit. Starting the analysis from this step ensures that further considerations are conducted in an organized manner.

Chapter three concerns the use of Power BI, an exemplary BI system, for financial modeling. It is an author's attempt to answer the question: In what aspect can BI be considered as an economic model of an entity? The methodological aspects described in this chapter correspond to examples of Power BI applications in specific areas of activity described in Chapter 11.

Chapters four to ten have a methodological character. They complement the research with essential tools that allow the reader to familiarize themselves with the methods currently used in sustainable financial analysis. While some may find it novel, the inclusion of sustainable development elements in financial analysis is becoming increasingly prevalent, marking a substantial expansion of traditional financial analysis. Thanks to them, the procedure of visual financial analysis becomes more comprehensive (Sadowska, 2019; Sadowska, 2018; Grześkowiak & Peternek, 2023).

Chapter 11 is an attempt to verify the project solutions and an attempt to answer the research questions. It is the result of interviews with key analysts from Aesculap Chifa Sp. z o.o.

The study concludes with a conclusion in which a discussion of the research results is conducted in the light of the literature review.

In conclusion, visual financial analysis, based on Business Intelligence (BI) solutions, introduces a new approach to financial analysis. Gathering and

combining data from various primary sources enables the creation of precise and up-to-date financial models for the enterprise. Additionally, it eliminates certain stages of traditional analysis, such as component extraction or criteria establishment, as they are already incorporated into the created model. This allows analysts to focus on inference, recommendations, and solving more advanced managerial problems. Analysis becomes more accessible and flexible, while the professional responsibility of analysts increases as they must base their conclusions on solid analytical foundations.

A disadvantage of visual analysis is the need for analysts to enhance their competencies not only in handling the dedicated software but also in programming to use a simplified interface (modular programming). This puts financial analysts in a challenging position, as they must either improve their skills and competencies or risk technological exclusion.

Today, tools are changing, technology is changing. Knowledge of classical, relevant tools and methods for analysing organizations is important because it allows, among other things:

- Effective and accurate assessments of the organization's situation: by properly utilising the tools and methods, a more comprehensive and accurate picture of the organization's situation can be obtained, enabling better decision making.
- Understanding complex processes and phenomena: the tools and methods allow for the analysis and understanding of complex processes and phenomena occurring within the organization.
- Evaluation and comparison against standards: the tools and methods enable the assessment and comparison of an organization's performance with other similar organizations or established standards.
- Providing recommendations and conclusions: the results of organizational analysis, combined with tools and methods, allow for specific recommendations and conclusions regarding improving the organization's operations.
- Increasing efficiency and effectiveness: through thorough analysis, an organization can identify its weaknesses and strengths and determine the appropriate directions for development, leading to increased efficiency and effectiveness.

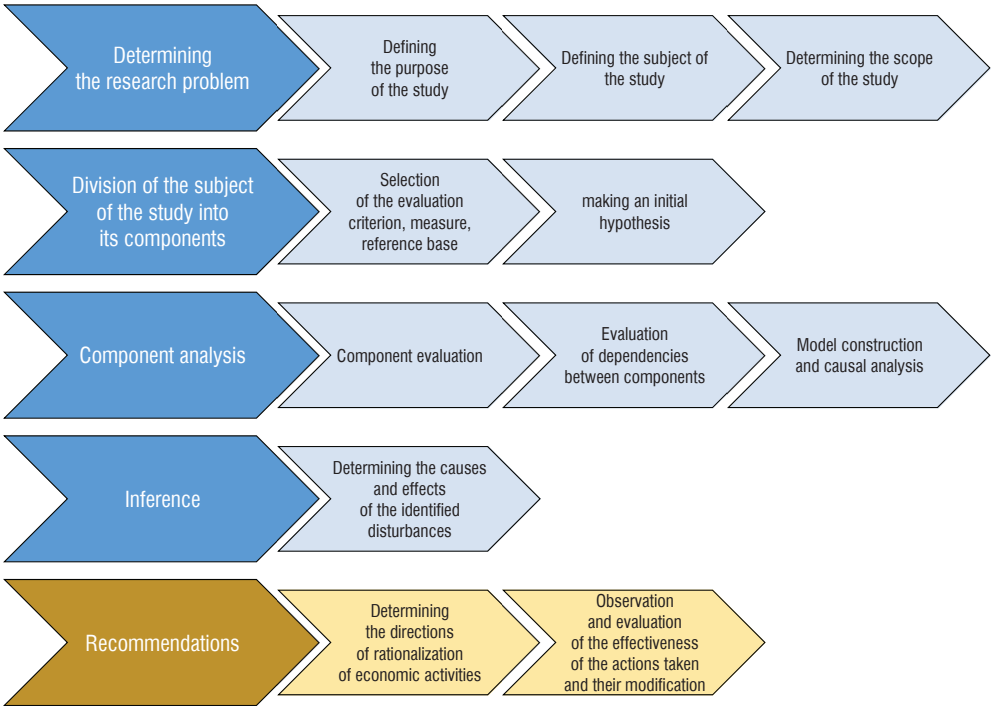
Peter Drucker (2001; 2003, p. 161; 2008, p. 20), an American management theorist and practitioner, used to say that: "the use of analytical logic and statistics, which used quantification" led to "convert experience and intuition into definitions, information, and diagnosis." Today, "intuition is not good enough" (Drucker, 2006, p. 50). Modern IT tools in visual analysis should also be considered as tools of financial analysis. Without them, there is currently no access to data. Without them, there is no possibility of its efficient processing. Without them, a recommendation in one minute is merely a voice of intuition.

Chapter 1

Economic analysis as a research method

The Merriam-Webster (2022) dictionary defines analysis as a detailed (thorough) study of something complex in order to understand its nature or determine its essential characteristics. The analysis generally refers to the method described by Descartes.

Figure 1.1. Stages of the analytical process



Source: own study based on Gos at al., 2023.

The Descartes Method, also known as the Doubt Method, is an approach developed by the French philosopher René Descartes. It consists in putting all your previous beliefs and assumptions under question in order to finally achieve certainty about the truth. In this process, Descartes begins with doubts about all the views held so far and tries to prove his claims by logical analysis. The aim of this method is to obtain certain and permanent knowledge that is not susceptible to doubt. The Descartes method is considered a key element of Western philosophy and continues to be used as a tool in philosophy, social science and science. It usually consists of the steps shown in Figure 1.1.

1.1. Determining the research problem

The first stage of the analysis is to determine the research problem. It is usually assumed that a research problem is a description of the research topic, purpose and questions to which the researcher wants to find answers by carrying out the research. In a narrower sense, a research problem is a question or a set of questions that the research is supposed to answer. Research problems concern the properties of the subject of the research. They require preliminary recognition of changes and conditions, dependencies between the features of objects, the significance of variables and their interaction, joint or exclusive impact (Jeszka, 2013, p. 32). These are both resolution and completion questions. Decision questions are built from a declarative sentence, specified, preceded by the interrogative particle "whether". There are only two contradictory answers to the decision questions: 'yes' or 'no'. Completion questions are all interrogative sentences other than resolution sentences. Due to the insufficient amount of information contained in the question, or the way in which the question was asked, it is impossible to give an unambiguous answer 'yes' or 'no'.

Basically, it comes down to asking a research question or formulating the purpose of the analysis. It requires consideration of why we are undertaking the research and what the results may be useful for us. We divide the research objectives into (Bereźnicki, 2010):

- cognitive purposes – to determine, study a phenomenon,
- theoretical goals – formulation of general assumptions of the concept; model development etc.,

- practical (utilitarian) goals - establishing pedagogical directives; determine the suitability of a method.

Cognitive and theoretical goals are usually considered by theoreticians or a point of contact between theory and economic practice. The answers to such questions are developed by the basic sciences (pure sciences), which are conducted to understand the foundations of all sciences, without being focused on a practical solution to a particular problem.

Utilitarian goals, in turn, solve the problems of economic practice and, as a result, develop applied science. Thus, it increases the part of the accumulated knowledge that makes it possible to solve specific real problems or the part of scientific activity that is undertaken to solve these problems.

The subject of research refers to a specific problem, process or phenomenon that the research is intended to investigate or understand. Defining the subject of research is an important step in the research process, because it helps to direct the research question and, at a later stage, determine the scope and direction of the research as well as research limitations. Determining the subject of data in the analysis also consists in recognising the components of the problem, process or phenomenon under investigation.

Determining the scope and direction of the study consists in the appropriate identification of the inclusion criteria (What to test?) and the exclusion criteria (What not to test? When to end the study?). Controversy concerns how broad or narrow the process of selecting the components to be tested should be. This is an important debate because the selection process determines the scope and validity of applications (Meline, 2006). The criteria for inclusion and exclusion of studies form an operational definition of the problem (Abrami, Cohen, & d'Apollonia, 1988). Selection criteria that are too narrow may severely limit the use of the results – risk of over-exclusion. On the other hand, selection criteria that are too broad may make comparison and synthesis of studies difficult, if not impossible – the risk of over-inclusion.

As scoping is often subjective, best practice is important. Examples of rules for determining the scope and direction of the audit include:

- Balanced approach (McGaw & Glass, 1980) should represent all parts of the research subject, e.g. in relation to opinions – arguments for, against and neutral.

- Slavin's (1987) principle of best evidence, which proposed the inclusion of only evidence that meets certain high methodological standards of quality.

Examples of inclusion criteria include (Melin, 2006):

- specific to the subject of the study,
- nature of the studied phenomenon,
- available meters and data,
- period of time,
- language, cultural restrictions, etc.

To sum up, determining the research problem consists in determining three elements:

- Purpose of the study – why do we analyse it?
- Subject of the study – what are we analysing?
- Scope of the study – what is it that we are analysing?

Determining the research problem can be supported by a number of integrated methods. Among the most popular of them are:

- literature review (systematic or scope review – the so-called scoping)
- qualitative research, such as a survey, interview or case study.

The use of this type of methods will allow, first of all, for justifying the adopted methods, but also for understanding the operating conditions of the analysed entities.

However, it may happen that the applied literature review or qualitative research will not allow for identifying either the methods or the conditions of functioning of the analysed entities. Then the analyst may encounter the so-called research gap. A research gap is a lack or insufficient amount of research in a given field or topic. This means that sufficient research has not yet been conducted in the field, or that existing research is not sufficient to fully understand or solve the problem. The research gap is a challenge for scientists who need to find a way to meet this need and provide important discoveries and knowledge in a given field. Finding and closing a research

gap is important for the development of science and is essential for further progress in a given field.

A research gap occurs when:

- there is a lack of or insufficient evidence in research on a particular topic,
- there is a lack of up-to-date and conclusive reviews on the topic,
- there is uncertainty about the quality of the evidence,
- there is a conflict between practice and theory,
- behaviours or practices used in business differ from those described in the theory,
- the existing evidence does not address the key issue directly,
- research results or theoretical proposals require evaluation or verification in practice (have not been tested),
- from the point of view of policy makers, additional research is needed,
- a change in test methods is required,
- the theory or methods should be applied to investigate other research issues than hitherto.

Identifying a research gap is a significant challenge for the analyst. In such a situation, the analytical problem is often complicated, and solving it requires additional research and analysis. In such cases, innovative solutions are often required that have not been used before. This often allows getting a complete and effective solution to the problem.

1.2. Division of the subject of the study into its components

Dividing the subject of study into components consists in analysing and dividing it into smaller, more defined parts in order to better understand and capture its essence. The aim is to gain a more detailed knowledge of the object under study and its functioning. The components can be divided in several ways, depending on the needs of the study. These can be, for example, system

components, process components, factors influencing a given phenomenon or data sources, such as individual elements of financial reporting. In financial analysis, there is also a classic division of the subject of the study into individual criteria of financial analysis. These usually include:

- profitability,
- liquidity,
- turnover or efficiency,
- risk and financial independence,
- entity value.

Currently, the classic criteria are also supplemented with environmental, social and corporate governance (ESG) factors. These factors have an increasingly detailed representation in the finances of individual organizations. ESG is a set of criteria used to assess the sustainability and social impact of an investment in a company or organization. It takes into account factors such as the company's environmental impact, how it treats employees and customers, and the ethical standards it sets for leadership and management. ESG is used by investors to assess the long-term risks and opportunities of a potential investment and to make informed investment decisions.

Profitability is the company's ability to generate profit, i.e. to achieve revenues exceeding the costs of obtaining them (Gabrusewicz, 2014, p. 293). "Profitability is related to a positive financial result. The concept opposite to profitability is deficit, recorded in the event of a negative result – losses." (Jerzemowska , 2018, p. 297). The amount of profit, in order to be comparable, is related to the amount of capital or the results of the production process (output). Therefore, profitability ratios are usually used in financial analysis to assess the amount of profit. In this approach, profitability is a relative size of the financial result expressing the degree of net efficiency of the capital and assets involved and the funds used in the business activity of the enterprise (Hamrol, 2005, p. 29).

Profitability is the guiding principle of enterprises. Even non-profit entities whose goal is not to make profits in the long term – have to cover the costs of their activities. As A. Blikle (2016) writes: "profit should not be a goal, but a means to implement activities and projects."

The second assessment criterion is financial liquidity. In the literature, the concept of financial liquidity is described in various meanings. Due to the

different perspective, financial liquidity can be defined in terms of (Poniatowska and Maruszewska, 2013, pp. 87-88; Gabrusewicz, 2014, p. 328):

- property,
- property and capital,
- cash flows,
- potential or hidden.

The first property aspect concerns the time in which it is possible to convert an asset into cash without losing its value. The shorter the term, the higher the level of liquidity (Cicirko, 2010, p. 11). For example, securities or other short-term securities are highly liquid because they are usually relatively easy to cash in. It takes more time to recover debts. In turn, cashing in inventories requires their sale and recovery of receivables, hence their liquidity level is even lower. Tangible fixed assets, such as buildings, machines, means of transport, or intangible assets such as patents or licenses are not liquid at all, because it is difficult to recover the cash invested in them without losing their value.

The property and capital aspect concerns the company's ability to timely settle its current liabilities. It determines the company's ability to meet its obligations. It illustrates the relationship between the property that secures the repayment of liabilities on time and the liabilities financing this property (Cicirko, 2010, p. 12). The asset and capital aspect of financial liquidity is based on the relationship between short-term assets and short-term sources of financing (usually described in the balance sheet). It is measured at a given moment, thus this liquidity is referred to as static liquidity.

The third aspect of cash flow illustrates the company's ability to balance inflows and outflows. Such liquidity is referred to as dynamic liquidity, which uses data in monetary form (usually from the cash flow statement) (Gabrusewicz, 2014, p. 329).

In addition to the above-mentioned aspects, there is also another definition of liquidity in the terminology, called potential or hidden, which defines the company's ability to quickly obtain external sources of financing (loans, credits) (Poniatowska and Maruszewska, 2013, p. 88; Gabrusewicz, 2007, p. 254).

The understanding of operational efficiency is usually associated with categories such as: effectiveness (understood as achieving a goal), advantage (understood as profitability) and economy (understood as saving, cost-effectiveness) (Zieleniewski, 1981, p. 235). J. Zieleniewski believes that efficient action is one that meets the requirement:

- minimum effectiveness with the highest benefit or economy, or
- highest efficiency at a given benefit or economy.

Naturally, the topic of operational efficiency is associated with the problem of profitability.

In the works of T. Kotarbiński, there are three approaches to efficiency:

- the universal meaning of efficiency refers to the cooperation of separate forms of human activities,
- concerns the competences required in each profession,
- in the manipulative sense, it is nothing more than the ability/dexterity in the use of organs or tools by people that are used during the action.

The importance of efficiency or rotation in financial analysis relates to the former. Individual asset management processes are assessed. This analysis makes it possible to examine how effectively a given entity manages its assets (Dyktus, Gaertner and Malik, 2017). This includes both the assets and the capital resources involved in the company's operations. The measure of the effects of activity is usually the revenue achieved, especially the revenue from sales, which refers to the value of the assets (total liabilities) involved (Nowak, 2005). This indirectly measures the quality of use of individual asset items (Dyktus, Gaertner and Malik, 2017).

Financial independence concerns the problems of financing enterprises, as well as partly the risks associated with it. There is no enterprise that would not have assets, because that is necessary to conduct current business activity. Each company is obliged to cover its assets using the selected source of financing. Choosing a financial source is a kind of strategic decision. This means that the selection of funding sources is not accidental but results from certain considerations and choices. In practice, however, a certain hierarchy of financing sources was noticed (1. Owners' contributions, 2. Credits and loans, 3. Leasing, 4. Other). This means that for a large part of entities the basic criterion for selecting sources of financing is the availability of capital.

Currently, the problem of financial independence concerns the degree of dependence of the business on both creditors and owners. The use of debt to finance the company's operations makes the entity dependent on the creditor. It must repay the capital with interest. Such a situation usually arises when the entity is unable to finance its operations solely from the generated profits or

accumulated equity. Therefore, since it is not capable of self-financing, it has a low level of financial independence, because it relies on debt in its activities.

Currently, it is believed that an independent enterprise is an independent organization also with regard to its own sources of financing. It does not hold shares in other enterprises and other enterprises do not have any share in its activities. An enterprise that holds less than 25% of the capital or votes in one or more other enterprises and those enterprises hold less than 25% of the capital or votes in this enterprise is treated as an independent enterprise (Targalski, 2009).

Often, financial independence is considered through the prism of the company's market, operational and financial risks. The company's market risk relates to the adjustment of the entity's offer to the demand reported by customers. This risk is external and depends not only on the company itself, but also on the behaviour of customers.

Operational risk represents a measure of the elasticity of the profit on sales relative to the change in sales. This flexibility depends to a large extent on the share of fixed and variable costs and the stability of all profit components over time.

Financial risk, on the other hand, is also a measure of the flexibility of financial results (financial performance) depending on the change in profit.

Currently, financial analysis is increasingly often supplemented with other result elements, such as ESG factors. ESG is an abbreviation of the words Environmental, Social and Governance, i.e. in Polish: environmental, social and management. ESG factor analysis is the study of how enterprises implement and manage these three areas.

Environmental ESG factors refer to the activities undertaken by the company in the field of environmental protection. Examples of such activities include reducing greenhouse gas emissions, reducing energy consumption, increasing energy efficiency, improving waste management or caring for biodiversity.

Social ESG factors relate to the company's relationship with its employees, the communities in which it operates, as well as its customers and suppliers. This category analyses factors such as job security, social diversity and inclusion, supply chain management and care for consumer rights.

Management ESG factors refer to how a company is managed. In this category, research addresses issues such as board structure, transparency and accountability, business ethics and compliance.

The analysis of ESG factors is aimed at understanding how companies make decisions, what values guide their activities, what risks and opportunities result from their activities, and how they affect the environment and society. Such an analysis is useful for investors who want to select companies that are both profitable and socially and environmentally responsible.

The division of the analysed subject of research into individual components is an important element of the research process, because it allows for a more detailed understanding of the essence of the problem under study. Analysing the whole without taking into account the individual components may lead to an incomplete understanding of the problem and to drawing incorrect conclusions.

The analysis of individual components allows for a better understanding of how each of them affects the whole problem under study. This can help you identify the key factors affecting said problem, as well as understand the complexity and variety of factors affecting the whole.

Considering the connections between the individual components allows for drawing conclusions regarding their mutual dependencies and impact on the whole of the examined problem. For example, the analysis of links between ESG factors allows you to understand how the activities undertaken by the company in the environmental, social and management areas affect the financial results and reputation of the company.

It is, therefore, important that the division into components is carefully thought out and based on previous research or observations. Thanks to this, the analysis of the components will allow for a better understanding of the problem, and the identified dependencies between them will allow for accurate conclusions and recommendations for further action.

Indicators are most often used to describe the components and the relationships between them. They simply compare one variable with another. Indicators use simple calculations based on interactions in datasets. For example; changes in selling costs are directly related to changes in trading activity. Changes in sales activity also affect payroll, accounts receivable, inventory, etc. The metrics allow us to see these interactions in a simple, concise format. The indicators themselves have a limited application and require commentary and broader interpretation (Kaplan, 2021), and above all, comparison of the results achieved with a reference value (benchmark).

In classical financial analysis, the comparison method is used for this. Evaluation of the examined phenomenon is possible when a specific standard

(base) value is adopted as the basis for the evaluation. The comparison method consists in comparing two quantities, of which the first variable is the evaluated value actually achieved, and the second is the reference base constituting the basis for comparisons. Comparisons are made in relation to quantities expressing the same economic substance (e.g. sales volume in two periods in the same economic unit or in the same period in two enterprises from the same economic sector) or quantities having different economic substance but mutually related and interdependent (e.g. increase in sales and increase in salaries of the sales department) (Gos et al., 2023, p. 246). Basically, there are the following lines of comparison in financial analysis:

- at a time when the reference base are the actual values of previous years; then, to analyse the direction of changes, at least three consecutive periods are analysed, while to assess the situation in a specific period – two moments, beginning and ending the analysed period, are compared,
- comparison with the plan, when the standard of comparison is the assumptions of the company's plan or budget or targets .
- comparisons in space, most often carried out using the size of the actual results of other enterprises as the basis of reference, but also other benchmarks, such as sector averages, inflation, GDP or wage growth rate.

In the economic reality, there is a whole range of factors distorting comparability. Comparison in the analysis is possible only when the existing comparability distortions are eliminated or their impact can be estimated and properly interpreted. These may be changes (Gos et al., 2023, p. 247):

- methodological ones resulting from differences in the method of calculating different economic categories and indicators,
- financial, which are the result of inflation and price shocks,
- organizational changes, such as mergers and acquisitions, subsidies and donations, sale or liquidation of separate parts of the entity,
- material concerning the subject of the conducted activity (e.g. products offered).

Some of the presented disturbances always occur, which is related to the dynamically changing conditions of the functioning of enterprises, as well

as the changes that the enterprises themselves are subject to. For example, adjustments to the balance sheet total resulting from the revaluation of assets represent methodological differences in the calculation of this economic category. In the financial analysis, this is particularly visible when the closing balance differs from the opening balance of the next period. However, it is usually possible to assess changes over time. Possible differences may sometimes require additional commentary. However, as long as they do not distort the results of the analysis, the situation does not require corrections. A different situation may occur when an entity creates provisions only to hide a profit. This is the practice of profit smoothing. Provisions will be released when profits are lower – usually in the next period. Similar effects can be achieved by changing the method of asset valuation (e.g. inventories), or cost accounting and calculation of the financial result. Then, it is advisable to assess the impact of such practices on the result of the analysis.

Financial distortions of comparability are also always there. The price level of goods and services is not always the same. However, this does not mean that individual values of revenues and costs should always be reduced to their present value. This is done when inflation or price shocks are particularly severe. The analysis is usually aimed at determining the strength of the phenomenon's impact on the economic category under study.

Organizational disruption is a phenomenon that can significantly affect the results of comparisons between entities. These are organizational changes, such as mergers and acquisitions, subsidies and donations, sale or liquidation of separate parts of the entity, which may affect the way in which the company conducts its business and, consequently, its financial results.

In the case of comparing financial results between entities that have experienced such organizational changes, these comparisons may be distorted and lead to erroneous conclusions. For example, comparing the financial results of a company after a merger with those of a company that has not undergone such a change may lead to false conclusions about the company's performance.

Therefore, when making comparisons between entities, these organizational changes and their impact on financial results should be taken into account. This may require adjusting comparison methodologies or excluding certain entities from the analysis if their financial performance has been significantly affected by such distortions. Often such changes cannot be reduced to comparability. Then the analysis concerns two types of entities: separately before the change and after the change.

Distortions of comparability of a material nature may relate to a change in the subject of the business, such as, for example, a change in the products or services offered by the entity. If an entity changes its products or services, this may affect its financial results and make it difficult to compare its results with previously achieved or planned results, and certainly also with the results of other entities that offer slightly different products or services. Therefore, it is important to take into account such changes in the subject of the conducted activity when comparing financial results. This may require comparing the entity's comparable financial results before and after the change in the subject of its activity. This can be done by e.g. excluding a new product from the analysis.

Financial analysis basically enables the formulation of research hypotheses. Generally speaking, a hypothesis is an assumption about reality (Jeszka, 2013, p. 33). A hypothesis is also an uncertain statement, a research assumption that aims to explain certain events and facts or predict the occurrence of new ones, they are also put forward to discover certain laws and generalisations (Stachak, 2006, p. 89; Jeszka, 2013, p. 33). Formulation of hypotheses essentially completes conceptual work in financial analysis.

1.3. Component analysis

The analysis of the components and the relationships between them is the next stage in which the previously formulated hypotheses are verified. Hypothesis verification (hypothesis veracity assessment) is carried out by comparing the hypothetical state with the actual one (Jeszka, 2013, p. 33).

The result of testing hypotheses is (Popper, 2002):

- confirmation (weak confirmation) and its special case – verification (strong, conclusive confirmation) and
- disconfirmation (refutation, falsification),
- corroboration – a case of an unsuccessful attempt to falsify a hypothesis.

Verification of the hypothesis on the basis of one or more case studies does not entitle to generalising conclusions and looking for regularities for

the entire economy. Such generalisations are unjustified due to the fact that the analysed research sample is not representative for the entire economy.

From a technical point of view, component analysis involves data collection and processing. Originally, financial analysis was based on financial reporting as the primary source of information. This reporting was supplemented with non-financial information as standard, such as employment and parameters characterising the company's position on the capital market. Later, apart from the classic financial figures, the strategic position of the entity began to be taken into account, and strategic information showing the relevant context of the entity's functioning gained importance (Duraj, 1992; Hamrol, 2004). Currently – financial analysis carried out by external entities with limited access to information is carried out in this classic way. Modern entities using financial analysis for their needs use all enterprise information systems, i.e. accounting, human resources and employee information systems, production information systems, quality management systems, warehouse and logistics information systems, performance measurement systems and other available information systems. In this type of analysis, financial reporting no longer performs such an important role as a source of information. It presents aggregated data from the accounting system.

The application of source data from multiple enterprise information systems faces classic Big Data challenges such as (Gudivada, Baeza-Yates & Raghavan, 2015):

- significant volume of data; currently processed data is measured in terabytes or even petabytes;
- data production takes place at a very high speed, and due to the same amount of data, some applications require real-time data processing to determine whether to store some of it;
- data is heterogeneous and can be highly structured (as in an accounting system), semi-structured (as in an ordering system) or completely unstructured (as in social media);
- due to intermediate processing, the diversity of data sources and the evolution of data raise security, privacy, trust and liability concerns, creating the need to verify the secure origin of data;
- due to imperfect predictive models, the analysis of this data can provide contradictory information, inconsistent with intuition and practice.

The biggest challenge is, therefore, to ensure the appropriate quality of data for analysis. Only then can it be used. High-quality data is accurate, up-to-date, relevant, complete, understandable and trustworthy (Olsen, 2003).

Data accuracy means no errors. Typical problems that may arise are incorrectly entered or processed records, missing data, outdated information. The lack of accuracy of the data is not always an obstacle preventing its use; however, high accuracy should be expected for analysis purposes.

The second feature is timeliness. Financial analysis compares data for the same periods of time. Comparison of data displaced in time is a methodological distortion of comparability. In practice, therefore, day zero or zero hour is used, until the point to which the data is collected. However, it should not be expected that all the data will be immediately available to the analyst. Sometimes its development requires additional time. Therefore, at the end of the billing period, the content is usually incomplete. The analysis process can only start when the data is completed and entered into the appropriate system.

The third feature is data relevance. Data is relevant if it contains information that is important to you. A typical problem causing the data to be inaccurate are the differences in marking the same economic events or resources in different information systems. If in the HR system, an employee has not been assigned to a team or shift, and in the accounting system, costs or revenues are settled in this way – then combining data from these two different systems is impossible.

Data completeness is related to the situation where data may be missing at a significant moment. It has its source in the lack of accuracy, timeliness or relevance of the data. In many cases, it makes it impossible to perform a full financial analysis.

Another feature is the comprehensibility of the data. It comes from diametrically opposed information systems. For example, the production process is described by many physical parameters that are often not understood by the accountant and vice versa. A lack of understanding of the specifics of data prevents its full use.

The last feature is data reliability. It is widely believed that accounting data is the most trustworthy. However, when combining it with information from other systems, a number of doubts may arise. For example, the company ordered materials, and the order was accepted for execution. The materials were shipped on day 0. The next day, the company received an invoice for the

purchased materials. However, the materials arrived at the warehouse after another two weeks. They can be issued for production the next day, when the order is checked for quality and completeness. Thus, there is a date t0 in the ordering system, t1 in the accounting system, t15 in the logistics system, and t16 in the warehouse. When were the materials purchased?

The analysis stage ends with model construction and causal analysis. The construction of the model may consist in the skilful combination of selected data from various information systems. This is in itself a simplification of the image of the studied fragment of reality. This step is very important because it allows you to apply visual financial analysis. The causal analysis then includes determining the factors affecting a given economic indicator and calculating their impact on changes resulting from previous comparisons. The determination of these factors is based on data linkage and logical reasoning based on the observation of real economic processes and their economic interpretation. Particular attention should be paid to the relationship between economic events and economic indicators, which can be diverse and complex.

1.4. Inference

Inference is the final phase of the causal analysis process, which aims to summarise the results and conclusions reached about the economic indicator under study. At this stage, the analyst analyses the results and interprets them in the context of specific factors affecting a given indicator.

Based on these conclusions, the analyst can anticipate the possible effects of the identified disruptions and determine what steps should be taken to minimise the impact of these factors on the economic indicator under study or to take advantage of the positive effects of these factors.

Extrapolation of the effects may consist in estimating what changes may occur in the studied economic indicator if the factors influencing it change. The inference may lead to specific recommendations or decisions that should be made based on the results of the causal analysis.

Inference is the last element that ends any study prepared by the analyst. Recommendations are rarely included in official analyses. This is because analysts do not want to take on such a huge responsibility that may have financial consequences.

1.5. Recommendations

After conducting the financial analysis, inference is one of the stages of the research process, but it does not end it. The analyst may be asked to identify directions for rationalising economic activities. In order to ensure effectiveness, it also observes and evaluates the actions taken. If it turns out that the effectiveness of actions is insufficient, the analyst proposes modifications to improve their effectiveness. They use the same tools and procedures described above.

1.6. The essence of visual financial analysis

Currently, financial analysis is being extensively automated. Economic data describing the company is collected and combined using specific Business Intelligence (BI) software. The amount of data is not a problem. The possibilities of processing large amounts of data are also not an obstacle with the current technological development. Data in these systems is not collected in an aggregated form, as it has been so far, but in the form of primary data: entries in the accounts of the HR systems, records from other databases that can be combined and aggregated. This is a fundamental difference compared to the classic financial analysis. Classic financial analysis is based on financial reporting. aggregated data representing a longer period of time. In the current analysis, reporting itself is losing its importance. It is not a source of information like it was a few years ago. The analysis is currently based on current data. It often appears in systems automatically from day to day, or from moment to moment. What used to take months and required the work of many specialists has been replaced with a financial model.

The consequence of combining data from many sources is the construction of a kind of model that reflects the functioning of the company through the data structure. Financial modelling then replaces some of the stages of classical financial analysis. For example, the division of the subject of the study into its components is no longer necessary. It is done automatically, determined by the data structure, its source of origin and the object it represents. Also component analysis has now been significantly modified. In the course of

financial modelling, a causal analysis model is created. In this way, component analysis is greatly simplified.

Then what is financial analysis now? Witold Kiliański – a business practitioner specialising in IT solutions for enterprises noticed that a new type of financial analysis is emerging. This is a visual financial analysis. What distinguishes this type of analysis from others is a kind of simplification in which the analyst bases the entire analysis on a financial model created in the BI environment. Thus, it eliminates a number of stages in classical financial analysis. The analyst can determine the research problem and move straight to the stage of making hypotheses and selection of the criterion for assessing whether the measures and reference bases have already been established at the stage of construction of the financial model. The analyst may, therefore, skip these steps if the scope of the analysis is defined within the existing financial model. Making an initial hypothesis can be almost instantaneous. It is enough for the analyst, after identifying the purpose and scope of the study, to look at the data structure and assess that it is sufficient.

The analysis itself is also greatly simplified. Evaluation of the components, as well as the relationships between them, is done very quickly through the appropriate selection of data filters and the way it is presented. Moreover, data is available not only on company computers. The analysis can be conducted almost anywhere. Just use cloud solutions. Therefore, carrying out the analysis requires only an access to the Internet using any device, regardless of the computing capabilities and internal memory.

Model building itself is no longer necessary in the case of visual financial analysis. The causal analysis is often limited to looking at the graph, comparing data, or introducing a new variable. Analytical elements, calculations, dependency analysis are additional benefits provided by the BI environment. The analyst can, therefore, focus on inferences and recommendations.

Do you need a financial analyst to perform financial analysis? Currently not. Managers at different levels often understand equally well the importance of individual economic and financial data showing the performance of their unit. The financial model itself is a source of data for them. In current operations, automatic solutions will be sufficient. So what is the role of analysts? Analysts create financial models and are responsible for their maintenance and development. Analysts also initiate research on regularities and solve management problems of which level of complexity is much higher. Ultimately, they can focus in this case not only on the results of the analysis but also on recommendations.

With the development of visual financial analysis, the computational elements are shortened. Can you notice other changes? Definitely yes. Focusing the attention of analysts not on the computational elements but on the purpose of the research - completely changes the optics of financial analysis. It makes the previously neglected stages of the analysis process, such as setting the goal and formulating hypotheses as well as drawing conclusions and recommendations, become increasingly important. You can spend more time with them. The requirements for analysts have also increased. Currently, financial analyses no longer end with conclusions on the last page of the report. The financial analysis ends with a specific question: What should be done about the situation? This makes the analyst's professional responsibility higher. The basis of the analysis must, therefore, be strong, and the conclusions supported by evidence from economic theory and practice. As a result, increasingly often a detailed analytical study is preceded by a literature review or preliminary study.

Chapter 2

Literature review and qualitative research as integrated methods of research objective identification

2.1. Literature Review

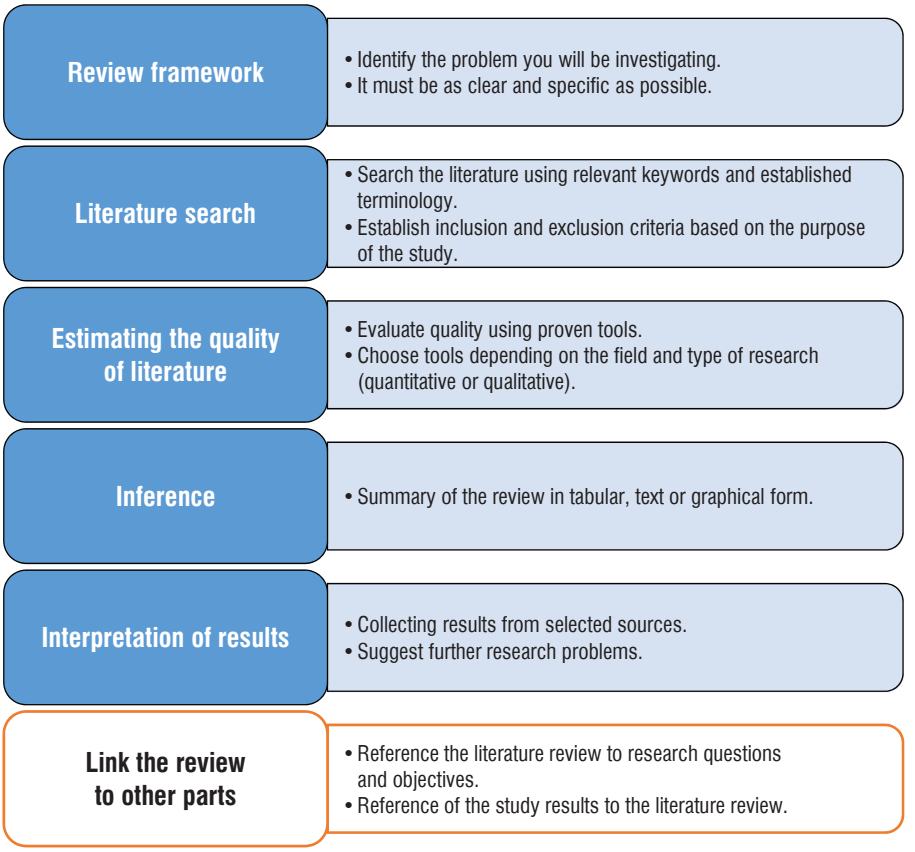
According to Hart's (2001) definition, a scientific literature review is a process of collecting and analysing information on a given issue or research problem, based on available documents, which may be published or unpublished. This review is intended to express specific views and objectives regarding the nature of the topic and how it is researched.

This process involves a thorough study of the literature related to the topic under study, which allows you to understand the current knowledge, ideas, data and evidence on the topic. A review of the scientific literature also helps determine what research questions to ask and what research methods to use.

Evaluation of documents for their usefulness in the context of the study is also an important element of the scientific literature review. This means that the analysis of documents is not only about collecting them but also about carefully assessing their quality and relevance in order to determine which documents are the most important and useful for understanding the problem under study.

All in all, the review of the scientific literature is a necessary step in the research process that allows you to understand the current knowledge, determine the research question, select the appropriate research methodology and evaluate the relevance of existing literature in the context of the study.

Figure 2.1. Steps to perform a review



Source: Samnani, Vaska, Ahmed & Turin, 2017; Oliver, 2012.

2.1.1. Review framework

Defining the review framework should first answer the key question: Is a systematic review needed (Booth et al., 2016)? Perhaps there are publications that answer the questions we ask ourselves. You just need to find them.

The first step in a literature review is, therefore, to identify the issues that the analyst will be investigating. This requires defining key elements such as (Booth et al., 2012):

1) research questions,
2) keywords,

3) list of electronic databases that will be or have been used in the initial search.

For example, the research question may be: "What are the current causes of bankruptcies of enterprises in the post-pandemic period?". The question formulated in this way seems too long to be entered into the selected database. Keywords, on the other hand, are relatively easy to identify. These are, for example: "bankruptcy" and "post-pandemic period". The choice of keywords will be important in defining the framework of the literature review. Replacing the word "bankruptcy" with a popular term in the literature – "financial condition" will certainly increase the number of articles to be researched, and thus expand the framework of the literature review. The last element is to determine the list of databases that will be used. These can be, for example:

- Library registers, which may be in a traditional or electronic form. Electronic catalogues such as WorldCat or BookFinder are becoming increasingly popular, and in the case of articles – Web of Science or Scopus.
- Electronic databases that often provide abstracts or full versions of scientific and industry articles. Some of them have relatively easy access, such as Google Scholar or PubMed. Some of them are purely scientific and are often associated with publishers, such as: ScienceDirect, SpringerLink, Taylor & Francis, Wiley Online Library. Some of them, apart from scientific articles, also contain grey literature, such as: EBSCO and ProQuest.
- Thesauri and bibliographies of the key study on which the research will be conducted.
- Gray literature. It includes various types of reports, working papers, agendas, interviews, conference materials, course materials and lecture notes, dissertations, research notes, essays, student theses, questionnaires, data collection and text translation tools, articles from the trade press, newspapers, newsletters, magazines and, as a last resort, even publications of activist or religious organizations. The use of grey literature is controversial in scientific works, however, it can be useful in business practice. They are especially valuable when they are specialised studies. Often, scientific articles try to generalise conclusions in order to build a specific paradigm. In addition, they are anchored in the theoretical layer and do not

show the possibility of applying the acquired knowledge. Grey literature often focuses on the problems of business practice, prefers individual cases to large-scale studies, and tries to solve specific problems of business practice. Thus it often has a certain level of specialisation and utilitarianism that scientific papers lack. On the other hand, it is difficult to attribute it to a specific theoretical trend or ideology. Others, such as newspaper articles, are also often characterised by direct presentation of the author's feelings. On the one hand, this is an advantage, because the author clearly communicates the essence of the statement. On the other hand, this is a disadvantage. Such a statement is often subjective in the selection of the presented content, and is also sometimes supported by non-substantive argumentation, which may refer to feelings, emotions, faith or features of authorities or theories described by the author. As a result, it is difficult to assess and verify its content. Grey literature is difficult to assign to a specific moment of creation or to identify a specific author. This poses a problem in establishing intellectual property rights to a particular idea.

After initial identification of these elements, the review framework is defined. It begins with an initial reading of the literature related to a given topic or by conducting preliminary research (e.g. qualitative) to better understand the topic under study.

Initial reading of the literature can be carried out in several ways. One of them is to identify key journals or books in the area that interests us, and then browse their bibliography. This provides you with a brief look at the literature in your area (Oliver, 2012, s. 40).

Another practice may be to identify people known and publishing in a given area. Evaluation of their achievements in a given area can be helpful in identifying leading institutions and other scientists who have a significant impact on the development of a given field. Finding leading scientists and their collaborators, as well as the institutions they work for, can provide valuable information on where the latest research is being conducted, what research issues are currently important in a given field, and what are the research trends. This information can be useful when creating a list of potential articles to read. You can also use this information to find mentors or experts or even research partners in your field (Oliver, 2012, s. 41).

Initial searches of electronic databases should be documented. You should first identify existing literature reviews on a given topic and determine whether they are sufficient or whether the problem requires more research. Existing evidence at this stage may be sufficient to establish a research problem in the analysis. A good textbook is all you need to know the terms and methods of analysis. To understand trends in the economy – an appropriate report (e.g. from institutions such as EUROSTAT, central banks or research institutes) or a review article listing the main ones.

If satisfactory answers are not obtained, the study should be continued. Then, the next stage of research is to assess what kind of evidence (e.g. what type of research) is available (Booth et al., 2016).

Literature analysis should focus here mainly on identifying what has been studied. The following are worth noting (Petticrew and Roberts, 2006, Booth et al., 2016):

- Population, i.e. who or what was studied. This is a different description of the research sample. The description of the research sample is presented in the methodological part of the work or in the abstract. Important parameters are the size of the study sample and its statistical description as well as the criteria for inclusion and exclusion from the study.
- Intervention, and more broadly – accepted research methods.
- Comparison bases, i.e. what was the subject of the study and in what aspect.
- Outcomes. They are usually the authors' contribution to the development of knowledge about a given phenomenon.
- Context, i.e. references to a theory, geographical or cultural area, a specific moment in time, etc. As part of referring to the context, stratification of texts into layers is also used in this case (Czakon, 2011):
  - directly related to the researched issue,
  - partly related to the researched issue,
  - weakly related to the researched issue.

When the literature is identified – apart from the content itself, it is worth paying attention to the keywords appearing in the identified publications. Keywords are placed in the article to help readers find the information they

find most interesting. Often keywords appear at the beginning of the article, in its title, abstract and section headings, which makes it easier for the reader to learn about the important issues raised in the publication. The authors of scientific articles try to choose keywords that best describe the topic and research problem, taking into account the specialist language and terminology used in a given field of science. Referring to keywords will allow you to name the research problem using specialist terminology. Identifying the terms that will be used to search databases and publications is not always easy.

The final task is to define the review framework in terms of the scope of the literature that the review could cover. Identifying a wide range of literature can lead to information overload and information noise. Instead of explaining, it gives the analyst a headache. Then clarification becomes necessary. Clarification is the process of clarifying or organizing information to make it more understandable, transparent and precise. Clarification is crucial in many areas of life, including scientific research.

In communication, clarification is essential to ensure that people understand information and messages conveyed by others. It is also important in the learning process as it helps you organize your thoughts and understand concepts. In scientific research, clarification is crucial to ensure that terminology, definitions and content are understood. Clarification should also lead to the determination of the final form (Booth et al., 2016) of:

1) research question,
2) criteria for inclusion and exclusion of the analysed literature,
3) keywords,
4) lists of databases and websites,
5) search strategies to be used in the full search.

This can be done by dividing identified key literature, researchers or entries into subgroups. They will correspond to individual research questions (Oliver, 2012, p. 8). Clarification by grouping can help reduce misunderstandings and prevent problems resulting from a lack of clarity and precision in naming the research problem using specific terms – keys. Hence these are some kind of key terms for a given subgroup. The scope of the subgroup will be determined by appropriately selected criteria for inclusion and exclusion from the study (Oliver, 2012, p. 41).

The inclusion criteria define the characteristics of the literature covered by the study (Polit and Beck, 2018). Typical inclusion criteria may be

demographic, geographical, occupational group or other parameters of the sample studied (Patino and Ferreira, 2018). These criteria help researchers determine whether a publication should be included or excluded from the study sample. In identifying the inclusion criteria, it is also useful to analyse the number of publications by year (Czakon, 2011).

Exclusion criteria are not the opposite of inclusion criteria (Connelly, 2020). Instead, they identify features that prevent a given publication from being included in the study (Gray et al., 2017) and thus may influence the results of the research. Exclusion criteria can also be divided into formal and methodological (Czakon, 2011). Formal ones may concern the quality of the analysed publications or their type. For example, research papers usually exclude industry communiqués, conference presentations, book reviews and editorial introductions (Coombs et al., 2009). Exclusions are often related to bibliometric parameters such as: number of citations, ranking of the journal in terms of the Impact Factor, an author's citation ranking (Hirsch index). Substantive considerations concern, for example, the exclusion of publications from various other disciplines or scientific specialties, such as medical, IT or legal studies (Lee, 2009).

The inclusion and exclusion criteria may also be related to the content of the publication. The evaluation of the publication then takes place during the analysis of the text. Criteria of this type often concern (Czakon, 2011):

- frequency analysis of keywords in the text itself,
- the research method used,
- dependent variables,
- theoretical trend,
- research problem.

Another aspect is to determine the list of databases and sources that will be the subject of the study and the search strategy.

2.1.2. Literature search

Typically, the search strategy should lead to limiting the number of analysed publications to the necessary optimum. T. Meline (2006) described a literature search strategy using seven steps:

1. Apply automatic (or title and abstract) inclusion and exclusion criteria to the list of candidates for the study (bibliography of candidate studies).
2. Eliminate studies that clearly do not meet one or more of the inclusion criteria or meet one or more of the exclusion criteria.
3. Get full versions of bibliographic sources.
4. Analyse the text to identify whether the publication meets the detailed inclusion and exclusion criteria and evaluate the quality of the publication.
5. Exclude from the study literature that does not meet the relevant inclusion criteria and quality parameters or meets the relevant exclusion criteria.
6. Exclude literature from the study for a specific reason. For example, the reason may usually be the lack of credibility or reliability of the analysed studies.
7. Accept studies for literature review.

Searching the literature using relevant keywords and established terminology is an important process in scientific research that helps you find relevant scientific publications, articles and other sources of information that are related to your research topic.

As already mentioned – in order to conduct an effective literature search, it is first necessary to determine the appropriate keywords and terminology that relate to the research topic. Then you can start searching various sources of information, such as databases, library catalogues, Internet search engines and other search tools. The search should be done using the relevant keywords and terminology that have been established beforehand. They will constitute a list of candidates for the study (bibliography of candidate studies).

Keep in mind that some databases and search engines have different ways of searching, thus it is worth getting acquainted with their functionality. This is important at this stage of the literature review, as it will enable the automatic application of the inclusion and exclusion criteria from the study and the elimination of redundant publications by clicking the mouse several times.

Obtaining access to full versions of bibliographic sources is a challenge in itself, which can also be a source of their exclusions. Currently, this problem is being solved systematically. On the one hand, research infrastructure

is developed, and on the other, open access to scientific publications and other bibliographic sources is promoted. Thanks to this, scientific work can become more accessible to everyone, not just those who have access to expensive journals.

Another way is to use public libraries, which often have access to a variety of bibliographic sources, including scholarly journals. In some cases, libraries also offer remote access services to these resources, allowing them to be used from anywhere.

Finally, there are also alternative sources of information, such as preprints, articles on science and community blogs like Research Gate or Academia, which are often free. Of course, you should be careful and check your sources carefully to ensure that your publications are reliable and scientifically correct.

After finding the full versions of the publication, you can start analysing the content. Content analysis is a research method that involves the systematic and fundamental study and interpretation of textual content in order to extract key elements and hidden patterns. It is an interdisciplinary approach that uses techniques from various fields such as sociology, psychology, linguistics, philosophy and anthropology.

In linguistics, content analysis can be applied to various types of texts, such as research articles, interviews, speeches, advertisements, websites and more. Content analysis breaks down the text into words, sentences or paragraphs, and then analyses their context, meaning and function in the text. This method can be used to study various aspects of a text, such as content, tone, style, structure, context and more. Content analysis can be used to study various phenomena and problems, such as social image, social media, organizational culture, politics or gender stereotypes.

In scientific research, the scope of analysis is not as extensive. During the literature search, information that appears in scientific publications should be collected and analysed. This can be done by reading summaries, abstracts and other short descriptions available in databases, and by carefully reading articles and other information sources.

When reviewing the literature, looking for trends, developments, contradictions or similarities, there are a few key elements to look out for (Oliver, 2012, p. 13-14):

1. Key terms and concepts – identifying and understanding key terms and concepts that are frequently used in research can help you understand developments and trends in the field.

2. Publications and their dates – the analysis of publications and their dates can help you identify directions of research development and indicate which areas are particularly active.
3. Theories, models and methods – identifying the dominant theories and models can help you understand the approach to researching a given issue and indicate which methods are most often used.
4. Contradictions and Unknowns – paying attention to research contradictions and unknowns can help you identify research gaps and directions that need further research.

It is worth remembering that the literature search process is iterative, sometimes requiring multiple attempts, as well as updating and clarifying keywords and terminology. It is worth repeating the literature search process regularly to stay up to date with the latest research findings.

2.1.3. Estimating the quality of literature

In any particular research area, some research will always be more influential than others. Some can be so influential that they change the direction of the entire theoretical stream and redefine or create new paradigms. Research can be very impactful for a variety of reasons (Oliver, 2012, p. 10):

- Research can develop and introduce new, widespread concepts applicable across the field.
- These concepts can change the way we look at a subject area.
- Therefore, they can initiate many new directions of research.
- They may result in the development of new methodological approaches.

In a literature review, these types of publications are usually of the highest quality. To identify them, the quality of the analysed literature is assessed. Popay, Rogers and Williams (1998), Transfield et al. (2003) and Czakon (2011) suggest that quality assessment should include the following:

Table 2.1. Criteria for evaluating publications in a systematic literature review

No.	Criterion	Purpose
1.	Purpose of the study	Research on management sciences focuses on determining the subjective assessments or meanings assigned by respondents to the studied phenomena, or on the relationships between data describing the studied reality.
2.	Contextual	Research methodology may take into account the context in which the phenomena under study occur, which is typical of case studies, or not, as in the case of most empirical tests of theories. Depending on the context and taking into account its influence is important for the range and legitimacy of generalisations or conclusions.
3.	Sampling	Purposefulness of selection leads to capturing particularly important conditions, but limits the possibility of generalising research findings. Alternatively, researchers aim to capture the diversity of contexts and meanings in the random selection of the study sample.
4.	Data quality	Databases can be based on a single source, with a well-recognised risk of error, or they can use multiple data sources, allowing them to be compared and cross-explored.
5.	Adequacy	It refers to the stage of interpretation of the obtained results. The research results should be clearly confronted with the predictions contained in the hypotheses in order to obtain the correct interpretation. On the other hand, theoretic research requires care and a detailed presentation of the path leading from empirical results to propositions of generalisations.
6.	Generalizing	The ability to generalise is a feature of research conclusions, and it may result from the features of the applied quantitative techniques (statistical generalisation) or the features of the theoretical analysis used (analytical generalisation).

Source: Shakon, 2011.

Other features describing the quality of the publication are not without significance. They include (Oliver, 2012, p. 19-20):

- the nature of the research question,
- key concepts and theories that the author refers to (their presence and topicality),
- authors' reputation (described by the Hirsch index or the number of articles on a given subject, and finally the status of the scientific centre they represent),
- citations,
- the nature and quality of the data and methods of analysis.

An additional quality criterion is the reliability and credibility of the study in the publication. If the study can be replicated with the same data collection procedures and methods, the results should be consistent with the results of the study in the literature. Then it is credible. Unfortunately, in practice, there are attempts to manipulate research results by manipulating "outlier"

observations in the research sample, using "unique" criteria for inclusion and exclusion from the study or "improving" statistical parameters by falsifying them. Therefore, articles are increasingly subject to methodological or statistical review.

2.1.4. Inference

Inference consists in collecting the results of literature research in the form of a table, graph or description. Table 2.2 presents the tabular form of data collection.

Table 2.2. An exemplary list of the most popular problems related to corporate bankruptcies

Q1 2023	Q4 2022
Bankruptcy prediction methods	COVID
Parties' claims	Bankruptcy prediction methods
Creative accounting, auditors' opinions	Parties' claims
COVID	Ways to exit the business, restructuring
Ways to exit the business, restructuring	Subsidies and problems with financing

Source: own study.

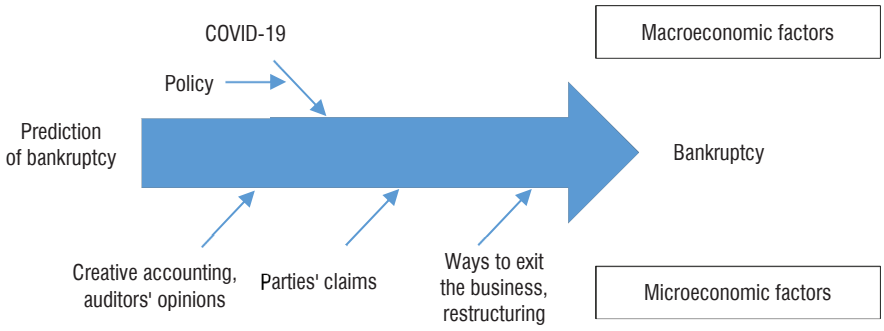
Bankruptcy issues have been broadly identified as all issues related to this term. In the second stage, studies were identified that belong to the leading scientific journals according to Scopus databases . The time scope of the study was also limited to the fourth quarter of 2022 and the first quarter of 2023.

The creation of the ranking was based on a list of problems, methods and research results. Their effect is the ranking presented in table 2.2.

The results of the literature analysis can be presented graphically (Figure 2.2).

A graphical form of data presentation is a way of presenting collected information using various types of charts, diagrams, maps and other graphic elements. The graphical presentation of the data is intended to facilitate the understanding and interpretation of the information. Literature maps have recently become particularly important in the literature review. They are a graphical representation of the relationships between different studies, authors, results and periods of creation. This map shows the interactions between different pieces of literature and helps readers better understand how the literature of a given subject has developed over time.

Figure 2.2. Graphical presentation of problems in bankruptcy literature



Source: own study.

A map of literature can take many forms, for example a family tree or a network of connections between various works. It can also be interactive, allowing users to explore various aspects of literature in a dynamic and interactive way. An example of such a map created as an Ishikawa diagram is shown in Figure 2.1.

Another form of research presentation is the description. Please note that the review (Oliver, 2012, p. 9):

- Should have a clear structure.
- There should be an explanation of this structure.
- Literature should be presented in a planned order for which there is a clear rationale.

The description adopts a discursive style. This is a style of writing that involves a number of different elements, including summary, description, analysis, discussion, evaluation, reflection and comparison. To achieve this style, the literature review cannot be concise (Oliver, 2012, p. 9).

For example, the analysis of the corporate bankruptcy literature presented above has identified the most important problems in the bankruptcy theory. Their hierarchy is presented in table 2.2. The most important problem related to the bankruptcy of enterprises, despite the end of the epidemic, was COVID-19. In 2022, this topic was still in the first place in terms of popularity. For example, E. Koudjom, S. Tamwo and K.D. Kpognon (2022) considered the problem of deepening poverty in African countries and e.g. the impact of the pandemic on the scale of bankruptcies in these countries. F. Eckert,

H. Mikosch, (2022) presented an interesting case-study of Switzerland, while G. Falavigna and R. Ippoliti (2022) focused on Italy, where they assessed the effects of the policy on the issue of pandemics and the scale of bankruptcies. The analysed geographical areas are different in terms of both economics and the policy of counteracting the effects of the pandemic. Basically, the scale of corporate bankruptcies depended on the policy pursued. In Africa, the effects of the pandemic were felt more strongly. This has led to an increase in the scale of poverty. Comparing the results of the research, a reflection arises that an additional effect of the pandemic was the growing economic stratification between Europe and Africa.

Traditionally, bankruptcy prediction methods were also the most popular topic. This topic is widely described in the literature, and every year new, interesting solutions are developed in this regard. For example, T. Nießner, D.H. Gross and M. Schumann (2022) proposed the Corpus Linguistic method Text Mining for bankruptcy prediction analysis. They applied context analysis using artificial intelligence to assess the reporting context of entities to identify bankruptcy risk. Their method proved successful. A different approach is represented by R.F. Brenes, A. Johannssen and N. Chukhrova (2022) who built a kind of "vanilla" neural network for predicting bankruptcy. Other methods also involved elements of artificial intelligence and machine learning. A relatively large number of articles referred not so much to the methods themselves as to the determinants of the bankruptcy of enterprises in specific sectors, economic conditions and areas of operation. Summing up, one can notice the changing determinants of corporate bankruptcy and the resulting even greater interest in advanced bankruptcy prediction methods.

It is very important that citations do not dominate the text, monopolise the chapter and obscure what you are about to write (Oliver, 2012, p. 27).

Citations should be limited to max. 4-5 lines of text (Oliver, 2012, p. 27).

If the topic is methodological in nature, part of the discussion may be included in the methodological section and part in the literature review. The development and nature of this division depends on the situation and the judgment of the author. Then, part of the literature review concerns the results of previous research by other authors. This provides an intellectual focus on the research problem. Without it, the article will only contain data and analysis. This may be satisfying for some research, but there will be no broader, educational context to enrich the discussion. If the literature review is included in the methodological chapter, then it focuses on the practical aspects of data collection and analysis (Oliver, 2012, p. 29).

2.1.5. Interpretation of results

The outcome of the literature review should be an effective, analytical, original assessment of previously published information (Jesson, Lacey. 2006, pp. 139-48).

When describing the results in a discursive style, the author should try to include connecting sentences, informing about the sequential nature of the presented literature, starting with the oldest and ending with the latest, in all sections of the chapter. In their scholarly work, the author may continue to describe the chapter plan further, e.g. in the first section, they will briefly look at some of the classical theories that have influenced philosophy; in the second section, they continue to analyse the perspective and key thinkers who contributed to this approach, and finally they will analyse the specific contribution of a particular group. This way of presentation helps the reader to understand the author's way of thinking (Oliver, 2012, p. 61).

It is particularly important to link the literature review with other parts of the study (Oliver, 2012, pp. 143-145):

- research questions and goals,
- data,
- results,
- methods,
- contributions/requests.

2.2. Scoping literature review

A useful method in this regard is scoping. It is a type of literature review that aims to map key concepts, research questions, research designs and methods used in a particular research area. It is typically used to identify gaps in existing literature and determine the feasibility of conducting a full systematic review. Scope reviews are often used in the early stages of a research project to inform the development of a research question and to identify the most relevant sources of information for a more in-depth analysis. Scoping in scientific research can be undertaken as stand-alone projects, especially where the area is complex or has not been comprehensively explored before (Mays et al., 2001, p. 194).

Scoping reviews differ from traditional systematic reviews in that that they are more inclusive and less stringent in their approach to research selection and evaluation. While systematic reviews aim to provide a comprehensive overview of all available evidence on a particular topic, scope reviews are more focused on identifying key themes and trends in the literature.

To conduct a scope review, researchers typically follow a set of specific steps, including (Arksey & O'Malley, 2005):

1. Identification of the research question – in the literature review, it is an element that does not consist only in formulating the research goal or research question. It has a slightly broader context. As part of the research question, it is necessary to set a date or dates that will be the basis for searching literature databases. Hence these are some kind of keywords for a given phenomenon. For example, the research question may be: "What are the current causes of corporate bankruptcies in the post-pandemic period?" The question formulated in this way seems too long to be entered into the selected database. Keywords, on the other hand, are relatively easy to identify. These are, for example: "bankruptcy" and "post-pandemic period". The choice of keywords will have a significant impact on the scope of the literature review. Replacing the word "bankruptcy" with "financial health" will certainly increase the number of articles to be researched.
2. Identification of relevant studies – this stage consists primarily in the selection of appropriate databases and literature sources. In science, there is a kind of hierarchy of literary sources. Scientific research and publications are of the greatest importance. Secondly, there are studies and reports of institutions and entities that are optionally involved in science. The least important are the opinions presented in the trade press, daily newspapers or the Internet. Literature review for scientific purposes is usually carried out within the framework of appropriate databases, such as Schoolar or Scopus. Both in these two and in other databases, you can usually apply specific search filters (e.g. time range), sort articles by popularity or other quality parameters.
3. Selection of studies – consists in skilfully defining the criteria for inclusion and exclusion from the study. They are often established after identifying relevant studies.

4. Graphing – consists in classifying the collected information from the literature review. Typically, key information is identified here, such as: bibliographic data of the article, description of the subject of the study, description of the tested sample, purpose of the study, method, measures, achieved results. The summary created in this way is the basis for further analysis of the study results
5. Compiling, summarising and reporting the results – during this stage, the results of the literature analysis are collected in appropriate reports or summaries. The purpose of these summaries is usually not to present all existing evidence, or to assess the quality of scientific sources and evidence in detail but to review them. As a result, the range of topics, main research trends and dominant research results are identified.

2.3. Qualitative research

Popular methods used in practice are also methods of qualitative research such as interviews, surveys, case studies. The purpose of qualitative research can vary, and its results are evaluated differently depending on the intended use of the research. Qualitative methods are often used in evaluations because they tell a story about a given topic by capturing the stories of the participants. An excellent example is the article by J. Morgan and MA Nasir (2021), who described the bankruptcy of the well-known company Toys'R'Us. In the background of the story, there are main characters such as private equity firms with significant resources, clients and creditors. The story itself illustrates debt roulette in a sales crisis. The company's capital structure is radically rebuilt, and equity is reduced and replaced with debt. The primary criterion for evaluating the effectiveness of such evaluations is the extent to which the intended users find the results reliable and useful for decision making and organizational improvement.

Qualitative research, on the other hand, aims to generate or test a theory and contribute to the creation of knowledge for its own sake. The main audience for this type of research are other researchers and scientists, as well as policy makers. An example of this type of research can be the study of S.M. Nayak and M. Rout (2022), who surveyed financial institutions to

determine what type of bankruptcy prediction models they employ with the use of artificial intelligence.

In general, the described research allows, firstly, for an understanding of the conditions of operation of the analysed entities, and secondly, for identifying adequate tools and methods of analysis.

Understanding the operating conditions of the analysed entities is important because it has a direct impact on the results of the analysis and directions for improving the activities of the analysed entities. These conditions include very different factors, such as the market environment and competition, resources, including capital and organizational competencies, as well as strategies and goals. Factors that have a direct impact on the activity of the analysed entity but are not directly controlled by it. There are also external factors such as:

- General economic conditions: economic situation, economic growth, inflation and interest rates.
- Technology: the level and pace of technological development and the availability of new technologies.
- Governments and Regulations: Government policies and regulations that affect the entity's operations.
- Environment and natural resources: availability of raw materials and energy and the state of the environment.
- People and culture: the level of education, values and beliefs of people who influence markets and the business environment.

These elements of the environment affect the activity of the analysed entity and should be taken into account in the interpretation of the analysis results. If one is not well versed in these conditions, it is difficult to make the right decisions and evaluate future results.

2.4. Preliminary analysis as an element of qualitative research

Preliminary analysis of economic data in the financial model can be a kind of element of qualitative research. Preliminary analysis, which is usually the

first stage in the entire analytical cycle, boils down to defining the subject, scope and purpose of research. At this stage of the analysis, the types and sources of non-numerical information are determined, the appropriate research method and the basis for comparisons are selected, as well as the form of illustration of the analysis results and the recipient of these results are determined. The initial orientation in the financial model does not currently consume much time for analysis. General knowledge of the subject of research determines the directions of detailed research. They require the collection, systematisation and verification of data on the studied economic phenomenon. That data make it possible to put forward a preliminary hypothesis or diagnosis of this phenomenon. (Sierpińska, Jachna, 2007, p. 24).

Chapter 3

Financial modelling using Power BI

3.1. The problem of obtaining data for analysis and their comparability

3.1.1. Power BI as a tool for preparing financial analyses

Intelligence class applications and services, largely based on cloud computing, help organizations collect, manage, process and analyse data from various sources using a user-friendly interface (Enterium, 2022). Although the user programs the execution of individual actions, and through their action subsequent programming lines are written, the user themselves (at the beginner/intermediate level) may even be unaware of it. Learning to work in Power BI as well as creating the first reports does not require IT knowledge, just a few to several hours of familiarisation with the program to be able to take the first steps and prepare basic analyses.

Microsoft released Power BI in 2015 (Microsoft, 2022A). Since then, the environment has been developing increasingly dynamically. On the one hand, it is integrated with the global Microsoft environment, and on the other, Power BI itself is periodically updated with new functionalities, significantly ahead of the competition in this matter. This is mainly due to the fact that Power BI is part of a very extensive Microsoft environment based on the latest technologies. In addition, the possibilities of connections between Power BI and other key IT environments, e.g. SAP, Oracle, IBM, Google, are also being developed.

Microsoft's computing power, which may be necessary with very large databases/a number of complex transformations. In addition, if all connections are properly prepared and placed in the Microsoft cloud – the analyses provided and their updates will not require any action on the part of people preparing them (the possibility of full integration and automation).

The Power BI environment is currently developing so dynamically and on such different fronts (new functionalities, machine learning, robotization, new operating environments) that it may be difficult for users to keep up with the possibilities it provides. It is also hard to imagine that any other software could threaten Power BI's position within the category of Business Intelligence software. Other products are also offered in this software group, some of which were available before 2015; however, none of them has achieved such high functionality and stability of operation with such a low entry threshold for the user. For the fourth year in a row, the analytical and research company Gartner ranked Power BI/Microsoft in first place in terms of completeness of vision and ability to implement it:

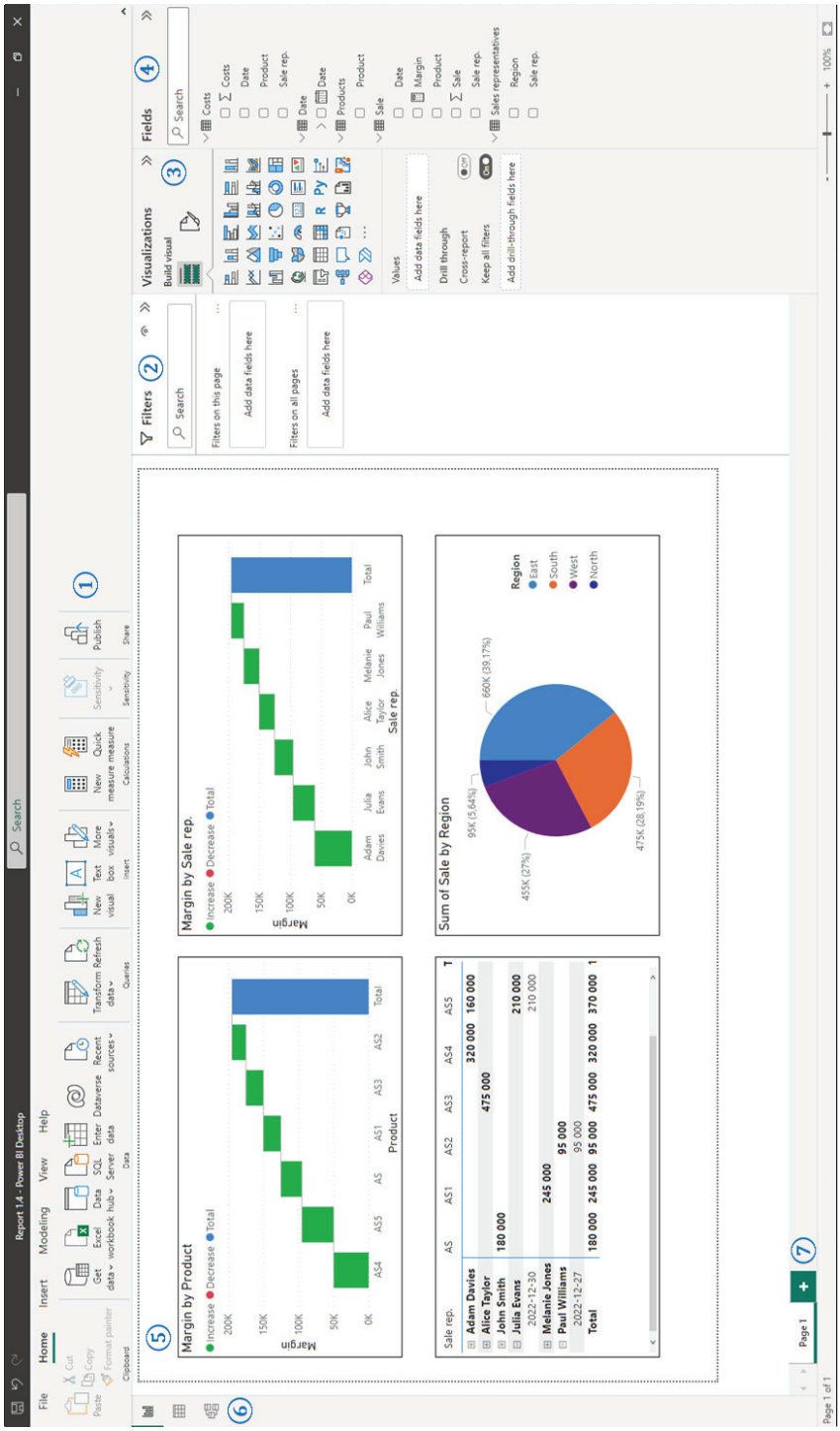
Figure 3.1. Magic Quadrant for Analytics and Business Intelligence Platforms

Source: Gartner, 2022.

It is worth noting that the basic version of Power BI (Desktop) is available as a free download from the Microsoft website. In addition, knowledge about its use is developed and made available for free on the Internet (e.g. on YouTube) by the global community of users.

The Power BI Editor consists of the following workspaces:

Figure 3.2. The Power BI Editor



Source: own.

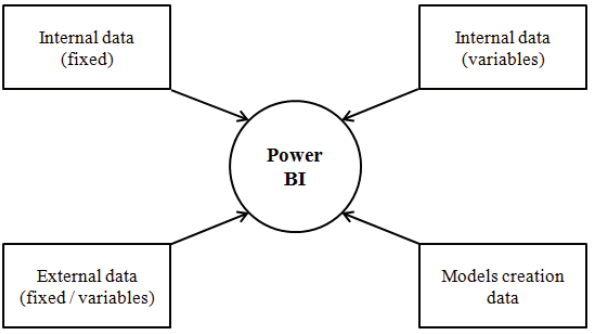
1. A menu with standard transformation commands available.
2. Filters that can be applied to a given page.
3. Available visualisations and functionalities of their preparation/formatting.
4. Imported data sources and prepared calculated measures.
5. Working area.
6. Available workspaces: report, data, data model.
7. Number/name of the report page.

3.1.2. Types/categories of data used to prepare the analysis

Before starting to prepare a financial analysis using Power BI software, you should first discuss the environment in which the analysis will be performed.

The key element of any financial analysis is the input data. There are four basic types/categories of input data used in Power BI:

Figure 3.3. Types/categories of data used to prepare the analysis



Source: own.

Internal constant data encompasses all kinds of statements with reference values (e.g. planned production cost), but also data tables used to calculate specific values (e.g. interest rates, discount rates). Power BI is used to program specific actions and then to display the results of these actions. Therefore, the said data tables may, for example, be of a technical nature, i.e. allow the user to program specific actions. They can facilitate programming work, e.g. instead of programming exponentiation, you can prepare a table with specific values,

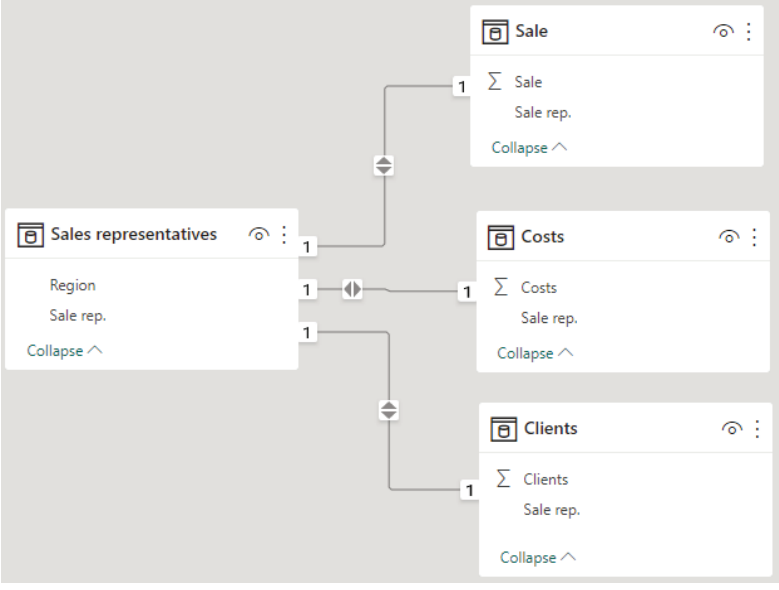
thanks to which it will be enough to program multiplication. Data arrays can be especially useful in the initial period of using Power BI, when learning and gaining experience, looking for simplified solutions.

Internal data variables include information resulting from actions taken in the analysed periods of time. They can be compared with each other but also referred to the indicated reference values. They are most often stored in the form of digital files or downloaded directly from the source of origin (e.g. firmware). Variable data is most often updated during the period of validity of internal fixed data (e.g. the profit and loss account plan is fixed for a given year, while performance is refreshed after each completed month).

Fixed/variable external data is the various data that is published in external sources (e.g. the Internet) and is used to perform calculations/conversions or serve as comparative values. That can be e.g. exchange rates, shares, statistical data but also qualitative data (e.g. recommendations)

Data dictionaries are something special to Power BI. They are used to connect data from different sources and perform different functions. The operation of data dictionaries will be discussed on the basis of the following example:

Figure 3.4. Data dictionaries



Source: own.

In this example, there is a data dictionary and three independent data sources for internal variables. Thanks to the dictionary (and creating a connection based on the Sale rep. column), it is possible to group and display the indicated data, e.g. in one table. Additionally (in further steps), in Power BI, you can create measures that will be automatically calculated (marked in the frame):

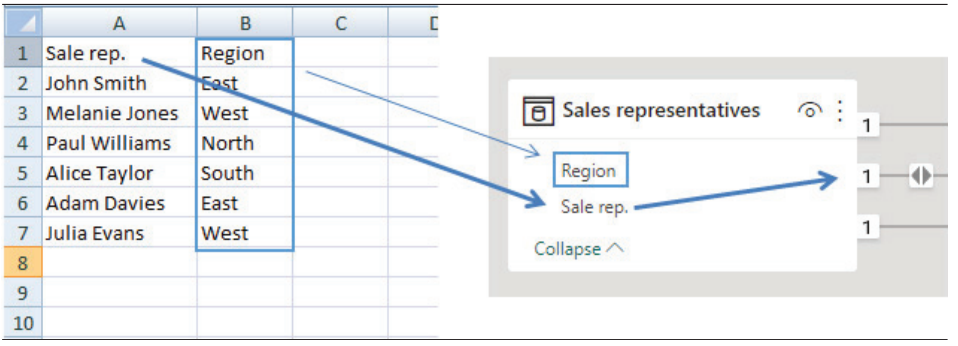
Figure 3.5. Group and display the indicated data

Sale rep.	Clients	Sale	Costs	Margin	Sale per Client
Adam Davies	6	320 000	270 000	50 000	53 333
Alice Taylor	5	475 000	450 000	25 000	95 000
John Smith	2	180 000	150 000	30 000	90 000
Julia Evans	2	210 000	175 000	35 000	105 000
Melanie Jones	3	245 000	220 000	25 000	81 667
Paul Williams	4	95 000	75 000	20 000	23 750
Total	**22**	**1 525 000**	**1 340 000**	**185 000**	**69 318**

Source: own.

If columns with additional filtering categories are created within the data dictionary, e.g. sales region, sales manager, etc. Then it is possible to group the analysed data by these categories (without the need to perform any additional preparatory actions). For example, creating a region column in the data dictionary:

Figure 3.6. Creating a region column in the data dictionary



Source: own.

displays the following data table:

Figure 3.7. Creating a region column in the data dictionary (data table)

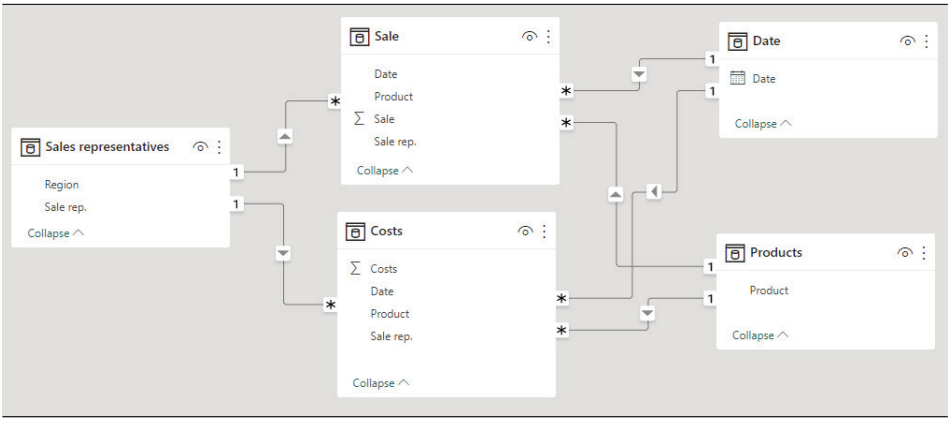
Region	Clients	Sale	Costs	Margin	Sale per Client
⊟ **East**	**8**	**500 000**	**420 000**	**80 000**	**62 500**
Adam Davies	6	320 000	270 000	50 000	53 333
John Smith	2	180 000	150 000	30 000	90 000
⊞ **North**	**4**	**95 000**	**75 000**	**20 000**	**23 750**
⊞ **South**	**5**	**475 000**	**450 000**	**25 000**	**95 000**
⊞ **West**	**5**	**455 000**	**395 000**	**60 000**	**91 000**
Total	**22**	**1 525 000**	**1 340 000**	**185 000**	**69 318**

Source: own.

All the formulas in the first example automatically work in the second example as well. The only effort on the part of the author of the analysis was to change the table type and add the "region" category to the rows.

When working in Power BI, it is possible to use more data dictionaries, e.g. sales representative, product, date of introduction, etc., e.g.:

Figure 3.8. Multiple data dictionaries



Source: own.

As a result of these connections, it is possible to group data interchangeably by representative, product and date of introduction, e.g.:

Figure 3.9. Multiple data dictionaries grouped by representative and product

Product / Sale rep.	ts	AS2 Sale	AS2 Costs	AS3 Sale	AS3 Costs	AS4 Sale	AS4 Costs	AS5 Sale	AS5 Costs	Total Sale	Total Costs
⊟ **Adam Davies**						**320 000**	**270 000**	**160 000**	**150 000**	**480 000**	**420 000**
2022-12-29						320 000	270 000			**320 000**	**270 000**
2022-12-30								160 000	150 000	**160 000**	**150 000**
⊟ **Alice Taylor**				**475 000**	**450 000**					**475 000**	**450 000**
2022-12-28				475 000	450 000					**475 000**	**450 000**
⊞ **John Smith**										**180 000**	**150 000**
⊞ **Julia Evans**								**210 000**	**175 000**	**210 000**	**175 000**
⊞ **Melanie Jones**	) 000									**245 000**	**220 000**
⊞ **Paul Williams**		**95 000**	**75 000**							**95 000**	**75 000**
Total	) 000	**95 000**	**75 000**	**475 000**	**450 000**	**320 000**	**270 000**	**370 000**	**325 000**	**1 685 000**	**1 490 000**

Source: own.

Figure 3.10. Multiple data dictionaries grouped by representative, product and date of introduction

Sale rep. / Product	lice osts	John Smith Sale	John Smith Costs	Julia Evans Sale	Julia Evans Costs	Melanie Jones Sale	Melanie Jones Costs	Paul Williams Sale	Paul Williams Costs	Total Sale	Total Costs
⊟ **AS**		**180 000**	**150 000**							**180 000**	**150 000**
2022-12-25		180 000	150 000							**180 000**	**150 000**
⊟ **AS1**						**245 000**	**220 000**			**245 000**	**220 000**
2022-12-26						245 000	220 000			**245 000**	**220 000**
⊞ **AS2**								**95 000**	**75 000**	**95 000**	**75 000**
⊞ **AS3**	**50 000**									**475 000**	**450 000**
⊞ **AS4**										**320 000**	**270 000**
⊞ **AS5**				**210 000**	**175 000**					**370 000**	**325 000**
Total	**50 000**	**180 000**	**150 000**	**210 000**	**175 000**	**245 000**	**220 000**	**95 000**	**75 000**	**1 685 000**	**1 490 000**

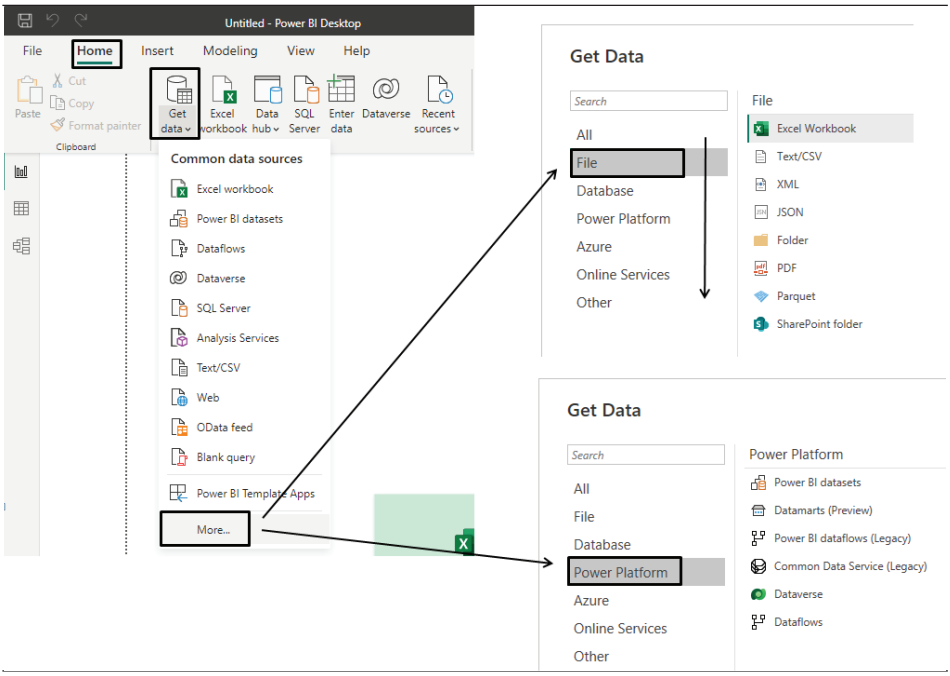
Source: own.

A correctly set data dictionary eliminates the risk of errors when changing variants of analytical data grouping.

3.1.3. Sources of data used to prepare the analysis

The discussed types/categories of data are stored in specific forms and locations. The form is understood as, for example, file extensions (xls, txt, csv, etc.), while the location, for example, a computer disk, network location, etc. Power BI has very extensive possibilities of supplying various forms of data (1). In addition, within the Power BI and Microsoft environment, it is possible to build your own databases/data warehouses, connections, etc. (2).

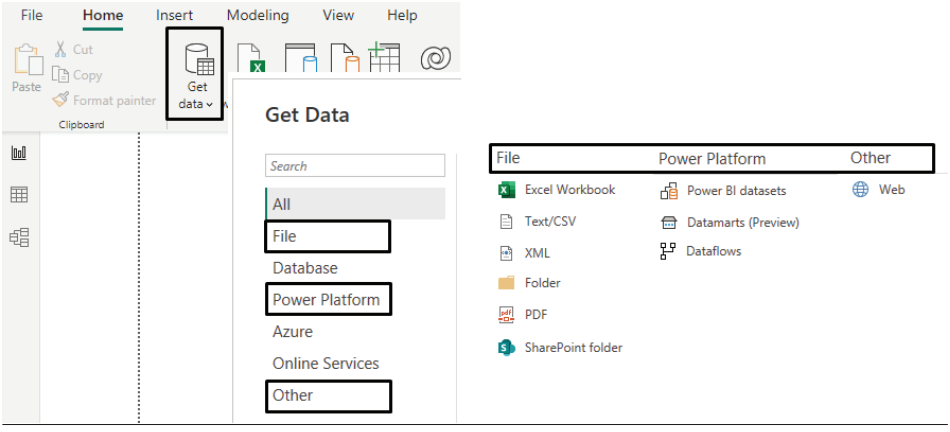
Figure 3.11. Types/categories of data



Source: own.

Currently, Power BI allows you to import data from 173 different sources. Being at the beginning and intermediate level, the user will most often use the following sources:

Figure 3.12. Own databases/data warehouses, connections, etc.



Source: own.

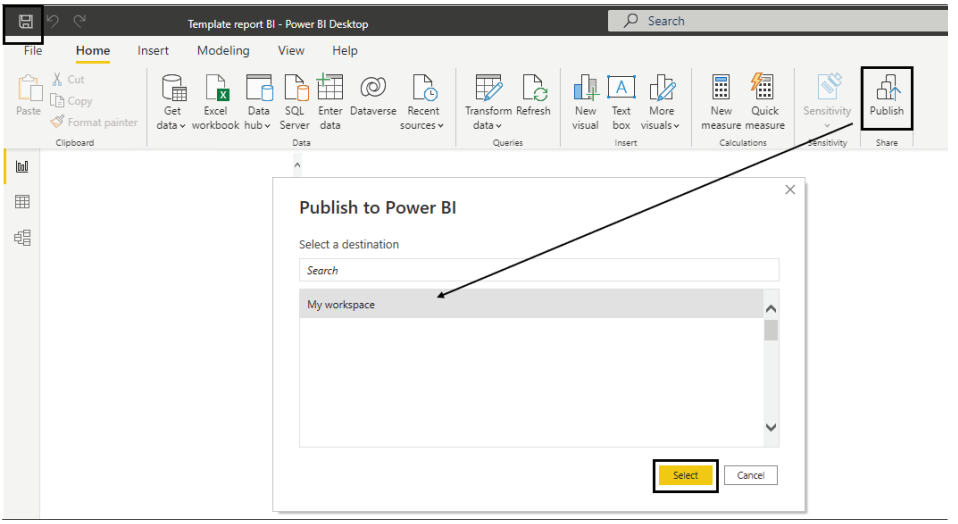
3.1.4. Sources of data used to prepare the analysis (Power Platform)

Beginners and intermediate users in their work with Power BI may come across three sources of BI data:

1. Dataset
2. Dataflow
3. Datamart

To be able to use these data sources, you must have access to the paid version of Power BI: PRO or Premium. They enable e.g. publishing reports to the Microsoft cloud (also known as a service or workspace). Thanks to this, it is possible to share reports with other users, e.g. by means of a link, access via a smartphone application, etc. This is a very useful function, especially in enterprises and a large number of recipients. In addition, these versions provide the option of setting automatic refreshes, which allows you to prepare reports that, once made available, will work and update as long as nothing is changed in the data sources (then information about a refresh error will be sent). There is a possibility of 8 (PRO) to 48 (Premium) refreshes per day.

Figure 3.13. Dataset (saving the report)

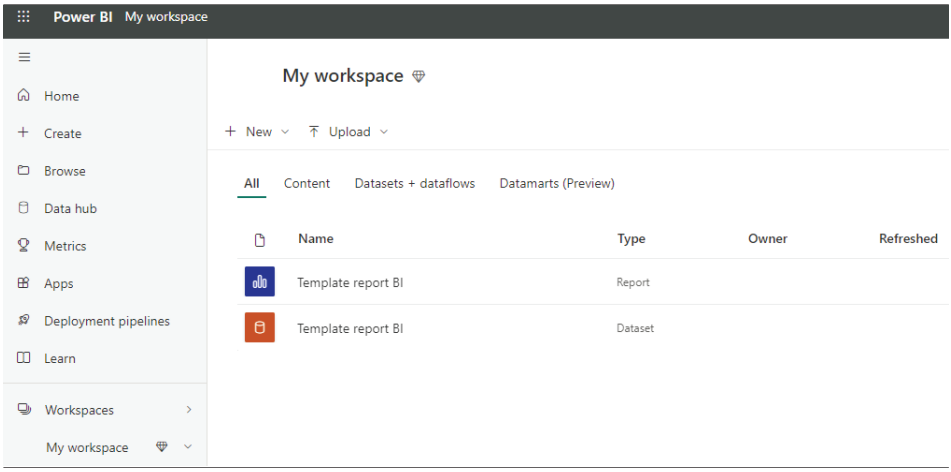


Source: own.

The first of the three BI sources discussed, i.e. **Dataset**, is most often created during the preparation of a report in Power BI Desktop. After saving the report and publishing the report in the Microsoft cloud, two icons are visible (dataset, i.e. data source and report, i.e. graphical and tabular analysis):

Published report in the Microsoft cloud:

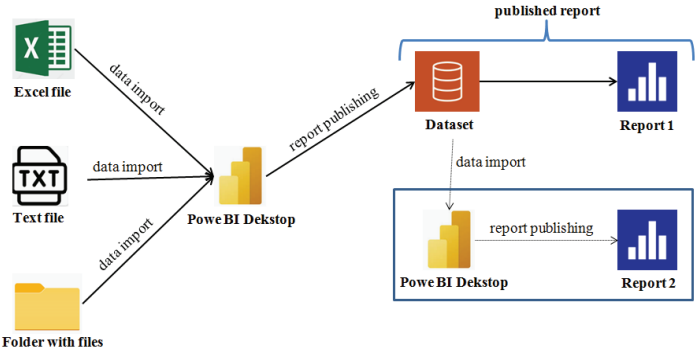
Figure 3.14. Dataset (publishing the report)



Source: own.

Thanks to this solution, it is possible to create additional reports based on a previously prepared dataset, e.g.:

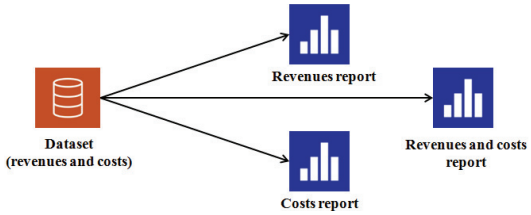
Figure 3.15. Creation of additional reports based on a previously prepared dataset



Source: own.

Usually one dataset is used for one report. This is due to the fact that a given dataset cannot be edited in any way for the purpose of creating subsequent reports (e.g. to add an additional data source or change something in the assignment of data dictionaries). However, if we want to publish various reports for which one data source is sufficient, the use of a dataset solution may be helpful (e.g. in a situation where we prepare one report for the director containing the analysis of revenues and costs, and then two separate reports for the manager responsible for revenue and manager responsible for costs):

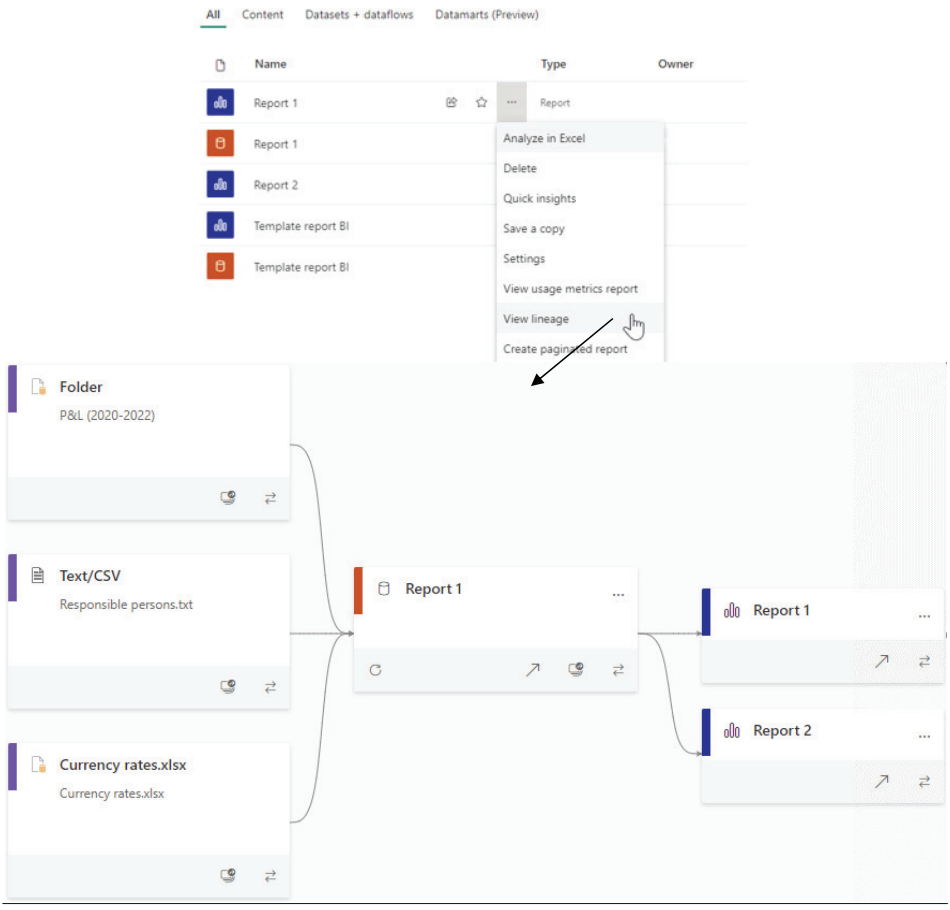
Figure 3.16. Use of a dataset solution



Source: own.

After publishing the whole thing in the cloud (workspace), it is possible to view and analyse the connections created between individual sources and reports.

Figure 3.17. View of the connections created between individual sources and reports

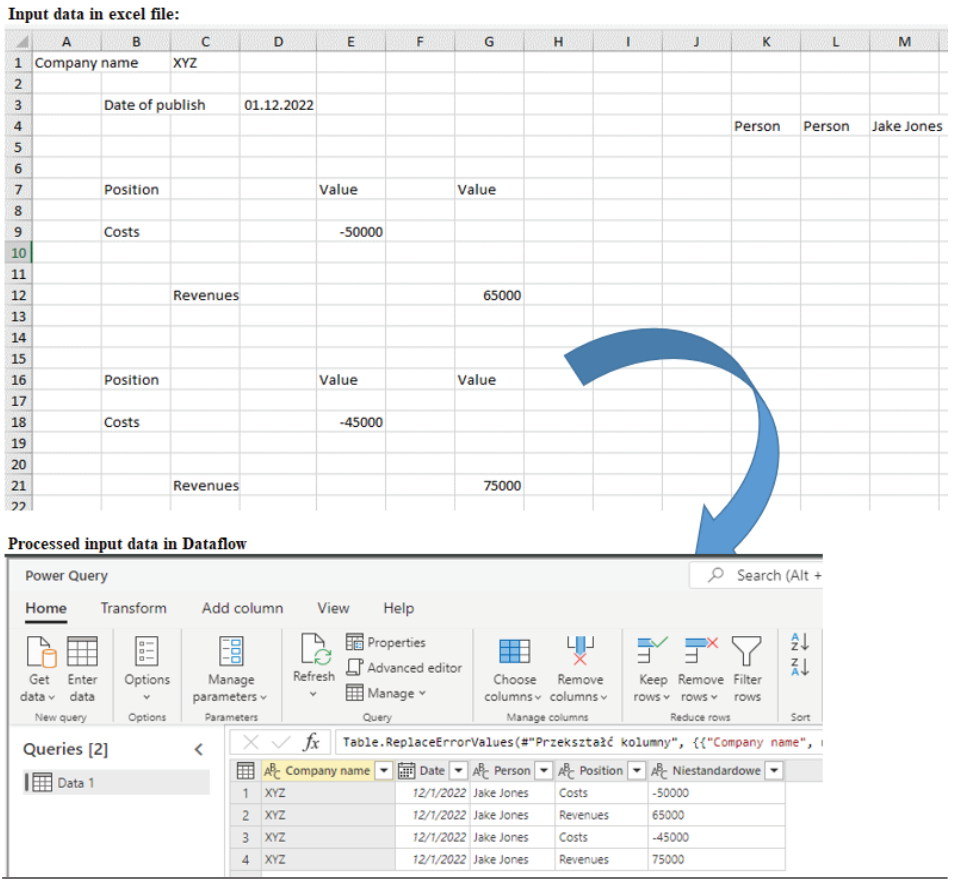


Source: own.

In the example above, there are three data sources that make up one Dataset from which two reports are published. In such a situation, however, specific restrictions should be applied so that individuals do not have access to the entire report.

The second of the discussed data sources, i.e. **dataflow**, is created entirely in the cloud (workspace). Dataflow is a table or tables with input data that has already been pre-processed (within Dataflow) and can be used to prepare a report.

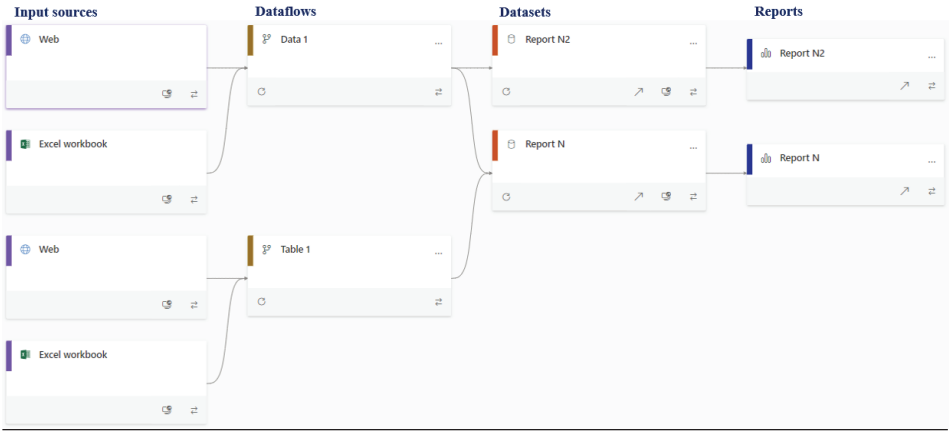
Figure 3.18. Dataflow



Source: own.

The use of this data source has a great advantage in terms of computing power of the computer used. In the case of a larger number of sources and complex transformations, there may be a situation where the IT equipment owned will not be able to perform the indicated actions. With Dataflow, all calculations are made using Microsoft's computing power. On the user's side, only activities related to creating data connections (data dictionaries) and preparing visualisations are performed. Another advantage of Dataflow is the ability to use more of them within one report, or to use only some of the tables contained within one Dataflow.

Figure 3.19. The ability to use more of Dataflow within one report

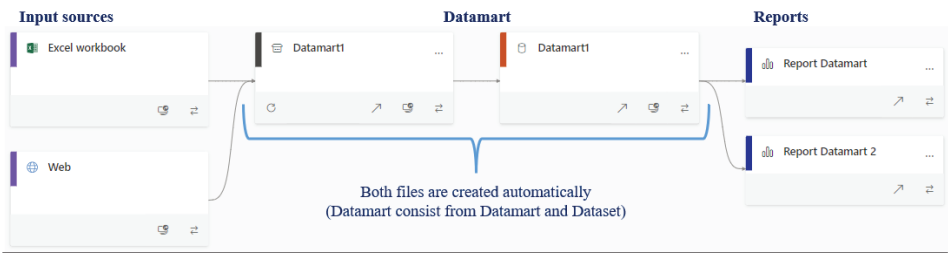


Source: own.

Thanks to the above solution, reports and their settings (e.g. access restrictions) will remain autonomous from each other. This solution also ensures greater security and stability of report operation.

The last of the listed data sources within the Power Platform is **Datamart**. It is intended to be an equivalent of Dataset , which (like Dataflow) is entirely prepared in the Microsoft cloud. Its advantage over Dataset is the use of Microsoft's computational fashion:

Figure 3.20. Datamart



Source: own.

With a very large amount of data, it may turn out that the preparation of the original Dataset will be impossible due to the limitations of the computing power of your own computer. Then you can prepare Datamart, which will

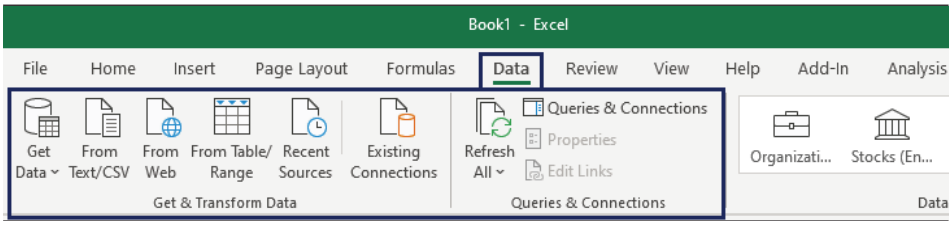
process the data thanks to Microsoft's computing power. However, Datamart has the same limitations as Dataset, i.e. lack of flexibility and differentiation of settings due to the subsequent reports created (based on this source).

3.2. Application of Power Query in data processing

Power Query – basic information

Power Query was originally created as an extension of Excel's capabilities. In the 2010 and 2013 versions, it appears as an add-on (it must be downloaded from the Internet), and in 2016 as a built-in functionality.

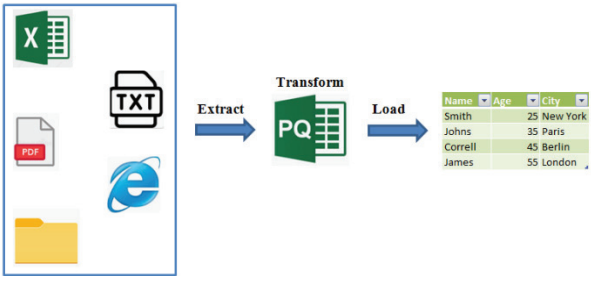
Figure 3.21. Power Query – menu



Source: own.

It is a tool from the ETL category (Extract → Transform → Load)

Figure 3.21. Power Query – basic information



Source: own.

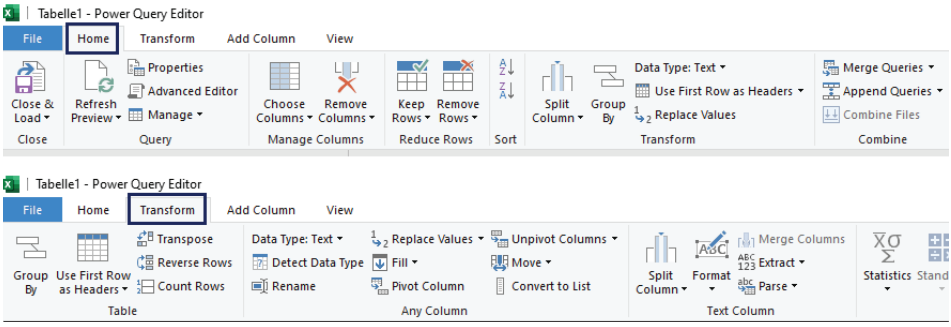
Power Query's core features include:

- Combine data from multiple files/sources
- Delete/add rows
- Combine/split columns
- Adding conditional/math/text/number columns
- Column formatting
- Transposing, rearranging columns
- … and many others

To put it simply, Power Query allows you to prepare clear tables with data based on (very often) incoherent and unrelated sources.

Power Query works in a similar way to the Office package, i.e. the user selects individual functions from a graphical and text menu:

Figure 3.23. Individual functions from a graphical and text menu

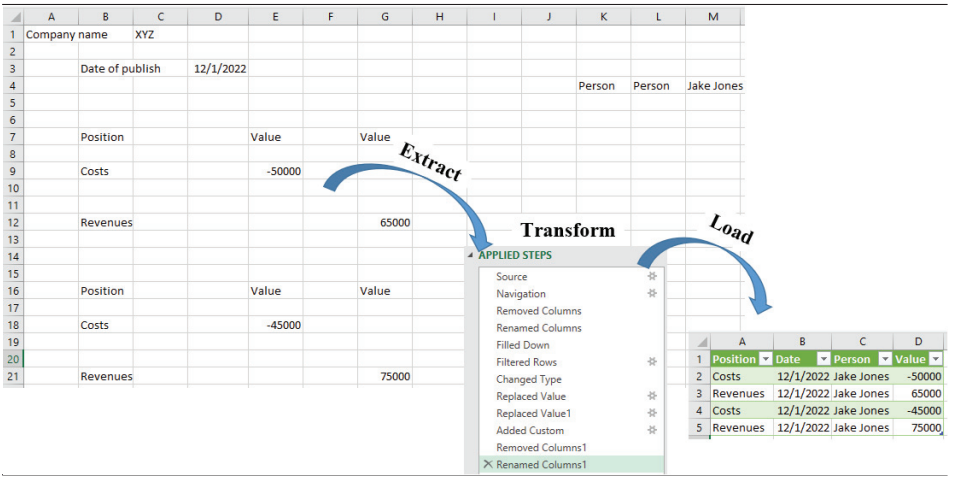


Source: own.

In contrast, in the case of Power Query (in the background), successive lines of commands are programmed in the Power Query M (also known as M) scripting language. In a situation where one of the standard transformations does not meet the user's expectations, they can make their own corrections within the given formula (Microsoft, 2022B).

Power Query has a relatively small entry threshold (a few hours of learning is enough) to be able to perform the first transformations on your own:

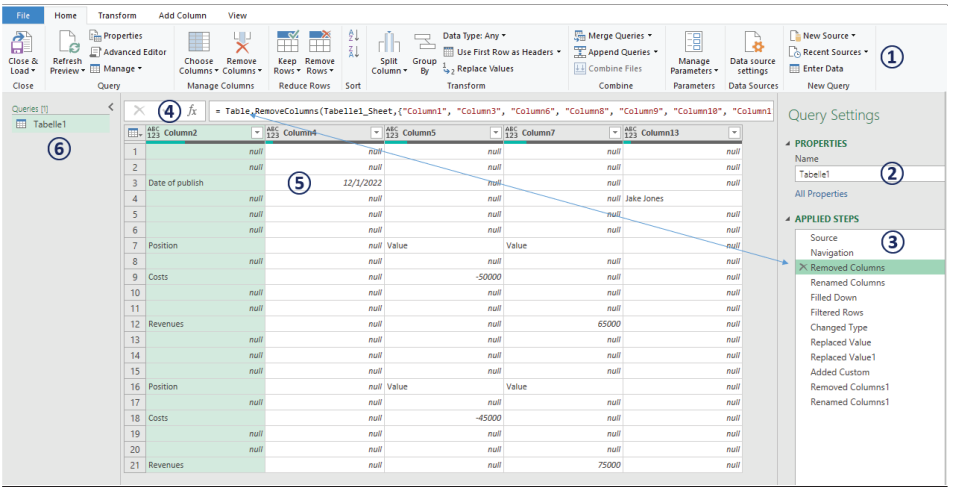
Figure 3.24. Power Query first transformations



Source: own.

Power Query Editor can be divided into six areas:

Figure 3.25. Power Query Editor six working areas



Source: own.

1. A menu with standard transformation commands available.
2. The name of the data source that is being converted.
3. List of steps of performed transformations within the indicated data source.

4. Formula in language M, which was written in the background of the selected step from point 3.
5. Preview of the data source after performing the selected step from point 3.
6. A list of data sources (tables) within a given Power Query query.

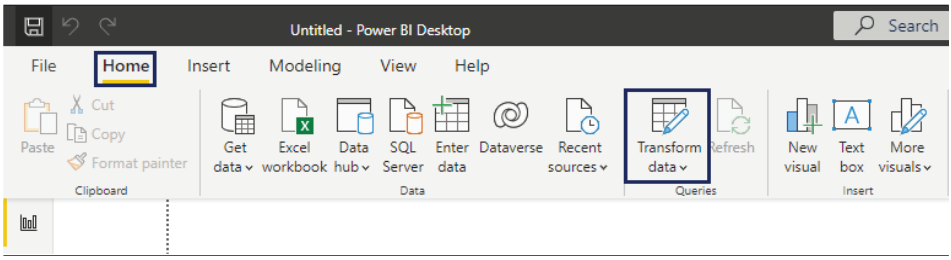
A very useful function in Power Query is the list of performed steps (area 3). Thanks to this, it is possible to preview the effect of the introduced transformations on an ongoing basis. In the event of an error, you can verify at what stage the problem arose and thus easily fix it. In addition, if a specific transformation is omitted, we can go back and add the preceding step.

Power Query is especially useful for very large, frequently refreshed datasets that additionally require transformation. In such a situation, it is difficult to imagine their manual processing. In addition, it would be associated with the risk of an error, omission of one of the stages.

A very important advantage of Power Query is the verification whether the refreshed data is always compatible with the performed transformations/indicated formats, if, for example, a given column should contain numbers, and a word appears in a row (e.g. in line no. 125,516), then Power Query will inform you about the error and the line number that needs to be verified; similarly, e.g. if the arrangement of columns changes or some other irregularity appears.

Power Query is also available in Power BI, where it is the basis for transforming and preparing data for the report or creating further formulas directly in Power BI:

Figure 3.26. Preparing data for the report or creating further formulas directly in Power BI



Source: own.

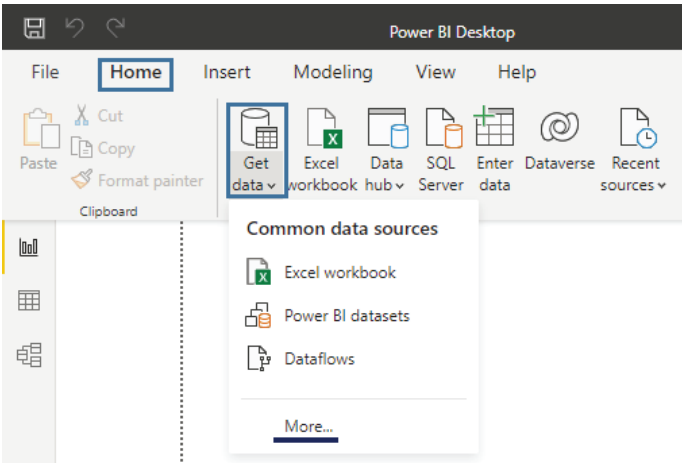
3.3. Import data to Power BI

Section 3.2 discusses the possibility of importing data to Power BI/Power Query from various sources. Beginner and intermediate users will most often use the following data sources:

- from the file
- from the folder
- from the internet
- from a network location (e.g. OneDrive)
- with date flow
- from the operational programme

Importing data always starts in the following Power BI location:

Figure 3.27. Importing data

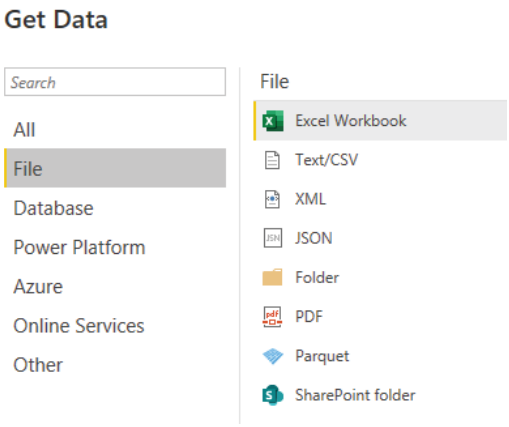


Source: own.

In addition to a few of the most frequently selected data sources, there is the option of clicking "More" and opening a window with almost 180 optional data sources.

In the case of **importing data from a file**, you must first indicate the file type:

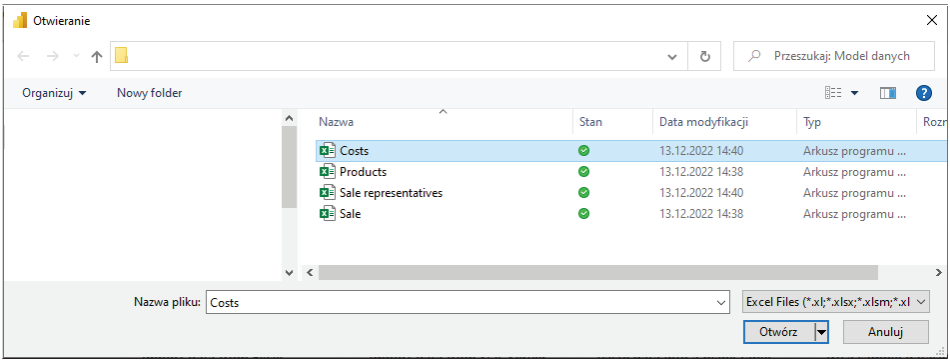
Figure 3.28. The case of importing data from a file



Source: own.

And then indicate its location:

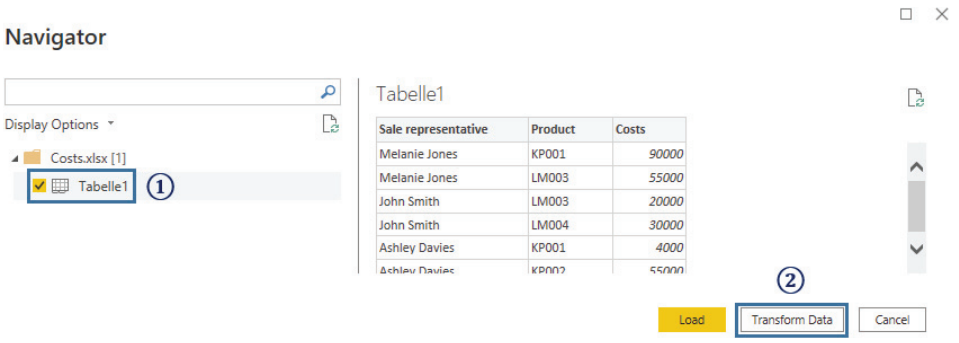
Figure 3.29. The case of importing data from a file (location)



Source: own.

Then select the element of this file ①, e.g. sheet / table, which is to be imported. Next, select "Transform Data" ② to open the file in Power Query and prepare the file for use in Power BI (e.g. indicate column formats, add conditional columns, etc.):

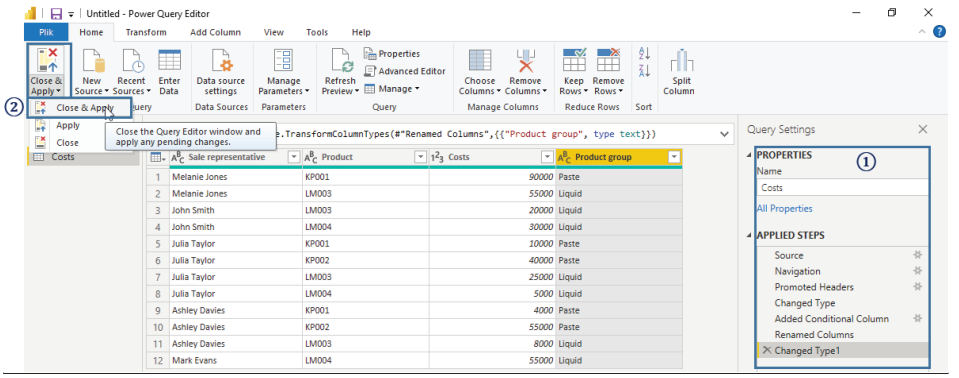
Figure 3.30. The case of importing data from a file (Transform Data)



Source: own.

After performing the necessary transformations ①, close the Power Query view and go to Power BI ②:

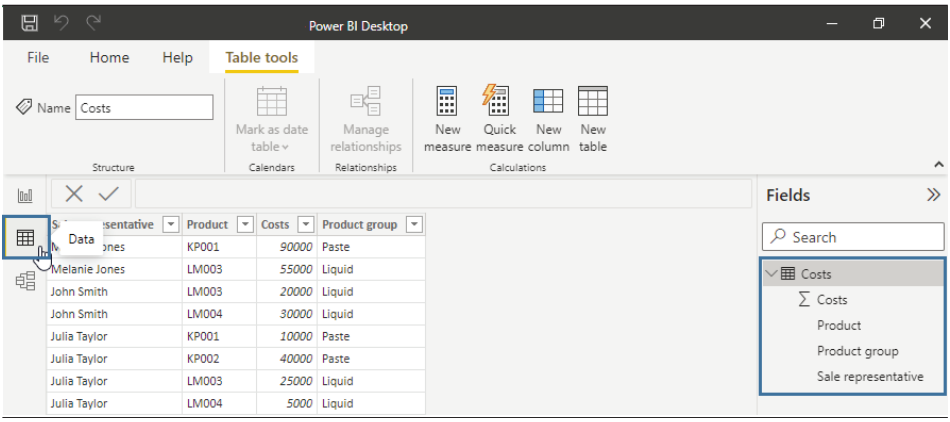
Figure 3.31. The case of importing data from a file (Close & Apply)



Source: own.

In Power BI, the imported data can be previewed in the "Data" tab:

Figure 3.32. The case of importing data from a file (preview)



Source: own.

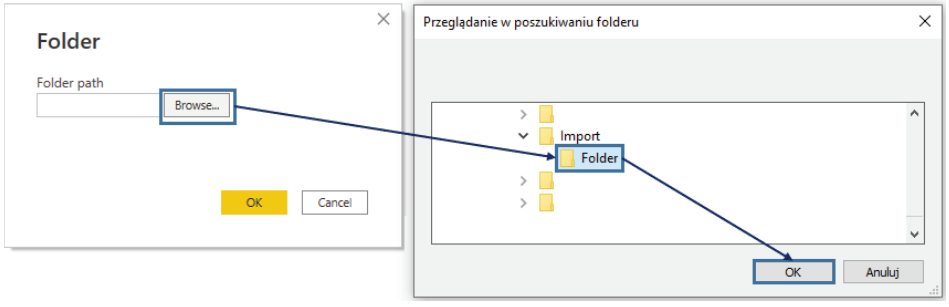
Data may undergo some further transformations within Power BI (e.g. changing column format, adding calculation formulas)

Importing data from a folder is useful when, for example:

1) in a given folder, there are more files concerning one issue (e.g. profit and loss account for individual years);
2) the data layout in these files is identical (or very similar).

Then we can import the whole thing in one go and perform the necessary transformations for them in one operation. This possibility of importing data is also useful, e.g. when new files with data for a given issue are saved every day. After selecting the "import from folder" option, indicate its location:

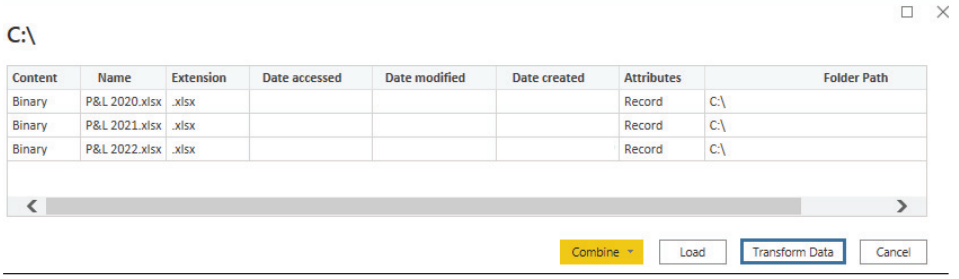
Figure 3.33. The case of importing data from a folder (location)



Source: own.

Then Power BI will indicate what files are currently in this folder:

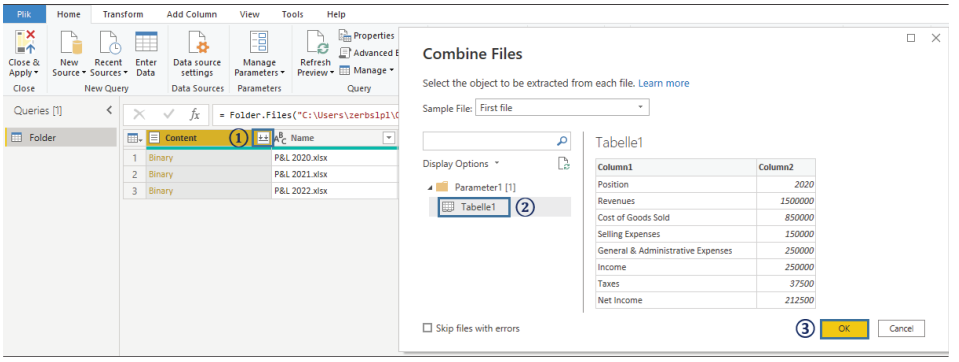
Figure 3.34. The case of importing data from a folder (Transform Data)



Source: own.

After selecting the "Transform Data" option, we will be redirected to Power Query, where the data will still be visible in the form of files. Then follow steps ①②③:

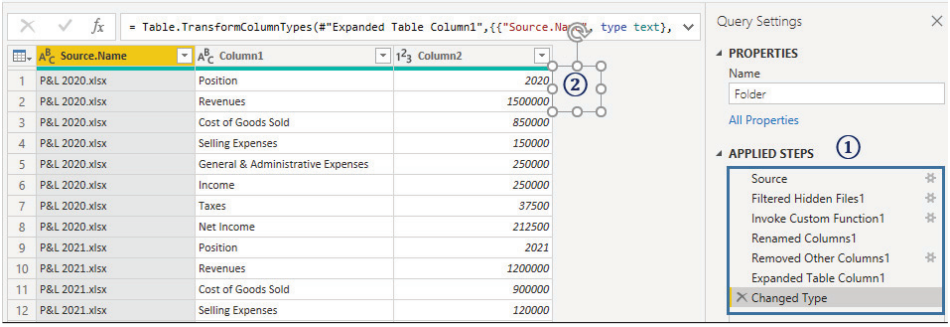
Figure 3.35. The case of importing data from a folder (Combine Files)



Source: own.

As a result, Power Query will perform transformations ① thanks to which we will get pre-merged files ②:

Figure 3.36. The case of importing data from a folder (transformations)

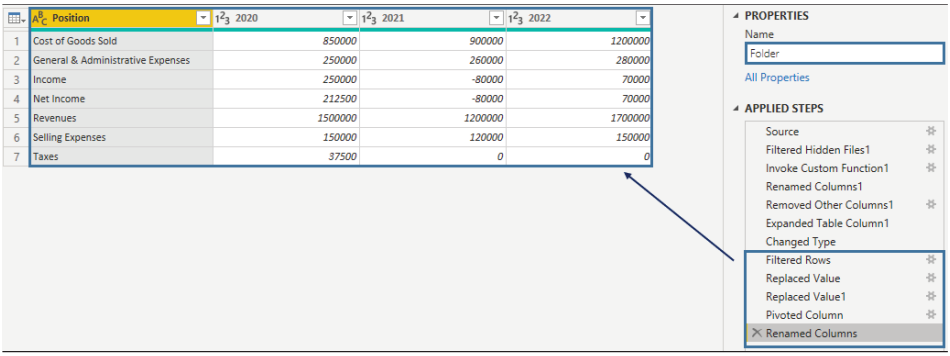


	Source.Name	Column1	Column2
1	P&L 2020.xlsx	Position	2020
2	P&L 2020.xlsx	Revenues	1500000
3	P&L 2020.xlsx	Cost of Goods Sold	850000
4	P&L 2020.xlsx	Selling Expenses	150000
5	P&L 2020.xlsx	General & Administrative Expenses	250000
6	P&L 2020.xlsx	Income	250000
7	P&L 2020.xlsx	Taxes	37500
8	P&L 2020.xlsx	Net Income	212500
9	P&L 2021.xlsx	Position	2021
10	P&L 2021.xlsx	Revenues	1200000
11	P&L 2021.xlsx	Cost of Goods Sold	900000
12	P&L 2021.xlsx	Selling Expenses	120000

Source: own.

The above data may be subject to further user transformations:

Figure 3.37. The case of importing data from a folder (transformation corrects)

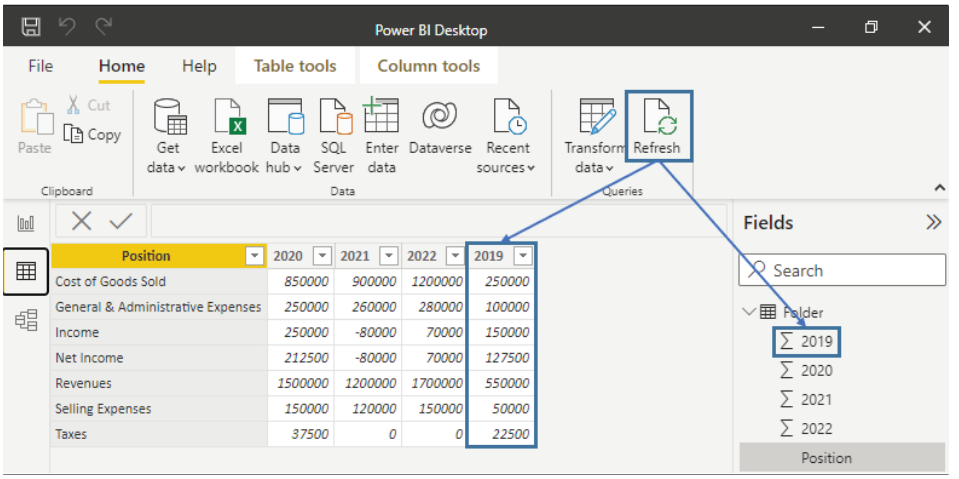


	Position	2020	2021	2022
1	Cost of Goods Sold	850000	900000	1200000
2	General & Administrative Expenses	250000	260000	280000
3	Income	250000	-80000	70000
4	Net Income	212500	-80000	70000
5	Revenues	1500000	1200000	1700000
6	Selling Expenses	150000	120000	150000
7	Taxes	37500	0	0

Source: own.

After closing the Power Query editor, we can refresh this data source. If a file for the next/previous year has been placed in the folder, then it will be automatically imported:

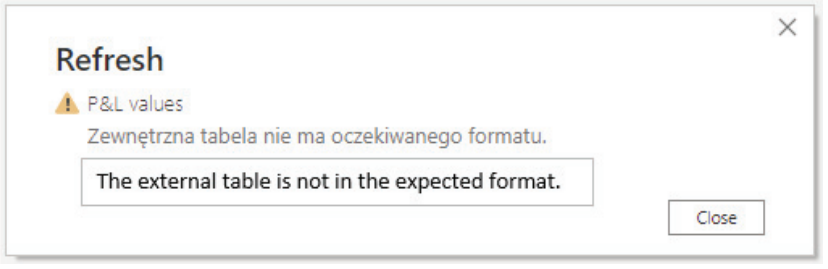
Figure 3.38. The case of importing data from a folder (Close & Apply)



Source: own.

The indicated data import is simplified – it assumes that the folder contains only those files that are to be imported and that they always consist of one sheet/table. In the case of a greater variety of data and their sources, additional transformation steps must be introduced, so that the program accurately locates the correct data. In the case of data that does not correspond to the indicated pattern, an error message will appear during refreshing, e.g.:

Figure 3.39. The case of importing data from a folder (Refresh)



Source: own.

Power BI/Power Query also has a built-in error reporting mode, which makes it very easy to verify the cause of the problem and make corrections in the transformation steps (or data source) to eliminate a given discrepancy.

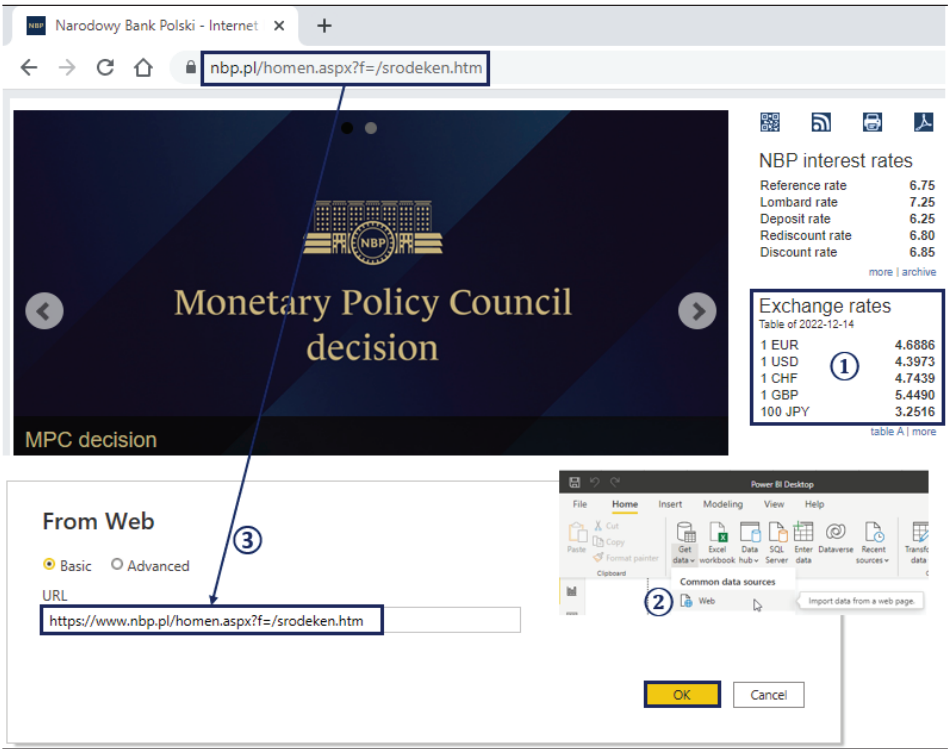
Importing data from the Internet can refer to two issues:

1) connecting to the table published on the website;
2) getting connection to the file/files shared within the URL (Uniform Resource Locator) address.

In both situations, using a once-set connection, it will be possible to refresh data as long as nothing is changed in a given source. Then, in Power BI, information about the data import error will appear.

To connect to the table published on the website ①, select the option to import data from the Internet in Power BI ② and then copy the URL of this page ③:

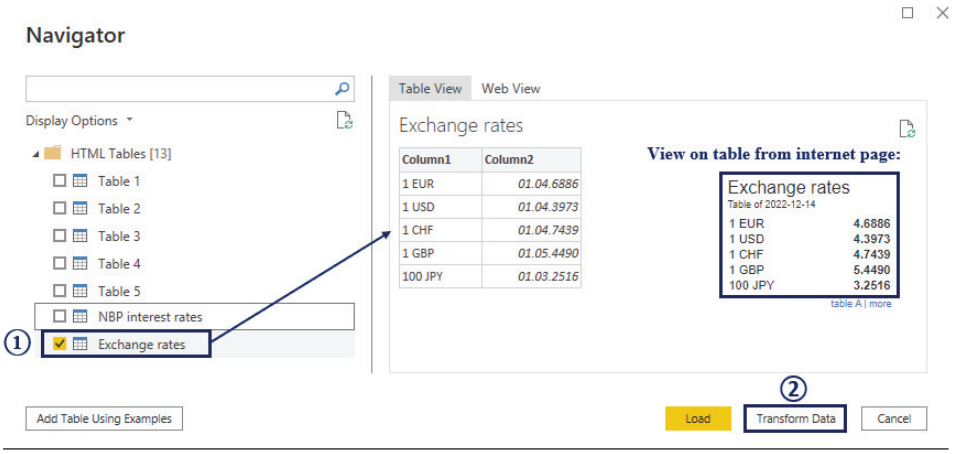
Figure 3.40. The case of importing data from the Internet (location)



Source: own.

Then Power BI will prepare a table of data that it recognised as tabular forms. Select the table to be imported ① and proceed to data transformations ②:

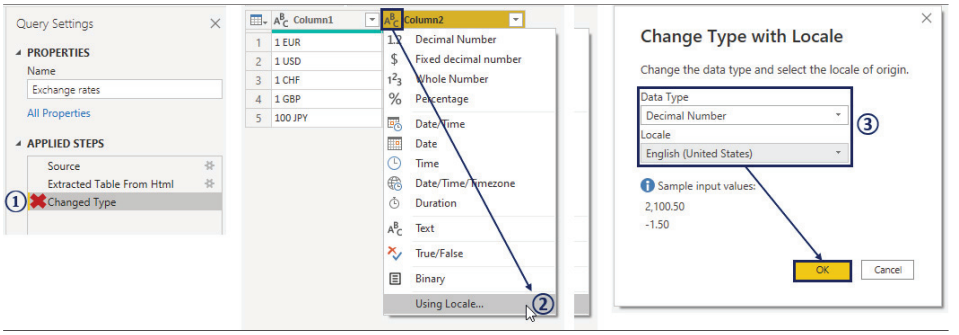
Figure 3.41. The case of importing data from the Internet (recognition)



Source: own.

In this example (due to local settings), Power BI incorrectly recognised the format of exchange rate values for individual currencies (displaying dates instead of numbers). Therefore, as part of your data source transformations, you need to remove the "Change Type" ①. Go to the column formatting and select the local settings ② and then indicate those that will correspond to the formatting of the source data ③:

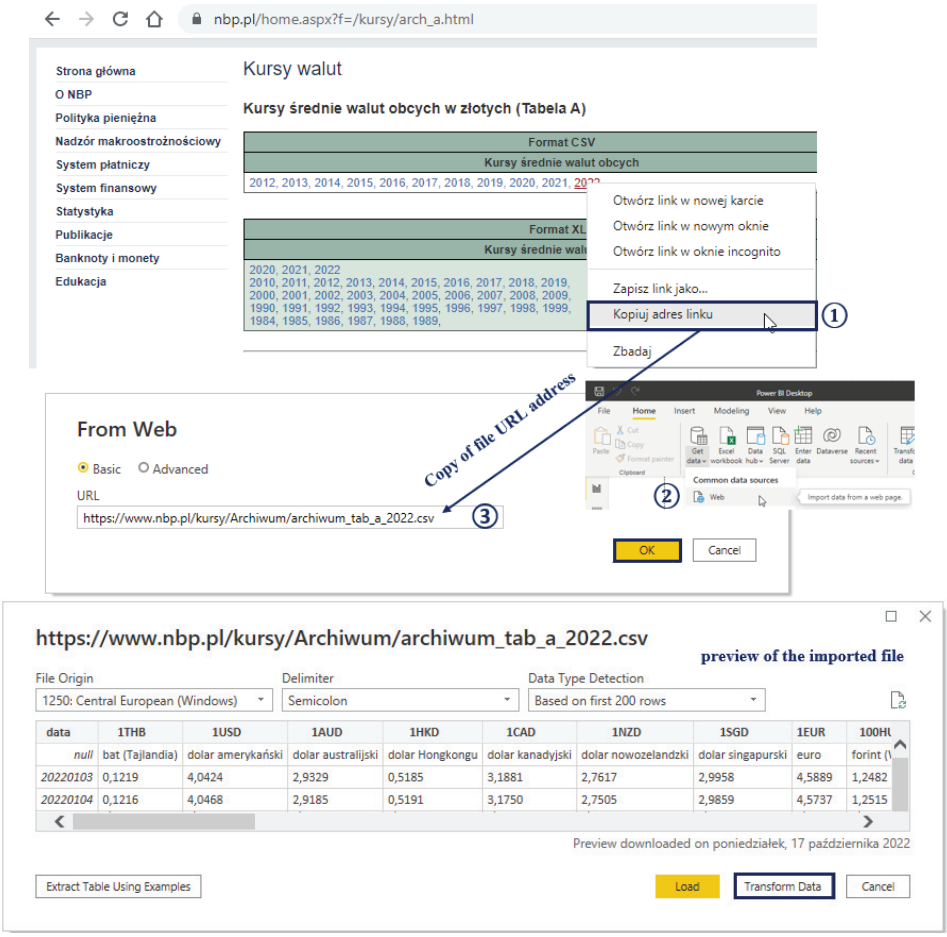
Figure 3.42. The case of importing data from the Internet (Change Type)



Source: own.

The second possibility of importing data from the Internet, i.e. connecting to the file/files shared within the URL address, is analogous:

Figure 3.43. The case of importing data from the Internet (data import)



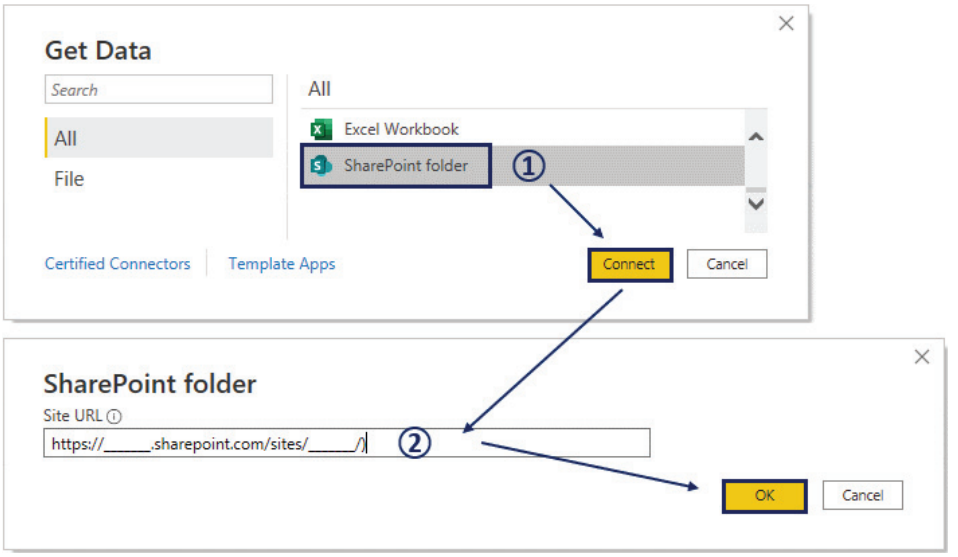
Source: own.

Importing data from a network location (e.g. OneDrive) is initially similar to an Internet connection, i.e. you need to have a general URL address of a given area (e.g. OneDrive location[1]: https://_____.sharepoint.com/sites/_____/).

In the first place, indicate the import of data from SharePoint ①, and then indicate its URL ②:

[1] OneDrive is Microsoft's cloud service that connects you to all your files. It allows you to store and protect your files, share them with others and access them from anywhere on all your devices. https://support.microsoft.com/pl-pl/office/what-is-us%C5%82uga-onedrive-u%C5%BCywana-at-work-or-school-187f90af-056f-47c0- 9656-cc0ddca7fdc2 of December 15, 2022.

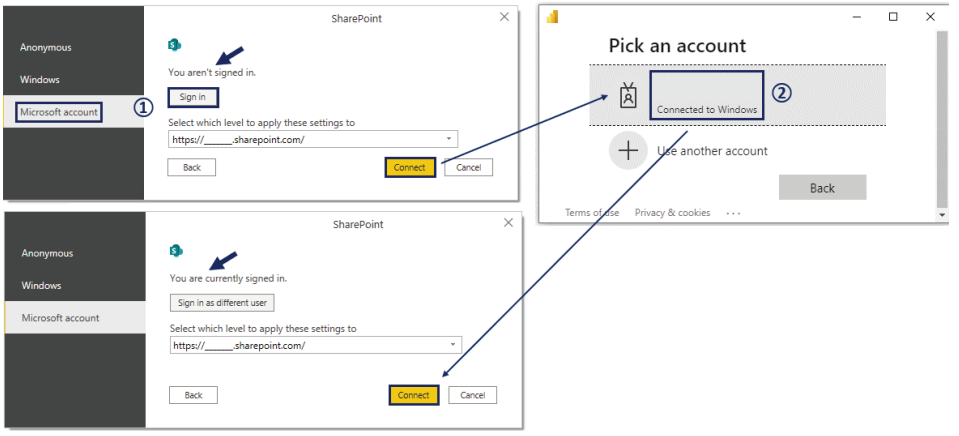
Figure 3.44. The case of importing data from a network location (e.g. OneDrive)



Source: own.

Next, we will be asked to authorise access to the indicated Sharepoint area. Select the Microsoft account option ①, and then select the name of the account through which the connection is to be made ②:

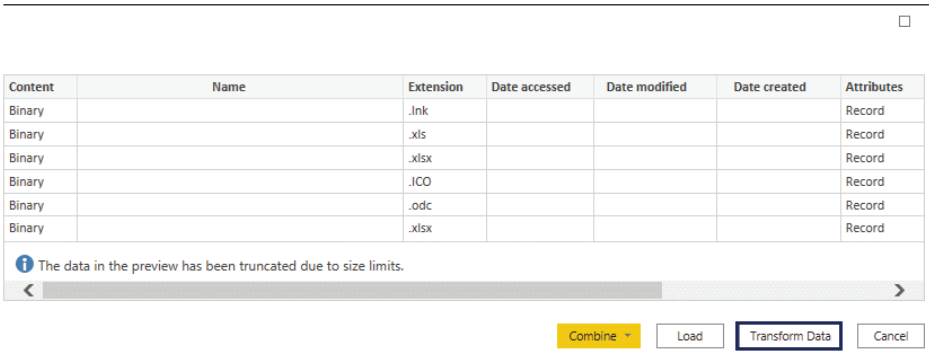
Figure 3.45. The case of importing data from a network location (e.g. OneDrive) (Sharepoint area)



Source: own.

Based on the entered data, Power BI will create a connection with the indicated Sharepoint area and display the files contained therein. Then go to Power Query (Transform Data button) to indicate the exact location of the folder/file that is to be imported into the prepared analysis:

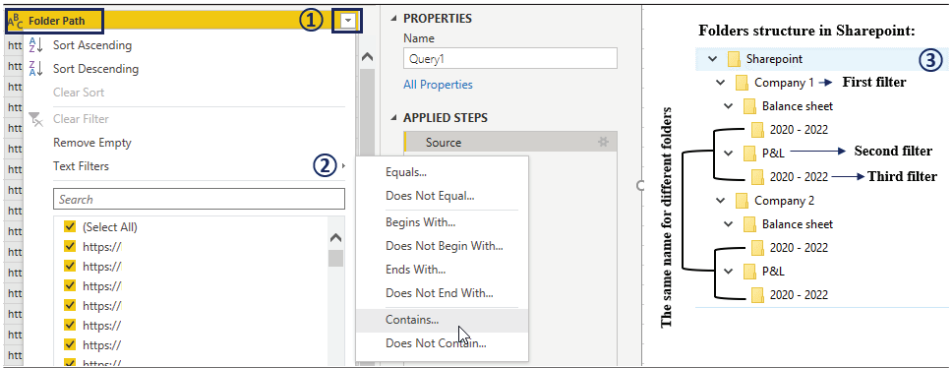
Figure 3.46. The case of importing data from a network location (e.g. OneDrive) (connection)



Source: own.

The location of the folder/file to be imported to Power BI is indicated by filtering the Folder Path column ①, which contains URL addresses of all files from a given Sharepoint address. Text Filters must be clicked and Contains variant should be selected ②. Due to the fact that there may be folders/files with the same names in the browsed location, it is recommended to apply filters in stages that will follow the location structure in Sharepoint ③:

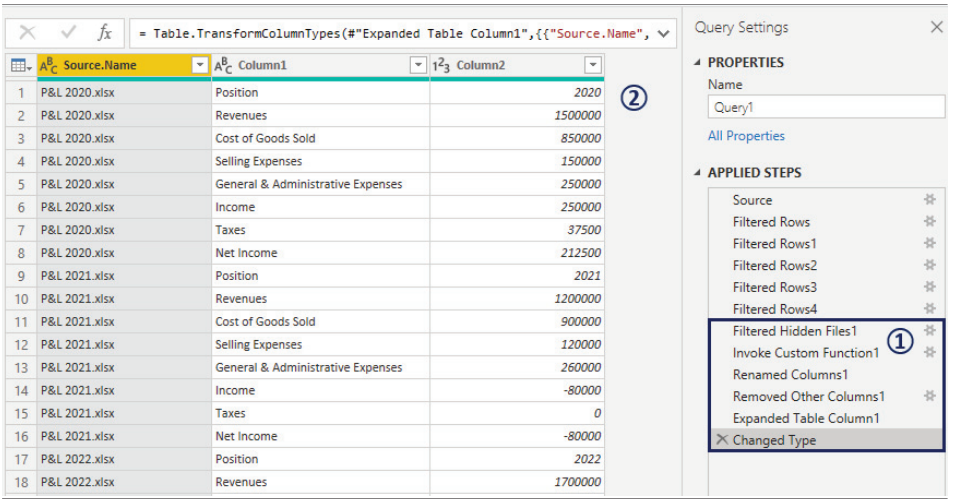
Figure 3.47. The case of importing data from a network location (e.g. OneDrive) (location)



Source: own.

After locating the folder/files, perform standard transformations ①, enabling the use of source data in Power BI ②.

Figure 3.48. The case of importing data from a network location (e.g. OneDrive) (Data Transformation)

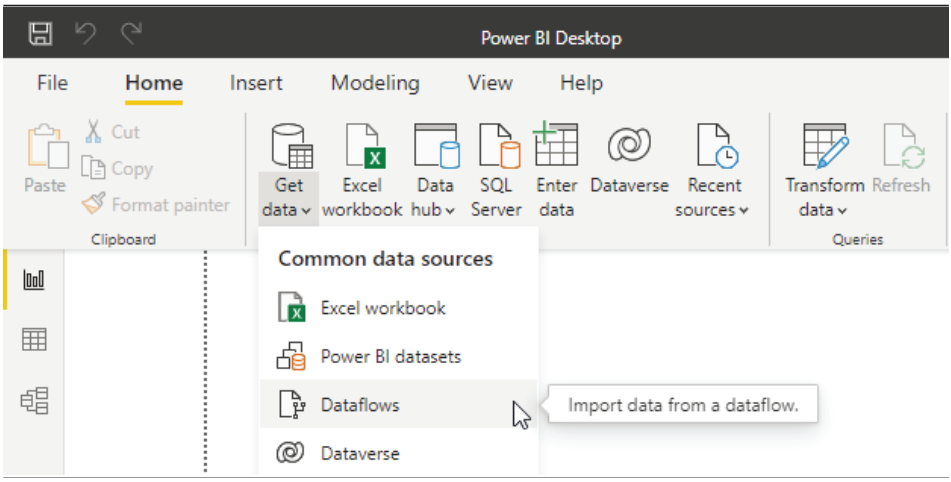


Source: own.

Importing data from Dataflow is a very useful source of data. It allows you to use Microsoft's computing power to perform transformations. In addition, the data is also stored in the Microsoft cloud, what for example reduces the risk of losing them. A very important issue is also the flexibility of using this source – you can import single tables from different, independent Dataflows into Power BI.

After selecting Dataflow as the data source:

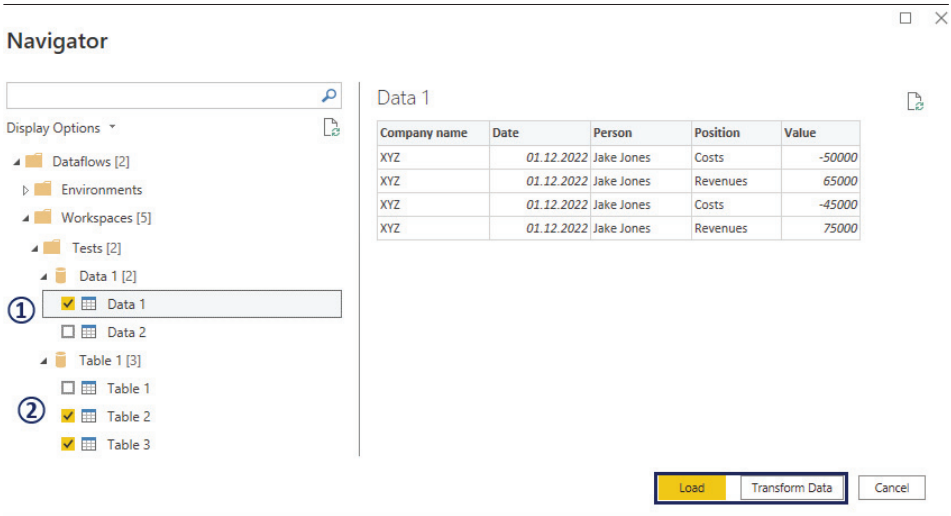
Figure 3.49. The case of importing data from Dataflow



Source: own.

We will be asked to authorise access (similarly as when importing from Sharepoint), or automatically redirected to the sources provided to us in the form of Dataflow. Individual Dataflows are visible within the workspaces used. Each of these sources can be expanded (in order to display individual tables with data included in them ①②):

Figure 3.50. The case of importing data from Dataflow (expansion)

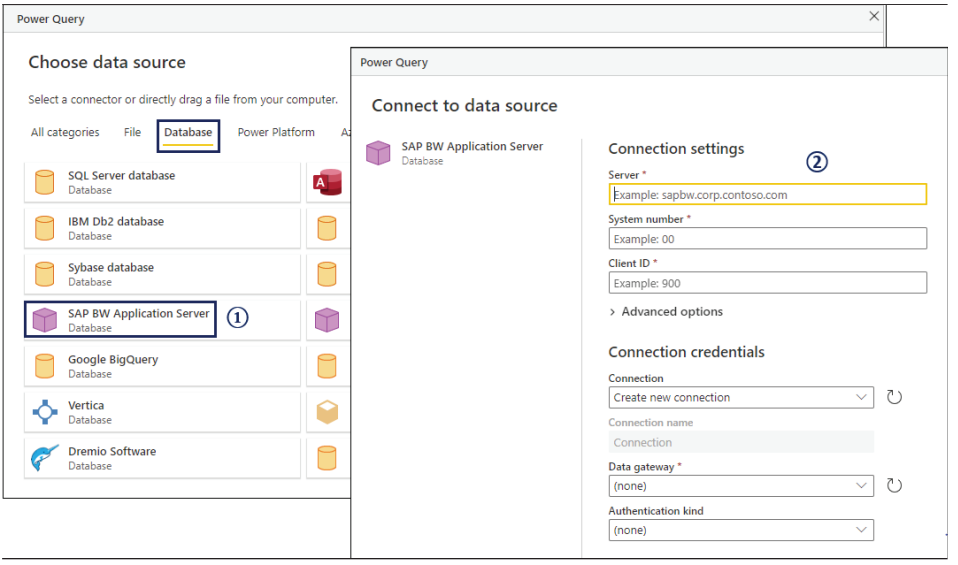


Source: own.

Power BI enables the use of individual tables from individual Dataflows, which is very useful when creating multi-threaded analyses.

Import from the operational program is a very useful possibility of downloading data, because you can potentially create a report that will provide data almost "on the fly". From the Power BI side, it is based on the preparation of Dataflow, which will be based on selecting the appropriate data source from the Database group ① and completing the access data ②.

Figure 3.51. The case of importing data from the operational program



Source: own.

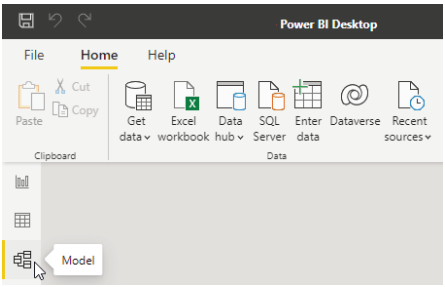
Subsequently, access to individual shared datasets will be displayed.

The problem with importing from an operational program is that this access must be prepared by the administrator of the given operational program. Therefore, in order to prepare the possibility of importing data under this solution, a person responsible for managing a given operational program should be engaged to enable the creation of this connection and indicate what access data should be entered.

3.4. Creating data models in Power BI

One of the key functionalities of Power BI is the ability to combine data from various sources using the so-called data models:

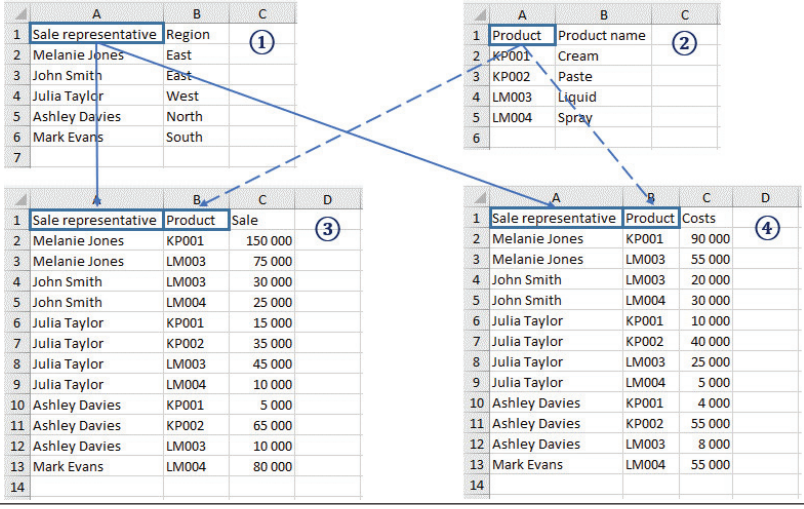
Figure 3.52. Creating data models in Power BI



Source: own.

The data model in Power BI creates connections between independent data sources, and then allows you to filter them. This issue will be discussed based on the following example:

Figure 3.53. Creating data models in Power BI (connections between independent data sources)



	A	B	C
1	Sale representative	Region	①
2	Melanie Jones	East	
3	John Smith	East	
4	Julia Taylor	West	
5	Ashley Davies	North	
6	Mark Evans	South	

	A	B	C
1	Product	Product name	②
2	KP001	Cream	
3	KP002	Paste	
4	LM003	Liquid	
5	LM004	Spray	

	A	B	C	D
1	Sale representative	Product	Sale	③
2	Melanie Jones	KP001	150 000	
3	Melanie Jones	LM003	75 000	
4	John Smith	LM003	30 000	
5	John Smith	LM004	25 000	
6	Julia Taylor	KP001	15 000	
7	Julia Taylor	KP002	35 000	
8	Julia Taylor	LM003	45 000	
9	Julia Taylor	LM004	10 000	
10	Ashley Davies	KP001	5 000	
11	Ashley Davies	KP002	65 000	
12	Ashley Davies	LM003	10 000	
13	Mark Evans	LM004	80 000	
14				

	A	B	C	D
1	Sale representative	Product	Costs	④
2	Melanie Jones	KP001	90 000	
3	Melanie Jones	LM003	55 000	
4	John Smith	LM003	20 000	
5	John Smith	LM004	30 000	
6	Julia Taylor	KP001	10 000	
7	Julia Taylor	KP002	40 000	
8	Julia Taylor	LM003	25 000	
9	Julia Taylor	LM004	5 000	
10	Ashley Davies	KP001	4 000	
11	Ashley Davies	KP002	55 000	
12	Ashley Davies	LM003	8 000	
13	Mark Evans	LM004	55 000	
14				

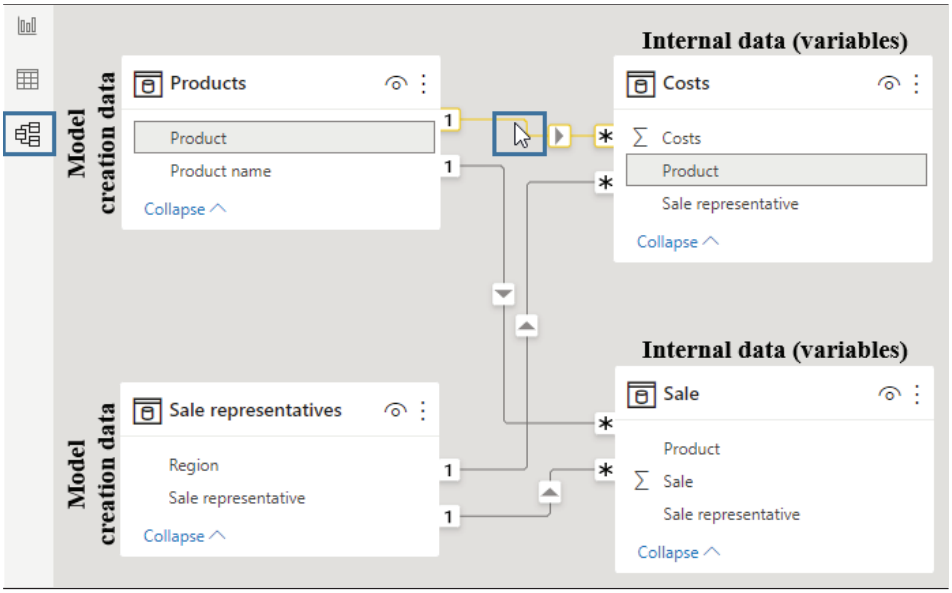
Source: own.

It contains four data sources:

1) a list of sales representatives and their assignment to sales regions;
2) a list of the portfolio offered and the names of individual products;
3) sale of individual products and their assignment to sales representatives;
4) the cost of individual products and their assignment to sales representatives.

Arrows mark the columns that allow you to prepare connections between individual data sources, i.e. sales representative and product symbol. After importing data to Power BI, the program will prepare connection suggestions:

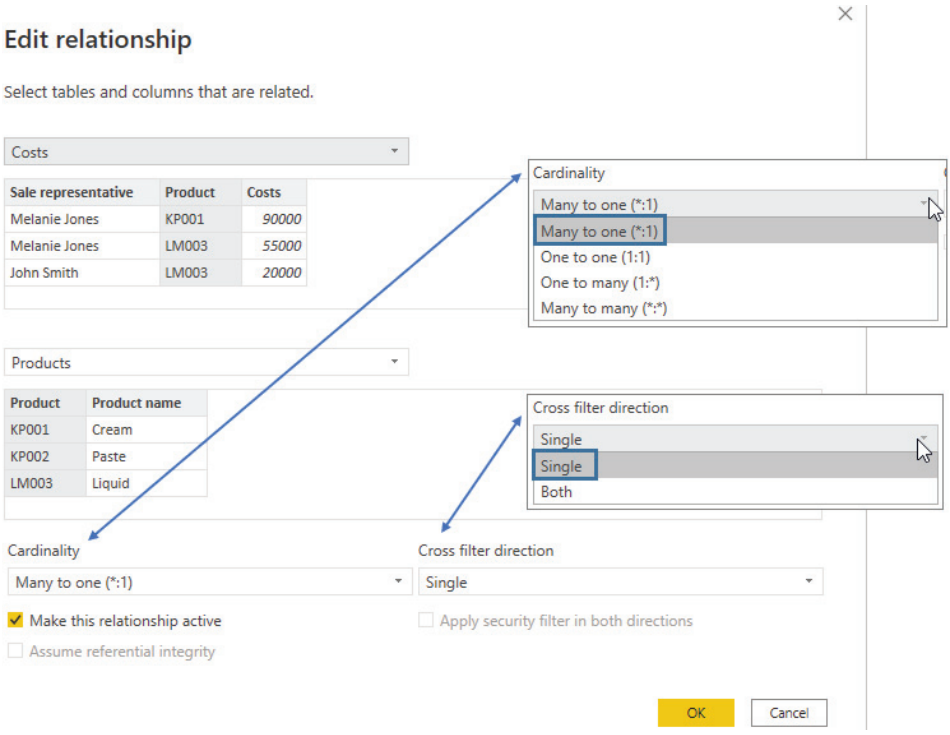
Figure 3.54. Creating data models in Power BI (importing data)



Source: own.

After indicating a given connection with the cursor, the program will mark the columns on the basis of which the connection was made. To check the details (or make changes), double-click on the given connection:

Figure 3.55. Creating data models in Power BI (relationships)



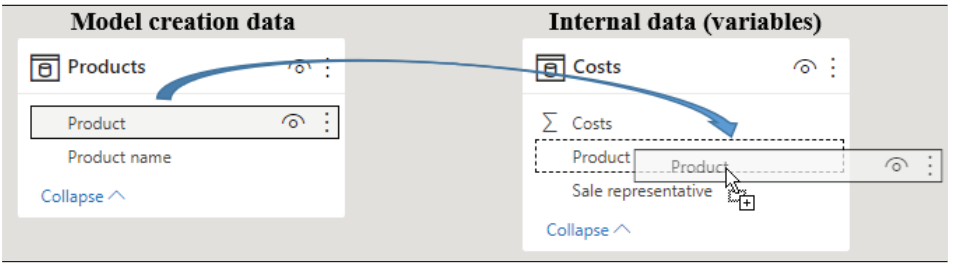
Source: own.

In the discussed example, a "Many to one" connection was created, i.e. Many items in the Costs source have their individual counterparts in the Products source. In addition, the connection only works one way. Creating a "Many to one"/"Single" connection is especially recommended in the initial period of using Power BI. Over time, it may turn out that it will be insufficient and the user will start using, for example, the "Many to many" connection.

In a situation where a given connection is incorrect or redundant (from the user's point of view), it can be deleted (select it and click 'delete').

The program creates proposals for connections between sources if the columns have identical names and their content corresponds to the connection possibilities (e.g. in one of the sources, there are no duplicates in the given column). If a connection is not created automatically, you can specify it manually. Just select the master column and then drag it to the column where the input variables are:

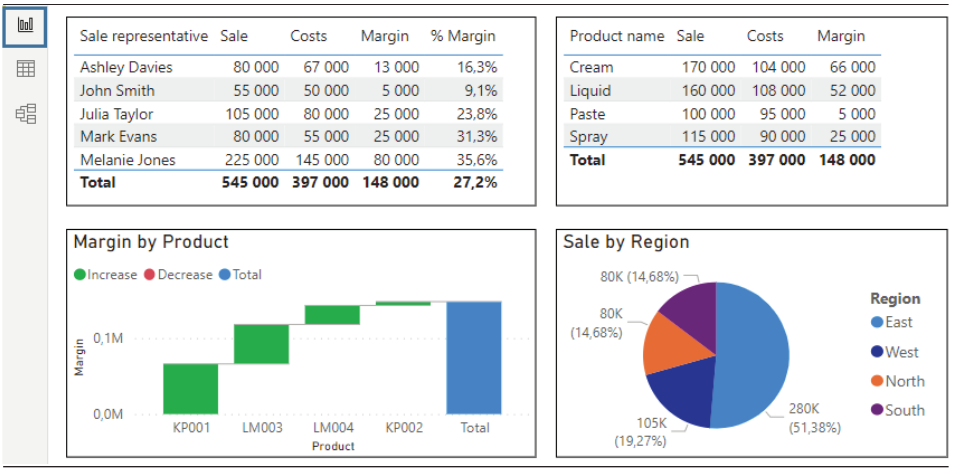
Figure 3.56. Creating data models in Power BI (connecting manually)



Source: own.

Based on the data model, further actions in Power BI are possible, e.g. presentation of data from various sources according to a given grouping category, creating measures and so on.

Figure 3.57. Creating data models in Power BI (presentation of data)



Sale representative	Sale	Costs	Margin	% Margin
Ashley Davies	80 000	67 000	13 000	16,3%
John Smith	55 000	50 000	5 000	9,1%
Julia Taylor	105 000	80 000	25 000	23,8%
Mark Evans	80 000	55 000	25 000	31,3%
Melanie Jones	225 000	145 000	80 000	35,6%
Total	**545 000**	**397 000**	**148 000**	**27,2%**

Product name	Sale	Costs	Margin
Cream	170 000	104 000	66 000
Liquid	160 000	108 000	52 000
Paste	100 000	95 000	5 000
Spray	115 000	90 000	25 000
Total	**545 000**	**397 000**	**148 000**

Source: own.

3.5. Basic operations in Power BI

In the previous subsections, the basic issues preparing for the development of an analysis/report in Power BI were discussed:

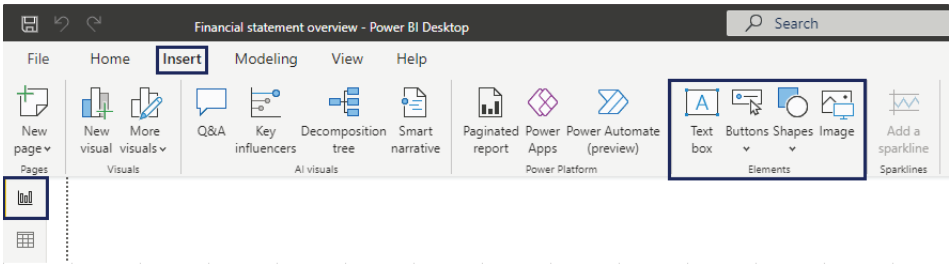
1) defining the data source;
2) transformation of source data into tabular summaries;
3) creating data models.

The next step is to prepare the report in a tabular and graphical form. A very big advantage of Power BI is the ability to create interactive dashboards[2]. Beginner and intermediate users will primarily benefit from:

- text/graphic fields
- tables
- measures/indicators
- charts
- filters

Text/graphic fields can be useful when creating a report frame, i.e. its title, company logo, etc.:

Figure 3.58. Basic operations in Power BI (text/graphic fields)

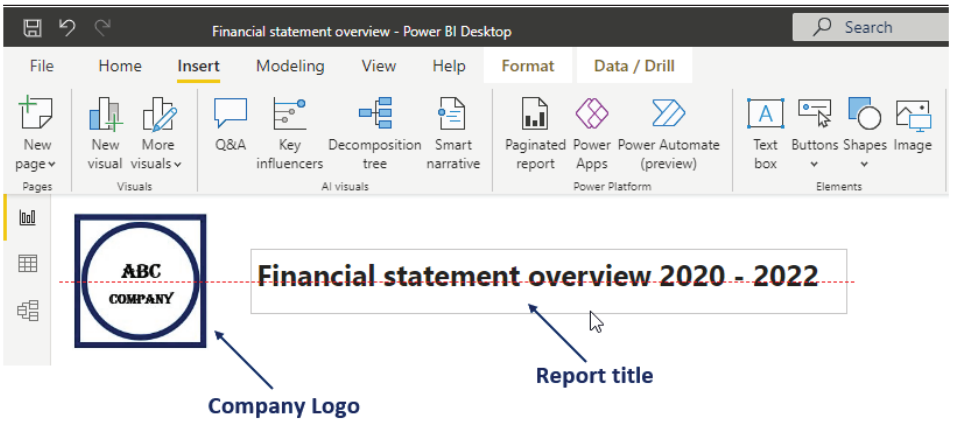


Source: own.

A very useful functionality is the automatic reference of the position of individual graphics to each other (dotted line visible on the screen):

[2] Dashboard – an extensive graphic form of data presentation, usually supplemented with small tables containing key values or indicators (Zerbst, 2016).

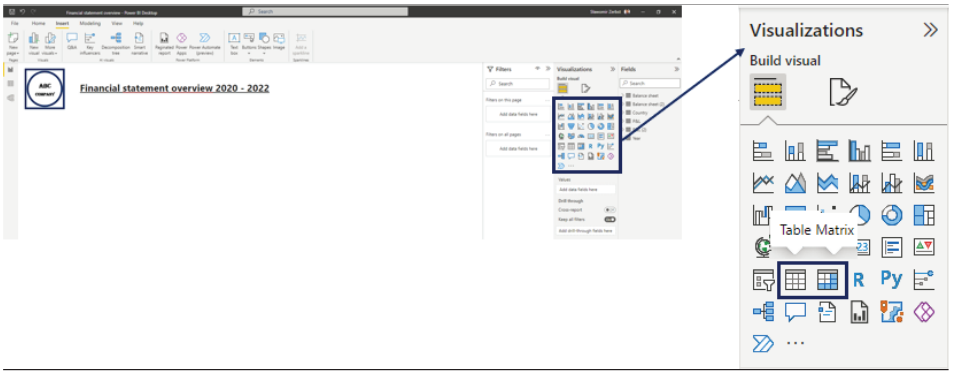
Figure 3.59. Basic operations in Power BI (text/graphic fields align)



Source: own.

The second form of presenting data, i.e. the table can be prepared in Power BI in two versions "Table" and "Matrix":

Figure 3.60. Basic operations in Power BI (adding "Table" and "Matrix")



Source: own.

"Table" is a classic table with data, while "Matrix" can be compared to a pivot table known from Excel. Depending on your needs, each of them can be used.

Figure 3.61. Basic operations in Power BI ("Table" and "Matrix")

Table:

P&L position	Value
1. Revenue	6 070 000
2. Cost of trading goods sold	3 440 000
3. Wages	592 000
4. Services	224 000
5. Utilities	132 500
6. Depreciation	61 000
7. Income before taxes	1 620 500
8. Taxes	216 850
9. Net income	1 403 650
Total	**13 760 500**

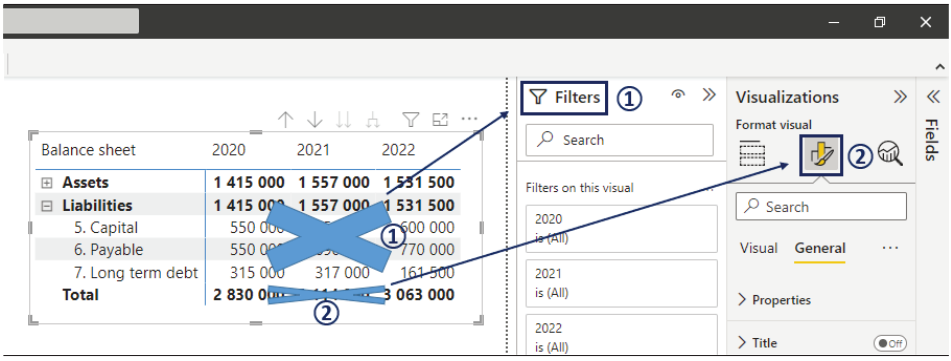
Matrix:

Balance sheet	2020	2021	2022
⊞ **Assets**	**1 415 000**	**1 557 000**	**1 531 500**
⊟ **Liabilities**	**1 415 000**	**1 557 000**	**1 531 500**
5. Capital	550 000	550 000	600 000
6. Payable	550 000	690 000	770 000
7. Long term debt	315 000	317 000	161 500
Total	**2 830 000**	**3 114 000**	**3 063 000**

Source: own.

All prepared objects in the Power BI report are subject to editing and formatting, thanks to which you can change the subject scope of a given item ① or its formatting ② (e.g. limit the table to display only assets ①, delete the summary for assets and liabilities ②, etc.).

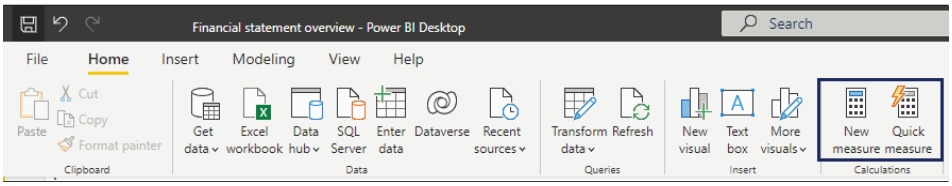
Figure 3.62. Basic operations in Power BI (editing and formatting)



Source: own.

Power BI enables preparation of **measures/indicators** based on developed patterns (Quick measure), or written entirely by the user in the programming language M (New measure):

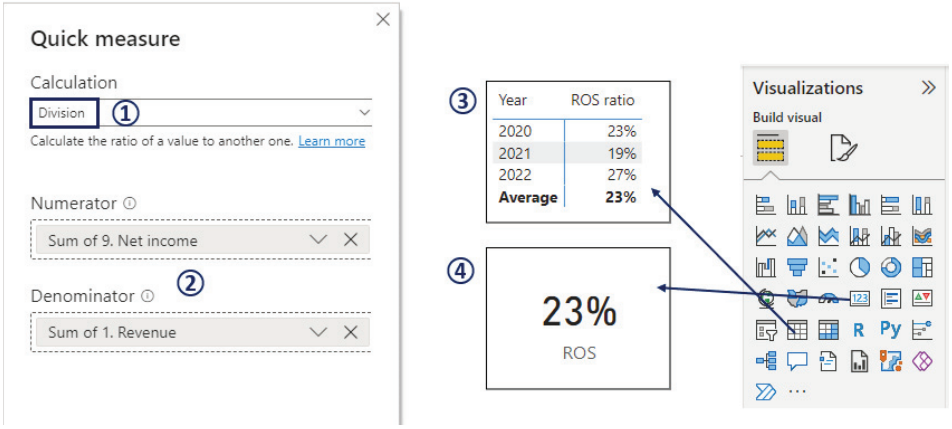
Figure 3.63. Basic operations in Power BI (preparation of measures/indicators)



Source: own.

For example, to calculate the return on sales ratio (net profit/sales revenue), select "Quick measure", then in the list of measures, indicate "Division" ①, and the source columns that need to be divided ②. The obtained value can be presented in a report, e.g. in the form of a table ③ or a card ④:

Figure 3.64. Basic operations in Power BI (presentation of measures/indicators)

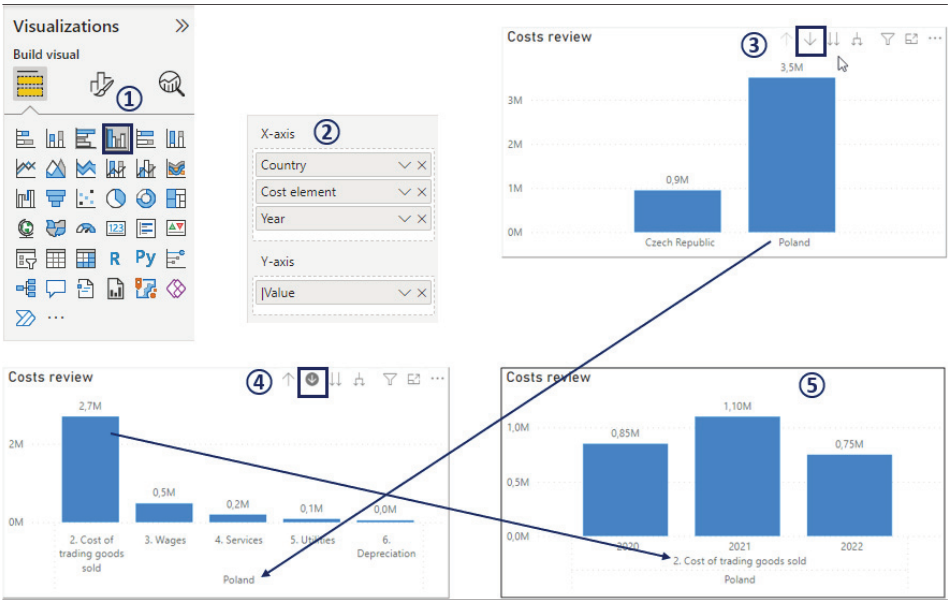


Source: own.

With regard to charts, Power BI provides you with the greatest opportunities. This applies to both the number of available variants and formatting options. This section will discuss a drill-down bar chart. This is especially useful for analysing the structure of a given issue. To create such a chart, select "Clustered column chart" ①, then in the X- axis field, indicate the criteria on the basis of which data drilling/structure analysis is to take place ②. Chart ③ shows the first level of cost structure analysis, i.e. breakdown by country. After clicking

on "↓" and selecting Poland, you can check the cost structure in this area and go to view ④. In the X-axis legend of this view, the individual cost categories and information about which country this view applies to are indicated. After clicking on "2. Cost of goods sold", you can proceed to the analysis of the structure of this item based on individual periods of time ④. To go back to the previous levels of analysis, click "↑":

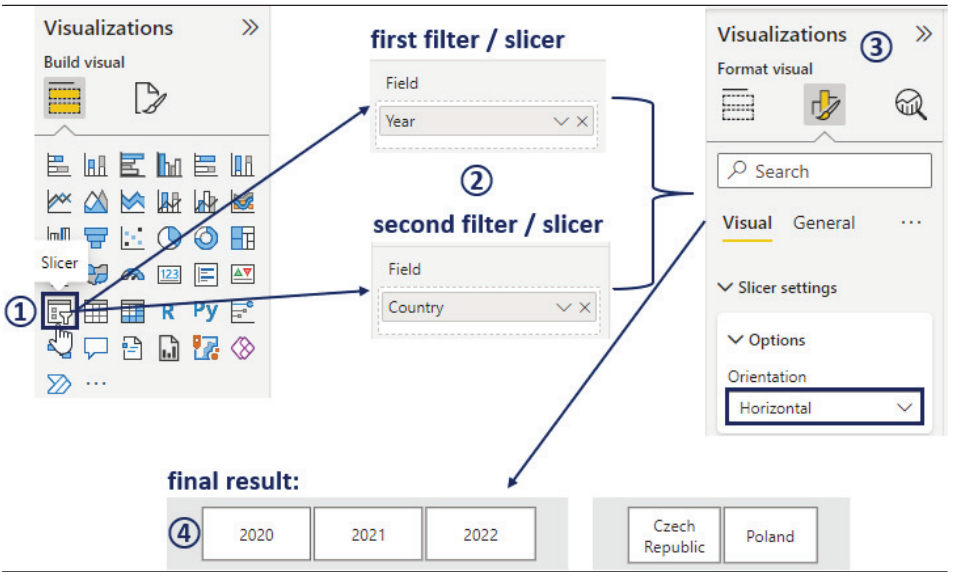
Figure 3.65. Basic operations in Power BI (charts)



Source: own.

Another very useful feature in Power BI is **the ability to use filters**. Thanks to this option, the content of the report can be limited, e.g. in relation to the time range, area of operation, product group, etc. This facilitates locating problem areas or comparing results on an ongoing basis from the perspective of individual criteria. After selecting the "Slicer" object ①, filter criteria ② should be indicated. Then you can leave or change the formatting of the prepared object ③. As a result (of the analysed example), two criteria for limiting the displayed values will be obtained (due to the financial year and area of operation) ④.

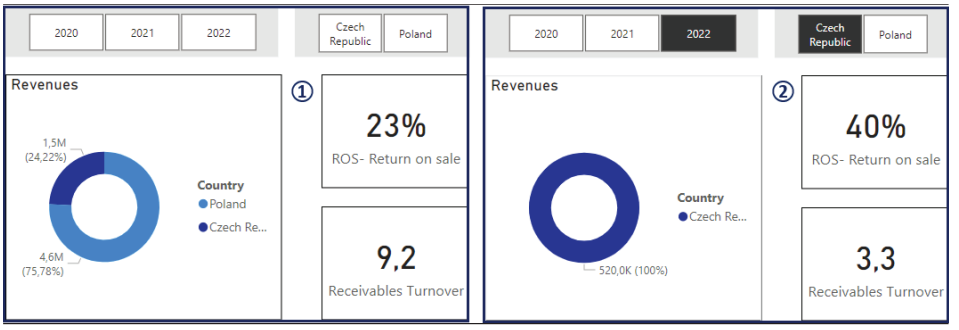
Figure 3.66. Basic operations in Power BI (charts and filters)



Source: own.

By selecting a given year or area of activity, all data in tables, ratio calculations or charts ① will be limited to the selected criterion ②:

Figure 3.67a. Basic operations in Power BI (selected criterion)



Source: own.

As a result of the actions discussed, the following data:

Figure 3.67b. Basic operations in Power BI (selected criterion)

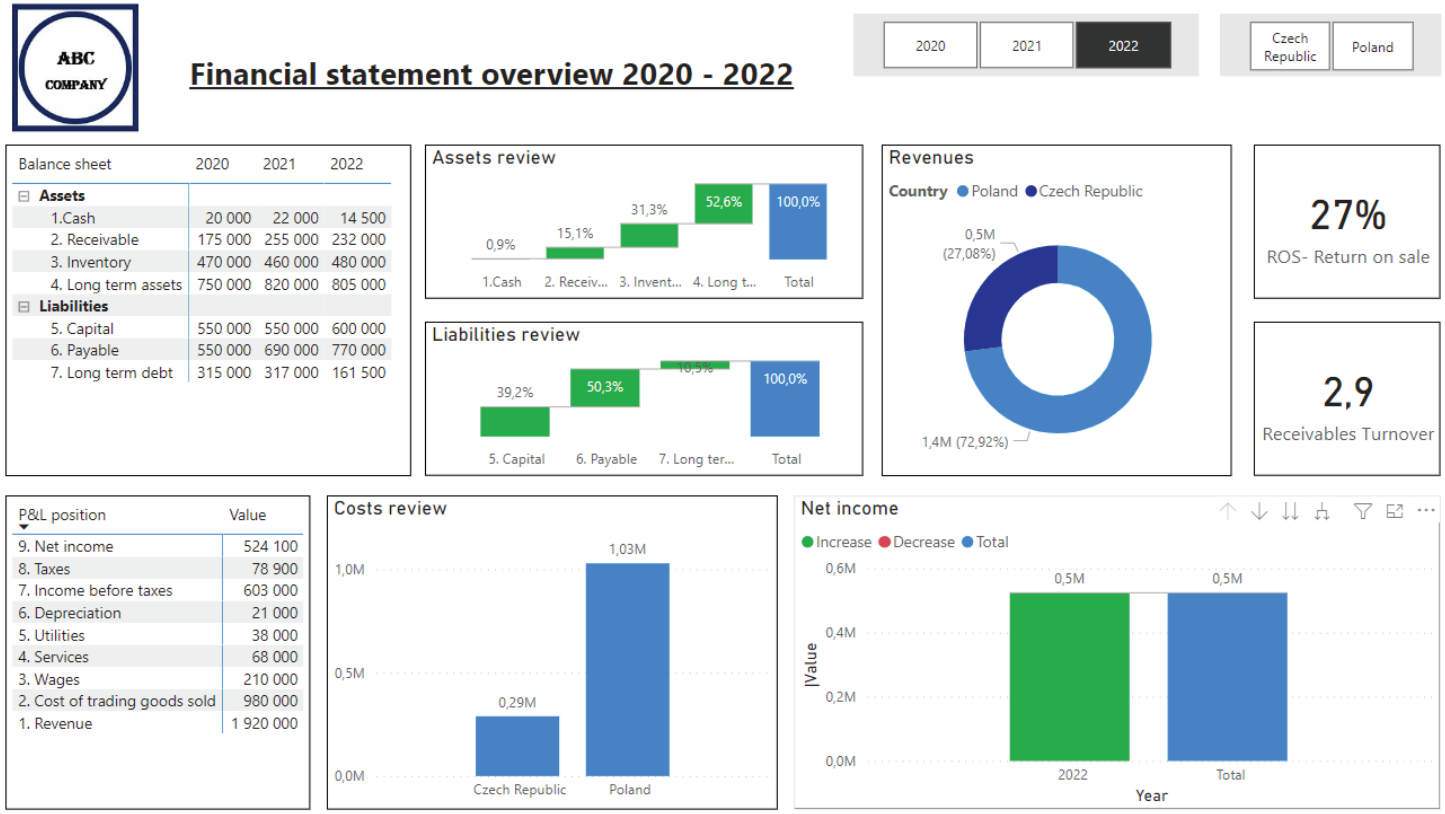
	A	B	C	D	E
1	Country	Position	2020	2021	2022
2	Poland	1. Revenue	1 500 000	1 700 000	1 400 000
3	Poland	2. Cost of trading goods sol	850 000	1 100 000	750 000
4	Poland	3. Wages	150 000	160 000	170 000
5	Poland	4. Services	80 000	55 000	60 000
6	Poland	5. Utilities	25 000	26 000	32 000
7	Poland	6. Depreciation	15 000	15 000	16 000
8	Poland	7. Income before taxes	380 000	344 000	372 000
9	Poland	8. Taxes	57 000	51 600	55 800
10	Poland	9. Net income	323 000	292 400	316 200
11	Czech Republic	1. Revenue	450 000	500 000	520 000
12	Czech Republic	2. Cost of trading goods sol	250 000	260 000	230 000
13	Czech Republic	3. Wages	35 000	37 000	40 000
14	Czech Republic	4. Services	10 000	11 000	8 000
15	Czech Republic	5. Utilities	3 500	40 000	6 000
16	Czech Republic	6. Depreciation	5 000	5 000	5 000
17	Czech Republic	7. Income before taxes	146 500	147 000	231 000
18	Czech Republic	8. Taxes	14 650	14 700	23 100
19	Czech Republic	9. Net income	131 850	132 300	207 900

	A	B	C	D	E	F
1	Country	Group	Position	2020	2021	2022
2	Poland	Assets	1.Cash	15 000	16 000	10 000
3	Poland	Assets	2. Receivable	125 000	200 000	180 000
4	Poland	Assets	3. Inventory	350 000	360 000	370 000
5	Poland	Assets	4. Long term assets	500 000	550 000	575 000
6	Poland	Liabilities	5. Capital	350 000	350 000	400 000
7	Poland	Liabilities	6. Payable	400 000	500 000	600 000
8	Poland	Liabilities	7. Long term debt	240 000	276 000	135 000
9	Czech Rep	Assets	1.Cash	5 000	6 000	4 500
10	Czech Rep	Assets	2. Receivable	50 000	55 000	52 000
11	Czech Rep	Assets	3. Inventory	120 000	100 000	110 000
12	Czech Rep	Assets	4. Long term assets	250 000	270 000	230 000
13	Czech Rep	Liabilities	5. Capital	200 000	200 000	200 000
14	Czech Rep	Liabilities	6. Payable	150 000	190 000	170 000
15	Czech Rep	Liabilities	7. Long term debt	75 000	41 000	26 500

Source: own.

can be presented in the form of an aesthetic, interactive and, above all, clear dashboard:

Figure 3.68. Dashboard



Source: own.

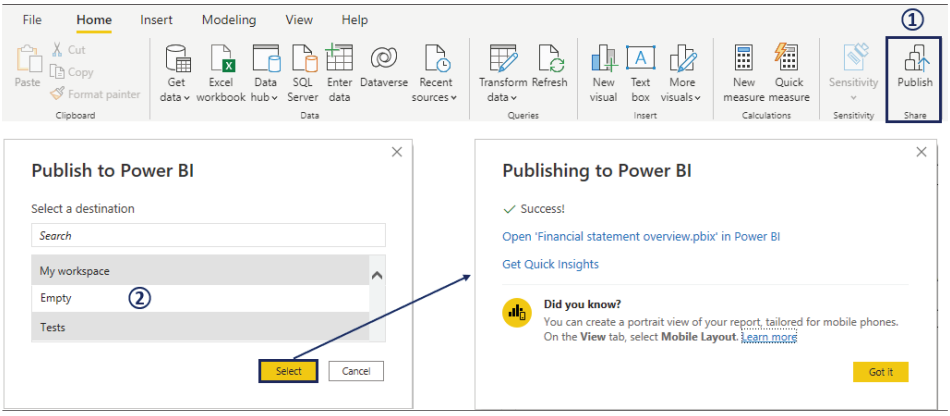
Even with such a small amount of data, you can prepare an interesting visualisation. However, the use of filters and data mining – the analysis of the sources of changes will be much easier and more efficient.

3.6. Reporting

3.6.1. Sharing the report

The prepared report can be made available to other users (after purchasing the PRO or Premium version). To do this, first save it, and then select the publish option ①. Next, indicate the location in the Microsoft cloud where the report is to be published ②. You can choose your own workspace (individual for each user) or a shared workspace ("Tests" in the example below):

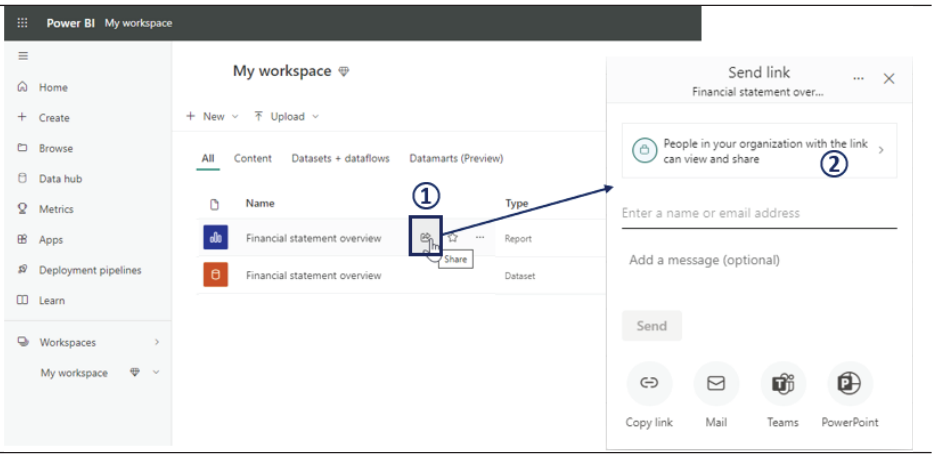
Figure 3.69. Publish option



Source: own.

After publishing the report, you should generate a link ① that can be sent to another user (also remember to set the permissions ②):

Figure 3.70. Generate a link to the report

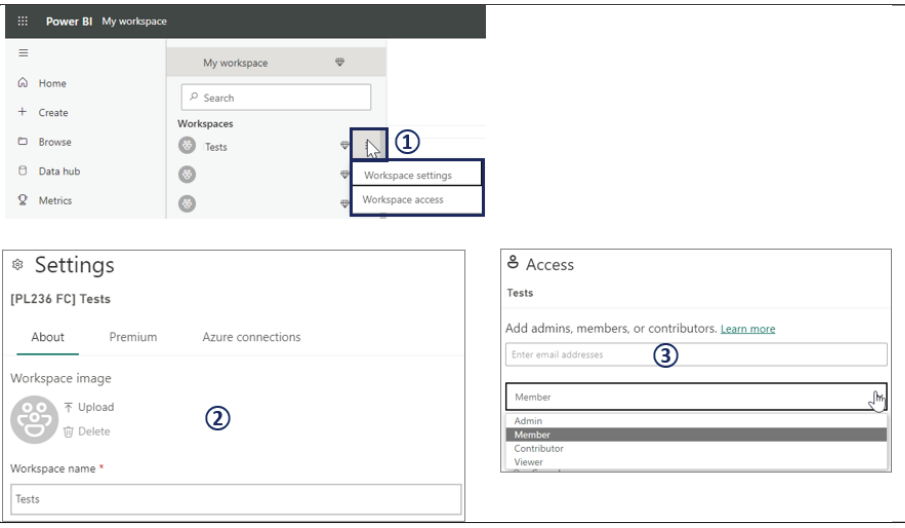


Source: own.

3.6.2. For securing access to the report

Sharing reports always carries the risk that they may fall into the wrong hands (e.g. an error in setting the eligibility criteria may result in the recipient being able to share the report as well). Therefore, it is worth using shared workspaces in your work:

Figure 3.71. Sharing reports



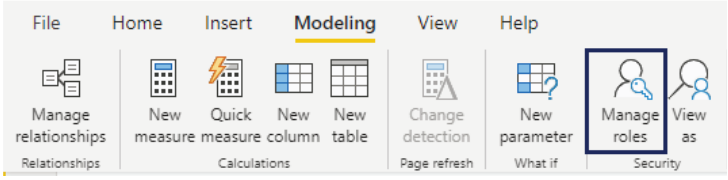
Source: own.

Thanks to the workspaces, individual reports can be grouped, e.g. production, sales, etc. Each of the workspaces can be customised ① both in terms of settings ② and access issues for individual users ③. Individual users can receive one of the categories of permissions:

1. Admin (workspace management)
2. Member (limited workspace management)
3. Contributor (publishing reports)
4. Viewer (displaying reports)[3]

To protect/limit access to the content contained in the reports, you can also use protection at the level of the access roles. The setting of this mechanism is partially done in the application (when preparing the report):

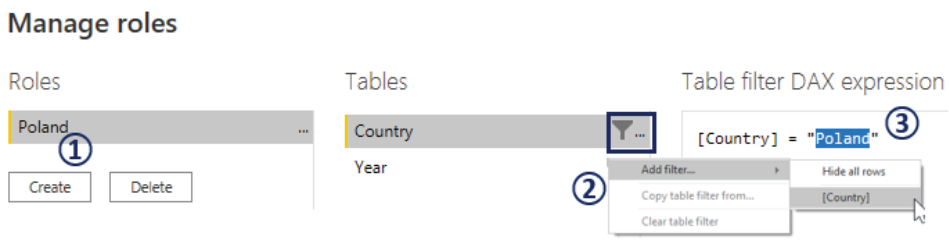
Figure 3.72. Protection at the level of the access roles



Source: own.

After selecting "Manage roles", enter the name of the role to be created ①, then select one of the available criteria for limiting the scope of data ② and then enter the value of this criterion ③:

Figure 3.73. Manage roles



Source: own.

[3] Details on the differences between the individual permission levels can be found at: https://learn.microsoft.com/en-us/power-bi/collaborate-share/service-roles-new-workspaces from 20.12.022.

In the example above, the user of this role ① will only see results for Poland (they will not see values for the Czech Republic or both).

In addition, roles have also been created for both countries and the Czech Republic ④:

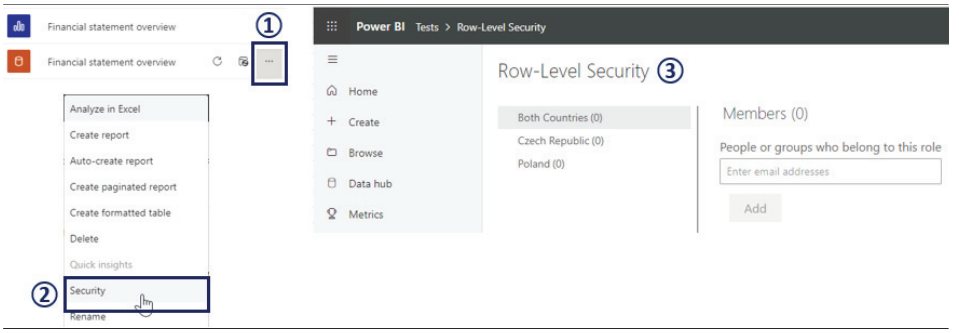
Figure 3.74. Manage roles (results)

Source: own.

Countries role (that is, even if someone has access to a given workspace, they will not be able to view this report). It is also possible to limit the displayed values to specific areas of activity (Czech Republic/Poland).

After preparing the parameters for each role, the report should be saved and made available to the workspace again. By selecting the Security point ①, ② with the published data set of the discussed report, the window for assigning individual roles to users ③ will open:

Figure 3.75. Securing the parameters for each role



Source: own.

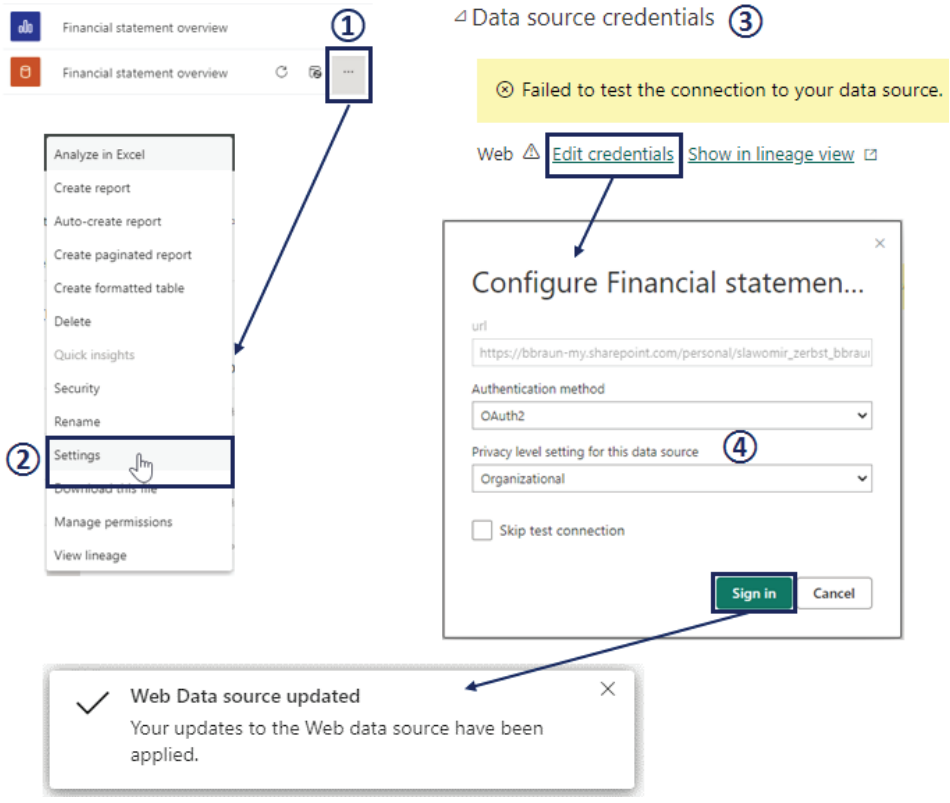
The report made available in this way has double access protection (workspace restriction and access role restriction). Taking advantage of these safeguards is especially useful with more reports, users and different

levels of responsibility for results. An additional benefit of this form of report management is the ability to publish one report with content restrictions instead of multiple reports with different levels of information.

3.6.3. Refreshing a published report

For a report that has been prepared using sources stored in OneDrive/Sharepoint/Internet/operational program, automatic data refresh can be set. After publishing the report, select Settings for Data set ① ②, then expand "Data source credentials" and select "Edit credentials" ③. This is where the authorisation parameters for connecting to OneDrive, Sharepoint ④ are saved.

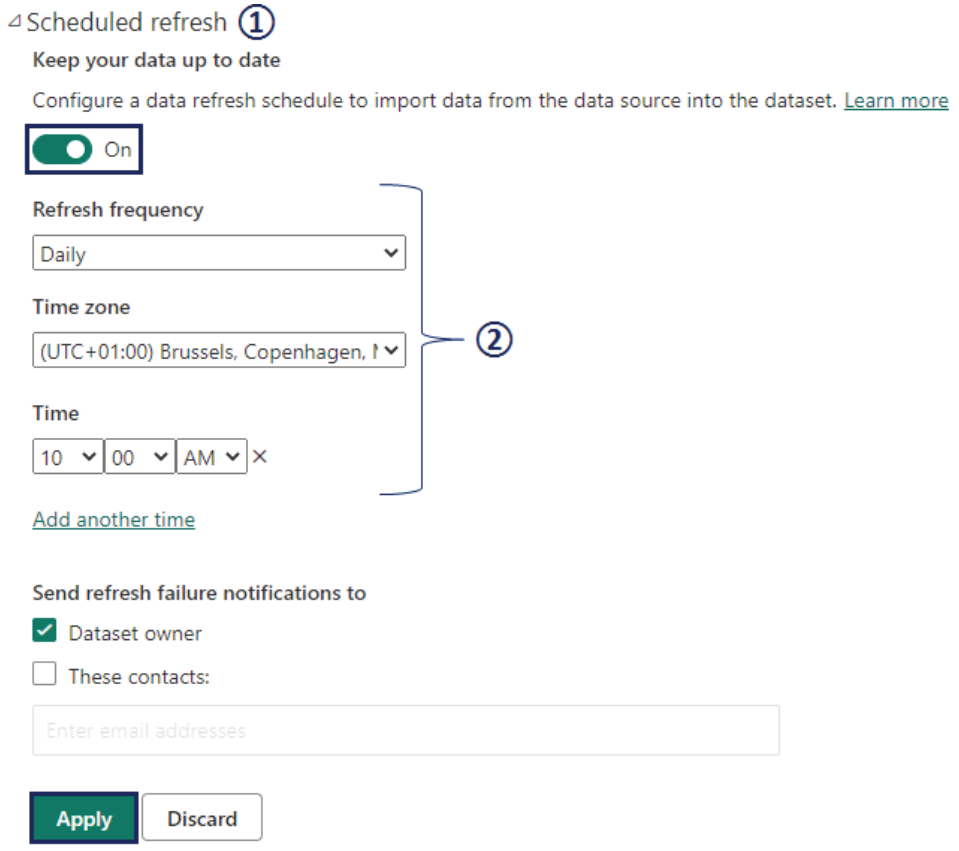
Figure 3.76. Refreshing a published report



Source: own.

Next, go to "Scheduled refresh" ① and set the report refresh rate ②:

Figure 3.77. Refreshing a published report (refresh rate)

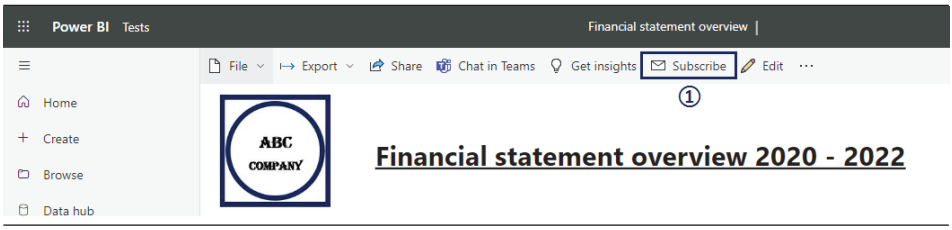


Source: own.

3.6.4. Subscription to a published report

The last action that can be performed for a published report is to send e-mail information regarding its update/refresh to its users. To do this, open the given report from your cloud workspace and select the "Subscribe" field:

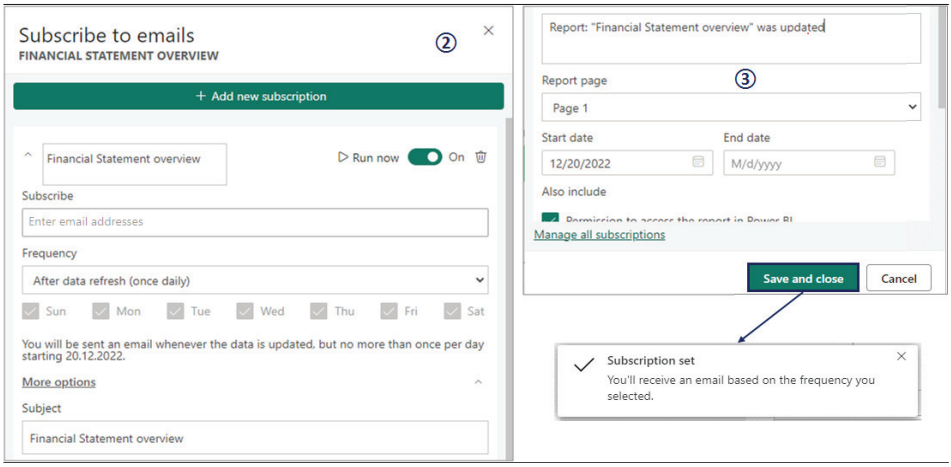
Figure 3.78. Subscription to a published report



Source: own.

Next, set the content to be included in the e-mail and the parameters related to sending this information ② ③:

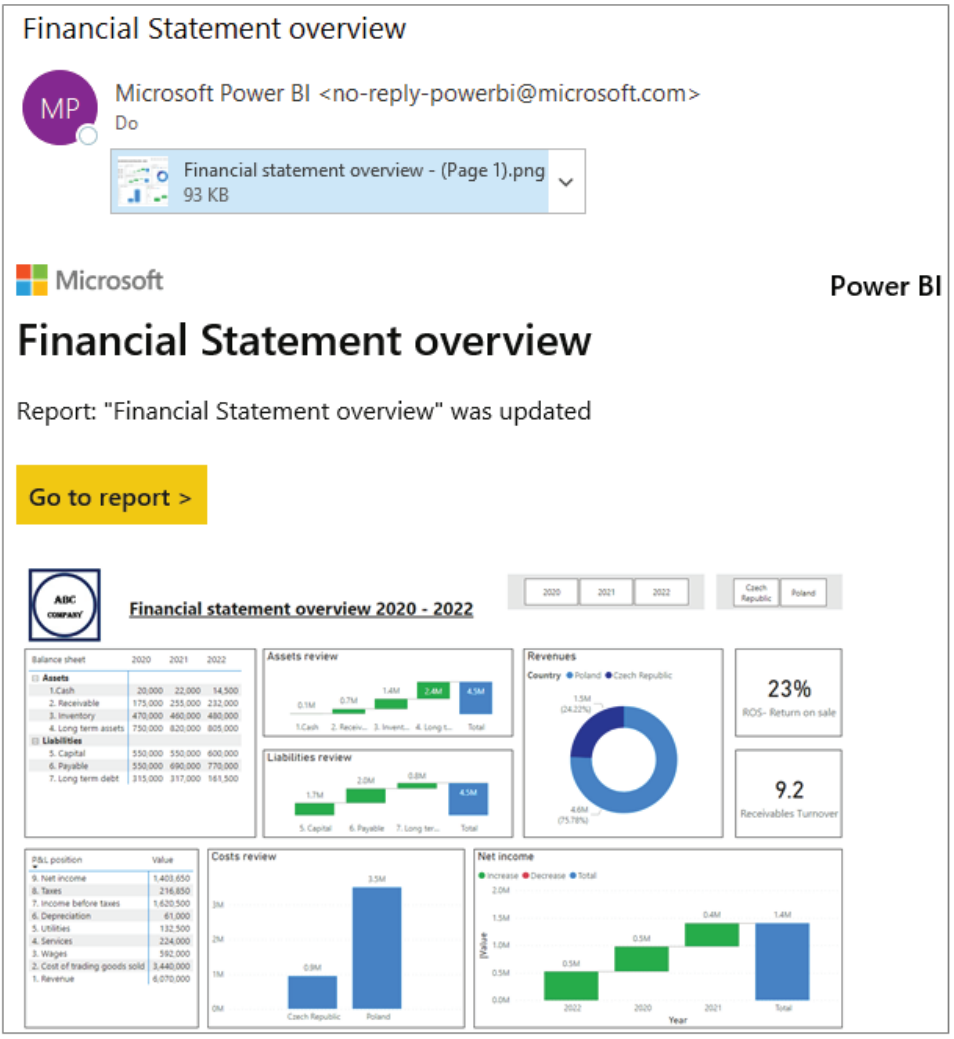
Figure 3.79. Subscription to a published report (set the content to be included in the e-mail and the parameters related to sending this information)



Source: own.

As a result, after the report is automatically refreshed, an automatic e-mail will be sent about this fact:

Figure 3.80. Subscription to a published report (result)



Source: own.

The user can go to the report directly from the e-mail (using the "Go to report" field).

Chapter 4

Analysis of the financial, capital and financial-capital situation with consideration of intangible assets and innovative activity

4.1. Classical analysis of the financial situation

In the preliminary analysis of the financial situation, two perspectives can be adopted: a broad and a narrow scope (Niemiec, 2023). In the broad scope, assets included in the balance sheet, as well as other resources, are analysed. Assets, both tangible and intangible, are defined in this context as resources available to the enterprise and utilised in the process of creating, producing and offering products or services in the market (this approach is described in the next point).

In the narrower scope of analysis, economic phenomena and processes are divided based on their disclosure in the balance sheet. The balance sheet, also known as the statement of financial position, is a compilation of assets, which are components of the company's wealth, and their corresponding liabilities, which are the source of financing for that wealth. It is prepared at a specific moment, known as the balance sheet date, and is historically the oldest and most important element of financial reporting (Sierpińska, 1997, pp. 11-12). The balance sheet presents key information regarding the assets and liabilities of the company. Assets are a significant measure of capital resources, and their value reflects the potential economic benefits that the entity may receive in the future.

From an accounting perspective, assets are controlled resources of the enterprise with reliably determined values that have arisen from past events

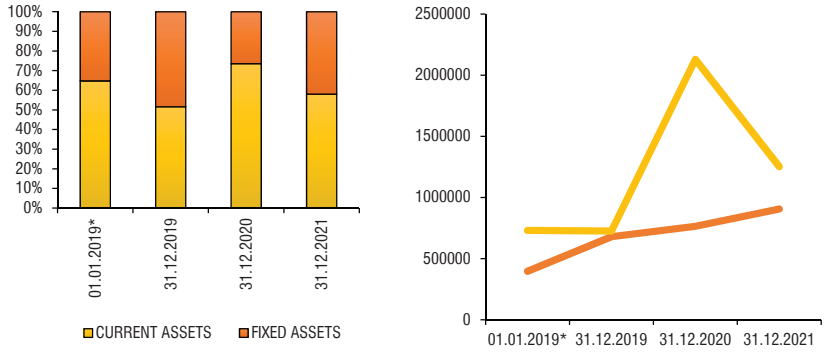
and are expected to generate economic benefits for the entity (UoR, 1994, Article 3, Paragraph 12).

Within the assets section of the balance sheet, we distinguish between fixed assets and current assets. Fixed assets have an expected period of economic usefulness longer than one year and typically have substantial value. Current assets refer to parts of the entity's assets, such as tangible assets (inventories), short-term receivables, financial assets (cash and cash equivalents) and interperiod settlements. All these categories are intended for sale, payment or consumption within 12 months from the balance sheet date or from the date of their establishment, issuance or acquisition.

Evaluating the structure of assets in a company's operations and considering the golden rule of accumulation and capital intensity are significant issues in the field of economics and financial management of enterprises. Understanding the role of fixed and current assets and the necessity to adjust the assessment of the asset structure to the specific nature of the company's operations is essential in analysing these topics. There are no universal normative indicators that would unambiguously determine a good or bad company's situation regarding the asset structure. The evaluation of the asset structure should be adjusted to:

- Type and scale of the company's operations. These factors allow assessing the effectiveness of asset allocation and adjusting asset management strategies to variable market conditions and internal company determinants.
- Market conditions by comparing with companies operating in a similar market segment. In this case, it should be remembered that the relationship between fixed and current assets differs depending on the industry and type of company's operations. A manufacturing company will have a higher commitment to machinery and equipment, which are essential for production. On the other hand, a trading company will have higher inventories, and a transportation company will focus on transportation means. Understanding these differences and appropriately adjusting the asset structure to the specifics of the operations is crucial.
- Financial capabilities of the company itself. Assets illustrate the capital resources available to the enterprise. Often, they represent specific barriers to entry into the market and can also determine the structure based on the same mechanism.

Figure 4.1. Structure and dynamics of fixed and current assets



Source: own calculations based on CD Projekt's consolidated financial statements for 2018-2021.

In the analysed company, the structure of fixed and current assets undergoes continuous changes. At the beginning of 2019, fixed assets accounted for 35% of all assets. By the end of 2019, fixed assets accounted for 48% of the asset structure. This was associated with an increase in the value of fixed assets while maintaining current assets at an unchanged level. In 2020, the value of current assets significantly increased (fixed assets accounted for only 26%). This was most likely related to the release of a new game – Cyberpunk 2077. The company prepared for an increased market demand and higher requirements. As a result, current assets increased in that year. In the last year of analysis, the share of fixed assets increased again to 42% of all assets. Evaluating the assets structure and its changes, it can be noticed that the type of business conducted and a certain cyclical pattern resulting from new releases of blockbuster productions have a significant impact on changes in the structure.

Fixed assets can be divided into those related to the implementation of the company's core activities and other assets. Examples of intangible assets often included in the assets related to core activities are intellectual property rights, licenses, patents or trademarks. They are examples of intangible assets that affect the way the company offers goods and services. The second group of such assets consists of tangible fixed assets. They include fixed assets that are either ready for use or under construction, as well as advances for them. Fixed assets are tangible components of the company's assets and have an expected economic useful life longer than one year. They are complete, usable and intended for the needs of the company (UoR, 1994, Article 3, Paragraph 15). Fixed assets include, among others:

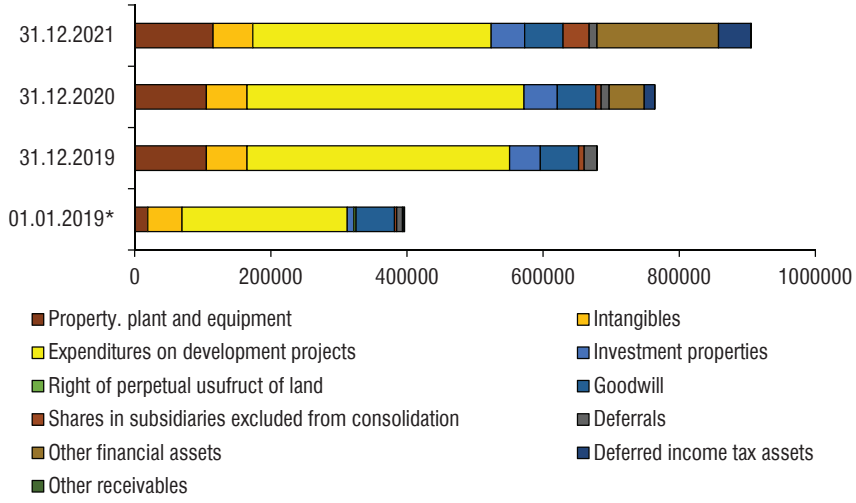
- Land, real estate, perpetual usufruct rights, buildings, and structures, as well as premises, including cooperative ownership rights to residential premises and cooperative ownership rights to commercial premises.
- Machinery, equipment, vehicles and other items used in the company's operations.
- Improvements made to external fixed assets, i.e. investments and modifications made to owned fixed assets to improve or modernise them.
- Livestock, such as farm animals, are also included in the fixed assets category.

It is worth noting that fixed assets leased are also classified as fixed assets of one of the parties to the agreement, in accordance with the conditions specified in the agreement.

The third group of fixed assets indirectly related to core activities consists of long-term inter-period settlements concerning expenditures incurred in the past, which will be settled as costs over a period longer than 12 months from the balance sheet date. They are usually associated with assets from deferred income tax. All assets related to the implementation of core activities in Figure 4.2 are marked in shades of brown – orange – yellow.

Other fixed assets illustrate the flow of capital between entities. The flow of capital is often associated with a desire to achieve additional profits, such as long-term investments in real estate for speculative purposes or investing in government bonds. Another motive, which is relatively common, is to acquire influence in other entities. In such cases, the entity may also develop its core business based on the created capital group, although there can be many more motives for such actions. The second group of assets illustrating the flow of capital consists of long-term receivables. These are receivables with a repayment term exceeding one year from the balance sheet date. However, there is a deviation from this rule in the balance sheet prepared in accordance with the Polish Accounting Act since receivables for supplies and services are always classified as short-term receivables but are separately identified within them. Long-term receivables usually consist of loans granted to other companies.

Figure 4.2. Structure and dynamics of fixed assets in the CD Projekt Group



Source: own calculations based on CD Projekt's consolidated financial statements for 2018-2021.

In the CD Projekt Group, dynamic changes in the structure of fixed assets can be observed. Initially, fixed assets related to core activities constituted a dominant part of the assets. They were largely associated with expenditures on subsequent development projects. The group also had some tangible fixed assets and intangible assets. Another portion consisted of other fixed assets, which were related to goodwill. Goodwill is an intangible asset that is associated with the purchase of one company by another. It represents value that can provide the acquiring company with a competitive advantage.

At the end of 2019, the value of tangible fixed assets significantly increased. This was due to the acquisition of a real estate complex at Jagiellońska 74 in Warsaw in October 2019. In the following months, the buildings and the space between them were arranged in such a way that the CD Projekt Warsaw campus became a place full of positive energy, comfortable and adapted to the growing team. In other fixed assets, an increase in shares in subsidiaries excluded from consolidation and deferrals can be observed. The value of these assets may be adjusted in the following years.

In 2020, the fixed assets related to core activities remained relatively unchanged, with only increased expenditures on development projects visible. However, other fixed assets clearly increased. These changes were associated with the appearance of other financial assets, which may have directly related

to the company's investment activities and the placement of surplus funds in long-term investments.

The year 2021 brought further significant changes in fixed assets. Part of the expenditures on development projects increased other operating costs. The group ceased work on its game engine, and the change of technology resulted in a write-off of a portion of those expenses. The second key change was related to other fixed assets. Between 2020 and 2021, the value of these assets tripled, indicating that the company continues to invest in other financial instruments with a long-term nature.

Current assets can be divided into two types: cash-engaging current assets and cash and cash equivalents.

Cash-engaging current assets in the company include various categories such as inventory, short-term receivables and short-term inter-period settlements. The inventory consists of materials, work in progress, finished products, goods and advances for future deliveries. Inventory management is crucial for warehouse management, logistics and production organization. Proper inventory management enables maintaining a balance between product availability and minimising the risk associated with excessive inventory accumulation.

Short-term receivables are amounts owed to the company for supplies, services or other obligations that are to be settled within 12 months from the balance sheet date. These receivables are often related to the sales process and trade settlements. However, it should be noted that they are not liquid assets and cannot be quickly converted into cash. Effective management of short-term receivables is crucial for maintaining financial stability and timely collection of payments from customers.

Short-term inter-period settlements refer to costs incurred by the company that are not related to the current reporting period but impact future periods. These can include prepaid expenses for future services, subscriptions or rents. These costs are classified as short-term assets because they pertain to the nearest periods and have an impact on the financial result in subsequent periods.

Effective management of these current assets is essential for the efficient functioning of the company. Adequate planning, monitoring and control of these assets are necessary to maintain financial liquidity and minimise the risk associated with tying up cash in these assets. In Figure 4.2, these elements are marked in shades of brown, orange and yellow.

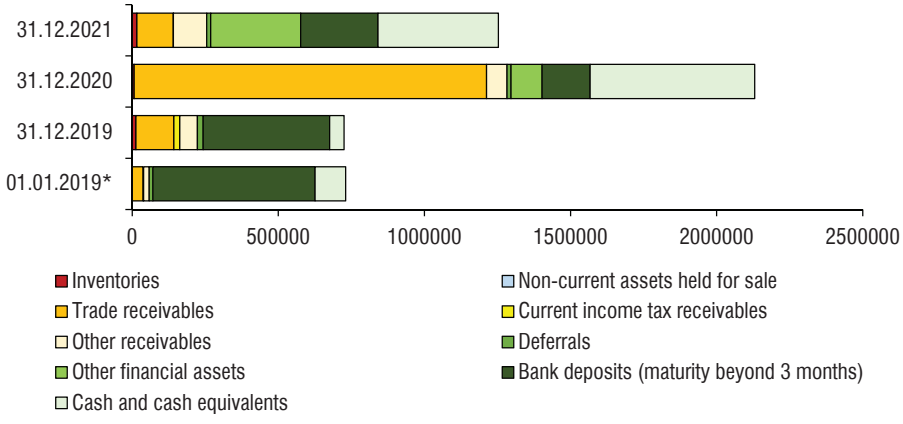
Cash and cash equivalents constitute an important category of current assets in the company's balance sheet (marked in shades of green in Figure 4.3). This category includes cash on hand and in bank accounts that are available for immediate use. Additionally, this category includes other cash equivalents such as promissory notes and checks.

As part of short-term investments, the company may hold cash invested in short-term securities. These can include bonds, treasury bills or other financial instruments that have a maturity period exceeding one year but the company intends to sell them in a short period, i.e. within 12 months. Furthermore, if the company has acquired stocks or bonds with the intention of reselling them in the short term, they are also included in this category.

It is worth noting that some financial instruments may have low liquidity, meaning that they are not easily converted into cash. Examples of such instruments are derivatives used as hedging tools against price fluctuations, interest rates, etc. While these instruments have their value, converting them into cash may require time or specific market conditions.

Cash and cash equivalents management is crucial for ensuring the financial liquidity of the company. Effective planning and control of these assets enable maintaining adequate cash reserves, minimising the risk of cash shortages and ensuring readiness for immediate payments. In day-to-day operations, companies strive to maintain a balance between cash-engaging elements and cash and its equivalents.

Figure 4.3. Structure and dynamics of current assets



Source: own calculations based on CD Projekt's consolidated financial statements for 2018-2021.

Similar to fixed assets, current assets have also undergone dynamic changes. The group has a significant cash and cash equivalents margin, initially in the form of bank deposits lasting over three months. Over time, the structure of these highly liquid assets has changed. In 2020, when the group released the game Cyberpunk 2077, a significant increase in cash was noticed while simultaneously eliminating bank deposits lasting over three months. The release of the new game required financial investments, and the group maintains a significant safety margin to secure the financing of the new product's market success. Other financial assets have also appeared. In 2021, the level of cash and cash equivalents decreased, while the values of other financial assets and deposits lasting over three months increased.

Cash-related assets in the CD Projekt group essentially consist only of receivables, particularly trade receivables. Receivables were at their lowest in the first year of analysis. With the introduction of the new game to the market, a significant increase in receivables was observed in 2020. Consequently, their size is incomparable to previous and subsequent periods.

4.2. The possibility of expanding the analysis of the financial situation with an examination of intangible assets and innovative activities

4.2.1. The concept of intangible assets and innovative activities

Intangible assets, as defined in the International Accounting Standard (IAS 38, 2023), are non-monetary assets that lack physical substance (IAS 38, 2023, Paragraph 8). This category includes various elements that contribute to the creation of a company's strategic options. The elements primarily include brand, human capital, customer relationships, partner and network relationships, organizational culture and leadership, reputation, technological intangible assets, other intangible assets and goodwill (Urbanek, 2008).

In the Polish Accounting Act (UoR, 1994, Article 3, Paragraph 1, Point 14), the counterparts of intangible assets are referred to as intangible and legal values. These values are acquired by the entity and classified as fixed assets, which are suitable for economic use for a period longer than a year, and intended for the company's needs, including:

a) Copyrights, related rights, licenses, concessions,
b) Rights to inventions, patents, trademarks, utility models and ornamental designs,
c) Know-how.

Intangible and legal values also include purchased goodwill and the costs of completed research and development activities.

Innovative activities encompass "the totality of scientific, technical, organizational, financial, and commercial actions, including investments in new knowledge, which actually lead to or can lead to innovation" (Oslo Manual, 2005). The terminology of innovative activities has been divided into:

- Research and development activities (R&D), which mainly refer to product and process innovation and to some extent, marketing or organizational innovations, along with basic research.
- Innovative activities not related to R&D but referring to marketing and organizational innovations, which are categorized as "preparation for marketing innovations" and "preparation for organizational innovations." This category includes the acquisition of external knowledge or capital goods, as well as training related to specific marketing or organizational innovation (Oslo Manual, 2005).

4.2.2. Analysis of intangible assets

Financial analysis of intangible assets can begin with examining the intangible and legal values from the balance sheet, although financial statements only reflect those intangible assets that have been acquired through buying and selling. They do not include intangible assets such as brand, human capital, customer relationships, partner relationships and others. Therefore, based on the balance sheet analysis, three key ratios are determined (Gildersleeve, 1999):

- $\frac{intangible\ and\ legal\ values}{total\ assets}$,
- $\frac{intangible\ and\ legal\ values}{equity}$,
- $\frac{individual\ intangible\ assets}{total\ assets}$.

These ratios are primarily used for time comparisons. As a complement to the analysis, additional ratios can be identified, such as:

- individual intangible assets (e.g., patents, trademarks, completed development costs, etc.)/total assets,
- sales revenue/intangible and legal values (average value),
- operating profit/intangible and legal values (average value).

In further analysis, a more detailed examination of selected elements reported under intangible and legal values can be conducted. Regarding the analysis of intangible assets not reported in the balance sheet, the following measures and measurement methods are applied:

- compensation and other benefits received by employees/total number of employees, relating to the measurement of human capital,
- analysis of various aspects of collaboration with customers (e.g. duration of relationships, intensity of relationships, customer satisfaction) and business partners (e.g. number of partners, share of outsourcing costs in total costs),
- measurement of organizational culture by assessing its impact on organizational efficiency (strategy, overall organizational goals, organizational structure and resource utilisation), process analysis (ability to develop innovation and effectiveness of management solutions in specific processes such as procurement, production, sales, distribution) and job position (work standards, feedback, rewards and training),
- reputation assessment (e.g. product and service quality, employee satisfaction, payment terms to external entities, value creation, financial strength).

Companies engaged in systematic research and development (R&D) activities can determine their level of engagement in R&D using indicators such as (Urbanek, 2008):

- absolute R&D expenditures,
- $\frac{R\,\&\,D\ expenditures}{sales\ revenue}$,
- $\frac{R\,\&\,D\ expenditures}{number\ of\ employees\ (average\ value)}$,

- $\frac{R\&D\ personnel}{number\ of\ employees}$,
- number of inventions and new product or component introductions (absolute or relative, i.e. per R&D employee or for the R&D area).

Similarly, companies engaged in patent activities can use the following catalogue of measures and indicators (Wijk, 2001):

- employee competencies (number of inventions/patent applications/ foreign patent applications per R&D employee and number of significant inventions per total inventions),
- internal structure (average age of patents, percentage of non-patented inventions, number of granted patents, number of patentable inventions, number of patent applications including foreign applications),
- external structure (percentage of patented inventions used commercially by the company/licensed to other companies/in dispute, and the percentage of time spent by the R&D unit on patents owned by other companies),
- alignment with strategy (share of sales of patented products in total sales and total offering, share of licensing revenue in total sales, and sales of patent-protected products/licensing revenue/total patent-related costs in relation to R&D expenditures).

4.2.3. Quantitative analysis of innovative activity of a company

A commonly used measure of a company's innovative activity is the number of patents granted or the number of patent applications filed. However, due to the delay between filing a patent application and its granting, additional measures can be introduced as complements, for example, in measuring the quality of innovation in companies, such as the number of patent citations. Another important measure of a company's innovative activity is the amount of funds allocated to research and development (R&D). Based on this criterion, the Central Statistical Office (GUS) (2020) identifies three main measures:

- The ratio of direct expenditures on R&D to value added,
- The ratio of direct expenditures on R&D to production (sales) value,

- The ratio of direct expenditures on R&D, including indirect expenditures (embedded in investment goods and semifinished products), to production (sales) value.

Different approaches to analysing the innovative activity of companies can also be found in the literature, taking into account three criteria:

- Expenditures on innovation (innovation efforts), such as R&D expenditures, expenditures on specialised employee training or outsourcing research.
- Impact on innovation (innovation impact), including the percentage of domestic sales of new products, export of new products.
- Financial performance, including financial indicators such as return on assets (ROA), return on sales (ROS), operating margin (Albuquerque et al., 2018), revenue, return on equity (ROE), sales growth and market share (Cegarra-Navarro et al., 2016).

In addition to the above-mentioned measures and indicators related to innovative activity, one additional measure should be mentioned (Nawrocki, 2012). It illustrates the degree of novelty of a given asset or group of assets. It is calculated by subtracting the redemption rate indicator from the value of "1":

$$DofNi = 1 - RIi = 1 - \frac{(Ri + Nwdi)}{Gvi},$$

where:

DofNi – novelty indicator of a given asset,

RIi – redemption rate indicator,

Ri – accumulated depreciation of a given asset,

Nwdi – write-offs updating the value of a given asset,

Gvi – gross value of a given asset.

A high value of the indicator indicates that the examined asset or group of assets is relatively new. A low value is achieved in the case of assets that have been almost completely depreciated or have lost their value due to other reasons. In the computational practice, the financial position with regard to intangible assets and innovative activity can be evaluated based on a series

of indicators. Most of them do not have specific names, and the names represent the method of calculating the respective indicator. The results of the calculations are presented below in a tabular form.

Table 4.1. Evaluation of the financial position considering intangible assets and innovative activity

Coefficient	01.01.2018-31.12.2018	01.01.2019-31.12.2019	01.01.2020-31.12.2020	01.01.2021-31.12.2021
$\frac{Intangible\ assets}{total\ assets}$	4.46%	4.26%	2.07%	2.70%
$\frac{Investments\ in\ development\ work}{total\ assets}$	21.55%	27.48%	14.05%	16.22%
$\frac{Intangible\ assets}{equity}$	5.01%	5.41%	2.73%	3.08%
$\frac{Patents\ and\ licenses}{total\ assets}$	0.08%	0.15%	0.05%	0.02%
$\frac{Sales\ revenue}{intangible\ assets\ (average\ balance)}$	-	9.48	35.78	15.03
$\frac{Investments\ in\ development\ work}{sales\ revenue}$	66.91%	74.02%	19.02%	39.43%
Depreciation of non-current assets (patents and licenses)	45.59%	51.11%	24.51%	10.49%

Source: own calculations based on CD Projekt's consolidated financial statements for 2018-2021.

Taking into account the above indicators, it can be stated that expenditures on development work constitute a significant portion of total assets. In the years 2018-2020, their nominal value increased, with a slight decrease in 2021. In this context, the decrease in the indicator value is a result of the increasing value of total assets. Similar conclusions can be drawn from the analysis of indicators presenting the ratios of intangible assets to total assets and intangible assets to equity. The share of patents and licenses in total assets is marginal and usually below 0.1%. The indicator illustrating the ratio of sales revenue to intangible assets was calculated for the years 2019-2021. For the year 2018, the indicator could not be calculated due to the need to average the balance values when creating indicators relating flow data to stock data. Its value is subject to significant fluctuations and did not indicate any clear trend. On the other hand, the ratio of expenditures on development work to sales revenue showed a downward trend, with a minimum recorded in 2020. However, during the period 2018-2020, this phenomenon could not be evaluated negatively, as

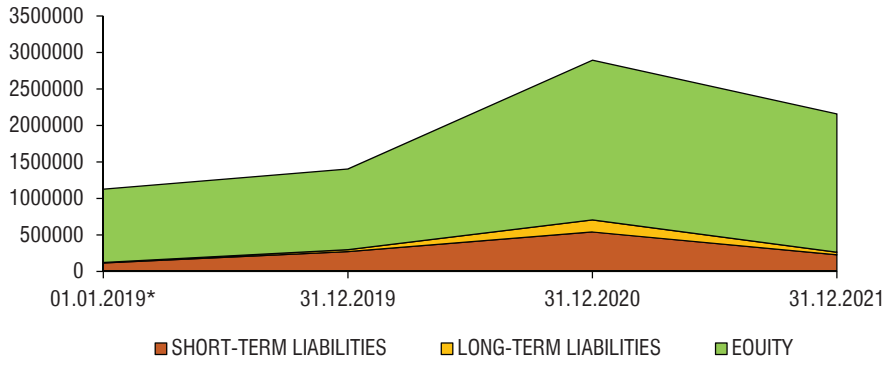
it was a result of increasing sales revenue. Only in 2021, both sales revenue and expenditures on development work showed a decrease compared to the previous year. The decrease in the indicator compared to the levels recorded in 2018-2019 can be interpreted as a negative phenomenon from the perspective of development activities. However, on the other hand, over the years 2020-2021, despite a significant decrease in sales revenue, expenditures on development work only decreased slightly, which may indicate the company's willingness to maintain its development potential. The degree of novelty of patents and licenses showed a decreasing trend, with a minimum reached in 2021.

4.3. Capital structure analysis

Liabilities are the second main part of a company's balance sheet, reflecting the sources of financing for its operations. Liabilities represent financial obligations and commitments that the company must repay or settle within a specified period of time. There are two main categories of capital: equity, and liabilities and provisions.

Equity is typically associated with owners. Liabilities and provisions reflect the financial obligations of the company to other parties and the creation of reserves to cover future obligations or losses. Liabilities are amounts that the company is obligated to repay to other parties in the future in exchange for goods, services or benefits received.

Figure 4.4. Size of individual types of capital



Source: own calculations based on CD Projekt's consolidated financial statements for 2018-2021.

As can be observed from the presented chart, the size of financing sources significantly increased until 2020, that is until the release of the game Cyberpunk 2077. Between 2019 and 2020, the total balance basically doubled. After the game's release, the total balance decreased. CD Projekt Group primarily utilises equity in its operations. During periods of increased financing needs, the company resorts to debt, which is mostly short-term in nature. Only in 2020 we could observe an increase in long-term debt as well. The release of the game Cyberpunk 2077 was a turning point. After this period, the total balance decreased, and the company reduced its already small indebtedness. Long-term obligations were the first to be repaid, along with a portion of short-term liabilities.

Equity encompasses various components. The first and primary component is owners' contributions. They form the basis of equity and represent monetary funds or other values contributed by owners or shareholders. Owners' contributions are significant for financing the company's operations and represent owners' participation in the company. Consequently, they are associated with issues of power and control. A portion of the contributed value related to profits from the sale of shares or stocks above their nominal value is visible in reserves related to equity.

Current and retained profits are also part of equity. They include the net profit earned by the company after deducting all costs and taxes. Some portion of profits is reinvested in the company for further development and growth. This means that instead of distributing all profits to owners, the company decides to retain a portion of the profit and invest it in the company. It is mandatorily allocated to reserves, but it can also increase reserve capital or remain as undistributed profits from previous years.

Adjustments are made to equity or profits and can result from various factors. These can include adjustments to owners' contributions that arise from the difference between declared owners' contributions and the actual funds contributed.

All these components of equity are significant for the financial structure of the company and influence its ability to finance its operations, grow and undertake investments. Equity forms the basis of the company's financial stability and allows owners or shareholders to share in the profits generated by the company.

Equity includes the funds that the company has received from owners or shareholders in exchange for ownership stakes in the company. Equity is the

primary source of financing for the company's operations and represents the net value of the company, i.e. the difference between assets and liabilities.

Financial liabilities are amounts that the company is obligated to repay in the future. These can include bank loans, bonds, trade debts or other forms of financial obligations. Financial liabilities are typically divided into long-term and short-term, depending on the repayment period. Long-term liabilities have a repayment term exceeding 12 months, while short-term liabilities are due within a period shorter than 12 months.

Another category of liabilities are reserves and provisions for future expenses. Reserves are funds that the company has set aside to cover future costs or obligations, such as reserves for renovations, warranties, compensations or deferred taxes.

The liabilities section also includes current liabilities, such as suppliers, tax obligations or wages and salaries owed to employees. These are amounts that the company owes to other parties and should be settled within a specified time.

Liabilities are significant from the perspective of financial management. Effective liability management involves monitoring obligations, ensuring timely repayments, minimising financing costs and optimising the capital structure. Proper liability management contributes to the financial stability of the company, maintains a good reputation with creditors and enhances the ability to obtain new sources of financing.

Equity represented 89% at the beginning of 2019. An important component of equity is reserve capital. It originates partly from the sale of shares above their nominal value, while the dominant value consists of retained earnings from previous years. Other significant items in equity are current-year profits and share capital. Analysing the sources of equity, it can be concluded that the majority of them are current profits reinvested in the equity group. Profit within the equity group increases financing sources on average by about 10%-12%. In 2020, when the company released a blockbuster game, profits reached a record level. The profit for the financial year then accounted for 40% of the total financing sources. It was an exceptional year in terms of profitability. As a result, reserve capital increased by 84% between 2020 and 2021.

Share capital initially accounted for 9% of the total balance at the beginning of 2019. Its share decreased to 3% of the total balance in 2020. This happened despite the fact that the company issued new shares between 2019 and 2020, increasing the share capital by 5%. At the same time,

Table 4.2. Structure and dynamics of financing sources

Itemisation	01.01.2019*	31.12.2019	31.12.2020	31.12.2021	2019:2018	2020:2019	2021:2020	2021:2018
EQUITY	**89%**	**79%**	**76%**	**88%**	**110%**	**198%**	**87%**	**189%**
Parent entity shareholders' equity	89%	79%	76%	88%	110%	198%	87%	189%
Share Capital	9%	7%	3%	5%	100%	105%	100%	105%
Supplementary Capital	65%	55%	27%	66%	106%	100%	184%	194%
Supplementary Capital from sale of shares above nominal value	0,3%	0%	0%	4%	5%	100%	2949%	102%
Other reserve Capital	2%	4%	2%	2%	209%	83%	105%	184%
Exchange rate differences	0%	0%	0%	0%	89%	121%	146%	157%
Retained earnings	3%	0%	0%	0%	-8%	129%	217%	-21%
Net profit (loss) for the reporting period	10%	12%	40%	10%	160%	658%	18%	191%
Minority interest equity				0%				
LONG-TERM LIABILITIES	**1%**	**2%**	**6%**	**2%**	**376%**	**660%**	**22%**	**540%**
Other financial liabilities	0%	1%	1%	1%	10890%	90%	132%	12933%
Other liabilities		0%	0%	0%		95%	90%	
Deferred tax liabilities		0%		0%				
Deferred revenues	1%	0%	0%	0%	6%	265%	667%	101%
Provisions for employee benefits and similar liabilities	0,0%	0%	0%	0%	0%	134%	156%	95%
Other provisions		0%	5%	0%		28385%	4%	
SHORT-TERM LIABILITIES	**10%**	**19%**	**19%**	**11%**	**233%**	**198%**	**42%**	**195%**
Other financial liabilities	0%	0%	0%	1%	876%	136%	880%	10489%
Trade liabilities	4%	4%	4%	2%	120%	193%	46%	107%
Current income tax liabilities		0%	0%	1%		1476%	1403%	
Other liabilities	2%	1%	1%	0%	63%	298%	30%	56%
Deferred revenues	2%	11%	2%	1%	617%	30%	66%	121%
Provisions for employee benefits and similar liabilities	0,0%	0%	0%	0%	0%	100%	200%	175%
Other provisions	2%	3%	12%	4%	167%	879%	24%	358%
TOTAL EQUITY AND LIABILITIES	**100%**	**100%**	**100%**	**100%**	**125%**	**206%**	**75%**	**192%**

Source: own calculations based on CD Projekt's consolidated financial statements for 2018-2021.

the profit from the sale of shares above their nominal value in reserve capital also increased. The release of the blockbuster game required the company to obtain external equity financing.

The identified increase in liabilities is not directly related to an increase in interest-bearing debt. Between the beginning of 2019 and its end, short-term liabilities doubled in the financing sources structure, mainly due to deferred revenues. In the following year, reserves of both long-term and short-term nature also increased.

4.4. Analysis of the capital and financial position

An independent analysis of the structure of assets and liabilities is not sufficient. To obtain a complete picture of the company's financial situation, it is necessary to assess the mutual relationship between financing sources (liabilities) and the corresponding resources (assets). When considering the nature of liabilities, it should be remembered that regardless of the repayment period, external financing sources must be repaid to the creditors. Therefore, it is essential to appropriately match the financing sources in terms of the time structure of their maturity with the level of liquidity of the assets they are meant to finance. The shorter the repayment period of external financing sources for assets, the greater should be the liquidity of the company's assets. Thus, an adequate balance sheet alignment involves linking assets to liabilities in such a way that the timeliness of the assets in the balance sheet corresponds to the timeliness of the financing sources in the liabilities. This assumption is embedded in the "golden rule of financing" (Waśniewski, Skoczylas, 2004). According to this rule, capital should not be tied to a particular asset component for longer than the period for which that capital remains in the company.

Table 4.3. Ratios for evaluating the golden rule of financing

The method of calculating the ratio	Description
$\frac{long-term\ assets}{long-term\ capital} \leq 1$	Long-term assets should be financed only from long-term sources of financing.
$\frac{short-term\ assets}{short-term\ capital} \geq 1$	Short-term assets can be financed from short-term sources.

Source: own.

However, the individual allocation or linkage of specific assets to specific liability items is not feasible in practical economic terms. Therefore, some authors propose two approaches to this issue.

Table 4.4. Ratios of coverage of fixed assets

The method of calculating the ratio	Description
Ratio of First Degree Coverage $\frac{equity}{fixed\ assets} \times 100$	The first degree coverage ratio illustrates how fixed assets are financed. The closer the value of this ratio is to 100%, the greater the portion of fixed assets that are financed by equity. As a result, owners bear the risk associated with investing in fixed assets. A ratio above 60% is sometimes considered appropriate, but it is not a strict rule.
Ratio of Second Degree Coverage $\frac{equity + long - term\ liabilities}{fixed\ assets} \times 100$	A second degree coverage ratio greater than 100% indicates that fixed assets are properly financed.

Source: own.

Table 4.5. Coverage Ratios in CD Projekt Group

Itemization	01.01.2019*	31.12.2019	31.12.2020	31.12.2021
First degree of coverage	2.5	1.6	2.9	2.1
Second degree of coverage	2.5	1.7	3.1	2.1

Source: own calculations based on CD Projekt's consolidated financial statements for 2018-2021.

As shown in Table 4.5, the capital group finances the entirety of its fixed assets with equity capital. Therefore, it can be said that in each of the analysed periods, the fixed assets are correctly financed, and additionally, the investment risk in these assets is attributed to the owners. This means that long-term assets do not need to be secured by long-term loans. The risk of losing these assets due to failure to repay obligations on time is, therefore, very low.

Chapter 5

Analysis of net working capital

5.1. The essence of net working capital

One of the conditions for maintaining financial liquidity in many enterprises is having net working capital. This capital can be calculated in two ways:

Net Working Capital = Fixed Capital – Long-term Assets

Net Working Capital = Current Assets – Current Liabilities

In many enterprises, current assets are equal to working assets, as there are no receivables from related entities and other economic entities exceeding 12 months in the structure of these assets.

In practice, there can be three situations:

- Positive net working capital
- Zero net working capital
- Negative net working capital

Positive net working capital – a positive difference between fixed capital and long-term assets indicates the financing of a portion of the enterprise's current assets by long-term sources and the availability of funds for its operational activities. The positive difference between fixed capital and long-term assets means that a portion of the enterprise's current assets is financed by long-term sources. Fixed capital, which represents net working capital, can be:

- Fully covered by equity capital
- Comprised of the sum of equity capital and long-term liabilities
- Fully covered by long-term liabilities

Utilising external capital comes with financial costs, hence using this source must be exceptionally cautious, taking into account both the aforementioned costs and the entity's ability to service the debt.

A zero level of net working capital is a situation where all long-term assets are financed by fixed capital, and current assets are financed by current liabilities. This situation is more theoretical than practical (in practice, net working capital may hover around zero).

A negative level of net working capital – a negative difference between fixed capital and long-term assets is only correct if a portion of the enterprise's long-term assets is financed by flexible sources of which repayment can be deferred. Such sources include rolling issuances of short-term debt securities and certain short-term loans that allow for deferred repayment. A negative level of net working capital may result from the specific nature of business activities and does not necessarily have to be an unfavourable situation. For example, most trading companies are in this situation. These companies extend payment terms for deliveries and sell the delivered goods for cash. Supermarkets, utilising their bargaining power, can be a prime example as they negotiate favourable long payment terms for their liabilities, thus financing not only their operational activities in this way. Enterprises with negative net working capital are characterised by shorter collection periods for receivables compared to the payment terms of their liabilities, resulting in the generation of free cash. These funds can be used to finance development projects. Negative net working capital can also be associated with long production cycles.

Methods of establishing relationships based on net working capital are presented in Table 5.1.

Table 5.1. Methods for calculating indicators based on net working capital

The method of calculating the ratio	Description
Net working capital to total assets ratio $\frac{net\ working\ capital}{total\ assets}$	This ratio shows the percentage of total assets that is represented by net working capital engaged in financing the operational activities of the enterprise.
Net working capital to current assets ratio* $\frac{net\ working\ capital}{current\ assets}$	This ratio highlights the financing structure of current assets and determines the percentage of these assets that is financed by net working capital.
Net working capital to inventory and receivables ratio* $\frac{net\ working\ capital}{(inventory+receivables)}$	This ratio informs about the degree of financing of the sum of inventory and receivables by net working capital.

The method of calculating the ratio	Description
Net working capital to sales ratio $\frac{net\ working\ capital}{sales\ revenue}$	This ratio indicates how much net working capital is engaged for every one unit of realised sales revenue of products, goods and materials.
Inventory holding period $\frac{average\ inventory}{cost\ of\ goods\ sold} \times \begin{matrix} number \\ of\ days \\ in\ the\ period \end{matrix}$	This indicator informs about the number of days the cost of goods sold represents in terms of inventory level.
Receivables collection period $\frac{average\ receivables}{sales\ revenue} \times \begin{matrix} number \\ of\ days \\ in\ the\ period \end{matrix}$	This ratio allows determining the number of days for which the enterprise has not recovered funds from its customers out of the realised sales revenue.
Short-term liabilities settlement period $\frac{\begin{matrix} average\ short \\ -\ term\ liabilities \end{matrix}}{cost\ of\ goods\ sold} \times \begin{matrix} number \\ of\ days \\ in\ the\ period \end{matrix}$	This ratio shows the period expressed in days for which the enterprise has not settled its short-term liabilities.
Cash conversion cycle = Inventory Holding Period + Receivables Collection Period – Short-term Liabilities Settlement Period	This cycle determines the time that elapses from the outflow of funds for settling short-term liabilities to the inflow of funds from receivables.

* Ratios are calculated for positive net working capital. In the case where net working capital is negative, its absolute value should be compared to the sum of long-term assets. This calculated ratio shows the proportion of long-term assets financed by short-term sources.

Source: own.

Table 5.2 presents the value of individual components of current assets and short-term liabilities, as well as their dynamics from 2018 to 2021. These values will be used to calculate ratios based on net working capital and the cycles of net working capital, along with their components.

CD Projekt maintains a low level of inventory. It serves only a supporting function for the core processes, such as game production, and has marginal significance in the current assets of the analysed company. It mainly consists of goods. The level of inventory showed exceptional instability from 2018 to 2021. In 2019, inventory increased 50 times compared to the previous year, while in the following year, inventory represented only 54% of its 2019 level. In 2021, inventory increased by 128.3% compared to 2020.

One of the most important components of current assets in companies is short-term receivables. In companies producing games, receivables arise from game sales and exhibit significant fluctuations over time. In 2019, trade receivables were 3.5 times higher than in 2018, while in 2020, trade receivables were over nine times higher than the previous year. In the last year of the

analysed period, receivables accounted for only 10% of their 2020 value. Such significant fluctuations in trade receivables are caused by the unevenness of revenue generation from sales, which sharply increases after the introduction of a new game to the market. The cyclicality of sales revenue depends on the duration of new game development and the expansion of existing games in the market. Other receivables also steadily increased.

Table 5.2. Value and dynamics of current assets and short-term liabilities in CD Projekt company from 2018 to 2021

Itemisation	2018	2019	2020	2021	Dynamics,%		
					2019/ 2018	2020/ 2019	2021/ 2020
Current assets, thousands PLN							
Inventories	258	12 862	6 957	15 886	4985.3%	54.1%	228.3%
Non-current assets held for sale	37 008	129 573	1 205 603	125 293	350.1%	930.4%	10.4%
Trade receivables	1611	20 349	-	98	1263.1%	-	-
Current income tax receivables	19 232	60 370	70 210	113 498	313.9%	116.3%	161.7%
Other receivables	12 880	19 556	13 383	13 763	151.8%	68.4%	102.8%
Deferrals	-	-	106 444	307 765	-	-	289.1%
Other financial assets	104 378	49 406	563 335	411 586	78.0%	38.0%	161.2%
Bank deposits (maturity beyond three months)	554 992	432 895	164 368	265 000	47.3%	1140.2%	73.1%
Cash and cash equivalents	49	-	-	-	-	-	-
CURRENT ASSETS	730 407	725 011	2 130 300	1 252 889	99.3%	293.8%	58.8%
Short-term liabilities, thousands of PLN							
Other financial liabilities	146	2 154	2 933	25 802	875.6%	136.2%	879.7%
Trade liabilities	49 914	59 866	115 444	53 380	119.9%	192.8%	46.2%
Current income tax liabilities	-	118	1742	24 446	-	1476.3%	1403.3%
Other liabilities	17 785	11 122	33 134	10 042	62.5%	297.9%	30.3%
Deferred revenues	26 172	161 364	47 758	31 548	616.6%	29.6%	66.1%
Provisions for employee benefits and similar liabilities	2	2	4	7	100.0%	200.0%	175.0%
Other provisions	23 164	38 673	339 954	83 042	167.0%	879.0%	24.4%
SHORT-TERM LIABILITIES	117 283	273 999	540 969	228 267	233.0%	197.9%	42.2%

Source: own calculations based on CD Projekt's consolidated financial statements for 2018-2021.

Recovered trade receivables contributed to the cash position, which increased by 11 times in 2020 compared to 2019. Cash invested in financial instruments, such as government bonds, corporate bonds and treasury bills, is included in other financial assets. This category also includes derivative instruments, options, futures, rights to subscribe for shares and loans to other economic entities. Other financial assets, cash and cash equivalents and deposits over three months collectively represent short-term investments.

In 2020, CD Projekt allocated PLN 106.4 million to other financial assets, while in 2021, it allocated PLN 307.8 million, nearly three times more. In 2020, the company had a total of PLN 834 million in free funds, which is 73% more than in the previous year. In 2021, the free funds included in the three mentioned categories amounted to nearly PLN 1 billion, an 18% increase compared to the previous year. These funds constitute the main component of current assets and are used to promptly settle short-term liabilities and cover costs in subsequent operating periods where sales revenue may be lower than the company's operating costs.

One of the sources of financing for current assets are short-term liabilities. During the analysed period, they grew at a slower pace than current assets. In 2019, short-term liabilities were 133.6% higher than their 2018 level. The following year, the growth rate was lower at 97.4%. In 2021, short-term liabilities decreased by almost 60% compared to 2020, mainly due to a decline in other provisions. The changes in individual items of short-term liabilities were uneven.

The company creates provisions when it has an obligation arising from past events, and it is probable that it will have to settle liabilities resulting from them. These provisions include reserves for warranty repairs, reserves for performance-based compensation costs, reserves for the costs of audits and reviews of financial statements, and external services. Nearly 90% of these provisions are for future compensation dependent on financial results. In the year of introducing a new game to the market, the company generates high revenues and retains a portion of the financial result as reserves for compensation, which will be paid in future years depending on the sales performance of that game. Therefore, the degree of change in other provisions is very significant. In 2019, these provisions increased by 66.9% compared to 2018, in 2020 they increased nearly ninefold compared to the previous year, and in 2021 they decreased by 75.6% compared to 2020. Interim settlements of costs and trade payables also show significant fluctuations over time. In 2019, these settlements increased by over six times compared to 2018, while in subsequent years, they exhibited a substantial decline. Trade payables increased by 19% in 2019 compared to the previous year, and in 2020, they increased twofold compared to their 2019 level. The company creates interim settlements for guarantees, advances, prepayments, software, licenses, future marketing service costs, rights of first refusal fees, property and personal insurance, costs of protecting IT resources, trade fair participation costs, business travel and marketing campaigns.

The company finances a portion of its current assets with net working capital. The methods of determining net working capital and the degree of changes compared to the previous year are presented in Table 5.3.

Table 5.3. Level of net working capital in CD Projekt company in the years 2018-2021

Itemisation	2018	2019	2020	2021
Equity	1 002 864	1 105 651	2 187 356	1 894 356
+Long-term debt	6 691	25 158	166 153	36 112
= Fixed capital	1 009 555	1 130 809	2 353 509	1 930 468
- Non-current assets	396 431	679 097	764 178	905 846
= Net working capital	613 124	451 712	1 589 331	1 024 622
Current assets	730 407	725 011	2 130 300	1 252 889
Short-term liabilities	117 283	273 299	540 969	228 267
Working capital	613 124	451 712	1 589 331	1 024 622
Growth rate, previous year = 100	-	73.67	351.85	64.47

Source: own calculations based on CD Projekt's consolidated financial statements for 2018-2021.

The changes in the level of net working capital involved in financing operational activities are significant. In 2019, the level of this capital decreased by over 23% compared to its value in 2018, and already the following year, it increased by 3.5 times relative to 2019. In 2021, the net working capital decreased by 35% compared to 2020. The changes in the level of net working capital are mainly the result of the amount of accumulated cash and various forms of its investment. In years of high revenues and increased profits, the level of equity capital involved in financing the growth of current assets increased primarily due to retained earnings and financed the increase in cash and cash equivalents.

Table 5.4 presents the structure of equity capital and the structure of financing the operational activities of the Company.

Table 5.4. Structure of fixed capital and sources of financing current assets

Itemisation	Structure, %			
	2018	2019	2020	2021
Equity	99.34%	97.78%	92.94%	98.13%
+ Long-term debt	0.66%	2.22%	7.06%	1.87%
= Fixed capital	100%	100%	100%	100%
Structure of operational financing				
Net working capital	83.94%	62.30%	74.61%	81.78%
Short-term liabilities	16.06%	37.70%	25.39%	18.22%
Sources of financing for current assets	100.00%	100.00%	100.00%	100.00%

Source: own calculations based on CD Projekt's consolidated financial statements for 2018-2021.

Fixed capital is mainly composed of equity. In 2019, slightly over 2% constituted external capital, in 2020 it was 7% and in 2021 it was less than 2%. The low share of long-term debts in the structure of net working capital may stem from market risks associated with the company's business activities, unpredictable financial effects of introducing games to the market, intense competition in the industry, cyclicality of game production and profits, as well as cash reserves. Net working capital in the analysed company is financed by equity, supporting its ongoing operations. On average, during the analysed period, its share in financing current assets amounted to nearly 76% and ranged from 83.96% in 2018 to 62.2% in 2019.

Table 5.5. Ratios based on net working capital in CD Projekt for the years 2018-2022

Itemisation	2018	2019	2020	2021
Net working capital	613 124	451 712	1 589 331	1 024 622
Total assets	1 126 838	1404 108	2 890 299	2 158 735
Current assets	730 407	725 011	2 130 300	1 252 889
Inventory + receivables	37 266	142 435	1 212 560	141 179
Sales revenue	362 901	521 272	2 138 875	888 172
Net working capital/assets	0.54	0.32	0.55	0.47
Net working capital/current assets	0.84	0.62	0.75	0.82
Net working capital/(Inventory + receivables)	10.55	2.02	1.24	4.02
Average net working capital/Sales revenue of products, goods, and materials	-	1.02	0.48	1.47

Source: own calculations based on CD Projekt's consolidated financial statements for 2018-2021.

All ratios based on net working capital show exceptionally high coverage of both total assets and current assets by this capital. In 2018, net working capital involved in operational activities accounted for 54% of assets, and in 2020, it was 55%. The financing of current assets by this capital is exceptionally high. The highest level of financing of current assets by net working capital occurred in 2018 and amounted to 84%, while the lowest was 62% the following year. The financing of inventories and receivables by this capital varied significantly. In 2018, net working capital was over 10 times higher than the sum of inventories and receivables, while in 2020, it was only 24% higher than these components of current assets. This is due to significant fluctuations in receivables dependent on sales revenue. These revenues increase significantly in the year of introducing a new game to the market, decrease in the following year and then rise again when a new game is successfully introduced. In industrial operations, it is assumed that the liquidity position of a company is satisfactory when the ratio is 0.5, indicating that net working capital

finances half of the sum of inventories and receivables (Sierpińska, Wędzki, 2005, p. 93). The presented ratios in the analysed company deviate significantly from the accepted standard due to the specificity of its operations.

5.2. Cycle of Net Working Capital and Its Components

The calculated cycles of inventories, receivables and short-term liabilities allowed for the determination of the cash conversion cycle. The calculation of the receivables cycle included total receivables, which encompass trade receivables and other receivables. In the structure of other receivables, the company records receivables related to taxes (excluding corporate income tax), advance payments for supplies, advance payments for research and development expenses, receivables from settlements with payment operators and deposits, prepayments for licensing obligations and receivables from employee settlements. Therefore, they are associated with the company's core operational activities.

Table 5.6. Cash Conversion Cycle of Net Working Capital and Its Components

Itemisation	2018	2019	2020	2021
Inventory, thousands of PLN	256	12 862	6 957	15 886
Short-term receivables, thousands of PLN	57 851	310 292	1 275 813	238 889
Short-term liabilities, thousands of PLN	117 283	273 999	540 969	228 267
Cost of goods sold, services rendered, products, and materials, thousands of PLN	106 254	161 308	491 364	250 234
Sales revenue of products, services, goods, and materials, thousands of PLN	362 901	521 272	2 138 875	888 172
Inventory turnover, days	-	4.6	1.7	4.7
Receivables turnover, days	-	93.9	126.8	311.2
Short-term liabilities turnover, days	-	137.0	69.5	158.1
Cash conversion cycle, days	-	- 38.5	59.0	157.9

Source: own calculations based on CD Projekt's consolidated financial statements for 2018-2021.

In 2019, the negative cash conversion cycle is a result of using the average levels of inventories, receivables and short-term liabilities in the calculations. The company's specificity, characterised by a significant temporal discrepancy in revenue generation, leads to high volatility in the levels of inventories, receivables and short-term liabilities. Calculating their average levels relative

to the sales revenue of a given year does not accurately reflect the time at which cash is tied up in current assets or the deferral of payment of liabilities.

In 2020, the gross operating cycle (the sum of the inventory and receivables cycles) was 128.49, and the payment deferral cycle was just over two months. Therefore, the cash conversion cycle was 59 days. In the last year of the analysed period, a characteristic feature is the very long receivables cycle, which represents the waiting time for funds from customers. It is a result of the high level of receivables at the beginning of the year, resulting from nearly five times higher sales revenue in 2020 compared to 2021. The cash conversion cycle is 158 days.

Therefore, it seems that using cycles to assess the financial liquidity of companies with significant revenue volatility is unnecessary, as they do not accurately reflect the financing status of their operational activities.

Chapter 6

Financial liquidity analysis

6.1. Static liquidity

The basis for the functioning of a Group on the market and ensuring its competitiveness in a dynamic environment is maintaining financial liquidity. Financial liquidity is most often understood as the ability to timely pay short-term liabilities. It can be provided by holding cash reserves, converting short-term assets into cash and access to short-term sources of financing. In other words, financial liquidity can be maintained by balancing inflows and outflows. The lack of this balance results in a loss of financial liquidity or the emergence of a cash surplus, known as financial over-liquidity. The shortage of cash needed for the timely payment of short-term liabilities may result from the low liquidity of current assets (short-term assets). Therefore, it is necessary to distinguish between asset liquidity and financial liquidity. Asset liquidity refers to the rate of conversion into cash, with higher rates of cash recovery from inventories and receivables indicating higher financial liquidity. This means that financial liquidity is a result of the level of liquidity of current assets. A Group that possesses assets that are difficult to cash in will face challenges in maintaining financial liquidity, even if static liquidity ratios are within the standard range. Both liquidity shortage and over-liquidity have financial consequences. Failure to settle liabilities on time will result in the accrual of penalty interest, and in the long run, it may lead to the bankruptcy of the business entity. On the other hand, an excess of cash will generate costs of missed opportunities. The method of calculating financial liquidity ratios and their interpretation is presented in Table 6.1.

Table 6.1. Methods of determining financial liquidity ratios, static approach

The method of calculating the ratio	Interpretation
Current ratio $\frac{current\ assets}{current\ liabilities}$	The size of the ratio shows to what extent short-term assets are sufficient to cover short-term liabilities. The industry standard level is 1.2-2.0.
Quick ratio $\frac{(receivables + short - term\ investments)}{current\ liabilities}$	The ratio informs to what extent the most liquid elements of short-term assets ensure the possibility of settling short-term liabilities. The standard level of this indicator is up to 1.0-1.2.
Cash ratio (short-term investments form) $\frac{short - term\ investments}{current\ liabilities}$	The report explains what size of short-term liabilities can be settled based on cash resources, deposits and other instruments in which the Group invested cash until the balance sheet year (treasury bills, treasury bonds, corporate bonds, etc.). There is no specific standard for this indicator.
Cash ratio $\frac{cash}{current\ liabilities}$	The ratio shows what level of short-term liabilities can be settled based on cash and cash equivalents held, from which cash is recovered within three months

Source: own study based on (Sierpińska-Sawicz, 2021, pp. 205-212).

The financial liquidity ratios presented in Table 6.1 can be compared with data from previous periods, ratios of competitors on the market, industry average ratios (ratios within a specific class of economic activity) and planned ratios. Standards defined for these ratios are rarely used in practice to assess the rational level of ratios for the evaluated Group.

Each disruption of financial liquidity in a Group can be associated with a series of negative economic consequences for the enterprise. The main threats to firms include deteriorating market position compared to counterparts, loss of flexibility in decision-making, worsening financial results and limited Group growth (Sierpińska, Jachna, 2004, p.161).

When financial liquidity is lost, the Group's market situation deteriorates both on the supply side and on the side of finished product sales. The Group's bargaining power drastically decreases in this case, which is associated with the inability to finance its customers. A Group that has lost financial liquidity is unable to meet the competitive conditions on the market, where it would have to extend invoice payment terms, offer discounts and allowances and expand credit provision. The result of such a situation can be a partial loss of customers and a lower level of sales, consequently affecting the financial performance.

A Group whose financial liquidity deteriorates loses the flexibility in making financial decisions and, at the same time, the ability to control financial performance. Entities that have provided the Group with trade credit may limit its scope. In a situation where a bank provides credit to

improve the financial liquidity of the Group, it does so on less favourable terms, demanding higher interest rates and risk premiums, which will have a negative impact on financial performance and the ability to flexibly choose sources of financing. Financial performance and financial liquidity are closely related; a decrease in financial liquidity is associated with a decline in financial performance.

On the other hand, in conditions of high financial liquidity, a Group is characterised by a reduced financial risk and increased development opportunities, the ability to control financial performance, enhanced sales through customer financing, and the use of monetary policy instruments, full availability of financial policy solutions.

The financial liquidity ratios were calculated based on the level of current assets and short-term liabilities (table 6.2).

Table 6.2. Data required to calculate financial liquidity ratios.

Itemisation	2018	2019	2020	2021
Inventories	258	12 862	6 957	15 886
Total receivables, including:	57 851	210 292	1275 813	238 889
- Trade receivables	37 008	129 573	1 205 603	125 293
- Current income tax receivables	1611	20 349	-	98
- Other receivables	19 232	60 370	70 210	113 498
Short-term investments, including:	659 370	482 301	834 147	984 351
- Other financial assets	-	-	106 444	307 765
- Cash and cash equivalents	104 378	49 406	563 335	411 586
- Bank deposits over 3 months	554 992	432 895	164 368	265,000
Non-current assets held for sale	49	-	-	-
Deferrals	12 880	19 556	13 383	13 383
TOTAL CURRENT ASSETS	**730 407**	**725 011**	**2 130 300**	**1 252 889**
CURRENT LIABILITIES	**117 283**	**273 999**	**540 969**	**228 267**

Source: own calculations based on CD Projekt's consolidated financial statements for 2018-2021.

Data contained in table 6.2. was used to calculate financial liquidity ratios.

Table 6.3. Development of financial liquidity ratios in CD Projekt SA

Itemisation	2018	2019	2020	2021
Current financial liquidity ratio	6.23	2.65	3.94	5.49
Quick liquidity ratio	6.12	2.53	3.90	5.36
Short-Term Investment Index	5.62	1.76	1.54	4.31
Cash ratio	0.89	0.18	1.04	1.80

Source: own calculations based on CD Projekt's consolidated financial statements for 2018-2021.

The current financial liquidity ratios in the analysed Group are exceptionally high, mainly due to maintaining a high level of cash and cash equivalents, bank deposits and investment in bonds. In 2018, current assets were over six times higher than short-term liabilities, which the Group should settle within a period of no longer than one fiscal year. In the following year, the ratio decreased by almost 2.4 times; however, the Group, with such a high cash level, had no problems with timely settling short-term liabilities. In 2021, current assets, from which the Group can recover cash within the fiscal year, were 5.5 times higher than the liabilities due within the year.

The quick financial liquidity ratios were calculated as the ratio of total receivables and short-term investments to short-term liabilities. The sum of trade receivables, current income tax receivables, and other receivables was calculated. Short-term investments include the sum of other financial assets, cash and cash equivalents and bank deposits exceeding three months. The quick financial liquidity ratio does not differ significantly from the current financial liquidity ratio, because the least liquid components of current assets, such as inventories and inter-period settlements, have a small share in total assets. In 2020, the share of these two components of current assets was less than 1%, resulting in the quick liquidity ratio being equal to the current liquidity ratio. In the last year of the analysed period, the current and quick liquidity ratios did not differ significantly from each other due to the low share of the least liquid components in the structure of current assets.

The measurement of financial liquidity was also conducted using the ratio of short-term investments to short-term liabilities. In 2018, the Group's short-term investments were as much as 5.6 times higher than short-term liabilities, and in 2021, they were 4.5 times higher.

The cash ratio of the Group was calculated as the ratio of cash and cash equivalents to short-term liabilities. According to the Accounting Act, cash includes the sum of cash in the Group's account and cash on hand, as well as all securities that can be converted into cash within three months. In 2018, cash was sufficient to cover 89% of short-term liabilities. In the following year, the ratio decreased to 18%, because the Group invested excess funds in bank deposits exceeding three months. In 2020, the cash balance was nearly equal to short-term liabilities, and in the following year, it was as much as 80% higher than short-term liabilities.

Maintaining a cash surplus may be a result of the specific nature of the Group's industry. The long project implementation period for developing a new game creates a significant time lag between costs incurred and revenues

generated. The Group needs to have a reserve of financial liquidity to timely settle current obligations, especially wages, which are not reflected in the balance sheet. Short-term liabilities only include accrued and unpaid employee obligations. However, it appears that the cash surplus in the Group is partially driven by the need to maintain a buffer of financial liquidity for security purposes, while another part is the result of cash surplus and financial excess. This is further explained in the previous analysis of net working capital.

The structure of current assets and short-term liabilities facilitates the interpretation of the level of indicators informing about the Group's ability to settle short-term obligations in a timely manner. It has been presented in table 6.4.

Table 6.4. Structure of current assets and short-term liabilities in CD Projekt in 2018-2021

Itemisation	structure,%			
	2018	2019	2020	2021
CURRENT ASSETS				
Inventories	0.04	1.77	0.32	1.27
Trade receivables	5.07	17.87	56.59	10.00
Current income tax receivables	0.22	2.81	-	0.00
Other receivables	2.63	8.33	3.30	9.06
Deferrals	1.76	2.70	0.63	1.11
Other financial assets	-	-	5.00	24.56
Cash and cash equivalents	14.29	6.81	26.44	32.85
Bank deposits (maturity beyond 3 months)	75.98	59.71	7.72	21.15
Non-current assets held for sale	0.01	-	-	-
TOTAL CURRENT ASSETS	**100.0**	**100.0**	**100.0**	**100.0**
CURRENT LIABILITIES				
Other financial liabilities	0.21	0.79	0.54	11.34
Trade liabilities	42.56	21.90	21.34	23.37
Current income tax liabilities	-	0.04	0.32	10.71
Other liabilities	15.15	4.07	6.12	4.40
Deferred revenues	22.32	59.04	8.83	13.81
Provisions for employee benefits and similar liabilities	0.01	0.01	0.01	0.01
Other provisions	19.75	14.15	62.84	36.34
TOTAL CURRENT LIABILITIES	**100.0**	**100.0**	**100.0**	**100.0**

Source: own calculations based on CD Projekt's consolidated financial statements for 2018-2021.

In the structure of current assets, short-term investments dominate, which include the sum of cash and cash equivalents, bank deposits exceeding three months and other financial assets.

They consist of loans granted to other entities, derivative financial instruments and government bonds, including Polish Treasury bonds, US Treasury bonds (denominated in USD) and German Treasury bonds (denominated in EUR). The Group has subsidiaries abroad, including in Los Angeles, which is why it invests free cash in US government bonds, and in Europe, it has branches in Berlin, Paris and Milan. For the purpose of preparing consolidated financial statements, the currencies were converted into PLN, resulting in exchange rate differences in the valuation of financial instruments. The share of short-term investments in current assets was as high as 90.2% in 2018, 66.5% in the following year and 78.6% in the last year of the analysed period.

In 2020, receivables were the main component in the structure of current assets, accounting for almost 60% of their value, while the share of cash and cash equivalents decreased to 39% compared to 66.5% in the previous year. The recovered funds from receivables were allocated to other financial assets in 2021, where their share increased from 5.0% in 2020 to nearly 25% in 2021. Within the structure of other financial assets, Polish Treasury bonds accounted for over 52% of their value, amounting to PLN 477.4 million in 2021. The remaining amount of PLN 486.3 million represents loans granted to other business entities.

The increase in the share of receivables in the structure of current assets was a result of exceptionally high sales revenue growth. Sales revenue increased from PLN 521.3 million in 2019 to PLN 2,138.9 million in 2020, which is more than a fourfold increase. In 2019, trade receivables accounted for 25% of sales revenue, while in the following year, it was 56.4%. In the overall structure of receivables, the share of other receivables increased from 2.6% in 2018 to 8.3% in the following year. In 2020, other receivables accounted for 3.3% of current assets, and in 2021, their share increased to over 9%.

Inventories and deferrals constitute a small share of total current assets. In 2019, both items accounted for only 4.47% of total current assets, less than 1% in the following year, and 1.4% of total current assets in 2021. Deferrals include costs spread over time, such as repair and maintenance costs, property and personal insurance, IT security costs, marketing campaigns, right of first refusal fees, software and license expenses.

The level and structure of short-term liabilities provide significant data for assessing financial liquidity. Some of these liabilities can be deferred based on an agreement, while others have fixed payment terms, and failure to settle them on time may result in penalty interest. Such liabilities include obligations

to public institutions, including taxes, social insurance contributions, fees and fines for exceeding environmental standards, etc.

The structure of short-term liabilities in the years 2018-2021 underwent changes resulting from the changes in the business activities of the companies within the CD Projekt capital group. In 2018, trade payables constituted the main position of short-term liabilities (42.3%). The share of deferred revenue in short-term liabilities was 22.3%, and other provisions accounted for 20.0%. In 2019, deferred revenue accounted for a significant 59% of liabilities, while the share of trade payables due to deferred invoice payments decreased to 22% and remained at a similar level in subsequent years. Deferred revenue represents revenues from future reporting periods that will be recognised in the income statement when realised. These mainly include expected revenues from royalties for pre-order sales in digital game distribution, advances on royalties, advances on goods received from distributors and settlements over time related to subsidies. In 2020, other reserves had a clear advantage over other liabilities, constituting 62.8% of short-term liabilities. Other reserves include provisions for warranty repairs and returns, performance-based compensation costs, costs of external services and provisions for the costs of audits and periodic financial statement reviews. In 2021, the share of other reserves decreased to 36.3%. In the structure of liabilities for that year, current income tax liabilities accounted for almost 11%, compared to only 0.3% in the previous year.

The presented structure of short-term liabilities has an impact on the financial liquidity of the analysed capital group. Deferred revenue, when realized, will generate additional profits that can be used for settling current liabilities and for further development. Similarly, other reserves, when incurred, will be recognised as costs, and their return will be generated through generated revenues.

6.2. Dynamic assessment of financial liquidity

A static measurement of liquidity based on asset data is insufficient for assessing financial liquidity. It shows to what extent short-term asset resources are sufficient to meet short-term liabilities. However, these assets have diversified liquidity, which means varying degrees of convertibility to cash. To accurately determine a Group's ability to meet short-term liabilities with

a maturity of less than 12 months, liquidity measurement based on cash flow data should be performed. Such data is included in the income statement and cash flow statement, which allow for comparing inflows and outflows to determine a positive or negative cash surplus. Cash inflows and outflows in a Group are associated with various types of activities. In the cash flow statement, they are captured within three areas: operating, investing and financing activities. Table 6.5 presents the levels of cash flows in these areas in CD Projekt Group.

Table 6.5. The level of cash flows in CD Projekt in 2018-2021

Type of flow	2018	2019	2020	2021
Net cash flows from operating activities in thousands PLN, including:	132 591	216 706	711 708	967 825
Net profit (loss)	109 334	175 315	1 154 327	208 908
Depreciation	4 768	8 117	13 559	17,764
Net cash flows from investment activities	(94 494)	(164 498)	(106 386)	(613 795)
Inflows	1 136 419	881 888	823 545	257 135
Outflows	1 230 913	1 406 386	929 931	870 930
Net cash flows from financial activities	(706)	(107 180)	(91 393)	(505 779)
Inflows	-	-	126 124	2 189
Outflows	706	107 180	217 517	507 968
Cash at the Balance of changes in cash and cash equivalents	37 391	(54 972)	513 929	(151 749)
Cash and cash equivalents at beginning of period	66 987	104 378	49 406	563 335
Cash and cash equivalents at end of period end of the period	104 378	49 406	563 335	411 586

Source: own calculations based on CD Projekt's consolidated financial statements for 2018-2021.

In 2018, the cash generated from operating activities was sufficient to cover investment expenses. These mainly included expenses for financial investments, such as long-term deposits and the purchase of financial instruments. The resulting cash surplus increased the cash balance that the Group had at the beginning of the period. In the following year, the net cash flows from operating activities were not enough to cover the cash deficits in the areas of investment cash flows and financial expenses. These deficits depleted the cash balance at the beginning of 2019, primarily due to dividend payments to shareholders. In 2020, only 28% of the cash generated from operating activities was absorbed by negative cash flows from investment and financing activities. The remaining 72% increased the cash balance that the Group had at the beginning of 2020. However, in 2021, these funds were reduced by nearly PLN 152 million, as the expenses for investment and financial purposes exceeded this amount by 13.6%. The structure of cash flows facilitates the interpretation of indicators based on these flows.

Several indicators based on cash flows from operating activities were used in the dynamic assessment of financial liquidity. The methods for calculating these indicators are presented in Table 6.6.

Table 6.6. Ways of calculating cash liquidity and adequacy ratios as well as cash performance and their interpretation

Indicator name	Interpretation
Cash liquidity ratio $\frac{net\ cash\ flows\ from\ operating\ activities}{current\ liabilities}$	The ratio reflects the extent to which funds generated from operating activities are sufficient to cover short-term liabilities.
Overall cash adequacy ratio $\frac{net\ cash\ flows\ from\ operating\ activities}{(financial\ expenses + investments\ in\ intangible\ assets\ and\ tangible\ fixed\ assets)}$	The ratio informs about the level of coverage of expenses for investments in intangible assets and tangible fixed assets as well as financial expenses.
Total monetary debt coverage ratio $\frac{(net\ cash\ flows\ from\ operating\ activities - dividends)}{average\ interest-bearing\ debt\ capital}$	The ratio shows how much of the debt generating interest costs can be repaid using net cash flows from operating activities less dividends paid in a given year from the profit of the previous year.
Asset cash performance ratio $\frac{net\ cash\ flows\ from\ operating\ activities}{average\ total\ assets}$	The ratio informs how much operating cash was obtained per one PLN involved in the Group's assets.
Sales cash performance ratio $\frac{net\ cash\ flows\ from\ operating\ activities}{sales\ revenue}$	This ratio informs what value of operating cash was obtained from one PLN of generated revenues.
Profit cash performance ratio $\frac{net\ cash\ flows\ from\ operating\ activities}{net\ profit\ (loss)}$	The ratio illustrates how the generated net financial result (profit/loss) translates into the generated funds from operating activities.

Source: own.

Table 6.7 presents data obtained from CD Projekt's consolidated financial statements and supplementary notes. They were used to calculate the indicators contained in the next table 6.8.

Table 6.7. Data necessary to calculate dynamic liquidity ratios at CD Projekt in 2018-2021

Itemization	2018	2019	2020	2021
Net cash flows from operating activities, in thousands PLN	132 591	216 706	711 708	967 825
Dividends in thousands PLN	-	100 926	-	503 694
Net cash flows from operating activities – dividends	132 591	115 780	711 708	464 131
Financial outflows	706	107 180	217 617	507 968
Purchases of intangibles and PP&E	15 176	91 509	18 516	27 969
Expenditures on development projects	98 475	164 990	203 076	155 401

Itemization	2018	2019	2020	2021
Total outflows	114 357	363 679	439 109	691 338
Interest-bearing debt capital in thousands PLN	409	19 905	18 939	16 654
Average foreign capital in thousands PLN	-	19 157	19 422	17 796
Total assets in thousands PLN	1 126 838	1 404 108	2 890 299	2 158 735
Average assets in thousands PLN	-	1 265 473	2 149 293	2 526 606.5
Sales revenues in thousands PLN	362 901	521 272	2 138 875	888 172
Net profit (loss), in thousands PLN	109 334	175 315	1 154 327	208 908
Current liabilities, in thousands PLN	117 283	273,999	540 969	228 267

Source: own calculations based on CD Projekt's consolidated financial statements for 2018-2021.

Table 6.8. Development of cash liquidity and sufficiency ratios at CD Projekt in 2018-2021

Indicator name	2018	2019	2020	2021
Cash liquidity ratio	1.13	0.79	1.32	4.24
Overall cash adequacy ratio	1.16	0.60	1.62	1.40
Total monetary debt coverage ratio	-	11.40	36.64	26.08
Asset cash performance ratio	-	0.17	0.33	0.38
Sales cash performance ratio	0.37	0.42	0.33	1.09
Profit cash performance ratio	1.21	1.24	0.62	4.63

Source: own calculations based on CD Projekt's consolidated financial statements for 2018-2021.

The cash liquidity ratios exhibited significant changes during the analysed period. In 2019, the ratio stood at 0.79, indicating that the net cash flows from operating activities were 21% lower than the current liabilities. However, in the following year, these cash flows were 32% higher than the liabilities to be settled within the operating year. The cash liquidity ratio reached an exceptionally high level in the last year of the period under review, that is 4.24. The cash generated from operating activities was more than four times higher than the short-term liabilities. The fluctuations in the cash liquidity ratio can be attributed to the structure of net cash flows from operating activities. In 2018, the cash flows from operating activities primarily originated from the retained net profit and the amortisation charges related to tangible assets, intangible assets and development work. These components accounted for 95% of the cash generated from operating activities. A similar structure characterised the cash flows from operating activities in the following year. In 2020, the cash flows from operating activities represented 60% of the sum of net profit and amortization, while in 2021, the cash flows were 4.3 times higher than the net profit and amortization. The main source of these cash flows was the release of funds from operational activities, primarily through a decrease in receivables.

Overall cash adequacy ratios (except for 2019) were higher than 1, which means that net cash flows from operating activities were higher than the funds needed to cover expenses for intangible assets and tangible assets, to cover expenditure on development works considered in the Group as intangible assets and for financial expenses. In 2018, the generated operating cash was 16% higher than the expenses listed, in 2020 as much as 62% higher, and in 2021 40% higher than the expenses they needed to cover.

The total monetary debt coverage ratios were exceptionally high in the analysed Group, representing the ratio of net cash flows from operating activities to debts generating debt financing costs. The Group does not utilise loans or borrowings, and the only debts it has are related to leasing of cars and office spaces. These liabilities are included in long-term and short-term liabilities under the category of other financial liabilities. This information is provided in the supplementary notes 28, 34 and 38 in the consolidated financial statements for 2019, and note 26 in the financial statements for 2021. In 2019, the net cash flows were over 11 times higher than the mentioned debts, in 2020 they were as much as 36 times higher, and in 2021 they were 26 times higher than the average total debt. The payment of dividends, amounting to over PLN 100 million in 2019 and nearly PLN 504 million in 2021, influenced the changes in the ratio.

Asset cash performance ratios inform how much operating funds were generated by PLN 1 engaged in the Group's assets. These ratios systematically increased from PLN 0.17 in 2019 to PLN 0.33 in the following year and PLN 0.38 in 2021.

Similar information to the cash performance of assets indicators is provided by the cash performance of sales ratios. They show how much operating cash corresponds to PLN 1 of revenue from the sale of products, services, goods and materials. In 2021, the Group generated as much as PLN 1.09 of net cash flows from operating activities per PLN 1 of revenue. This includes both the generated net profit, the depreciation charged as expenses, and the funds recovered from receivables, including those from the previous year's revenue, which were 2.4 times higher than the sales revenue in 2021. In previous years, the cash performance of sales indicators averaged PLN 0.37.

The indicators of cash performance of profit exhibited significantly greater fluctuations during the analysed period compared to the indicators of cash performance of sales, which resulted from large changes in net sales profitability. The net profit-to-revenue ratio was 33.6% in 2019, 54% in 2020 and 25.7% in the last year of the analysed period. In the years 2018-2019, the

cash performance of profit indicators was similar. In 2020, there was a 50% decrease in the ratio compared to the previous year due to the allocation of generated cash flows, mainly net profit, to finance the increase in current assets, especially the increase in receivables from increased revenue. In 2021, the cash performance of profit indicator was as high as 4.69, indicating that for every PLN 1 of net profit, PLN 4.63 of net cash flows from operating activities were generated. Such a significant increase in the indicator was a result of increased cash flows from collected receivables.

Chapter 7

Capital structure, risk and cost of capital in business operations

7.1. Determinants and analysis of the capital structure of a company

The capital structure of a company is the result of various factors and variables, and the choice of structure is often derived from the individual characteristics of the firm, its goals, risk and market conditions (Duliniec, 2015). Among the theories based on empirical evidence, the theory of financing hierarchy, also known as the 'pecking order' theory, deserves attention. This theory assumes that companies have preferences regarding the use of different sources of financing. According to this theory, the order of using available sources of financing, known as the pecking order, is as follows:

- First, internal sources are preferred: retained earnings (as an internal source of equity) and excess cash and short-term financial assets (such as marketable securities). An important factor in determining internal sources of equity (retained earnings) are the company's profit allocation policies. Companies should not radically change their dividend policy (if changes are necessary, they should occur gradually).
- When internal sources of financing are exhausted, companies turn to external sources. Debt securities are issued first, followed by hybrid securities and, finally, stocks. This happens because gaining access to equity capital can be more time-consuming and costly than using debt capital. Companies must provide potential investors with relevant financial and business information to persuade them to invest in equity. The costs associated with developing and presenting

this information can be substantial. In the case of debt capital, such as bank loans or bond issuances, information costs may be lower. Companies can present more standardised financial data and information on collateral that are required by financial institutions. This can expedite the capital-raising process and reduce transaction costs associated with information gathering.

The preferences of companies regarding the choice of financing sources suggested by the hierarchy theory are often modified in practice under the influence of other factors. In relation to the entity itself, it depends primarily on factors such as (Kurczewska, 2010, p. 328) the size of the company, the industry in which the company operates, the cost of capital, liquidity, the level of risk acceptance, the perception of the company's market position, the size of assets in the company (asset structure), the profitability of the company, the dividend policy in the company and the adopted investment strategy.

The capital structure of companies may also depend on macroeconomic factors. These include primarily determinants such as (Nawrot, 2007, p. 23):

- level of economic development of the country (inflation level and interest rates),
- fiscal policy pursued,
- legal regulations,
- size and efficiency of the banking sector,
- level of available technological advancement in the country,
- level of development of financial markets (the development of emerging markets makes borrowing in the form of bank loans or bond issuance increasingly important for large companies).

Observations of decisions made by companies in this regard have led to the formulation of the "market timing" theory. Baker and Wurgler (2002) confirmed in their research that decisions regarding stock issuance depend on the ratio of market value to book value of the company (known as the market-to-book ratio). Companies are more inclined to issue new stocks when their current market prices are higher compared to book value and previous market valuation. Conversely, when the current market valuation is low, companies often make decisions to repurchase their own stocks. There is no definitive evidence as to whether companies' decisions regarding stock issuance or

repurchase, made in response to the current market situation, only have a short-term impact on the capital structure (Alti 2006), or if the cumulative effects of these decisions determine the capital structure in the longer term (Baker, Wurgler 2002). Decisions regarding the choice of financing sources based on "market timing" do not necessarily result from the traditional theory of financing hierarchy.

If a company aims for rapid growth and expansion, it may prefer a more aggressive capital structure based on a higher proportion of debt capital. On the other hand, if financial stability and risk minimisation are a priority, the company may prefer a lower proportion of debt capital and greater utilisation of equity capital (Duliniec, 2015). Skoczylas (2004) identified principles for financial managers shaping the capital structure:

Principle of liquidity maintenance: The amount of capital invested in a company should always ensure its ability to meet its obligations promptly.

Principle of appropriate risk management: A company must safeguard operational risks by maintaining an adequate level of equity capital. This enables the establishment of a long-term, stable and reliable customer base, which is particularly crucial in sectors characterised by rapid technological advancements and production innovations.

Principle of financial efficiency: Acquiring funds for business operations incurs costs. Taking into account the aforementioned principles, a combination of capital sources should be devised to minimise costs while maximising the company's value.

Principle of independence and autonomy preservation: The choice of financing methods influences the degree of control over the management of a company. Although ownership formally grants control, a significant level of debt can limit this autonomy due to the influence of creditors. Loan renewals and obtaining new credits depend on the company meeting specific criteria set by the bank. Additionally, the influx of new shareholders may lead to a change in voting rights.

Principle of shaping an optimal financing image: The presentation of a company's financing sources in its balance sheet determines its position on the market for both the customers and suppliers. This becomes particularly crucial when seeking new sources of funding.

The analysis of capital structure can primarily focus on two issues: solvency and the level of debt.

The ratios of capital structure form the basis for assessing the proportion of equity and debt in financing a company's assets.

A set of ratios used to assess solvency is presented in Table 7.1.

Table 7.1. Ratios used to assess capital structure

The method of calculating the ratio	Description
Overall Debt Ratio $\frac{liabilities\ and\ provisions}{total\ assets} \times 100$	This ratio represents the share of external funding in financing a company's assets, expressed in book value or market value. It is often considered a financial risk indicator. A high level of this ratio can imply reduced independence of the company, increased creditor risk, limited access to new credit, and heightened liquidity risk. Interest payments on debt must be made regardless of the achieved level of profits. In practice, this ratio varies depending on the type of business conducted and cash flow variability. Creditors usually expect this ratio not to exceed 50%, as assets could potentially lose half their value before endangering the safety of debt capital. If the ratio exceeds 50%, there may be a situation where the generated cash flow is insufficient to repay the debt. Evaluating the level of the overall debt ratio should be conducted in conjunction with assessing stability and potential future growth of profits and cash flows.
Debt to Equity, D/E $\frac{total\ debt}{total\ equity}$	The financial leverage ratio is another fundamental ratio used to assess the capital structure. This ratio measures the extent to which a company relies on borrowed funds relative to its own equity to finance its assets. A higher financial leverage ratio indicates higher financial risk and potential amplification of returns (both positive and negative) for equity shareholders.

Source: own.

The ratios illustrating the capital structure of the CD Projekt capital group are presented in Table 7.2.

Table 7.2. Capital structure of the CD Projekt capital group

Itemisation	2018	2019	2020	2021
Equity	1 002 864	1 105 651	2 187 356	1 894 356
Long-Term Liabilities	6691	25 158	166 153	36 112
Short-Term Liabilities	117 283	273 299	540 969	228 267
Total Assets	1 126 838	1 404 108	2 894 478	2 158 735
Overall Debt Ratio	11%	21%	24%	12%
Debt To Equity	0.12	0.27	0.32	0.14

Source: own calculations based on CD Projekt's consolidated financial statements for 2018-2021.

As the analysis shows, the level of indebtedness in the CD Projekt capital group is significantly low. At the beginning of 2019, liabilities and reserves accounted for only 12% of total liabilities. In the following years, the level of indebtedness slightly increased as the capital group prepared for the release of a new blockbuster game and increased its liabilities. However, these liabilities did not have an interest-bearing nature. In 2021, the level of liabilities essentially returned to the level of early 2019. Throughout the analysed period, the level of indebtedness remained significantly low, and the group was primarily financed through equity capital. The liabilities mainly pertain to the operational activities of the entity. In addition to equity capital, the company finances itself through leasing, although the value of leasing is practically negligible compared to the value of equity capital.

This financing approach is in line with the theory of the hierarchy of financing sources. The capital group primarily relies on equity capital to finance its operations, with the majority of it coming from retained earnings. This represents an internal source of financing. In the second order, CD Projekt utilises external financing sources. This includes the aforementioned leasing, which is a type of capital that can be relatively easily obtained. During the analysed period, the group also issued shares.

These ratios are crucial for understanding a company's financial health and risk profile. The assessment of capital structure involves analysing the company's funding mix, evaluating the potential risks associated with its financial decisions and considering the implications for future growth and profitability.

Solvency of a company refers to its ability to timely meet all its obligations. It is a term similar to financial liquidity and is often confused with it. Financial liquidity, like solvency, relates to the timely settlement of obligations. However, in the case of solvency, it concerns the settlement of all obligations, while in the case of financial liquidity, it concerns current liabilities. As a result, companies that have solvency can still be exposed to liquidity risk. In situations where current liabilities are particularly high and there are transient difficulties in settling them, even solvent companies may face financial liquidity problems.

A set of ratios used to assess solvency is presented in Table 7.3.

Table 7.3. Ratios used to assess solvency

The method of calculating the ratio	Description
Debt Service Cover Ratio $\frac{net\ profit + depreciation + interest}{capital\ installments + interest} \times 100$	If in each period the ratio takes a value greater than 1, it means that the entity has cash to repay the debt. The minimum value of the ratio for banks is (usually) 1.2 (1.15-1.35), which means that the bank has greater certainty that the potential borrower will regularly repay the contracted liability.
Interest coverage ratio $\frac{EBIT}{interests\ expens} \times 100$	The minimum size is rated at 1.5. This means that the entity has the ability to pay interest in excess of the interest to be repaid. The correct size for secured loans should be 2.4; for unsecured loans 5.0.
Debt Amortisation Period *The total time it takes the company to pay off the loan – usually months or years*	If a company chooses a short amortisation period, it will pay less interest overall but will have to make higher principal payments (the original loan amount before interest). A business that has a longer amortisation period will have lower monthly payments but will generally pay higher interest.
Loan Life Cover Ratio $\frac{net\ present\ value\ (NPV)\ of\ the\ money\ available\ for\ debt\ repayment + cash\ reserve\ available\ to\ repay\ the\ debt}{outstanding\ debt}$	A higher LLCR indicates a more favourable situation, as it suggests that the project's cash flows are sufficient to cover the debt obligations. Generally, a ratio of 1 or higher is desirable, indicating that the project's cash flows can fully cover the debt payments. Ratios below 1 imply that the cash flows are insufficient to repay the debt, posing a higher risk to lenders or investors.

Source: own.

In the analysed capital group, the following dependencies can be observed (Table 7.4).

Table 7.4. Solvency analysis for CD Projekt Group

Itemisation	2018	2019	2020	2021
Net profit (loss)	109 334	175 315	1 154 327	208 908
Depreciation	16 635	37 487	267 664	104 729
Interest payments	13	546	401	541
Payment of liabilities arising from lease agreements	693	5708	2857	3733
Income tax	13 699	13 847	10 622	10 200
EBIT	123 046	189 708	1 165 350	219 649
Debt Service Cover Ratio	178.4	34.1	436.6	73.5
Interest coverage ratio	9465.1	347.5	2906.1	406.0

Source: own calculations based on CD Projekt's consolidated financial statements for 2018-2021.

Both the Debt Service Cover Ratio (DSCR) and the Interest Coverage Ratio (ICR) meet the requirements. It means that the company has the necessary capacity to service its debt and cover interest costs. The Debt Service Cover Ratio (DSCR) measures the company's ability to repay its debt, taking

into account both interest and principal payments. If the DSCR meets the requirements, it indicates that the company generates sufficient financial resources to cover its obligations.

The Interest Coverage Ratio (ICR) evaluates the company's ability to cover interest costs based on its financial results. If the ICR meets the requirements, it signifies that the company generates enough profit to repay the interest on its debt.

Of course, meeting the requirements by both ratios is significant from the perspective of the company's financial health. High DSCR and ICR indicate financial stability and the company's ability to service its debt, which in turn builds trust among investors and creditors.

The evaluation of the capital structure from an income perspective can involve assessing the capacity to meet current debt obligations or both to service and to repay debt. In many instances, financial institutions rioritizes retaining existing clients, particularly those who have established a solid track record as borrowers. Acquiring new customers to replace current ones with proven creditworthiness is typically more expensive. Consequently, creditors place greater emphasis on the ability to service ongoing debt obligations as it serves as an early warning indicator. When extending bank loans, both factors, i.e. the ability to service and to repay debt, are crucial considerations. In any scenario, this assessment necessitates a comprehensive analysis of cash flows.

7.2. Types of leverage – operating, financial, and total

The principles of appropriate risk management emphasise the importance of safeguarding operational risks by maintaining an adequate level of equity capital in a company. This principle recognises that having sufficient equity capital provides a cushion against potential risks and uncertainties that may arise in the course of business operations. The degrees of operating leverage (DOL), financial leverage (DFL) and total leverage (DTL) perform a crucial role in understanding and managing operational risks. DOL, DFLs and DTL are essential tools for assessing and managing operational and financial risks.

Degree of Operating Leverage (DOL) measures the level of operational risk in a company by assessing the impact of a change in sales on operating profit.

A higher DOL indicates a greater reliance on fixed operating costs, which can amplify the impact of changes in sales on the company's profitability. By understanding and managing DOL, a company can assess its sensitivity to changes in sales volume and take appropriate measures to mitigate operational risks. Safeguarding operational risks through appropriate risk management involves maintaining a balance between fixed operating costs and sales volume to ensure the company's financial stability. Operating leverage refers usually to managing the structure of an entity's assets and their utilisation in creating enterprise value. With an increase in production capacity, there is a relative change in fixed costs, which leads to a greater-than-proportional change in earnings before interest and taxes, compared to the rate at which net sales revenues change (Pomykalska, 2017, p. 142).

Degree of Financial Leverage (DFL) measures the level of financial risk in a company by evaluating the impact of a change in operating profit on net profit. It considers the fixed financial costs, such as interest payments on borrowed capital. A higher DFL indicates a greater reliance on debt financing, which can magnify the effect of changes in operating profit on net profit. Appropriate risk management requires careful consideration of DFL to ensure that the company's capital structure is balanced and sustainable. By maintaining an optimal level of debt and interest coverage, the company can mitigate financial risks and ensure long-term stability.

Degree of Total Leverage (DTL) combines both operating and financial leverage to provide an overall assessment of the company's risk profile. It measures the impact of changes in sales on net profit per share. Managing DTL involves balancing the trade-off between operational and financial risks to achieve an optimal risk-reward profile. By understanding DTL, a company can assess the combined effect of its operational and financial leverage and take appropriate measures to mitigate risks.

The analysis of operating, financial and total leverage can be conducted using both static and dynamic approaches. The static approach assumes the constancy of individual relationships over time, such as fixed costs. In the dynamic approach, calculations are based on the classical sensitivity analysis. However, this approach aligns with the definition of each type of leverage.

The formulas for calculating individual ratios are presented in Table 7.5.

Table 7.5. Ratios of operating, financial and combined leverage

Static formula	Dynamic formula
Degree of Operating Leverage (DOL) $DOL = \frac{(Rev - FC)}{(Rev - VC - FC)}$	$DOL = \frac{\%\Delta EBIT}{\%\Delta Rev}$
Degree of Financial Leverage (DFL) $DFL = \frac{(Rev - VC - FC)}{(Rev - VC - FC - I)}$	$DFL = \frac{\%\Delta EPS}{\%\Delta EBIT}$
Degree of Total Leverage (DTL) $DTL = \frac{(Rev - FC)}{(Rev - VC - FC - I)}$	$DTL = \frac{\%\Delta EPS}{\%\Delta Rev}$

Where: *Rev* – sales revenues; *VC* – variable costs; *FC* – fixed costs; *EPS* – earnings per share ratio
Source: own.

Calculations of individual operating, financial and combined leverage ratios are presented in Table 7.6.

Table 7.6. Operating leverage ratios in the CD Projekt capital group

Itemisation	2018	2019	2020	2021
Sales revenues	362 901	521 272	2 138 875	888 172
Net profit (loss)	109 334	175 315	1 154 327	208 908
Interest payments	13	546	401	541
Income tax	13 699	13 847	10 622	10 200
EBIT	123 046	189 708	1 165 350	219 649
EPS	1.14	1.82	11.47	2.07
%Δ Sales revenues		-0.44	-3.10	0.58
%Δ EBIT		-0.54	-5.14	0.81
%Δ EPS		-0.60	-5.29	0.82
DOL		0.81	0.60	0.72
DFL		0.90	0.97	0.99
DTL		0.72	0.59	0.71

Source: own calculations based on CD Projekt's consolidated financial statements for 2018-2021.

The result of the conducted analysis shows that in 2018, the earnings per share (EPS) amounted to PLN 1.14. In the following years, this ratio significantly increased, reaching PLN 1.82 in 2019 and PLN 2.07 in 2021. The exceptional year was 2020, where the scale of profits was incomparably higher, with an EPS ratio of PLN 11.47.

Analysing the operating leverage, it can be observed that the flexibility of earnings is relatively low. In 2019, each PLN of revenue contributed to an increase in earnings before interest and taxes (EBIT) by PLN 0.81. A growth of EBIT by one PLN translated into an increase in EPS by PLN 0.90. As a result, a one PLN increase in revenue led to a PLN 0.72 increase in EPS that year. In 2020, every additional PLN of growing revenue translated into a PLN 0.60 increase in earnings before interest and taxes. Therefore, the group was less effective in translating revenue growth into profit growth. Some profits may have been consumed during the achieved market success. However, the increase in EBIT was evenly reflected in the increase in EPS. If EBIT increased by one PLN, EPS increased by PLN 0.97. Ultimately, each PLN of growing revenue resulted in a PLN 0.59 increase in EPS.

In 2021, the elasticity of EBIT relative to sales revenue slightly increased. A one PLN increase in revenue caused a PLN 0.72 increase in EBIT, and simultaneously, the financial leverage mechanism directly offered EBIT to EPS. The total leverage indicates that a one PLN increase in revenue leads to a PLN 0.71 increase in EPS. This result is comparable to 2019.

In summary, it can be observed that the company carries a low level of both operational and financial risk. When revenues increase, profits also increase, but at a slightly slower pace. In the opposite situation, a decrease in turnover is expected to result in a slower decline in profits. The mechanism of transferring EBIT to EPS is more proportional. Since all ratios are less than one, it can be inferred that the group carries a low level of operational, financial and total risk.

7.3. Analysis of the risk of bankruptcy of the company

7.3.1. Theoretical foundations of discriminant analysis

The complexity of relationships between company values and its environment leads analysts to use tools that allow for a simplified assessment of bankruptcy risk. The most commonly used tools in financial analysis are financial ratios and discriminant models.

Discriminant models are mathematical equations in which the independent variables are carefully selected financial ratios that best predict the risk of company bankruptcy. The selection of these variables is done

using discriminant methods belonging to statistical methods. Discriminant models are most commonly used for initial assessment of companies in the decision-making process for credit and for monitoring them based on the classification of companies into two classes: those at risk of bankruptcy and those not at risk. The tool of discriminant analysis models eliminates the drawbacks of comprehensive financial analysis, which is more time-consuming and requires high competence, especially in interpreting the results. Creating discriminant models requires a database consisting of two groups of companies: those that have gone bankrupt in the past and those most similar to them that have not. The analysis conducted using the developed models is not without its limitations. The limitations of this method primarily result from possible mismatching of the company being assessed with the companies used to develop the model. This mismatching is mainly related to the time of model creation, as well as the scope and geographic area of business operations. Therefore, individual discriminant analysis models can yield different results in terms of classifying companies as at risk or not at risk of bankruptcy. Thus, when using discriminant methods to assess the bankruptcy risk of a company, it is advisable to use more than one model. It is worth utilising models that are as up-to-date as possible but have also been properly verified in economic practice.

Since the 1960s, discriminant analysis, along with comprehensive financial analysis, has been consistently used to study the bankruptcy risk of companies worldwide. In this context, it is worth noting that one of the pioneers in applying discriminant methods in economic analysis, Edward Altman, does not see differences in the effectiveness of bankruptcy risk prediction between well-established discriminant analysis theory and practice, and the latest methods used for this purpose (Altman and Hotchkiss, 2010, pp. 189-216). Discriminant analysis allows for obtaining unambiguous and easily interpretable results, while detailed financial analysis enables the identification of specific aspects. Both analyses do not always lead to convergent conclusions. In this sense, considering the strengths and weaknesses of comprehensive financial analysis and discriminant analysis, it can be concluded that they complement each other.

Generally, the optimal forecasting horizon for discriminant models, beyond which their effectiveness decreases, is one year. Models for forecasting bankruptcy risk can be classified as single-period models with one classification rule, single-period models with multiple classification rules, multi-period models with one classification rule and multi-period models with multiple classification rules. Although advances in this field have led

to increased effectiveness of short-term forecasts, unfortunately, they have not resulted in improved accuracy of medium-term forecasts, which remain similar to the accuracy of models from the 1960s and 1970s (du Jardin, Veganzones, and Séverin, 2019).

In addition to the indications of bankruptcy risk arising from comprehensive financial analysis and discriminant analysis, when assessing bankruptcy risk, it is worth paying attention to certain types of warning signals that may prompt conducting the analyses discussed above. Among them, the following can be distinguished:

- regular write-offs updating the value of assets,
- rapid increase in profits after the company's acquisition by another entity,
- regular and high profits with low cash flows,
- receivables and inventory growing faster than sales revenue,
- significant selling of shares by company employees,
- achieving profits significantly exceeding those of competitors in a situation where the company is not a monopolist, produces products that customers can easily abandon, does not have unique resources and does not have unique patented products.

7.3.2. Fundamental calculations of discriminant models

There are many discriminant models. These models were created at different times for companies operating in different markets. Below, a selection of models was made based on their suitability for Polish conditions, as well as their relevance and verification in economic practice. The selected models are presented below:

- Mączyńska's model (1994),
- Hołda's model (2001),
- Gajdka and Stos' model (2003),
- Appenzeller-Szarzec's model (2004),
- "Poznań" model (2004),
- Polish Academy of Sciences Institute of Economic Sciences' model (2004),
- Prusak's model (2005).

All of the above models are presented in the same way. Firstly, a brief description of the model is provided, followed by its computational form and, finally, the calculation results for the analysed company.

The possibility of using the classical Altman models to analyse the risk of bankruptcy for Polish companies is limited. As emphasised by Prusak (2004), these models were developed based on data from the American market and are, therefore, somewhat dedicated to that market. Empirical research indicates that directly applying the above models to Polish companies is not recommended.

Mączyńska's model (cited in Tomczak, 2019) was developed in 1994 as a response to the need to adapt the Western Altman model to Polish conditions (Wardzińska, 2012). It categorises companies into those at risk of bankruptcy ($Z < 0$), weak but not at risk of bankruptcy ($0 < Z < 1$), financially sound companies ($1 \leq Z < 2$) and very financially sound companies ($Z \geq 2$). The model is expressed by the following equation:

$$Z = 1.50 \times x1 + 0.08 \times x2 + 10.00 \times x3 + \\ + 5.00 \times x4 + 0.30 \times x5 + 0.10 \times x6$$

where:

$x1$ – (gross profit + depreciation) / liabilities and provisions for liabilities,

$x2$ – assets / liabilities and provisions for liabilities,

$x3$ – gross profit / total assets,

$x4$ – gross profit / sales revenue,

$x5$ – inventories / sales revenue,

$x6$ – sales revenue / total assets.

The results obtained for the analysed company consistently exceed 2. According to this model, the company is in a good financial condition. The results are included in the table below.

Table 7.7. Bankruptcy risk according to Mączyńska's model

Model	31.12.2019	31.12.2020	31.12.2021
Z	4.72	10.19	4.79

Source: own calculations based on CD Projekt's consolidated financial statements for 2018-2021.

The Hołda model (Hołda and Micherda, 2007, p. 123) divides companies into bankruptcy-threatened and non-bankruptcy-threatened, taking zero as the threshold value, with the uncertainty zone ranging from -0.3 to +0.1. The model has the following form:

$$Z = 0.605 + 0.681 \times x1 - 0.0196 \times x2 + 0.00969 \times x3 + \\ + 0.000672 \times x4 + 0.157 \times x5$$

where:

$x1$ – current assets / short-term liabilities,

$x2$ – (total liabilities / total equity) × 100,

$x3$ – (net profit / average total assets) × 100,

$x4$ – (average short-term liabilities / (cost of goods sold) × number of days in the period,

$x5$ – total revenue / average total assets.

Based on the Hołda model, positive results significantly above the uncertainty zone (+0.1) were obtained for the analysed company. According to this model, the company is not threatened by bankruptcy. The results are presented in the table below.

Table 7.8. Bankruptcy risk according to the Hołda model

Model	31.12.2019	31.12.2020	31.12.2021
Z	2.49	3.69	4.61

Source: own calculations based on CD Projekt's consolidated financial statements for 2018-2021.

The Gajdka and Stos model (cited in: Tomczak, 2019) also takes zero as the threshold value. Positive values indicate no bankruptcy risk, while negative values indicate the presence of this risk. The uncertainty zone ranges from -0.49 to +0.49. The model has the following form:

$$Z = -0.0005 \times x1 + 2.0552 \times x2 + 1.7260 \times x3 + 0.1155 \times x4$$

where:

$x1$ – short-term liabilities (average) / cost of goods sold,

$x2$ – net profit / total assets (average),

$x3$ – gross profit / total revenue,

$x4$ – total assets / total liabilities.

Using the Gajdka and Stos model, results exceeding the upper uncertainty threshold defined by the authors (+0.49) were obtained for the analysed company. According to this model, the company is not threatened by bankruptcy. The results are presented in the table below.

Table 7.9. Bankruptcy risk according to the Gajdka and Stos model

Model	31.12.2019	31.12.2020	31.12.2021
Z	1.46	2.52	1.54

Source: own calculations based on CD Projekt's consolidated financial statements for 2018-2021.

Another model analysed is the Appenzeller and Szarzec model (cited in: Hamrol and Chodakowski, 2008). In this model as well, zero is adopted as the threshold value. The model takes the following form:

$$Z = -0.556326 + 0.819138 \times x1 + 2.56661 \times x2 - 0.0050002 \times x3 + \\ + 0.000629 \times x4 - 0.00951358 \times x5$$

where:

$x1$ – current assets / short-term liabilities,

$x2$ – operating income / total revenue,

$x3$ – (average inventory / total revenue) × number of days in the period,

$x4$ – accounts receivable cycle + inventory cycle (in days),

$x5$ – liabilities and reserves / [(operating income + depreciation) × (12 / accounting period)].

As a result of the calculations, positive results were obtained for the analysed company, indicating no bankruptcy risk. The authors did not specify an uncertainty zone. The results are presented in the table below.

Table 7.10. Bankruptcy risk according to the Appenzeller and Szarzec model

Model	31.12.2019	31.12.2020	31.12.2021
Z	2.53	4.12	4.78

Source: own calculations based on CD Projekt's consolidated financial statements for 2018-2021.

The "Poznań" model (cited in: Hamrol and Chodakowski, 2008) divides companies into bankruptcy risk ($Z < 0$) and non-bankruptcy risk ($Z > 0$). The model is expressed by the following equation:

$$Z = -2.368 + 3.562 \times x1 + 1.588 \times x2 + 4.288 \times x3 + 6.719 \times x4$$

where:

$x1$ – net financial result / total assets,

$x2$ – (current assets – inventory) / short-term liabilities,

$x3$ – (equity + long-term liabilities) / total assets,

$x4$ – sales result / total revenue.

The results obtained using the "Poznań" model are positive, indicating no bankruptcy risk directly, as the model authors did not specify an uncertainty zone. The results are presented in the table below.

Table 7.11. Bankruptcy risk according to the "Poznań" model

Model	31.12.2019	31.12.2020	31.12.2021
Z	7.96	12.46	12.43

Source: own calculations based on CD Projekt's consolidated financial statements for 2018-2021.

The model of the Institute of Economic Sciences of the Polish Academy of Sciences (cited in: Zielińska-Sitkiewicz, 2016) divides companies into bankruptcy risk ($Z < 0$) and non-bankruptcy risk ($Z > 0$). The model is expressed by the following equation:

$$Z = -1.498 + 9.498 \times x1 + 3.566 \times x2 + 2.903 \times x3 + 0.452 \times x4$$

where:

$x1$ – operating result / total assets,

$x2$ – equity / total assets,

$x3$ – (net result + depreciation) / liabilities and provisions for liabilities,

$x4$ – current assets / short-term liabilities.

The results obtained using the model of the Institute of Economic Sciences of the Polish Academy of Sciences are positive, indicating no bankruptcy risk. The model does not include an uncertainty zone. The results are presented in the table below.

Table 7.12. Bankruptcy risk according to the model of the Institute of Economic Sciences of the Polish Academy of Sciences

Model	31.12.2019	31.12.2020	31.12.2021
Z	5.80	12.61	8.58

Source: own calculations based on CD Projekt's consolidated financial statements for 2018-2021.

The Prusak model (cited in: Tomczak, 2019) divides companies in the following way: those whose result falls below -0.7 are at risk of bankruptcy, those whose result falls within the range from -0.7 to 0.2 are in the "grey zone" and those whose result is higher than 0.2 are not at risk of bankruptcy. The model takes the following form:

$$Z = -1.8713 + 1.4383 \times X1 + 0.1878 \times X2 + 5.0229 \times X3$$

where:

$X1$ – (net profit + depreciation) / total liabilities,

$X2$ – operating costs (excluding non-operating costs) / average short-term liabilities (excluding special funds and financial liabilities),

$X3$ – sales result / average total assets.

The use of the Prusak model indicates no bankruptcy risk. Each time, results exceeding the threshold value of 0.2 were obtained. The results are presented in the table below.

Table 7.13. Bankruptcy risk according to the Prusak model

Model	31.12.2019	31.12.2020	31.12.2021
Z	0.79	5.29	3.02

Source: own calculations based on CD Projekt's consolidated financial statements for 2018-2021.

The conducted discriminant analysis indicates no risk of bankruptcy for the company. The results obtained using all selected models show no discrepancies and lead to the same conclusion.

7.4. Weighted Average Cost of Capital (WACC)

The cost of capital is an essential concept in finance and is used in various financial decisions, such as investment appraisal, capital budgeting and determining the feasibility of projects. It is a critical factor in assessing the profitability and viability of an investment opportunity. It refers to the rate of return that a company's investors or capital providers expect to receive in exchange for investing their capital in the company. It represents the cost or expense incurred by a company to finance its operations and fund its investments.

The cost of capital is influenced by several factors, including the company's capital structure (the proportion of debt and equity), the prevailing interest rates, the risk associated with the investment and the company's overall financial health and market conditions. Different sources of capital, such as equity (stockholders' investments) and debt (borrowed funds) have different costs associated with them. The cost of equity is determined by the returns expected by shareholders, considering the company's risk profile and market conditions. The cost of debt is typically the interest rate the company pays on its borrowed funds.

There are several theories of capital structure that attempt to explain the relationship between capital structure and the cost of capital. They differ in the time period in which they were developed and their underlying assumptions. The fundamental models are considered to be the Modigliani-Miller models. The second Modigliani-Miller model relaxes the assumption of no taxes and has thus become the basis for constructing and modifying other models. In a world with linear taxes, for an unleveraged firm:

$$WACC_N = ke$$

In a leveraged firm:

$$WACC_Z = kd(1 - T)(D / V) + ke^Z(E / V)$$

where:

kd – cost of debt,

T – income tax rate,

D – value of debt,

V – total invested capital in the firm ($V = D + E$),

ke – cost of equity,

E – value of equity.

Because shareholders also expect a higher cost of capital in this case due to the difference resulting from the lower cost of debt; however, in this case, this surplus is reduced by taxes.

$$ke^Z = ke + (ke - kd)(1 - T)(D / E)$$

As a result:

$$WACC_Z = WACC_N[1 - T(D / E)]$$

Therefore, in a leveraged firm, the cost of capital is lower than in an unleveraged firm by the value of the tax shield proportional to the debt. Cornell (1993, p. 151) defines the following problems associated with estimating the cost of capital:

- Companies issue various securities to finance their activities, including common stock, preferred stock, debt securities and bank loans. To estimate the cost of capital, the costs of individual financing methods need to be averaged.
- The company will have future payments to make to investors. Therefore, the cost of capital is influenced by the time value of money. Additionally, future payments to equity holders will be affected by inflation. As a result, the price investors pay for securities issued by the company, and thus the company's cost of capital, will depend on the expected inflation rate. (This is true only when free cash flows are also expressed in real values.)
- There is a risk that investors will not receive the expected payments from the company when they provide capital. They are aware of this possibility and, therefore, require an additional risk premium associated with purchasing specific securities. This premium increases the cost of capital, thus estimating the cost of capital requires calculating the amount of this premium first.

The solution to these problems lies in structuring the approach to the cost of capital. Estimating the weighted average cost of capital (WACC) requires determining:

- cost of equity,
- cost of debt,
- capital structure.

The key and most problematic element of WACC is estimating the cost of equity. This cost itself is a fundamental component of measuring a company's value. At the same time, it appears that the problem of estimating the cost of equity is a barrier to the widespread use of discounting techniques. In general, various methods for estimating the cost of equity are presented in the literature. The most popular ones include:

- Capital Asset Pricing Model (CAPM), also known as the market equilibrium model in the Polish literature,
- Arbitrage Pricing Model (APM),
- Bond plus approach,
- Constant growth dividend model.

Of these, the most commonly used, despite criticism, is the Capital Asset Pricing Model, which takes into account both investor risk and expected inflation. Its independent creators are considered to be Sharpe (1964), Lintner (1965) and Mossin (1966). The essence of this model can be summarised by the statement that the expected total return for shareholders corresponds to the risk-free rate of return increased by the average market risk premium multiplied by the beta risk index of the evaluated company. The cost of equity in this case is expressed by the formula:

$$ke = R_f + \beta_i(R_M - R_f),$$

where:

R_f – risk-free rate,

R_M – market rate of return,

β – beta coefficient of the company's stock.

The risk premium is captured in the relationship $\beta_i(R_M - R_f)$, where the market risk premium represents diversifiable risk, while β_i represents firm-specific risk.

Since the Polish capital market is still underdeveloped, there is no direct possibility of determining key parameters for estimating the cost of equity, and there is a need to monitor the values of companies that are not subject to direct market valuation, it is thus possible to adopt the methodology proposed by K. Byrka-Kita (2004) for estimating the cost of equity. The author adopted the recommendation of Copeland and Weston (1992), who believe that the best method for estimating the cost of capital in emerging markets is to use the CAPM model indirectly and rely on parameters transposed from economies with developed capital markets. The process of estimating the cost of equity involves the following stages:

- determining the risk-free rate of return,
- determining the risk premium,
- estimating beta based on the risk index transposed from the US economy.

In summary, these problems are limited to properly estimating the elements that should reflect the cost of capital, namely the risk-free rate of return, the risk premium corresponding to the weight and type of financing source, and the change in the value of money over time (Houng-Yhi, 1967, p. 318). When capital providers are certain about achieving the forecasted cash flows, the cost of capital is the risk-free rate of return. Unfortunately, achieving the intended results in the form of forecasted future cash flows is subject to risk and inflation. Therefore, the expected rate of return is higher due to the so-called risk premium and inflation expectations. Damodaran characterises risk-free assets as those that provide certain profits to the investor. Consequently, such assets can be considered risk-free in a given period if (additionally) two conditions are met (2001, p. 55):

- they are not subject to the risk of defaulting on conditions (contract), which generally means they are debt securities issued by the State Treasury. However, in some countries, the State Treasury is not free from this risk, which poses a practical problem in estimating the cost of capital in those countries,
- there is no reinvestment risk due to the lack of cash flows preceding the redemption date, for which there is no certainty regarding the interest rates at which they will be reinvested.

The risk-free rate of return can be assumed as the yield on the longest-term government bonds, similar to the company's operating period. Due to the irregularity of zero-coupon bond issuances for 20 years, it is justified to use the interest rate on 10-year government bonds in the Polish context. Alternatives to bonds are short-term interest rates such as the 52-week WIBOR, LIBOR, EURIBOR. However, they are exposed to reinvestment risk, which disqualifies them as risk-free rates of return.

The second element of the cost of capital is determining the risk premium. The risk premium should reflect two elements (Damodaran, 2001, p. 58):

Risk aversion, which is expressed in increasing shareholder expectations. These expectations may be based on subjective risk assessment but mainly concern the assessment of macroeconomic parameters or the capital market. Typically, risk aversion manifests itself during periods of declining economic growth or stock market declines.

Risk of an average investment. If the average risk borne by owners increases, the premium also increases.

The size of the average market risk premium is determined by three key factors (Damodaran, 1996, p. 49; Zarzecki, 1999, p. 88):

- volatility of the economy – the greater the volatility of the economy, the greater the risk premium. Therefore, the risk premium will be higher in dynamically developing economies.
- political risk as a result of political instability.
- market structure, especially the share of large, diversified, and stable companies. If this share is large, the risk premium may be low. In the case of a small share, i.e. a predominance of small, risky companies, the risk premium will be higher.

Taking into account the results of research conducted by Ibbotson, which demonstrate that the premium estimated based on long time series is relatively stable, it is worth considering transposing it from the US economy, for which it has been estimated without significant disruptions since 1927. In Poland, the risk premium is then calculated according to the formula (Damodaran, 1999; Zarzecki, Byrka-Kita, 2003):

$$\begin{matrix}\text{Equity} \\ \text{premium}\end{matrix} = \begin{matrix}\text{Equity} \\ \text{premium} \\ \text{USA}\end{matrix} + \left(\begin{matrix}\text{Spread between Polish} \\ \text{bonds denominated} \\ \text{in dollars and US bonds}\end{matrix} \times \begin{matrix}\text{Average global} \\ \text{volatility of the stock} \\ \text{market compared} \\ \text{to bonds}\end{matrix} \right)$$

The key component of such risk premium is the premium estimated for the US market starting from 1927 based on the difference in monthly returns between the market and long-term government bonds.

The estimation of beta coefficients is a crucial element in risk assessment. For companies listed on the Warsaw Stock Exchange or other stock exchanges, it is possible to calculate these coefficients based on historical data. The beta coefficient is calculated using the least squares method or according to the formula:

$$beta = \frac{Cov\left[R_i, R_m\right]}{Var\left[R_m\right]}$$

where:

$Cov[R_i, R_m]$ – covariance between the return rate of a specific security and the expected return of the market portfolio,

$Var[R_m]$ – variance of the expected return of the market portfolio.

Damodaran presents the relationship between beta coefficients levered and unlevered as follows (Damodaran, 1994, p. 31):

$$betal = betau + (D / E) \times betau \times (1 - T)$$

The difference between these two approaches arises from the tax shield. However, A. Damodaran's approach is more commonly used in theoretical studies.

Another integral component of the weighted average cost of capital is the cost of debt. To estimate its magnitude, it is necessary to determine the pre-tax cost of debt and the tax benefits.

The pre-tax cost of debt represents the weighted average interest rate on obligations. This value can be obtained from the company's documentation and is determined in internal analyses. In external studies, information on the

conditions and interest rates of individual obligations is often lacking, hence simplified solutions are commonly used in practice. One of these solutions is to determine the cost of debt based on the relationship:

$$kd = YTM \times (1 - T) \qquad \text{or} \qquad kd = \frac{interests}{superior\ debt}$$

or weighted interest rate of debt

where:

kd – cost of debt,

YTM – yield to maturity of the company's debt instruments,

T – income tax rate.

This approach assumes that the yield to maturity represents the pre-tax cost of debt, and the tax benefits are calculated by multiplying it by the tax rate. It provides a simplified estimation of the cost of debt in the absence of detailed information on individual obligations.

In Table 7.14, the data and calculations of the cost of capital are presented.

Table 7.14. Data and calculations of the cost of capital

Itemisation	01.01.2019*	31.12.2019	31.12.2020	31.12.2021
Risk free rate	2.85%	2.13%	1.25%	3.71%
Market risk premium	6.00%	6.60%	6.60%	5.50%
Beta	1.2	1.2	1.2	1.2
Cost of equity	10.05%	10.05%	9.17%	10.31%
Cost of debt after tax	28.24%	2.73%	3.45%	5.71%
Share price	139.412	268.897	264.284	190.931
Weighted average number of shares	96 120 000	96 120 000	96 461 316	100 717 756
Market value of equity	13 400 281.44	25 846 379.64	25 493 182.44	19 230 141.87
Debt value	409	19905	18 939	46 882
Percentage share of equity	100.00%	99.92%	99.93%	99.76%
Percentage of debt	0.00%	0.08%	0.07%	0.24%
Weighted average cost of capital	10.05%	10.04%	9.17%	10.29%

Source: own study based on CD Projekt's consolidated financial statements for 2018-2021.

As a result of the conducted analysis, risk-free rates decreased significantly between the beginning of 2019 and the end of 2020. This was due to the ongoing pandemic and the associated lockdown, which effectively slowed down the economy and resulted in lowered interest rates. In 2021, pandemic

restrictions were lifted, leading to an increase in economic activity and inflationary pressures, causing interest rates to rise significantly. The increase in the risk-free rate translated into an increase in both the cost of equity and the cost of debt. The cost of equity was around 10% in the previous year and decreased to 9.17% in 2020 but increased to 10.31% in 2021.

In terms of market-based debt structure, equity capital dominates, accounting for nearly 100% of the financing sources. Interest-bearing obligations do not exceed 1%. As a result, the weighted average cost of capital is almost identical to the cost of equity.

Chapter 8

Financial analysis of revenues, costs, financial result, and profitability

8.1. Revenue analysis

Revenue has been defined as "gross inflows of economic benefits during a period resulting from ordinary activities of an entity that result in increases in equity, other than increases relating to contributions from equity participants". (IFRS 18, 2008). Revenues can be divided into:

1. Sales of products, goods and materials (Revenues). The increase in economic benefits is associated with the sale of:
   a. Products, which include goods produced by the entity for sale (IFRS 18, 2008).
   b. Goods, which can include items purchased by the entrepreneur for further resale.
   c. Materials, which are typically used in production but can also be traded. Resold materials are analysed together with goods.
   d. Services, which usually involve the performance of specified tasks by the entity based on a contractual agreement for a defined period of time (IFRS 18, 2008).
2. Other revenues. These relate to other transactions and events. Among them, the following can be distinguished:
   a. Other operating revenues, which are indirectly related to the entity's operating activities and may include social activities, gains from the disposal of tangible fixed assets and intangible assets, revaluation of assets, write-offs of expired or cancelled liabilities, resolution of reserves, receipt of compensations and

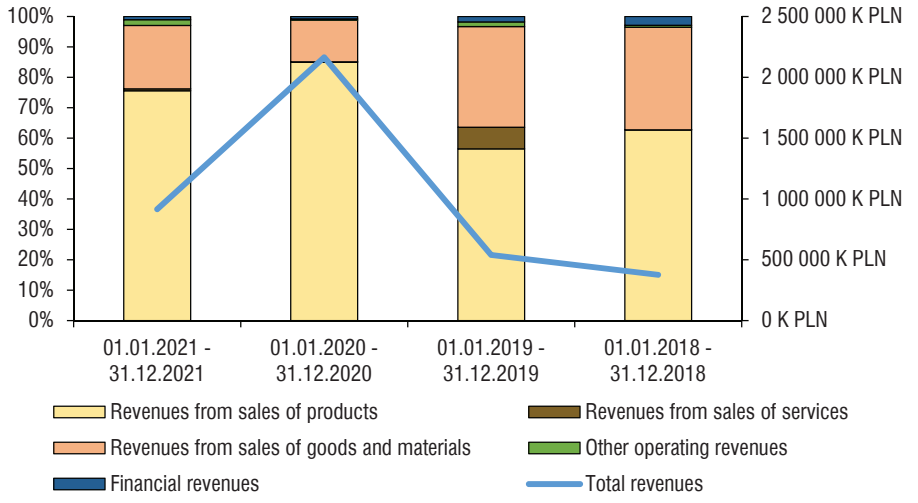
receipt of assets free of charge. This is a highly eclectic group of revenues. If their value is significant, attention should be paid to their components and causes.

b. Financial revenues, which include dividends and shares in profits, interest received, gains from the disposal of financial assets, as well as other items such as positive exchange differences.

c. Other.

Revenue analysis involves determining their sources and identifying the nature of transactions and events that led to their generation. Figure 8.1 illustrates the overall structure of revenues, while Figure 8.2 presents the dynamics of selected components of total revenues.

Figure 8.1. Size and structure of total revenues



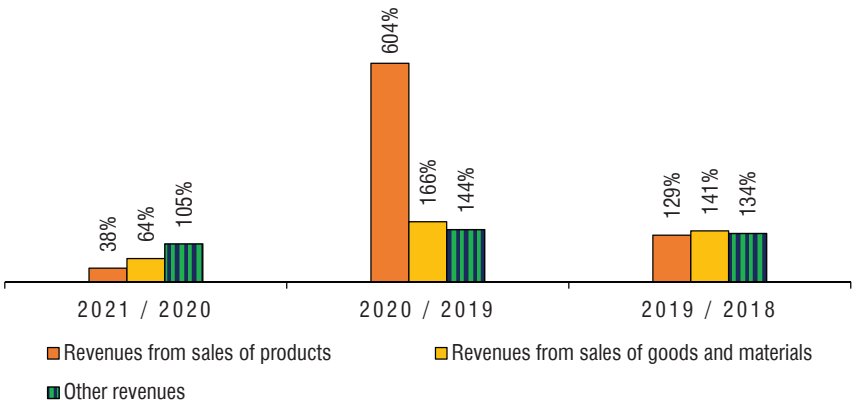
Source: own calculations based on CD Projekt's consolidated financial statements for 2018-2021.

At first glance, it can be observed that the dynamics of revenues showed significant fluctuations during the analysed period. After a period of substantial growth between 2018 and 2020, there was a significant decline in revenues in 2021.

Revenues from the sale of products seemed to be largely responsible for this situation. Between 2018 and 2019, they increased by 29%, and between 2019 and 2020, their growth was fivefold. In 2021, their value decreased by

62% compared to the previous year. Therefore, the year 2020 was exceptional in terms of revenues from the sale of products.

Figure 8.2. Dynamics of selected components of total revenues



Source: own calculations based on CD Projekt's consolidated financial statements for 2018-2021.

To understand these changes, it is necessary to focus on deepening the analysis with information from the activity report, as well as press and internet publications. These studies have shown that the increase in turnover in 2020 was largely associated with the release of another CD Projekt RED blockbuster game, Cyberpunk 2077, as well as with revenues related to the continuation of The Witcher saga (The Witcher 3: Wild Hunt with expansions – Hearts of Stone and Blood and Wine, and Blood of Elves: Witcher Tales), and sales generated within the GWENT: The Witcher Card Game project. Additionally, 2020 was a year marked by isolation and quarantine due to the COVID-19 pandemic, which could have influenced the growth in sales. This is also confirmed by research on players' behaviour during the pandemic. M. Barr, A. Copeland-Stewart (2022) proved in their studies that the time spent on gaming increased for 71% of respondents, while 58% of respondents stated that playing games had an impact on their well-being, with the majority of responses indicating a positive influence. The record-breaking revenues were followed by the next year, which marked a challenging period of emerging from the pandemic.

Revenues from the sale of goods and materials also showed significant growth in the first years of the analysis. Between 2018 and 2019, they increased by 41%, and in 2020, they further increased by 66% compared to

2019. However, in 2021, the sales of goods and materials decreased by 36% compared to 2020.

A detailed analysis revealed that the value of this item in recent years was mainly comprised of revenues from the sale to distributors of finished sets and elements such as carriers, boxes, figures, gadgets, The Witcher 3 and Cyberpunk 2077 games, as well as sales from the CD Projekt RED GEAR online store. The higher value of revenues in 2020 was primarily due to the physical sales of goods related to the release of the game Cyberpunk 2077.

The dynamics of other revenues indicated a constant growth. Initially, there were dynamic increases of 34% in the period 2018/2019 and 44% between 2019 and 2020. In 2021, other revenues also increased, but the growth rate was noticeably slower (by 5% compared to the previous year).

In the structure of total revenues, revenues from the sale of products and services, as well as goods and materials, dominated. Their combined share exceeded 96% in all years. Revenues from the sale of products performed a significant role here, although their share varied greatly. They initially accounted for 63% of total revenues in 2018. Then their share decreased to 56% in 2019. However, in that year, sales of services appeared, which accounted for 7% of total revenues. It was the cause of changes in the revenue structure in 2019. Detailed research reveals that CD Projekt achieved this through cooperation with publishing partners as part of a promotional campaign, mutual promotion and partners' cost participation, primarily in the Cyberpunk 2077 game and to a lesser extent in The Witcher 3: Wild Hunt Complete Edition for the Nintendo Switch platform. Another breakthrough period of analysis was the year 2020, which was marked by the mentioned release of Cyberpunk 2077 and COVID-19, where product sales were at a record high. The share of product sales in total revenues increased to a record level of 85%. In 2021, product sales accounted for 76% of total revenues.

Changes in the revenue structure from product sales compensated for the corresponding changes in the sales of goods. Initially, the sales of goods accounted for 34% of total revenues in 2018 and 33% in 2019. In 2020, the share of sales of goods in total revenues decreased to 14%, only to increase to 21% in 2021.

In the structure of total revenues, other revenues were not significant. Other operating revenues accounted for up to 2% of total revenues. In the last year of analysis, they were greatly influenced by grants and rental income from investment properties, and to a lesser extent, by recharging. Previously, they

also included the sales of IT and marketing services, as well as other revenues.

Financial revenues decreased in the revenue structure. Initially, they accounted for 3% of total revenues in 2018. Ultimately, they decreased to 1% in 2021.

The driving force behind financial revenues was originally interest from short-term bank deposits. However, starting from 2020, their nature began to change. Other financial revenues from settlement and valuation of derivative financial instruments, as well as interest income from bonds, started to dominate. In-depth analysis revealed that the derivative instruments used were the result of hedging transactions related mainly to the foreign currency-denominated treasury bonds purchased by CD Projekt.

Key elements of revenue analysis include describing customer relationships. Revenue classifications based on various criteria are presented in Table 8.1 and Figures 8.3-8.5.

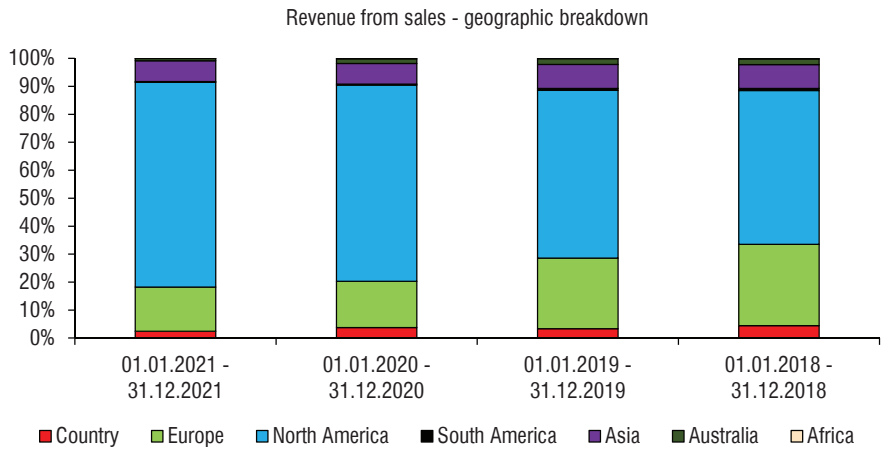
Table 8.1. Sales revenues in two key business segments

Consolidated statement of profit and loss segmented for the period from 01/01/2021 to 12/31/2021	CD Projekt RED	GOG.com	Exclusions from consolidation	Total
Revenue from sales	701 739	199 983	-13 550	888 172
Revenue from product sales	678 507	8 264	4 793	691 564
Revenue from service sales	8 103	286	-2 524	5 865
Revenue from sales of goods and materials	15 129	191 433	-15 819	190 743
Consolidated statement of profit and loss segmented for the period from 01/01/2020 to 12/31/2020				
Revenue from sales	1 895 913	343 748	-100 786	2 138 875
Revenue from product sales	1 786 145	12 937	40 850	1 839 932
Revenue from service sales	5 251	132	-3 141	2 242
Revenue from sales of goods and materials	104 517	330 679	-138 495	296 701
Consolidated statement of profit and loss segmented for the period from 01/01/2019 to 12/31/2019				
Revenue from sales	369 332	162 256	-10 316	521 272
Revenue from product sales	292 386	7 633	4 456	304 475
Revenue from service sales	41 945	250	-3 891	38 304
Revenue from sales of goods and materials	35 001	154 373	-10 881	178 493
Consolidated statement of profit and loss segmented for the period from 01/01/2018 to 12/31/2018				
Revenue from sales	227 830	144 317	-9 246	362 901
Revenue from product sales	220 641	12 782	2 496	235 919
Revenue from service sales	4 409	15	-4 316	108
Revenue from sales of goods and materials	2 780	131 520	-7 426	126 874

Source: own calculations based on CD Projekt's consolidated financial statements for 2018-2021.

As indicated by the conducted comparison, the group operates based on two business segments: CD Projekt RED, which deals with the production and publishing of video games (such as Cyberpunk 2077, The Witcher series, and GWENT: The Witcher Card Game, which is an online card game with built-in microtransactions), as well as accompanying products utilising the company's owned brands. The second segment is GOG – a company responsible for the digital distribution of computer games through its own platform, GOG.COM, and the GOG GALAXY application. The platform allows for game purchase, payment and downloading games onto the user's computer. Additionally, the GOG GALAXY application enables features such as automatic updates, cloud game saves, online multiplayer, including cross-platform play, and also handles the online functionalities of GWENT, sales support and payment processing within the PC version of the game. As the comparison shows, the RED segment is primarily responsible for the sale of products and services, while GOG mainly offers goods.

Figure 8.3. Sales Revenue – Geographic Structure

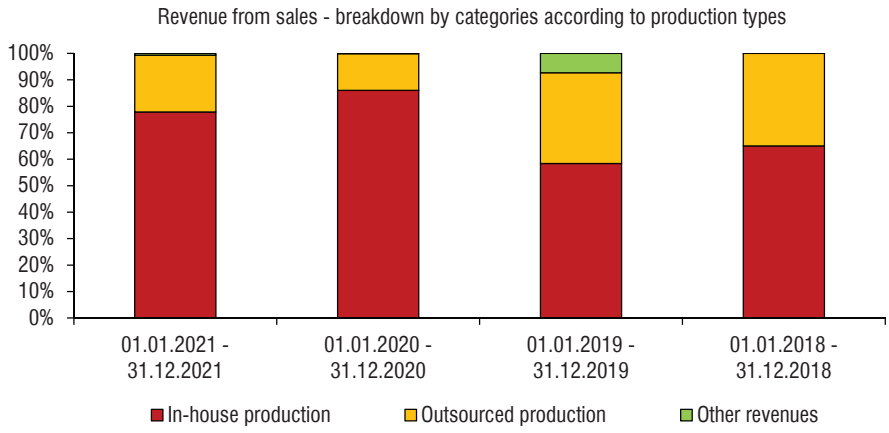


Source: own calculations based on CD Projekt's consolidated financial statements for 2018-2021.

The CD Projekt group primarily sold its products on the North American market. Originally, this region accounted for 55% of sales revenue in 2018. This share increased to 73% in 2021. The second distribution market was Europe. The structure of revenue showed a gradual decline. Initially, European sales accounted for 29% of sales revenue in 2018. Eventually, this share decreased

to 16% in 2021. The third market was Asia. Similar to the European market, sales in the Asian market had a lower share in the revenue structure. It initially accounted for 9% in 2018 and 2019 and decreased to 7% in 2020 and 2021. Domestic sales were marginal. Initially, they constituted 4% of the group's revenue and ultimately decreased to 1% in 2021.

Figure 8.4. Sales Revenue – Breakdown by Production Types

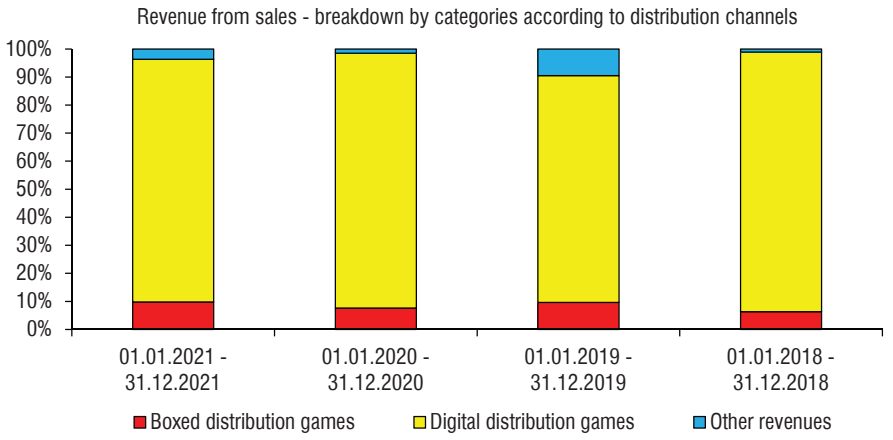


Source: own calculations based on CD Projekt's consolidated financial statements for 2018-2021.

The share of in-house production dominates in the sales revenue structure. These revenues exhibit some cyclical patterns. Prior to the release of Cyberpunk 2077, they originally accounted for 65% of sales revenue in 2018 and 58% in the following year. With the release of the new blockbuster – Cyberpunk 2077 in 2020, the level of in-house production sales reached 86%, which was the highest during the analysed period. In 2021, this share decreased to 78%. These changes are balanced by revenues from sales of external production.

Between 81% and 93% of sales revenue was generated through digital sales. This distribution was carried out through the GOG.COM portal and external platforms such as Steam, PlayStation Store, Xbox Games Store, Origin, Amazon, Humble Bundle, Epic Games Store and App Store. The share of digital sales exhibits cyclical patterns corresponding to the sales of in-house production. A higher level of in-house production sales seems to translate into slightly higher physical distribution, and vice versa.

Figure 8.5. Sales Revenue – Breakdown by Distribution Channels



Source: own calculations based on CD Projekt's consolidated financial statements for 2018-2021.

8.2. Cost Analysis

According to the guidelines of the International Financial Reporting Standards, it is difficult to establish specific standards for costs. Typically, costs can be presented based on their origin or by type. The classification of costs by origin includes the following categories:

- Cost of goods sold and materials. This category shows the cost of producing or purchasing all the goods sold by the company. It includes costs related to the production of sold goods, such as materials and energy consumed, wages of production workers, machine maintenance costs, etc. Depending on the breakdown of revenue, costs are further divided into:
  - Cost of goods manufactured (services).
  - Value of goods and materials sold.
- Selling expenses: These costs are associated with product distribution and broader external logistics processes. Common categories of selling expenses include packaging costs, loading and unloading costs of sold goods, transportation costs to customers, advertising costs,

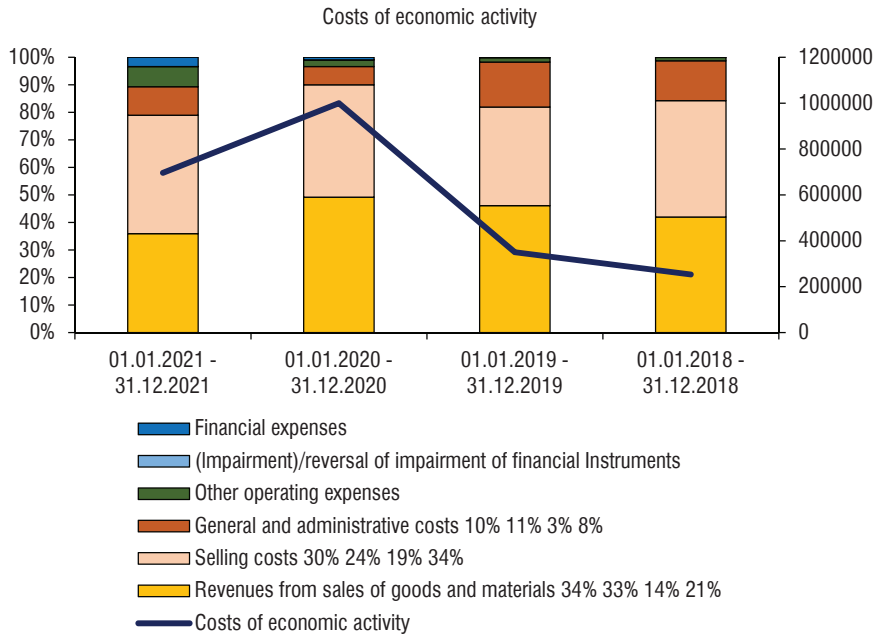
sales commissions, network maintenance costs, goods insurance costs, trade fair booth expenses, etc.

- General administration, also known as administrative costs: These costs are primarily divided into two groups:
  - Administrative and general costs: Costs associated with maintaining the company's management (salaries, business travel, taxes, office expenses, etc.)
  - General department costs: Costs related to the part of production that is not allocated to specific departments, such as maintenance costs of facilities necessary for the overall functioning of the company (warehouses), security, general transportation, etc.
- Other operating costs: These costs are influenced by events that are opposite in nature to other operating revenues.
- Financial costs, which are typically divided into:
  - Interest on borrowed capital: Costs associated with servicing interest-bearing debt.
  - All other financial costs (see financial revenues).
  - Others.

In this context, cost analysis typically focuses, in the initial stage, on evaluating the structure and dynamics of costs. The relevant figures are presented in Figure 8.6 and 8.7.

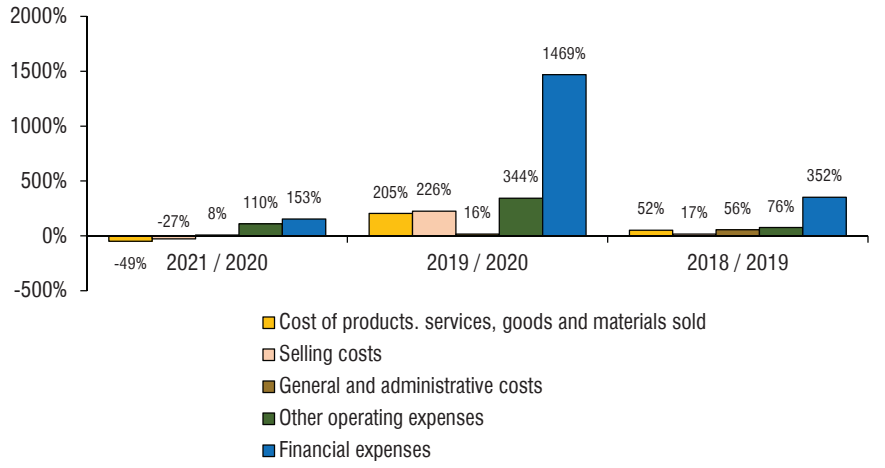
Cost analysis reveals that costs were highly variable during the analysed period. This applies not only to changes in the size of costs themselves but also in their structure. Furthermore, the dynamics of individual cost components do not fully reflect changes in revenues, which may suggest that some costs have a fixed nature. The dominant costs in the structure were the costs of sold products, services, goods and materials, as well as sales costs. The costs of sold products initially increased by 52% in 2019 compared to the previous year. In 2020, they doubled compared to the previous year. Finally, their value decreased by almost half in 2021 compared to 2020. Sales costs initially grew at a slower pace (17% in 2019 compared to the previous year). Then, in 2020, a significant increase was observed. Within one year, these costs increased by 226%. In the more challenging year for the company, 2021, the magnitude of these costs decreased by 27%.

Figure 8.6. Size and Structure of Business Activity Costs



Source: own calculations based on CD Projekt's consolidated financial statements for 2018-2021.

Figure 8.7. Dynamics of Selected Components of Business Activity Costs



Source: own calculations based on CD Projekt's consolidated financial statements for 2018-2021.

The share of costs of sold products, services, goods, and materials increased from 42% of the total business activity costs in 2018 to 49% by 2020. In the recent period, the share of the costs of sold products in the cost structure decreased to 36%. Therefore, the magnitude of these costs is relatively small compared to other business activity costs, indicating that the production of products or the value of goods at purchase prices seems to be less costly compared to other costs associated with the computer gaming market.

Distribution-related costs appear to be more stable and fluctuated within the range of 41%-43%, except for 2019 when their share was only 36%. Such a significant share of costs related to product distribution seems to be a characteristic feature of the computer gaming market.

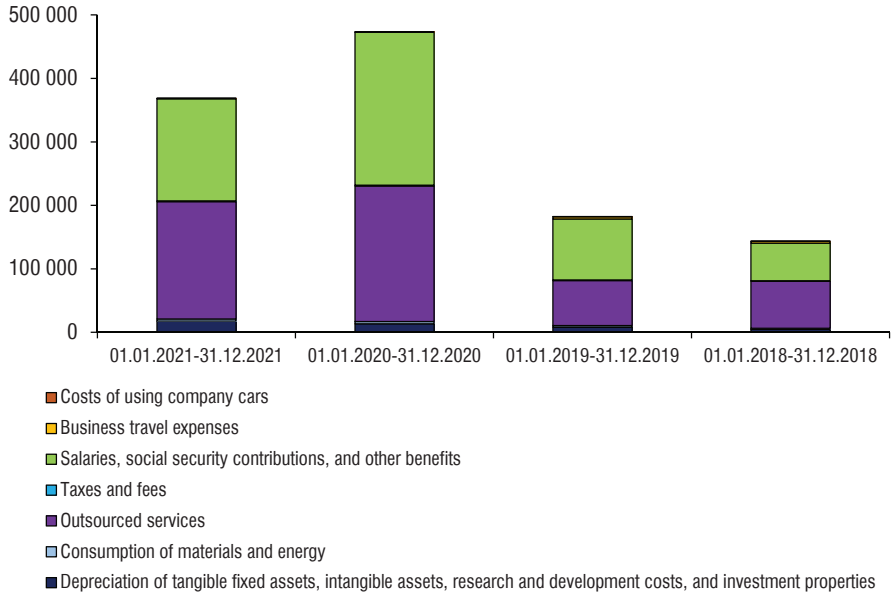
General management costs increased in each period. Initially, they increased by 56% in 2019 compared to the previous year. In the following years (year-on-year), their share increased by 16% in 2020 and 8% in 2021. The magnitude of these costs was not related to changes in revenues or other costs. It also did not reflect changes in assets or the company's value. Therefore, while the initial increase in these costs until 2020 can be considered justified, the 8% increase in these costs in the recent period should not be well received.

In the cost structure of business activity, general management costs accounted for 14% in 2018. Then, their share increased to 16% in 2019. The breakthrough year 2020, characterised by increased turnover and thus higher variable costs, caused their value to increase but their share in the structure to decrease to 7%. In the following year, the share of these costs in the structure increased again to 10%.

Figure 8.8 illustrates the magnitude of sales and general management costs in the breakdown of cost types. The dominant part of these costs consists of employee remuneration on one hand and external services on the other. They likely largely reflect the costs associated with product (and service) distribution, goods and materials, as well as the remuneration of administrative and management staff. The company discloses that employed individuals participate in the jointly generated profit within the Group's incentive system. This may indicate some kind of bonus system where the effects of work translate into employee remuneration. Such costs are of a variable nature.

Costs related to external services behaved similarly. A significant portion of these costs likely also pertained to product distribution costs, advertising costs and maintaining distribution channels. Since their magnitude seems to change similarly to revenues.

Figure 8.8. Sales and General Management Costs



Source: own calculations based on CD Projekt's consolidated financial statements for 2018-2021.

Business travel and car usage costs are practically negligible; however, the group makes decisions to minimise them.

Continuing the cost analysis, it can be observed from Chart 8.7 that other operating costs and financial costs were noticeable, especially in the last year of analysis. This is related to write-downs adjusting the value of tangible fixed assets, intangible assets and development expenses. Some of these write-downs were associated with discontinuing work on the multiplayer technology of the RedEngine, which was widely commented on by computer gamers. In financial operations, the increase in costs mainly concerned the negative exchange rate differences surplus. These costs result from the adopted investment strategy. The group invested free cash in foreign government bonds, which it secured with forward contracts. Negative differences are the result of the adopted hedging strategy.

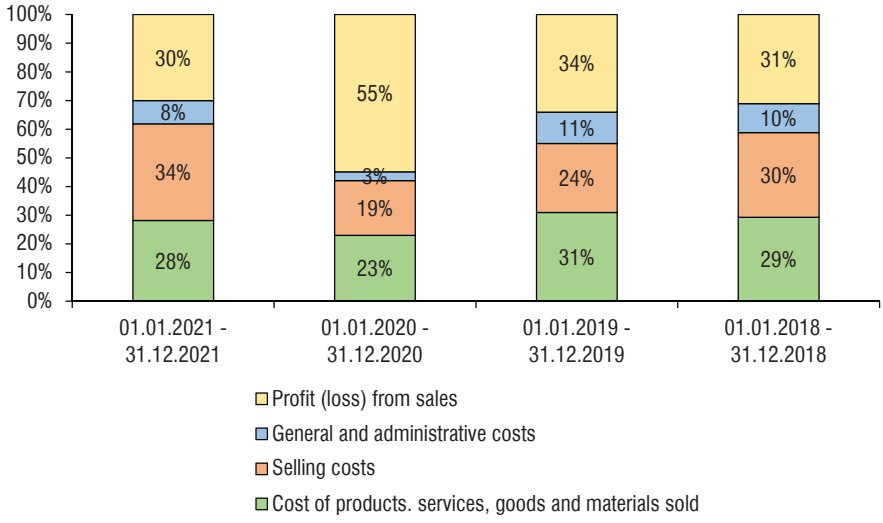
A useful tool in cost analysis is the cost level analysis (Chart 8.9). The cost level indicator is the ratio:

$$\frac{Costs\ (e.g.,\ operating\ costs)}{Revenues\ (e.g.,\ from\ sales\ of\ products,\ goods,\ and\ materials)} \times 100\%$$

It informs about what the customer pays for. The compilation of cost level indicators can relate to calculations on products or product groups, customers, sales markets or other, depending on the applied cost accounting and financial analysis, as well as the available information on products, customers and others. The presentation of costs itself can also pertain to both their type and the places of origin. As a result, such analyses can be very detailed. This area also serves as a link between cost analysis and sales profitability analysis.

Where the profit from sales is the revenue from sales – costs of sold products, services, goods, and materials – sales costs – general management costs.

Figure 8.9. Level of (basic) operating costs and sales profitability



Source: own calculations based on CD Projekt's consolidated financial statements for 2018-2021.

Excluding other operational activities, financial costs and tax items, it can be assumed that basic operating costs constituted 69% of sales revenue in 2018, 66% in 2019, 45% in the exceptional year 2020 and 70% in 2021, respectively. The remaining portion represents the profit from sales. As the group aims to self-finance future productions, it can be expected that the achieved profits will be reinvested to a large extent in subsequent productions.

Costs primarily consist of the expenses associated with the production of sold products and sales costs related to their distribution. The level of costs of sold products fluctuates between 23% and 31% of sales revenue, depending

on the period. While this may appear relatively low, it is rather a result of the market success of the game producer, who has been able to maintain high margins in a competitive market, while effectively leveraging its resources, organizational competencies and workforce talents.

Sales costs account for 19% to 34% of sales revenue. The level of sales costs may seem relatively high; however, it is important to consider that it encompasses not only the costs associated with the distribution of games themselves but also the maintenance of infrastructure dedicated to pre- and post-sales communication with customers.

Management costs typically range from 8% to 11% under normal circumstances, with the exception of the breakthrough year 2020 when they represented 3% of revenue. The level of these costs in relation to revenue generally decreases, which is a manifestation of effective operations. However, it should be noted that these costs are of a fixed nature and, in situations of continuous growth and sales expansion, they usually do not pose problems for management. This holds true for the CD Projekt Group as well.

8.3. Analysis of financial performance levels (chart)

In finance and accounting, several types of profits can be identified. They include:

1. Gross financial performance (profit or loss) from sales occurs in the calculation system of the profit and loss statement. It is the difference between net revenue from the sales of products, goods and materials, and the sum of costs of sold products and the value of sold goods and materials at the purchase price. Gross financial performance from sales is the sum of expressed margins on sales of individual products. Profitability analysis in this area can be conducted based on product divisions, customer groups, distribution channels and others.
2. Financial performance (profit or loss) from sales encompasses the difference between net revenue from the sales of products, goods and materials, and the sum of operating costs (excluding other operating activities). It appears in both the calculation and comparative versions of the profit and loss statement. It represents the sum of net margins on the sales of individual products. The difference between

this concept and gross profit from sales lies in the fact that this profit is adjusted for sales costs related to distribution and general management costs associated with administration.

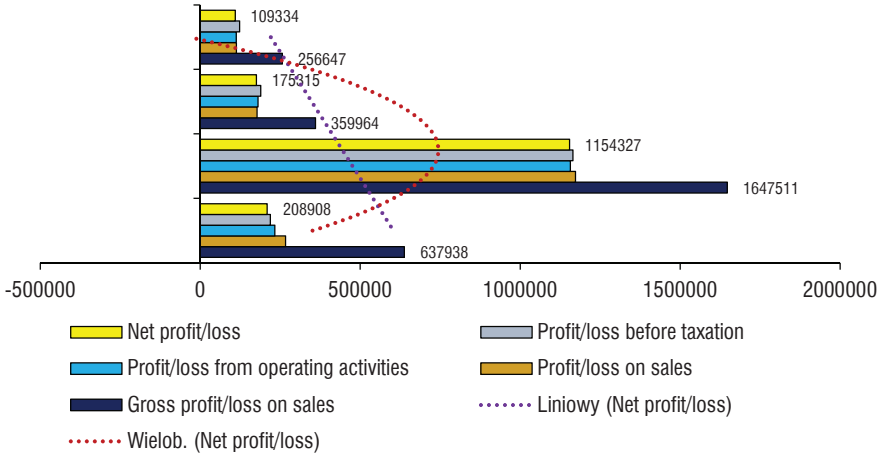
3. Financial performance (profit or loss) from operating activities, also known as operating financial performance. It consists of the financial performance from sales, increased by other operating income, and decreased by other operating costs. In the case of consolidated financial statements, there may also be other elements resulting from consolidation, such as the share in the financial performance of entities valued using the equity method.
4. Profit (loss) before interest and taxes (EBIT) includes the financial performance from operating activities, increased by financial income and decreased by financial costs, excluding debt service costs (mainly interest on borrowed capital). Although it is usually not itemised in financial statements, it performs a significant role. It separates the sphere related to profit creation from the sphere related to profit redistribution. It is independent of the financing structure and the obligations of the State Treasury. Therefore, it provides information about the hypothetical scale of profits detached from the claims of capital providers and tax obligations related to income tax.
5. Gross financial performance (profit or loss), also known as pre-tax financial performance. Computationally, it is the profit from operating activities adjusted for financial income and expenses.
6. Net financial performance (profit or loss), also known as balance sheet financial performance. It is the difference between gross financial performance and obligatory charges to financial performance. These charges include income tax and other obligatory reductions of profit.
7. Total net income. It is the difference between net financial performance and adjustments of asset components directly related to equity, excluding profit in the current fiscal year. These adjustments include, firstly, corrections that will not subsequently be reclassified to profit or loss, such as those concerning the fair value measurement of investment properties or other long-term investments, as well as employee savings plans. The second group of adjustments includes those related to cash flow hedging instruments, the revaluation of financial assets available for sale, as well as foreign exchange differences arising from the translation of foreign operating units.

These, along with the corresponding portion of tax, will be reclassified to profit or loss in the near future upon closing positions.

8. Retained earnings or accumulated losses resulting from the division of net profit. Mathematically, it is the difference between the achieved net profit and the paid dividend.

Figure 8.10 presents the values of selected levels of profits.

Figure 8.10. Value of individual profit levels



Source: own calculations based on CD Projekt's consolidated financial statements for 2018-2021.

The group is profitable in each of the analysed years. Two trend lines have been marked on the chart: linear and exponential. Both trend lines are not statistically significant, thus no conclusions can be drawn regarding further changes based on them. According to the exponential trend, profits increased until 2020 and then significantly decreased. According to the linear trend, the level of profits generally increased during the analysed period. The year 2020 was particularly pivotal and exceptional. The group released the game Cyberpunk 2077, which clearly distinguishes that year from previous years. 2020 was also a pandemic year, and it should be taken into account that the time spent by players in front of consoles or computers increased for as much as 71% of respondents (Barr, Copeland-Stewart, 2022). This significantly

complicates the analysis of profit changes. Excluding 2020 as incomparable, it can also be stated that profits increased during the analysed period. Initially, net profit was PLN 109 million in 2018. Ultimately, it increased to PLN 209 million in 2021. Over the four-year analysis period, it doubled. In the exceptional year 2020, net profit reached a record high of PLN 1,154 million.

In each of the analysed years, product sales were the basis of profits. Initially, gross profit from sales was 2.3 times (2018), 2.1 times (2019) higher than net profit. In 2020, a significantly larger portion of the sales profit remained in the Group as net profit. The ratio of gross profit from sales to gross profit is 1.4 to 1. The year 2021 is also different from the others. Sales profit is over three times higher than net profit. This means that profits were adjusted at each level of the profit and loss statement.

Net profit from sales translates almost entirely into other types of profit and ultimately net profit. In the years 2018-2020, a slight effect of profits achieved in financial activities is visible, compensated by a reverse tax effect. In 2021, net profit from sales is adjusted for the presented write-offs in other operating activities, as well as the costs of strategies hedging investments in foreign currencies in financial activities, and ultimately income tax.

The effective tax rate (*Te*) was evaluated in the financial performance analysis:

$$Te = \frac{income\ tax}{gross\ profit\ (profit\ before\ taxation)} \times 100\%$$

Table 8.1. Effective tax rate (*Te*)

Itemisation	01.01.2021--31.12.2021	01.01.2020--31.12.2020	01.01.2019--31.12.2019	01.01.2018--31.12.2018
Te (own calculations)	4.66%	0.91%	7.32%	11.13%
Te (company data)*	4.28%	0.91%	7.33%	11.16%

* The company uses the appropriately adjusted profit before taxation to calculate the effective tax rate. This rate will be used for further calculations.

Source: own calculations based on CD Projekt's consolidated financial statements for 2018-2021.

As can be observed, the income tax actually paid is significantly lower than what results from the applicable tax rates in Poland (19%). The company employs tax optimisation. As a result, it settles taxes based on different tax rates (5%, 8.84%, 19%, 21%).

8.4. Profitability analysis

Profitability ratios answer the question of what is the magnitude of already realised and potential benefits. Their analysis shows us whether the operation of the enterprise is profitable for the owners (Wędzki, 2009, pp. 41-48). There are three main groups of profitability ratios (Table 8.2).

Table 8.2. Profitability analysis ratios

The method of calculating the ratio	Description
Return on sale group, also known profit margins	
Gross profit margin ratio $\frac{gross\ profit\ from\ sales}{net\ revenue\ from\ sales\ of\ products,\ goods,\ and\ materials} \times 100$	It presents the percentage value of gross profit from sales generated by the company's sales revenue. It answers the question: how many cents of gross profit from sales will remain in the company for every one PLN of sales revenue.
Profit margin ratio $\frac{profit\ from\ sales}{net\ revenue\ from\ sales\ of\ products,\ goods,\ and\ materials} \times 100$	It presents the percentage value of net profit from sales generated by the company's sales revenue. It answers the question: how many cents of net profit from sales will remain in the company for every one PLN of sales revenue.
Operating profit margin ratio $\frac{operating\ profit}{\left(\begin{array}{l} net\ revenue\ from\ sales\ of\ products,\ goods,\ and\ materials \\ +\ other\ operating\ income \end{array}\right)} \times 100$	It shows the overall profitability of the entire operating activities. It answers the question: how many cents of operating profit does the entity receive for every one PLN of operating revenue.
Net profit margin ratio (Return on Sales, ROS) $\frac{net\ income}{total\ revenues} \times 100$ It is sometimes included in the numerator as sales revenue, but this is an incorrect version, because it assumes that sales revenue is the sole source of profits. It omits, for example, grants and gains from investments in financial instruments, resulting in an incomplete picture.	It is the most popular indicator in this group. It is used to present profits generated in all types of activities. It answers the question: how many cents of net profit, on average, remain from every one PLN of revenue achieved.
Return on assets (ROA), also known as economic profitability	
Return on Assets (ROA) $\frac{net\ profit\ (loss)}{average\ total\ assets} \times 100$	It informs about the effectiveness of utilising owned assets. It complements the information on the profitability of assets between the profitability of assets from core operating activities and the profitability of assets in relation to net profit.

The method of calculating the ratio	Description
Return on Assets from Operating Activities $\frac{operating\ profit\ (loss)}{average\ total\ assets} \times 100$ For calculations, total assets at the end of the period are often used. However, this is a mistake because the profit is related to the capital that is increased by the financial result of the current year. Not all of these assets were used to generate this profit. It is advisable to average the assets using the formula (assets at the end of the period + assets at the end of the previous period)/2. This complements the information on the profitability of assets between the profitability of assets from core operating activities and the profitability of assets in relation to net profit.	It informs about the effectiveness of utilising owned assets. It complements the information on the profitability of assets between the profitability of assets from core operating activities and the profitability of assets in relation to net profit.
Return on invested capitals	
Return on Equity (ROE) $\frac{net\ profit\ (loss)}{average\ equity} \times 100$ when equity > 0 For calculations, equity at the end of the period is often used. However, this is a mistake because the profit is related to the equity that is increased by the financial result of the current year. Not all of this equity was used to generate this profit. It is advisable to average the equity using the formula (equity at the end of the period + equity at the end of the previous period)/2.	Return on Equity (ROE) ratio presents the number of units of profit from every 100 unit of equity. The value of equity includes not only contributed shares and stocks but also other capitals, as well as adjustments to asset values or reinvested profits. Return on equity provides a perspective on the issue from the owners' point of view.
Return on Capital (ROC) $\frac{net\ profit\ (loss) + interest\ on\ debt\ capital \times (1 - Te)}{average\ total\ capital} \times 100$ when equity > 0 For calculations, equity at the end of the period is often used. However, this is a mistake because the profit is related to the equity that is increased by the financial result of the current year.	Return on Capital Employed (ROCE) ratio presents the issue of efficiency of invested capital differently. It is a ratio that assumes a hypothetical net profit in the numerator, which the entity would achieve regardless of the capital structure. The denominator expresses the capital invested for this purpose. Total capital can be interpreted differently depending on the specific situation.

Source: Mikołajewicz, Nowicki, 2021.

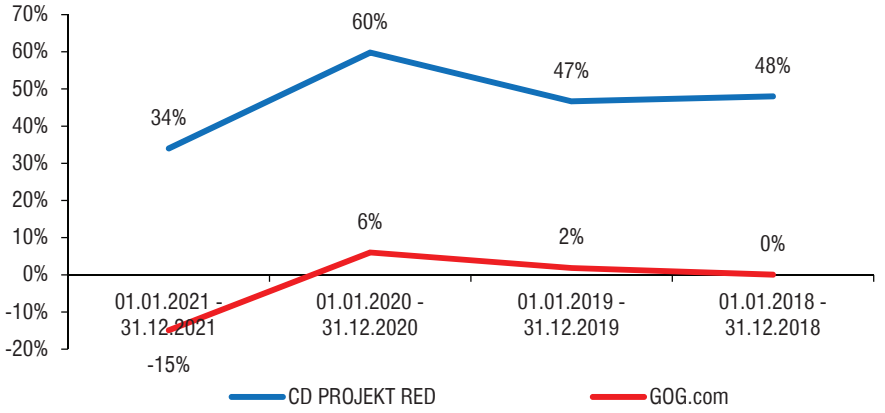
The first group of indicators concerns the profitability of sales from various types of activities. Gross sales profitability ratio directly relates to the sales of products, goods and materials. The sales result is mainly determined by factors such as:

- the quantity of products sold,
- sales price,

- unit costs,
- sales assortment structure (Skowronek-Mielczarek et al., 2008, pp. 181-182).

Analysis using Power BI usually relies on primary data regarding sales, and sales profitability or gross sales profitability is presented in divisions based on product groups, functional areas or customer segments, for example. Figure 8.11 presents the profitability of sales divided into segments (functional areas).

Figure 8.11. Profitability of sales divided into segments (functional areas)



Source: own calculations based on CD Projekt's consolidated financial statements for 2018-2021.

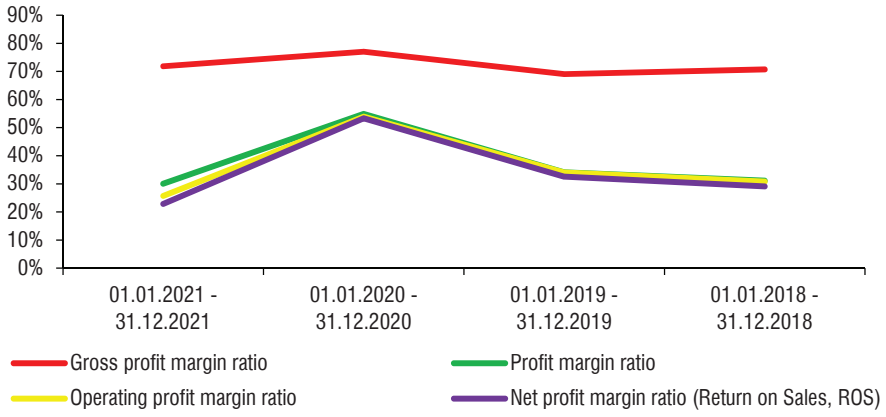
CD Projekt RED is the segment responsible for the production and publishing of video games and related products utilising the Company's brands. As seen in Figure 8.10, the profitability of this activity is significant. In 2018, the company achieved a net sales profit of PLN 0.48 from every PLN of sales revenue. In 2019, it was PLN 0.47. The company reached record profitability in 2020, with net sales profits reaching PLN 0.60 from every PLN of sales revenue. However, in 2021, the profitability of sales significantly decreased, with only PLN 0.34 of profit from every PLN of revenue. The decrease in profitability may, on the one hand, be related to the lifting of COVID-19 restrictions and a mass exodus from screens. On the other hand, CD Projekt RED's new game, Cyberpunk 2077, was highly acclaimed by players but not as highly as the previous productions in The Witcher series. This may have affected profitability through the revenue side (e.g. pricing

policy) as well as potential costs associated with the game's development. The decline in profitability in 2021 seems to be the result of a complex phenomenon reflecting unfavourable global and company-specific factors.

GOG.COM is a segment involved in the digital distribution of computer games through its own platform, GOG.COM, and the GOG GALAXY application. The profitability of this segment is considerably lower. It appears that this activity should cover the costs. In 2018, the company practically did not achieve noticeable profitability. However, it was profitable in 2019 and 2020. The sales profit from every PLN of revenue was PLN 0.02 in 2019 and PLN 0.06 in 2020. In 2021, the company incurred a loss on sales. The source and nature of the problems may be essentially similar to those in game production.

Figure 8.12 presents all the indicators of sales profitability.

Figure 8.12. Return on sales ratios



Source: own calculations based on CD Projekt's consolidated financial statements for 2018-2021.

Table 8.3. Return on sales ratios

Itemisation	01.01.2021-31.12.2021	01.01.2020-31.12.2020	01.01.2019-31.12.2019	01.01.2018-31.12.2018
Gross profit margin ratio	72%	77%	69%	71%
Profit margin ratio	30%	55%	34%	31%
Operating profit margin ratio	26%	54%	34%	31%
Net profit margin ratio (Return on Sales, ROS)	23%	53%	33%	29%

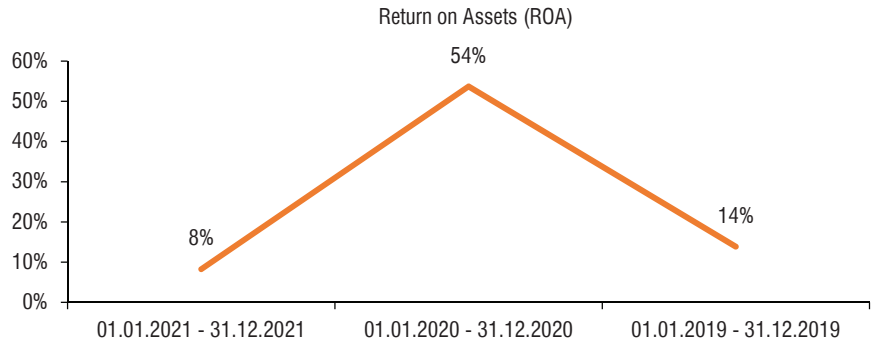
Source: own calculations based on CD Projekt's consolidated financial statements for 2018-2021.

Profitability analysis of sales indicates fundamentally that sales are the main source of profits in a company. Sales profitability analysis was conducted in conjunction with the analysis of (basic) operating costs and sales profitability; therefore, there will be no appropriate description at this point.

Operating and net profitability generally align with sales profitability. The exception was the year 2021 when both operating and net profitability were significantly lower than sales profitability. This is due to higher costs of other operating activities and financial costs. The sources of this situation have been described in earlier points.

Asset profitability essentially presents the profit in relation to the assets (capital stock), which is considered the basis for its achievement. It basically illustrates the level of profits generated through the involvement of the owned capital. It is, therefore, a very general measure. Its magnitude is influenced not only by factors shaping sales profitability but also by how the accumulated capital has been utilised to achieve profits. In companies where capital is used to generate profits in operating activities, the asset profitability ratio in operating activities can be applied. Where assets are used to achieve profits from different areas of activity, it is better to use the asset profitability ratio (ROA). This is also the case in the CD Projekt group (Figure 8.13). For example, the company invests free funds in financial instruments and deposits, while updating the value of assets in other operating activities.

Figure 8.13. Return on assets

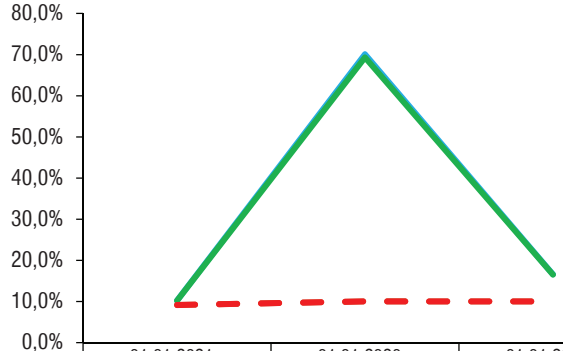


Source: own calculations based on CD Projekt's consolidated financial statements for 2018-2021.

In terms of profitability analysis, the record-breaking year in terms of profit is particularly noticeable in 2020. Profits exceeded 54% in relation to

the owned assets. In the other years, the company achieved a profit of PLN 0.14 from every PLN invested in assets in 2019, and PLN 0.08 in 2021. What is the reason for such a disparity? The group undertakes large-scale computer game projects, which often take longer than a year to complete. This implies a certain cyclicality in realising above-average profits if the production turns out to be successful. This was the case in 2020 with the release of Cyberpunk 2077. In the other years analysed, the releases were not as spectacular.

Figure 8.14. Return on equity, return on capital, cost of equity capital and weighted average cost of capital



	01.01.2021 - 31.12.2021	01.01.2020 - 31.12.2020	01.01.2019 - 31.12.2019
Return on Equity (ROE)	10,2%	70,1%	16,6%
Return on Capital (ROC)	10,2%	69,3%	16,5%
Cost of equity capital	9,2%	10,1%	10,0%
Weighted average cost of capital	9,2%	10,0%	10,0%

Source: own calculations based on CD Projekt's consolidated financial statements for 2018-2021.

The final element of the analysis is profitability from a capital perspective. This is a view of profits from the standpoint of capital providers. These metrics are used to present financial results from the perspective of individual stakeholders. These indicators are often compared to other benchmarks, such as the cost of capital. If profitability exceeds the cost of capital, it can be inferred that the level of profits exceeded the cost of capital acquisition, and the company created value. If profitability is lower than the cost of capital, the level of profits may be insufficient to cover the cost of capital acquisition. In such cases, despite the company being profitable, the profit is insufficient to cover the entire cost of capital. In this situation, value is not created and there may even be value destruction. Of course, profitability

pertains to only one period, and in this case, it additionally refers to the past. Therefore, it has relatively little impact on the overall value of the entity, which reflects the current situation or extrapolates future expected financial results. The indicators of equity profitability and total capital profitability are presented in Figure 8.14.

8.5. Pyramidal analysis

Return on equity is sometimes analysed using pyramid analysis. It is the most comprehensive measure of profitability. It takes into account not only the same relationships with customers and similar relationships with other stakeholders as sales profitability but also reflects the value of accumulated capital and its utilisation. The final element is capital structure. The use of debt in the financing of a company's operations signifies the use of financial leverage. If the financial leverage effect is positive, then the generated profits increase the owners' profitability. This happens because a portion of the earned profit is used to repay interest on the debt, while the remaining portion of the profits represents additional earnings for the owners. The application of this entire mechanism to increase return on equity has been known for over 100 years, yet it is still successfully utilised by companies seeking to enhance their value. Mathematically, return on equity is described by the DuPont model (Figure 8.15).

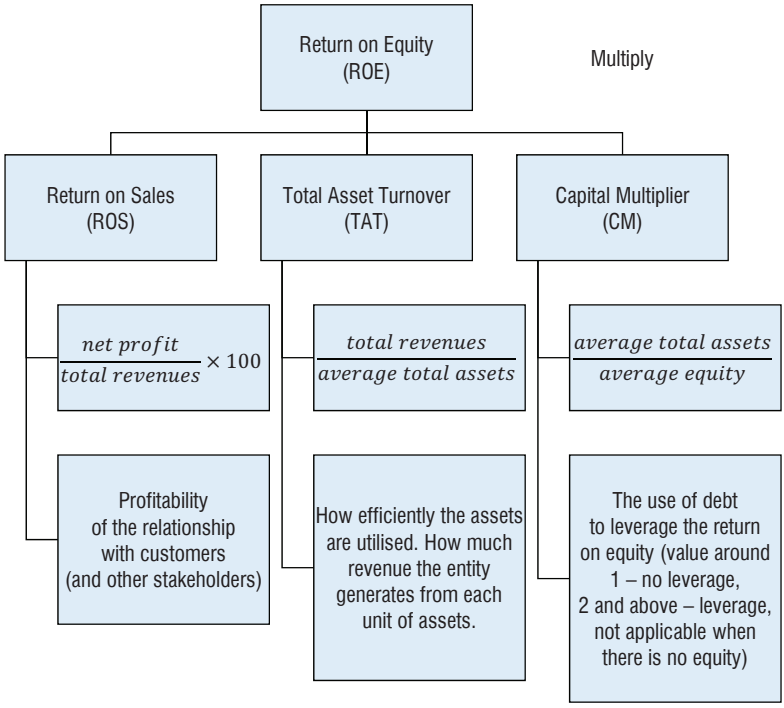
In table 8.4, the calculations of ratios for pyramid analysis using the modified DuPont model are presented.

Table 8.4. Pyramid Analysis using the modified DuPont Model

Itemisation	01.01.2021- -31.12.2021	01.01.2020- -31.12.2020	01.01.2019- -31.12.2019
Return on Sales (ROS)	22.8%	53.3%	32.5%
Total Asset Turnover (TAT)	0.36	1.01	0.43
Capital Multiplier (CM)	1.24	1.31	1.20
Return on Equity (ROE)	10.2%	70.1%	16.6%

Source: own calculations based on CD Projekt's consolidated financial statements for 2018-2021.

Figure 8.15. Modification of the DuPont Model



Source: own.

According to the conducted analysis, the sales profitability in the analysed period fluctuated. Initially, it grew to astronomical proportions in 2020 and then declined. This was the basis for the profitability of equity capital. Other factors also influenced the magnitude of equity profitability. The total asset turnover ratio in 2019 was PLN 0.43, which means that every PLN invested in assets translated into PLN 0.43 groszy of revenue. This was relatively low and characterises companies with high capital intensity. It is surprising considering that the group is a software producer in the gaming industry. In the following year, the utilisation of owned assets improved significantly. On average, every PLN invested in the group's assets translated into PLN 1.01 of revenue. In the last period of the analysis, in 2021, the utilisation of owned assets deteriorated again. Every PLN invested in assets was a source of only PLN 0.36 of revenue

in this period. The group does not use financial leverage to leverage its profits. The capital multiplier is close to unity, indicating that the company's debt is low. Since the company does not use debt, it does not achieve additional profits. In summary, the following observations can be made:

- The group conducted highly profitable operations.
- The utilisation of assets was conservative. The accumulated assets could be invested in new projects, scaled up operations and achieved additional profits. However, it seems that the group focuses on quality rather than quantity.
- The company did not use financial leverage. Increasing the scale of operations is possible through better asset utilisation. During periods of new releases, the owned assets appear to be better utilised. Having such large financial resources in assets eliminates the need for external sources of funding.

The key conclusion from the analysis is that the group operated very conservatively. It tried to avoid risks and pursued well-thought-out but limited projects. It could successfully increase the scale of operations and utilise additional resources by better asset utilisation and implementing financial leverage, which would further enhance the profitability of equity capital.

Chapter 9

Position of the enterprise on the capital market and value creation

9.1. Capital market ratios related to profit or dividend

9.1.1. Earnings Per Share (EPS)

Earnings Per Share (EPS) analysis allows investors to assess the trajectory of a company and the potential for future profits. The value of the EPS ratio is calculated based on the earnings figure for the latest reported period – typically the latest quarter – divided by the number of common shares outstanding (Table 9.1).

The year-over-year changes in earnings per share demonstrate a company's ability to maintain profitable growth from one year to the next. A competent management team is capable of not only generating profits but also maintaining a satisfactory growth rate over many years. This underscores the importance of consistent growth and the ability to adapt to market conditions and competitive challenges.

Positive and continuous growth in earnings per share indicates healthy and promising prospects, while stagnation or a decline in earnings per share growth may signal concerns about a company's ability to generate sustainable profits. Therefore, monitoring and evaluating earnings per share growth are essential aspects of fundamental analysis and identifying growth opportunities in the stock market. In the case of a growth stock, it is reasonable to expect that earnings per share will increase over time, assuming profitability is reflected in market value perceptions. If these perceptions do not align with the underlying fundamentals, it may be an indication of other problems. For example, the industry itself may be unattractive to investors, or the company may be suffering from negative news about a direct competitor.

9.1.2. PE Ratio

One of the fundamental indicators in the capital market that should be regularly taken into account is the price-earnings ratio, or PE ratio. This popular ratio is published in most stock listings and is considered a reliable tool for comparing a wide range of stocks.

It combines important financial information (earnings per share) with the current market price of the stock. The PE ratio is calculated according to the formula presented in Table 9.1. The closing price from the last trading day is used for the calculations. The PE ratio compares this price with the latest annual earnings per share.

The PE ratio is imperfect, like most indicators in the capital market, because it ignores the comparability of the quantities in the numerator and denominator. As a result, it compares stock prices, which are constantly changing, to earnings figures for the entire past period (although sometimes the stock price is related to projected earnings per share). By nature, annual earnings per share are already outdated by the time the information becomes available. The final market price may reflect a change completely unrelated to the company's earning capacity. Nevertheless, the PE ratio is valuable because it effectively shows the market's perception of the value of a given stock at a given moment.

The ratio informs us how much market valuation assigns to each PLN of earnings. In other words, we can ask the question: To what extent does the market valuation of this stock reflect potential future profits based on what the company has recently achieved?

By comparing the PE ratios of many companies, one can observe that some stocks are currently very popular, while others are less popular or not popular at all. When the fundamentals are identical in other cases, the PE ratio informs about the current market perception of the potential earnings-generating ability or what the market expects in the future.

A very low PE ratio indicates the perception that the company is not particularly exciting at the moment. Investors believe that the growth potential in the future is not as attractive as in the case of companies that currently have relatively high PE ratios. Thus, the general rule is that high PE ratios indicate better-than-average growth prospects for a company, and low PE ratios indicate the opposite situation – at least as it is currently perceived. For some investors, these types of stocks are seen as attractive. Perhaps other investors

simply have not discovered the potential for future profits? Additionally, by buying units of earnings at a low cost, investors are relatively low in cost for the right to receive dividends.

As the ratio increases, it means that the market as a whole attributes significant importance to the potential for future earnings. In other words, the market expects the company to be able to maintain a high level of profit in the future. If the ratio takes on high values (above 20 for some investors), it can be inferred that a speculative bubble has occurred in the stock market. In this situation, the stock price has been artificially inflated by speculative investors.

Analysing using the PE ratio encounters problems with comparability. When comparing PE ratios between companies, the reporting period and stock valuation should be consistent. The comparison can be distorted if one company uses the latest fiscal quarter while another relies on the previous fiscal year.

9.1.3. Dividends per share (DPS)

Dividends per share (DPS) is a financial measure that represents the portion of a company's earnings allocated to each outstanding share and distributed to shareholders. When a company earns profits, it can choose to reinvest those earnings into its operations or distribute them as dividends. DPS reflects the total dividends paid by the company for each outstanding share during a specific period.

By examining the company's dividend per share value, investors can assess the amount of money they will receive per share.

One of the advantages of investing in stocks is the dividends they offer. Dividends, which are the distribution of a company's profits to its shareholders, foster trust and confidence among investors.

9.1.4. Dividend yield (DY)

Dividend yield is a financial metric that indicates the return on investment generated from the payment of dividends. It represents the percentage of the annual dividend in relation to the stock's closing price. Since the market price of a stock fluctuates daily, the dividend yield also varies accordingly. It is calculated by dividing the latest reported annual dividend by the closing price of the stock.

The formula for calculating dividend yield, as illustrated in Figure 9.3, helps determine the proportion of dividends relative to the stock's market value. For instance, if the result is 0.6 in the figure, it signifies that the dividend yield is six-tenths of one percent.

Dividend yield serves as an important tool for investors as it provides insight into the potential returns generated through dividend payments. By comparing the dividend yield of different stocks, investors can evaluate and compare the income-generating capabilities of various investment options. It enables them to make informed decisions based on the relationship between the dividend payout and the current market price of a stock.

It's crucial to note that dividend yield is a dynamic measure that changes alongside market conditions and fluctuations in stock prices. Therefore, investors need to regularly monitor and assess the dividend yield to stay updated on the potential returns associated with their investments.

9.1.5. Dividend Payout Ratio (DPR)

One important ratio to closely monitor is the dividend payout ratio, which provides valuable insights into dividend payments. While tracking the dividend rate over time is a common practice among investors, it may not provide a comprehensive picture. A more insightful approach to monitoring dividends is through the dividend payout ratio, which takes into account both common and preferred stock dividends.

Dividend Payout Ratio (DPR) indicates the percentage of net profit that is paid out as dividends. An increase in the ratio signifies higher dividend payments to shareholders. The dividend payout ratio is particularly relevant for tracking common stock dividends, as it adjusts for any dividends declared and paid on preferred stock. This adjustment ensures that the ratio accurately reflects the dividends received by most stockholders. It becomes especially significant when the rate of preferred stock dividends changes significantly relative to comparable profits. To calculate the dividend payout ratio, divide the common stock dividends paid by the adjusted net profits (net profits minus dividends paid on preferred stock), and express the result as a percentage.

It is worth noting that any future changes in the rate of payment on preferred stock would impact the payout of common stock dividends. Additionally, if a corporation were to issue a large number of preferred stock shares and subsequently declare and pay dividends, it would also affect the payout ratio. By using the dividend payout ratio, you can accurately track the trend of common stock dividends over time.

The dividend payout ratio provides valuable insights into how management distributes dividends to shareholders while accounting for adjustments related to preferred shareholders. This ratio, combined with careful monitoring of sales trends, forms the foundation for a robust fundamental analysis program. It helps identify the actual payout trend and allows for a thorough evaluation of management policies regarding preferred shareholders.

9.1.6. Total Shareholder Return (TSR)

Total Shareholder Return (TSR) is a measure that evaluates the profitability of an investment in stocks through two primary sources: capital gains and current income. Capital gains refer to the profit generated by the change in the stock's market price from the purchase date to the sale date. On the other hand, current income represents the dividends paid by the company to its shareholders while they hold the stock.

When calculating TSR, it is important to consider the dividends that the investor actually received or were eligible to receive. The investor must own the stock on or before the ex-dividend date to be eligible for dividend payment, even if they are in possession of the stock on the dividend payment date. Therefore, knowledge of the stock's ex-dividend date is crucial for TSR calculation.

Dividends, which are distributions of a portion of a company's earnings to specific classes of stockholders, can include various forms such as stock buybacks, one-time payments and regular cash payouts on a quarterly or semi-annual basis.

TSR is most effective when analysed over an extended period as it provides insights into the long-term value of the investment. It serves as a reliable metric for assessing success, particularly for individual investors.

Table 9.1. Capital market ratios related to profit or dividends

The method of calculating the ratio	Description
Earning per Share, EPS $\frac{(Net\ Income - Preferred\ Dividends)}{weighted\ average\ number\ of\ shares\ outstanding}$	The year-over-year changes in EPS demonstrate a company's ability to sustain profitable growth. A competent management team can generate profits and maintain a satisfactory growth rate over many years, highlighting the significance of consistent growth and adaptability to market conditions and competition. Positive and continuous EPS growth indicates healthy and promising prospects, while stagnant or declining EPS growth may raise concerns about a company's ability to generate sustainable profits. Therefore, monitoring and evaluating EPS growth are crucial for fundamental analysis and identifying growth opportunities in the stock market.
Price-to-earnings, PE $\frac{share\ price\ (closing)}{EPS}$	The PE ratio, or price-earnings ratio, is a fundamental indicator in the capital market that provides valuable insights and is widely used for comparing stocks. It combines earnings per share with the current market price of a stock. Calculated using the closing price from the last trading day and the latest annual earnings per share, the PE ratio informs investors about the market's perception of a stock's value. However, it has its limitations, as it ignores comparability between the numerator and denominator, comparing stock prices that are constantly changing to earnings figures from the past. Despite its imperfections, the PE ratio is a useful tool for understanding market valuation and expectations for future profits. It reveals how much market valuation is attributed to each PLN of earnings and helps identify stocks that are currently popular or less favoured. A high PE ratio suggests better growth prospects, while a low ratio indicates a lack of excitement, at least in the current perception. However, analysing PE ratios requires caution, as comparability issues can arise when different reporting periods and stock valuations are used.
Dividends per share, DPS $\frac{dividends\ paid\ on\ common\ stock}{weighted\ average\ number\ of\ shares\ outstanding}$	DPS informs investors about the amount of dividend per share or unit. It is a significant measure for shareholders as it indicates how much dividend is currently being paid or has been paid in the past for each share owned. Investors can use this indicator to calculate the expected dividend by multiplying the number of shares owned by the DPS. Changes in this ratio can indicate an increase or decrease in profit distributions, which can result from both lower dividends and a larger number of shares on the market.

The method of calculating the ratio	Description
Dividend yield, DY $\frac{annual\ dividend}{closing\ price}$	Indicator, which provides an estimate of the return on investment in the form of dividends. This indicator shows how much a shareholder earns on each unit of currency invested in purchasing stocks. Due to the variability of dividend income with changes in stock prices, this indicator may appear particularly high for stocks that rapidly lose value. Dividend yield facilitates the comparison of different stocks. An increase in the indicator indicates lower dividend payout costs for shareholders, which can result from either higher dividends paid by companies or a lower stock value of a given entity.
Dividend payout ratio, DPR $\frac{dividends\ paid\ on\ common\ stock}{net\ income - dividends\ paid\ on\ preferred\ stock}$	The dividend payout ratio is a crucial ratio for monitoring dividend payments and gaining insights into a company's dividend distribution. It considers both common and preferred stock dividends, providing a comprehensive perspective on dividend payments. An increase in the ratio indicates higher dividends for shareholders. Changes in the rate of payment on preferred stock and the issuance of preferred stock can impact the dividend payout ratio. By tracking this ratio, investors can accurately observe the trend of common stock dividends over time and evaluate management policies regarding preferred shareholders.
Total shareholder return, TSR $\frac{\left(current\ price - purchase\ price\right) + dividends}{purchase\ price}$	In calculating Total Shareholder Return (TSR), investors consider both capital gains and current income from dividends. Capital gains refer to the change in a stock's market price from purchase to sale, while current income is the dividends received while owning the stock. When calculating TSR, dividends are only accounted for if the investor owned the stock on or before the ex-dividend date. TSR is particularly useful when measured over time as it reflects the long-term value of an investment. It is calculated by adding the stock's appreciation and dividends during a specific period and dividing it by the initial purchase price of the stock.

Source: own.

The ratios illustrating the capital market ratios related to profit or dividend of the CD Projekt capital group are presented in Table 9.2.

Table 9.2. Capital market ratios related to profit or dividend of the CD Projekt capital group

Itemisation	2018	2019	2020	2021
Net profit (loss)	109 334	175 315	1 154 327	208 908
Dividends and other payments to equity holders		100 926		503 694
Share price	138.838	266.689	269.867	187.269
No. of shares	96120	96 120	96 461	100 718
Earning per Share, EPS	1.14	1.82	11.97	2.07
Price-to-earnings, PE	122.06	146.22	22.55	90.29
Dividends per share, DPS		1.05		5.00
Dividend yield, DY		378.44		2689.68
Dividend payout ratio, DPR		0.92		0.44
Total shareholder return, TSR		93%	1%	-29%

Source: own calculations based on CD Projekt's consolidated financial statements for 2018-2021.

CD Projekt Group had a relatively low earnings per share (EPS) value in 2018, with PLN 1.14 per share. In 2019, the EPS increased to PLN 1.82 per share, and in 2021, it reached PLN 2.07 per share. The high EPS values were observed in 2020 when the group released a new blockbuster game, indicating significant profits during that period. However, in other years, the earnings potential of the group is considered low.

The price-to-earnings ratio (PE) was extremely high at the beginning and end of 2019, with a PE ratio exceeding 100, which many investors would consider speculative. The potential for future earnings was significant in those years. In 2020, the PE ratio significantly decreased, with shareholders paying PLN 22.55 per unit of earnings. Similarly, the future earnings potential appears to be significant. Some investors may have considered investing in the company's stocks as speculative even in that year. In 2021, the PE ratio increased again to PLN 90.29 per share. Whether this represents a financial bubble or reflects the actual earnings potential of the group depends on the individual investor's perspective.

The group paid dividends for the years 2018 and 2020. In 2019, the group paid PLN 1.05 per share in dividends. In 2021, the dividend per share was significantly higher at PLN 5. The dividend yield is practically negligible, with the dividend per share in 2021 representing only 0.03 of its value. Dividend earnings are overshadowed by the capital gains of the company.

Dividend payments are typically made in the year following the earnings generated. Analysing the dividend payout ratio (DPR), it can be observed that in 2019, the group paid out 92% of the earnings generated in 2018. In 2021, the company paid out 44% of the earnings generated in 2020 as dividends and other payments to shareholders.

The total shareholder return (TSR) varied significantly throughout the analysed period. In 2019, investors who invested in the group's stocks could earn a return of 93%. In 2020, the return on investment was approximately 1%. The profits generated from the sale of the new blockbuster game were discounted by shareholders in 2019. In 2021, the TSR was negative, with shareholders losing 29% of their capital. It can be observed that the earnings forecasts estimated by shareholders seemed to exceed the company's actual capabilities. The declines in 2021 were associated with overestimated expectations of future earnings potential by shareholders.

From the shareholders' perspective, it is essential for the company to generate profits, as higher profits can potentially lead to higher dividends. Shareholders who rely on consuming current earnings will expect more regular payouts, while other investors may focus on long-term gains. Profit is correlated this way with the company's value.

9.2. Capital market ratios related to value

In financial analysis, the results of the capital market also have broad application, illustrating the value of the company itself.

9.2.1. Book Value Per Share (BVPS)

Book Value Per Share (BVPS) is a financial ratio that measures the net asset value of a company on a per-share basis. It is calculated by dividing the equity available to common shareholders by the number of outstanding shares. BVPS represents the minimum value of a company's equity and is used by investors to assess whether a stock is undervalued.

BVPS indicates what shareholders would receive if the company was liquidated and all assets were sold to pay off liabilities. However, it is important

to note that market value per share is considered a better indicator than book value as it reflects future earning potential and growth prospects.

If a company's BVPS is higher than its market value per share, the stock is considered undervalued. This suggests that investors may have an opportunity to buy the stock at a lower price relative to its intrinsic value. BVPS can increase through earnings retention, where a portion of profits is used to acquire assets or reduce liabilities. Companies may also repurchase common stock to increase BVPS.

Overall, BVPS provides insights into a company's net worth on a per-share basis and helps investors evaluate stock prices in relation to their intrinsic value.

9.2.2. Price to Book Value (P/BV)

Price to Book Value (P/BV) ratio is a widely used financial analysis indicator that measures the value of a company. It falls under the category of market value ratios.

The book value is calculated by subtracting the company's liabilities from its assets. The P/BV ratio indicates how much we are paying for each unit of the company's net assets. Generally, if we buy stocks of a company below its book value (a ratio less than 1), the stocks are theoretically considered to be fundamentally undervalued. Therefore, over the long term, the transaction should be profitable.

This ratio provides us with information on how the market currently values the company's equity. The general interpretation of the P/BV ratio is that ratios below 1 indicate a low stock price, while ratios above 3 indicate overvaluation. This means that even if the company were to go bankrupt the day after investing in its stocks with a P/BV ratio below 1, theoretically, the investor would still make a profit from the investment. This is because the company's assets are theoretically worth more than the invested amount. It is important to note that it is very rare for a company to go bankrupt the day after purchasing its stocks. In practice, if the company continues to operate and generates profits, it can prove to be an attractive investment.

9.2.3. Tobin's Q

Tobin's Q ratio is a measure used in economics and finance to assess the value of a company. It was introduced by James Tobin, an economist and Nobel laureate, in 1969.

The Tobin's Q ratio reflects the relationship between the market value of a company and the replacement value of its assets. It can be used to evaluate the competitiveness and efficiency of a company's investments. There are various definitions and variants of the Tobin's Q ratio, but in general, it measures whether the market value of a company exceeds the value of its assets, indicating value creation by the firm.

Originally, the Tobin's Q ratio was defined as the ratio of the marginal product of capital to the required rate of return on equity. Subsequent considerations led to a different definition, which calculates the Q ratio as the ratio of the market value of a company to the replacement value of its assets (Erickson, Whited, 2001).

In the short term, the Q ratio may reflect a company's competitive advantage and intangible assets, while in the long run, the Q ratio should converge towards unity, indicating a balance between the market value and the replacement value of assets. It can also be an alternative measure of company competitiveness (Chen, Lee, 1995), a predictor of investment project profitability (Lang, Litzenberger, 1989), an indicator of intangible firm value (Hall 1993, Hirschey 1982, Megna, Klock 1993), as well as a measure of brand and technology value. If the Q ratio exceeds unity, it suggests that investors expect future value growth of the company. On the other hand, a Q ratio below unity may indicate an undervaluation of the market value of the company. Understanding the context and characteristics of the industry in which a company operates is important because different industries may have different Tobin's Q values. For example, technology-based industries often have higher Q values due to their innovation and growth potential. Conversely, traditional industries may have lower Q values due to limited growth opportunities.

The Tobin's Q ratio has its limitations, especially in terms of interpretation. There are various factors that can influence the Q value, such as market volatility, investor expectations, economic policies, as well as industry-specific and company-specific factors. Therefore, it is important to consider other indicators and analyse the context to gain a more comprehensive understanding of the value of a company.

Table 9.3. Capital market ratios related to value

The method of calculating the ratio	Description
Book Value Per Share, BVPS $\frac{total\ equity - preferred\ equity}{weighted\ average\ number\ of\ shares\ outstanding}$	Investors often use BVPS to assess whether a stock is undervalued or overvalued. If a company's BVPS is higher than its current market price per share, it suggests that the stock may be undervalued and potentially a good investment opportunity. Conversely, if BVPS is lower than the market price per share, it may indicate that the stock is overvalued.
Price to Book Value, P/BV $\frac{closing\ price}{BVPS}$	The P/BV ratio, on the other hand, compares the market's valuation of a company's equity to its book value. A P/BV ratio greater than 1 indicates that the market is valuing the company at a higher price than its book value per share, suggesting that the stock may be overvalued. Conversely, a P/BV ratio less than 1 suggests that the market is valuing the company at a lower price than its book value per share, indicating that the stock may be undervalued.
Tobin's Q $\frac{market\ value\ of\ a\ company}{replacement\ value\ ofits\ assets}$	Tobin's Q is used as an indicator of investment efficiency and can provide insights into whether a company's stock is overvalued or undervalued. If Tobin's Q is greater than 1, it suggests that the market value of the company is higher than the replacement value of its assets, indicating potential overvaluation. Conversely, if Tobin's Q is less than 1, it implies that the market value of the company is lower than the replacement value of its assets, suggesting potential undervaluation.

Source: own.

The ratios illustrating the capital market ratios related to value of the CD Projekt capital group are presented in Table 9.4.

Table 9.4. Capital market ratios related to value of the CD Projekt capital group

Itemisation	2018	2019	2020	2021
Equity	1 002 864	1 105 651	2 187 356	1 894 356
Liabilities and provisions for liabilities	123 974	298 457	707 122	264 379
Market value	13 469 083	25 932 604	26 738 763	19 125 738
Replacement value of its assets	1 021 423	1 102 086	1 525 531	1 845 637
Share price	138.838	266.689	269.867	187.269
No. of shares	96 120	96 120	96 461	100 718
Book Value Per Share, BVPS	10.43	11.50	22.68	18.81
Price to Book Value, P/BV	13.31	23.18	11.90	9.96
Tobin's Q	13.19	23.53	17.53	10.36

Source: own calculations based on CD Projekt's consolidated financial statements for 2018-2021.

As shown in the presented comparison, the book value of one share was initially PLN 10.43 at the beginning of 2019 but increased to PLN 11.50 by the end of 2019. This indicates that the book value of the shares is significantly lower than their market value. The market price was more than 10 times higher at the beginning of 2019, and over 25 times higher at the end of 2019. This relationship suggests that the stock prices may be overvalued. The book value

per share continued to increase in 2020, reaching PLN 22.68, but decreased to PLN 18.81 in 2021. Comparing these values with the stock prices, it can be observed that, similar to the first year, the market values of equity were 10 times higher than their book values.

The invested capital can be relatively easily reproduced. However, the challenge lies in reproducing the tangible capital resources, which are not the key element here. The main assets for which the owners pay are intangible resources and intellectual capital. The disparity between market value and book value indicates that it is precisely this type of capital that is most valued by the owners and generates potential future profits.

9.3. Forecasting cash flow and business valuation

The complexity of CD Projekt's business, driven by the rapidly changing gaming industry and its innovative projects, demands a careful consideration of various factors that can impact the company's future performance and value. Some of the key aspects that analysts need to take into account include the success of upcoming game releases, market demand for their products, competition from other gaming companies, and the effective utilisation of technological advancements in their game development process.

Additionally, the company's financial management practices, investment decisions and strategic partnerships can significantly influence its overall value. Therefore, analysts must continuously monitor and assess CD Projekt's financial performance, market trends and industry developments to ensure that their valuation remains accurate and relevant.

Analysing companies as dynamic and rapidly evolving as the CD Projekt Group poses a significant challenge for analysts. Creating a professional valuation requires relying on a considerable number of estimates, assumptions and forecasts. However, for the purpose of financial analysis, this procedure has been considerably simplified, thus the results should not be regarded as the sole criterion for investment decisions. Valuation in the analysis typically serves a complementary role. The analyst estimates the enterprise's value not to determine the share price but rather to establish a range within which it may fall. As such, a certain level of simplification is allowed, which might be considered too extensive in a conventional valuation approach.

While the simplified valuation approach can provide a general sense of the company's value range, it is essential for analysts to be aware of its limitations. A comprehensive analysis should be performed to capture the intricacies of CD Projekt's unique business model and dynamic market conditions.

Moreover, it is crucial for investors and stakeholders to recognise that valuations are subject to uncertainty and potential risks. Market dynamics and unforeseen events can impact the company's future outlook, making it essential to use valuations as a part of a broader investment decision-making process.

9.3.1. Analysis of group in economy

In recent years, social factors have shown relatively little change. There has been a noticeable increase in interest in video games, especially mobile games, which have gained significant popularity among teenagers and young adults. Additionally, the pandemic led people to spend more time playing games, both on consoles and mobile devices. This was mainly due to individuals seeking diverse forms of entertainment while in quarantine, and video games proved to be a compelling option. The trend towards virtual entertainment continues to rise, particularly because gaming remains highly popular among the younger generation. Moreover, there is a certain attachment to this form of entertainment. People who grew up in the 2000s, discovering and playing computer games in their youth, still maintain an interest in gaming even as they have become adults in their forties. While films, series and literature also perform significant roles in entertainment, they are different forms of media and do not necessarily compete directly with the products of the studied company.

Technological factors have always performed a crucial role in the gaming industry. Games have become increasingly complex, sophisticated and visually appealing year after year, often requiring substantial financial investments and involving a large workforce to create these masterpieces. Graphics engines are periodically replaced by newer generations, offering better visual experiences. New innovative technologies also demand considerable financial resources, like the highly popular ray-tracing technology featured in the latest games, providing realistic lighting effects. It is worth considering various emerging virtual technologies, such as VR (Virtual Reality) and AR (Augmented Reality). Both have immense potential and could bring about a major transformation

in the gaming industry in the coming years. However, currently, they are not as refined and widely accessible as computer games.

9.3.2. Analysis of group in competitive environment

The group currently competes on the international stage with giants in its industry such as Ubisoft, Electronic Arts and Take-Two Interactive, creating video games for players worldwide. Thanks to the success of The Witcher, the company has solidified its leading position on the domestic market and gained global recognition, expanding its market reach from national to global. Additionally, the company competes with digital distribution platforms like Steam and Epic Games Store through its platform GOG. Thus, it is logical to say that the competition the company faces is well-established within the sector. This is primarily due to their widespread recognition among their audience and the release of numerous highly-reviewed and best-selling video games. However, it is essential to consider that competitors have been present in this sector much longer than CD Projekt and offer a more extensive range of products. Nevertheless, CD Projekt stands out for its fresh approach, customer focus and willingness to leverage customer feedback, which can be advantageous both now and in the future.

Understandably, new entrants face high barriers when attempting to enter the video game market. Often, substantial capital is required to employ numerous specialists capable of creating a product, especially in the AAA game segment, which is characterised by the largest budgets and high risks. While there have been cases in history where independent, small development studios, and even individual developers, have created successful games that garnered a loyal fan base, such instances are relatively rare. Mobile games offer more accessible entry barriers, requiring lower initial capital compared to other segments.

As for potential substitutes, it is challenging to replace video games with other forms of entertainment. While television series and books provide enjoyment and diversification in leisure time, they offer vastly different experiences from video games. Video games, particularly RPGs, allow players to control characters and influence the development of the storyline, creating a unique interactive experience. As such, while some overlap in entertainment preferences may exist, substitutes do not pose a significant threat to the group. However, the potential rise of virtual reality games could potentially disrupt

console and PC gaming segments, although this scenario is currently limited by the still relatively low popularity and refinement of the VR technology.

The video game market's consumers are discerning and have high expectations for the products they choose. Some may prefer specific genres, such as strategy games, while others exclusively play AAA productions and are not interested in low-budget, less recognised video games. Each consumer is unique and selects products that align with their preferences. To appeal to a broader audience, companies need to offer something unconventional, ambitious and exceptional or establish a solid market position and gain recognition among players. Customer feedback performs a significant role in shaping the market, and if a group releases an underdeveloped game, players can be ruthless in pointing out flaws, compelling the group to regain customer respect.

"Deliverers" refer to the employees of CD Projekt Group. They perform a strategic role in the group's operations and pursuit of sustainable development goals. The group emphasises managing environmental, social and governance (ESG) issues, and it reveals that the core values of CD Projekt, including tolerance, fairness and openness, align with sustainable development goals. The Group takes an admirable care of its employees, striving to create encouraging working conditions and a motivating development program. The Group's incentive program is a testament to its concern for employees and key individuals, focusing on achieving better financial results and long-term growth in the Group's value. By granting special privileges, employees have the opportunity to engage in the Group's success, either through receiving the so-called "subscription warrants" or acquiring the Group's own shares. This innovative approach encourages long-term commitment and active contribution to achieving the set goals. The motivational program in which employees participate requires them to meet loyalty criteria, further emphasising the Group's care for long-term relationships with the team. The desire to retain skilled and dedicated employees highlights the organizational culture that values cooperation based on mutual trust and strengthening internal bonds. Employees, appreciating this concern for their loyalty and dedication, can feel motivated to take on ambitious challenges and actively participate in the group's development.

Another significant aspect on which the Group places great emphasis is the expansion of its headquarters in Warsaw's Praga district. The planned creation of an entirely new complex means that CD Projekt not only cares

for its employees but also creates an inspiring workplace tailored to the Group's dynamic growth. The modern office building surrounded by greenery and numerous recreational spaces shows that the Group is not only focused on results but also on the well-being and comfort of its employees. A model workplace fosters creativity and motivates employees to achieve the highest quality in designing and publishing video games.

All these initiatives indicate that employees are essential components of CD Projekt's success. Through the creation of a conducive work atmosphere, innovative motivational programs and the expansion of a modern headquarters, the group directs its efforts towards gaining the trust of its employees, providing them with opportunities to develop their skills and engage in the group's mission. This harmonious combination of caring for the team and organizational goals contributes to achieving outstanding results and strengthening CD Projekt's position as a leader in the video game industry.

To forecast the ability to generate cash and future earnings in practice, a certain kind of comprehensive approach is used. This means that the analyst assumes the constancy of certain relationships in the business. In the comprehensive approach, therefore, besides the described elements of financial analysis, elements of economic and strategic analysis are also essential, helping analysts make informed decisions about the future state of the company. This approach also takes into account various market and economic factors that can influence the forecasts. These factors include, in particular:

- Sales growth,
- Earnings.

9.3.3. Sales growth

The fundamental assumption is the dynamics of sales growth. This indicator depends on the individual group. For the CD Projekt Group, the sales growth dynamics were as follows (table 9.5).

Table 9.5. Dynamics of key value predictors

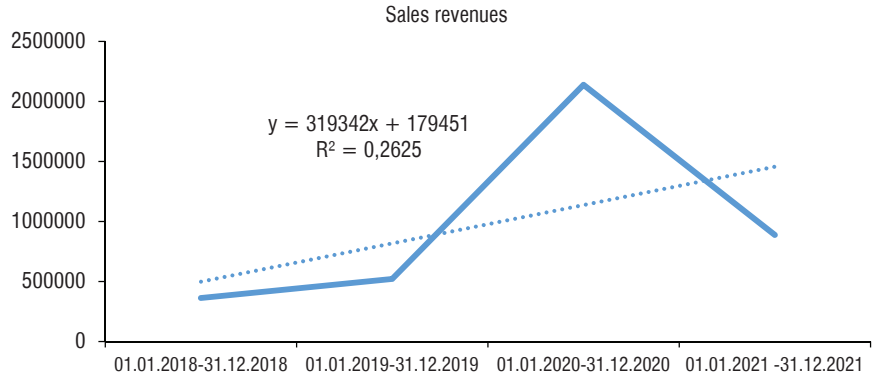
Itemisation	2019	2020	2021	Average
Sales revenues growth of CD Projekt Group	44%	310%	-58%	98%

Source: own calculations based on CD Projekt's consolidated financial statements for 2018-2021.

The CD Projekt Group experiences fluctuations (irregularities) in the level of its revenues from period to period. This is a common phenomenon occurring in various industries and may result from many factors, such as market volatility, changing consumer trends, seasonal shifts in demand, competition, changes in industry regulations or even unpredictable events, like economic crises or natural disasters. Companies dependent on individual large clients or transactions may also experience significant revenue fluctuations. In the case of computer games, a significant factor was the already described consumer behaviour during the pandemic. The second factor is the observed seasonality of revenues related to successive blockbusters.

Revenue instability can affect a group's ability to plan, invest and manage finances. For investors, revenue instability can represent a risk associated with investing in a particular firm. Companies with more stable revenues are typically perceived as less risky and more attractive to investors. On the other hand, companies with the potential for dynamic growth but also more exposed to instability may attract investors with a higher risk tolerance, seeking higher returns. Figure 9.1. presents the amount of revenue with the trend analysis.

Figure 9.1. Revenues with the trend analysis



Source: own calculations based on CD Projekt's consolidated financial statements for 2018-2021.

The trend matching factor is extremely low, rendering any predictions based on it unreliable.

Sales growth rates tend to gravitate towards the "average" value. Companies with above-average or below-average sales growth rates typically revert to a "normal" level within three to ten years (usually in the range of 5 to 10%).

Table 9.6. Dynamics of key value predictors for the industry

Itemisation	2019	2020	2021	Average
Sales revenues growth	4%	25%	6%	12%

Source: own calculations based on CD Projekt's consolidated financial statements for 2018-2021.

One explanation for this sales growth pattern is that as industries and companies mature, their growth rate slows down due to demand saturation and intra-industry competition. Therefore, even if a group is currently experiencing rapid growth, it is generally unrealistic to assume that the high growth rate will persist indefinitely. Of course, the speed at which a group reverts to the average level depends on the characteristics of its industry and its own competitive position within the industry. Therefore, the ultimate analysis tool is the strategic analysis of group revenues.

Table 9.7. Revenue dynamics of major competitors

Itemisation	2019	2020	2021	Average
UbiSoft Entertainment	5%	-17%	46%	12%
Electronic Arts	-3%	12%	2%	4%
Take-Two Interactive Software	49%	16%	9%	25%

Source: own calculations based on CD Projekt's consolidated financial statements for 2018-2021.

In the simplified SWOT analysis, several key findings are outlined.

Table 9.8. Simplified SWOT Analysis of CD Projekt

Strengths	Weaknesses
• Recognisability of the company both in Poland and worldwide. • Established and highly visible brand for "The Witcher" series. • Solid financial situation of the company. • Loyalty employees programs within the company.	• Still infrequent release of major AAA productions, unlike some competitors. • Limited portfolio of the company, with only The Witcher and Cyberpunk 2077 franchises.
Opportunities	**Threats**
• Strong economic position provides significant growth possibilities for the company. • Global growth in the video game market. • High demand for games among young people due to the rising popularity of this form of entertainment.	• Strong and recognisable competition in the gaming industry. • Prevalent piracy leading to a reduced number of product buyers. • Mixed reception of Cyberpunk 2077 in comparison to The Witcher.

Source: own.

In conclusion, the company should focus on expanding its portfolio and utilising its strengths to develop and produce more successful products.

It should also closely monitor the global economic situation to timely respond to any potential crisis. Additionally, after the less successful release of Cyberpunk 2077, the company cannot afford another such situation with the next major AAA production from the company.

9.3.4. Earnings

As evident from the profitability analysis conducted in the previous section, the operating profit margin ratio has shown a relatively stable performance, with the exception of the year 2020. By excluding this year from the analysis, it can be observed that the ratio fluctuated within approximately 30%. This stability in the operating profit margin ratio indicates a consistent financial performance for the group, providing a reliable point of reference for future earnings potential.

Considering the overall earnings pattern, it aligns with a process akin to a "random walk" or "random walk with drift". This implies that the group's earnings tend to follow a somewhat unpredictable yet continuous path, with some gradual trends in the long run. As a result, the previous year's earnings often serve as a good benchmark for predicting future earnings.

Surprisingly, even a simple forecast based on the random walk method, assuming that next year's earnings will be the same as last year's earnings, holds practical value. However, to enhance the accuracy of predictions, it is reasonable to consider adjustments based on recent earnings changes within the most recent half-year or quarter, while also taking into account any deviations from the long-term trend in the earnings series. Long-term trends in earnings tend to persist on average, and their evaluation remains pertinent for making informed projections.

Furthermore, any notable shifts from the long-run trend during the latest sub-period should be carefully taken into consideration. These changes often exhibit some level of repetition in subsequent sub-periods for most companies, suggesting the need for a thorough analysis of short-term fluctuations to make more precise forecasts.

9.3.5. Forecasting working capital investments

Identification of working capital at the beginning of a period is possible through the analysis of the balance sheet or cash flows. In the first approach,

the analysis of inventory turnover, receivables turnover, payables turnover and the proportion of working capital to sales is essential. Assuming stability over time in the turnover of inventory, receivables and payables, the size of working capital at the beginning of the period can be determined, along with subsequent investments in this capital. This approach is particularly valuable when the conversion periods of inventory, receivables and payables, as well as the proportion of working capital to sales, remain relatively constant over time. However, in the case of CD Projekt, working capital in relation to sales is both significant and highly variable. Considering the dynamic nature of CD Projekt's working capital, forecasting its future value becomes more complex. Various factors can influence working capital, such as changes in production volumes, sales patterns, payment terms and other management practices. Additionally, the company's growth and expansion plans can significantly affect working capital requirements. In 2019, working capital was comparable to the size of revenues, while in 2020, it constituted half of the revenues, and in 2021, it was one and a half times larger. Such considerable variability and the sheer size of working capital make it relatively challenging to predict its future value.

To develop a more accurate forecast, analyst should conduct a detailed analysis of its working capital components and their relationships with revenue generation. Understanding the drivers of working capital changes can help the company make informed decisions about optimising its capital structure and liquidity management.

The other approach to forecast working capital is through a cash flow analysis, focusing on changes in inventory, receivables, payables and inter-period settlements (some analysts also add a change in reserves). These components serve as adjustments to operating activities in cash flows and are considered investments in working capital.

By scrutinising the cash flow statement, a more refined calculation of working capital can be achieved. This method enhances the understanding of cash flows, particularly those directly related to operational activities, by excluding flows associated with financing and investing activities. It isolates the categories that directly pertain to operational activities, providing a clearer picture of the working capital dynamics. It allows for a deeper examination of how working capital is impacted by day-to-day operations, sales and financial transactions.

Moreover, delving into the changes in inventory, receivables and payables in cash flow analysis sheds light on the efficiency of the company's working

capital management. Understanding how cash flows are affected by these elements helps identify potential areas for improvement in inventory turnover, collection processes and payment terms.

Additionally, evaluating working capital through the cash flow perspective enables a better assessment of the company's cash position. It provides a comprehensive understanding of how cash is generated and utilised within the core business operations, offering valuable information for strategic decision-making.

9.3.6. Forecasting capital investments expenditures

In the identification of investment expenditures for non-current assets, two approaches are commonly used – the balance sheet approach and the cash flow approach. The balance sheet approach relies on two assumptions: the stability of total asset turnover over ratio and the stability of the asset structure. However, as demonstrated in the analysis of financial position and profitability, neither the asset turnover nor the asset structure in the CD Projekt Group are stable. The overall asset turnover fluctuated between 0.36 and 1.01 during the analysed period. The proportion of non-current assets in the asset structure was 48% at the end of 2019 but decreased to 26% in 2020. Such a significant variability indicates that investment sizing for non-current assets cannot be based solely on the proposed indicators. The analysis of non-current asset dynamics suggests a more systematic growth pattern. Unfortunately, the changing structure of non-current assets complicates the identification of investments in tangible assets. The group invests in both tangible assets and, increasingly, long-term investments constituting capital reserves for the group.

An alternative approach is the cash flow-based method. For short-term forecasting, investment expenditures can be estimated based on the entity's published investment plans or assumptions formulated from historical data.

9.3.6.1. Valuation of cash flows and selection of interest rate

Valuation of cash flows and the selection of the interest rate primarily depend on what we want to calculate. When aiming to determine the overall value of a company, analysts often turn to the FCFF (Free Cash Flow to Firm) approach. This method takes into consideration all cash flows generated by the business, irrespective of whether they are distributed to equity holders or creditors. By including both equity and debt financing, the FCFF approach

provides a comprehensive perspective that accounts for the interests of all stakeholders. Consequently, it is a valuable tool for assessing the intrinsic worth of the entire enterprise.

On the other hand, if the goal is to ascertain the value of the equity portion alone, the FCFE (Free Cash Flow to Equity) approach is employed. This method focuses exclusively on the cash flows available to equity holders after accounting for interest payments to debt holders. By concentrating on equity-related cash flows, the FCFE approach delivers insights into the potential returns that equity investors can expect to receive. It is particularly useful when the valuation is intended to cater specifically to shareholders' interests.

In situations where the analysis centres on cash flows that pertain to both equity and debt capital, the CCF (Capital Cash Flow) approach is applied. This technique encompasses all cash flows attributed to capital providers, including both equity holders and debt holders. In contrast to the FCFF and FCFE approaches, which focus on either the entire business or equity alone, the CCF approach captures the broader financial implications of cash flows for all contributors of capital.

Table 9.9 presents the calculation method for cash flows and the appropriate discount rate for the chosen technique.

Table 9.9. Calculation method for cash flows and the appropriate discount rate

Free Cash Flow to Firm	Free Cash Flow to Equity	Capital Cash Flow
Cash Flows		
Net Operating Profit After Tax + Depreciation ± Change in Reserve Status - Investments in Fixed Assets - Investments in Working Capital = Free Cash Flows to Firm (FCFF)	Net Operating Profit After Tax + Depreciation ± Change in Reserve Status - Investments in Fixed Assets - Investments in Working Capital - After-Tax Interest ± Change in Debt Status = Free Cash Flows to Equity (FCFE)	Net Operating Profit After Tax + Depreciation ± Change in Reserve Status - Investments in Fixed Assets - Investments in Working Capital - Interest Tax Shield = Capital Cash Flows
Discount Rates		
WACC	Ke	WACC before taxes

Source: own.

The methods mentioned above outline the calculation of cash flows and the appropriate discount rates depending on the chosen valuation approach. The FCFF approach is used to assess the value of the entire company, the FCFE approach is applied for equity valuation, and the CCF approach is used for cash flows to capital valuation. These methods are pivotal in determining the financial value and investment decisions for a company.

However, the differences between the Entity and Equity approaches do not only pertain to the free cash flows themselves but also to the cost of capital. Following the principle of appropriateness applied in financial analysis, cash flows of a particular type should be discounted by the cost of the corresponding capital. In general terms, it can be stated that in the Equity approach, the discount rate is the appropriately expressed cost of equity capital, while in the Entity approach, it is the weighted average cost of capital (WACC) suitable for the chosen calculation technique. For the CCF (Capital Cash Flow) approach, the discount rate will be the WACC before taxes ($WACC_{BT}$).

This differentiation in discount rates is essential to accurately reflect the risk associated with the type of cash flows being analysed. Each approach considers the source of funding differently and aligns the discount rate with the relevant capital structure. The Entity approach, by employing the WACC, takes into account both the cost of equity and the cost of debt, reflecting the interests of both equity holders and creditors. On the other hand, the Equity approach focuses solely on the cost of equity capital since it is concerned with valuing only the equity holders' interests.

In summary, the choice of approach and the corresponding discount rate ensures that the valuation of cash flows and the determination of value align with the specific nature of the analysis, accurately representing the different stakeholders' perspectives and interests.

9.3.6.2. Business valuation in sustainable development conditions

Sustainable development of society focuses on three pillars: environmental, economic and social. While economic sustainability is fully profitable, values associated with environmental and social sustainability are not as easily achievable. In the context of business, companies achieve economic sustainability by producing goods and services and being compensated for what they sell. In this production process, companies also generate environmental or social sustainability, positive or negative, which is often overlooked. As a result, these hard-to-assess values are not considered in the company's valuation.

9.3.6.3. Discounting future cash flows and terminal value

The Discounted Cash Flow (DCF) valuation method faces a significant challenge when attempting to estimate cash flows for an indefinite future. This challenge becomes particularly relevant when considering the continuous

existence of a business entity. To tackle this issue, financial analysis commonly employs a two-stage approach, dividing the analysis into a well-defined projection period and a subsequent period referred to as the "terminal value" (Mączyńska, Kasiewicz, 1999, p. 125) or the "residual value" (Fierla, 2008, p. 63) (Panfil, Szablewski, 2016).

The projection period is usually set at around 7-8 years (Helbling 1991, p. 72 and 534). Instances where this period is shorter than seven years are rare (Copeland, Koller, Murrin 1997, p. 282). Due to economic uncertainties, some regions reduce the projection period to five years or even less (Borowiecki, Jaki, Kaczmarek, 1999, p. 51, Panfil, Szablewski, 2016).

When estimating the terminal value, analysts must exercise caution, as this value often constitutes a substantial component of the overall valuation (Copeland, Koller, Murrin, 1997, p. 265). The following recommended methods for calculating the residual value are:

- A prolonged and clearly delineated projection period (75 years or more), where the value of the business or equity income diminishes insignificantly beyond this horizon.

$$V = \frac{FCF_1}{(1+r)^1} + \frac{FCF_2}{(1+r)^2} + \frac{FCF_3}{(1+r)^3} + \ldots + \frac{FCF_n}{(1+r)^n} + \frac{RV_n}{(1+r)^n}$$

  where:

  FCF – Free Cash Flows,

  r – Cost of Capital,

  RV – Residual Value.

- The perpetuity model of consistent growth (Gordon Growth Model), assuming that free cash flows will sustain a constant growth rate in the extended phase.

$$V = \frac{FCF_1}{(1+r)^1} + \frac{FCF_2}{(1+r)^2} + \frac{FCF_3}{(1+r)^3} + \ldots + \frac{FCF_T}{(1+r)^T} + \frac{FCF_T(1+q)}{(r-q)}$$

where:

q – Expected growth rate of FCF in perpetuity,

T – Last year of detailed forecast.

This formula is meaningful only when $q < r$.

- A formula that encompasses the variables that shape the company's value.

$$V = \frac{FCF_1}{(1+r)^1} + \frac{FCF_2}{(1+r)^2} + \frac{FCF_3}{(1+r)^3} + \ldots + \frac{FCF_T}{(1+r)^T} + \frac{NOPAT_{T+1}\left(1+\frac{q}{RONIC}\right)}{(r-q)}$$

where:

NOPAT – Net Operating Profit After Tax,

RONIC – Expected rate of return on new investments,

q – Expected growth rate of *NOPAT* in perpetuity.

Ultimately, the valuation process demands a meticulous approach to ascertaining the terminal value, recognising its potential to significantly sway the overall assessment of a business's valuation.

Table 9.10. Historical data for valuation

Itemisation	2018	2019	2020	2021
Net Operating Profit After Tax	104 524.56	167 665.98	1 076 081.61	216 599.79
Depreciation	16 635.00	37 487.00	267 664.00	104 729.00
Change in Reserve Status & Investments in Working Capital	16 380.00	-1 221.00	-734 200.00	620 358.00
Investments in Fixed Assets	-123 945.00	-256 363.00	-221 570.00	-183 129.00

Source: own calculations based on CD Projekt's consolidated financial statements for 2018-2021.

Table 9.11. Assumptions for valuation

Itemisation	Assumptions
Net Operating Profit After Tax	The revenue growth rate was estimated based on historical data. The projected profit growth is 65%. It is composed of expectations regarding a new blockbuster production, a small number of ongoing projects (adjusted negatively) and further updates to the CyberPunk game. The average profit of the analysis period serves as the foundation for building the forecast. The effective income tax rate represents the average and amounts to 7%.

Itemisation	Assumptions
Depreciation	The growth rate of depreciation and investment flows has been estimated at 20.3%, similarly to the growth of working capital investment. Investment expenditures for tangible fixed assets and intangible assets, as well as investment projects, have increased on average by 25.3%. With the group's development, a lower scale of growth dynamics is expected.
Change in Reserve Status & Investments in Working Capital	Since the analysis covers nearly the entire lifecycle of creating the blockbuster production, the average annual value of working capital investment for the entire cycle has been adopted as its basis.
Investments in Fixed Assets	The construction of the forecast is based on the last period and the assumed growth rate of 20.3%.
Expected growth rate of FCF in perpetuity	It is based on long-term GDP growth forecasts, which have been assumed at the level of 0.4%.

Source: own calculations based on CD Projekt's consolidated financial statements for 2018-2021.

Table 9.12. Detailed forecast for valuation

Itemisation	2022E	2023E	2024E	2025E	2026E
Net Operating Profit After Tax	357 389.65	589 692.93	972 993.33	1 605 439.00	2 648 974.35
Depreciation	125 988.99	151 564.75	182 332.40	219 345.87	263 873.08
Change in Reserve Status & Investments in Working Capital	-29 678.91	-46 140.26	-57 551.89	218 360.07	-53 481.80
Investments in Fixed Assets	-220 304.19	-265 025.94	-318 826.20	-383 547.92	-461 408.15
FCFF	233 395.54	430 091.48	778 947.64	1 659 597.02	2 397 957.49
1/Discount	0.91	0.82	0.75	0.68	0.61
Present Value of FCFF	211 619.86	353 580.71	580 630.51	1 121 651.91	1 469 470.24

Source: own calculations based on CD Projekt's consolidated financial statements for 2018-2021.

Table 9.13. Detailed forecast for valuation

Itemisation	Residual Value
FCFF	2 674 534.79
WACC-q	9.89%
1/Discount	0.61
Present Value of FCFF	16 571 860.78

Source: own calculations based on CD Projekt's consolidated financial statements for 2018-2021.

Table 9.14. Valuation

Year	PV (FCFF)
2022E	211 619.86
2023E	353 580.71
2024E	580 630.51
2025E	1 121 651.91
2026E	1 469 470.24
RV	16 571 860.78
Total	**20 308 814.01**

Source: own calculations based on CD Projekt's consolidated financial statements for 2018-2021.

Table 9.15. Sensitivity analysis in valuation

Itemisation		Assumptions regarding NOPAT						
		59%	61%	63%	65%	67%	69%	71%
Assumptions regarding the growth rate of depreciation and investment cash flows	18,3%	17 010 695	18 065 405	19 171 944	20 332 225	21 548 205	22 821 890	24 155 333
	19,3%	16 999 149	18 053 858	19 160 397	20 320 678	21 536 658	22 810 343	24 143 786
	20,3%	16 987 285	18 041 994	19 148 533	20 308 814	21 524 794	22 798 479	24 131 922
	21,3%	16 975 097	18 029 806	19 136 345	20 296 626	21 512 607	22 786 291	24 119 734
	22,3%	16 962 579	18 017 288	19 123 828	20 284 108	21 500 089	22 773 774	24 107 216
	23,3%	16 949 725	18 004 434	19 110 973	20 271 254	21 487 234	22 760 919	24 094 362

Source: own calculations based on CD Projekt's consolidated financial statements for 2018-2021.

The valuation of a company clearly indicates that, especially in the case of the CD Projekt Group, there is no single value that can be attributed. With changes in assumptions, a range of results emerges, each of which can be valid depending on the specific market and economic situation of the entity. Interpreting the value of a business requires an understanding that the chances of an accurate valuation are significantly limited. After all, who can predict the future? For some analysts, this final step of analysis is more art than science. In the outlined example, only general calculations were made, and the assumptions adopted are simplified. However, even in a professional valuation, an analyst encounters the same challenges, especially if the company itself is highly variable and operates in a dynamic and ever-changing environment.

Chapter 10

Analysis of key achievements of the company in the social and environmental areas using key performance indicators (KPIs)

10.1. Sustainable development goals (SDGs)

The 2030 Agenda, also known as the Agenda for Sustainable Development 2030, is a world development strategy developed by the United Nations (UN). It was adopted in 2015 by all 193 UN member states in the resolution 'Transforming our World: the 2030 Agenda for Sustainable Development.' The main goal of the 2030 Agenda is to promote sustainable development, which encompasses three main aspects: social, economic and environmental.

Agenda 2030 consists of 17 Sustainable Development Goals, which are divided into five thematic areas called the 5Ps: People, Planet, Prosperity, Peace, and Partnership. Each goal has specific tasks to be achieved by 2030, totalling 169 tasks.

Indicators are assigned to monitor the progress in achieving the goals of Agenda 2030. In total, there are 231 global indicators reported by governments. In the case of the European Union, Eurostat has prepared a set of EU indicators for Agenda 2030 for member countries. In Poland, the Central Statistical Office (GUS) is responsible for monitoring the progress in implementing Agenda 2030.

Implementing Agenda 2030 requires the engagement of all sectors of society, including businesses. Companies have a significant impact on achieving the Sustainable Development Goals and should measure and report their actions in this regard.

The first goal of Agenda 2030 aims to eliminate poverty in all its forms worldwide. From a business perspective, there are many ways in which companies can contribute to achieving this goal. Firstly, companies can develop inclusive business models, products and services that are tailored to the needs of poorer customers. By creating products and services that are accessible and affordable for people in poverty, companies can gain new customers and tap into new markets. Secondly, it is important for businesses to provide fair wages to employees, also known as "living wages," which allow for basic needs to be met and help avoid poverty. Wages should take into account local conditions and the cost of living to ensure fair living conditions for workers.

Another aspect is a sustainable supply chain. Companies should strive to collaborate with suppliers who provide fair working conditions and wages, especially in poverty-stricken regions. This helps reduce poverty and social inequalities throughout the supply chain.

Companies perform a significant role in supporting development through various business strategies (Sadowska, 2019; Sadowska, 2018; Grześkowiak & Peternek, 2023). An example is supporting access to financial services, such as microfinance, which helps poor individuals and entrepreneurs access capital and tools needed for entrepreneurial development. This, in turn, supports the development of microenterprises and helps lift people out of poverty. Partnerships with civil society organizations are another important element where businesses can collaborate to provide training, mentorship and entrepreneurial skills development to the poor, increasing their chances of employment and starting business ventures. Cross-sectoral collaboration is also crucial in strengthening the social protection system for the poorest, where businesses work with governments and non-governmental organizations to ensure access to healthcare, essential goods and services for people in poverty. Implementing these business strategies contributes to poverty reduction, improves the living conditions of the poorest social groups, and brings business benefits such as access to new markets, innovation and strengthening supply and distribution networks.

The second goal of Agenda 2030 offers businesses many opportunities to engage in business activities that will contribute to the eradication of hunger, ensuring food security, promoting sustainable agriculture and improving quality of life. There are various actions within the broader food industry. These include minimising the negative impact on the natural environment through investments in sustainable food production practices and involvement in genetic diversity of seeds and livestock. Increased investment in rural

infrastructure, agricultural research and technological development is also important, particularly in developing countries. Implementing mechanisms to ensure the proper functioning of food markets and facilitating access to market information is essential to limit food price volatility.

Beyond the obvious solutions in the food industry – every company can support programs related to child nutrition, both in terms of quantity and quality, by collaborating with aid organizations and engaging local producers and suppliers. Innovations in agriculture are crucial, and companies can create crops resistant to variable weather conditions and crop diseases, while also protecting the environment.

In the context of the business role, the third goal of Agenda 2030 encompasses actions for health and well-being:

- Development of innovative solutions and technologies supporting patients in diagnosis and treatment.
- Creation of products and services promoting a healthy lifestyle.
- Care for the safety and mental health of employees.
- Popularisation of health and safety issues throughout the supply chain.
- Development of public-private partnerships to increase access to healthcare.
- Cooperation between companies for health prevention and education.
- Limiting the negative impact of certain industries on human health and the environment.

Businesses are tasked with engaging in these actions to contribute to a healthy life and promote societal well-being.

The fourth goal of Agenda 2030, which focuses on quality education and lifelong learning, is significant for the business sector. Companies can perform an active role in promoting and supporting these goals. They can provide effective and affordable educational products and services, particularly based on digital technologies. Investing in education in natural sciences, technology, engineering and mathematics (STEM) is also beneficial for both businesses and society. Companies should also support lifelong learning and the development of skills related to new technologies among their employees. Furthermore, initiating educational initiatives for local communities, especially disadvantaged groups, is important for businesses to engage in social initiatives.

Businesses can take various actions to achieve gender equality and empower women and girls (Goal 5):

- Increasing the level of female employment in managerial positions.
- Ensuring fair and equal pay and additional benefits for work of equal value.
- Recognising and supporting parental care for a child or other dependents by providing services, resources or information.
- Implementing a "zero tolerance" policy for all forms of workplace violence and preventing sexual harassment.
- Developing business relationships with women-led companies, including small businesses and women entrepreneurs.
- Utilising new technologies, including information and communication technologies, to strengthen the role of women and their digital skills needed for the future.
- Strengthening the role of women throughout the value chain and eliminating harmful practices towards them.
- Meeting social or environmental needs and reaching new customer groups by leveraging the knowledge and experience of companies whose business strategy is strongly linked to achieving the fifth goal.

Businesses also perform a significant role in achieving goals related to access to water and sanitation and sustainable water resource management. They can take actions such as improving water efficiency in production processes, upgrading production processes, wastewater treatment and management, developing new products and services protecting water resources, replacing water-intensive processes and products, educating and encouraging employees to save water and educating consumers about water conservation. Through these actions, businesses contribute to ensuring universal and equitable access to safe drinking water, improving sanitation conditions, reducing water pollution, efficient water use across all sectors, protecting water-dependent ecosystems and strengthening cooperation for water resource management.

Goal 7 of sustainable development focuses on ensuring access to affordable, reliable, sustainable and modern energy for all people. To achieve this goal, businesses have several tasks to accomplish.

Firstly, they must ensure universal access to affordable, reliable and modern energy services by 2030. This means that energy companies should operate in

a way that makes energy available to all people, regardless of their socio-economic status.

Secondly, businesses should significantly increase the share of renewable energy sources in the global energy mix by 2030. This requires investing in the development and implementation of renewable energy technologies such as solar, wind, hydro and geothermal energy.

Thirdly, businesses should double the global rate of improvement in energy efficiency by 2030. This entails striving to minimise energy losses in operational processes and supply chains through the use of efficient technologies and innovative solutions.

Moreover, businesses should enhance international cooperation to facilitate access to clean energy research and renewable energy technologies, energy efficiency, as well as advanced and cleaner fossil fuel technologies. They should also invest in energy infrastructure and clean energy technologies.

Additionally, businesses should expand infrastructure and upgrade technologies that enable access to modern and sustainable energy services for all residents of developing countries, especially the least developed countries, small island developing states and landlocked countries, in line with their development plans.

To achieve these objectives, businesses should also invest in research and development related to sustainable energy services and local, energy-efficient infrastructure. These actions will help increase energy efficiency, reduce greenhouse gas emissions and reduce dependence on traditional energy sources.

The tasks to be accomplished under Goal 8 involve promoting stable, sustainable and inclusive economic growth and ensuring full and productive employment and decent work for all people. This can be achieved by increasing economic productivity, diversifying and upgrading technological capabilities, focusing on high-value-added sectors and promoting sustainable production and the creation of sustainable supply chains. Businesses can also support the development of micro, small and medium-sized enterprises, invest in mentoring for aspiring entrepreneurs, facilitate access to financial services, create fair workplaces and safe working environments, combat unfair employment practices and promote pay equality. Moreover, businesses can create opportunities for employment and skills development for young people and engage in the elimination of child labour and forced labour. All these actions contribute to achieving the goal of promoting stable, sustainable and inclusive economic growth and full and productive employment for all.

Goal 9 raises issues of sustainable development. It involves building resilient infrastructure, promoting sustainable industrialisation and fostering innovation. To achieve this, businesses should develop reliable, sustainable and resilient high-quality infrastructure that supports economic development and people's well-being. At the same time, they should strive to ensure equal access to affordable infrastructure for all people.

Businesses should also promote inclusive and sustainable industrialisation by increasing the industry's share in employment and GDP. Special attention should be given to the least developed countries, where the industrial sector's share should be doubled. It is also important to increase access to financial services and affordable credit for small and other businesses, as well as to integrate them into value chains and market participation. Businesses should also invest in research and development, support research and development centres and engage in innovation and stakeholder openness. Supporting micro, small and medium-sized enterprises, especially industrial ones, by integrating them into value chains and facilitating access to financing, is also essential for building stable infrastructure and promoting sustainable industrialisation.

Lastly, businesses should strive to increase access to information and communication technologies and ensure affordable and universal internet access. This will help increase technological levels and enhance innovation in various countries. In summary, businesses perform a crucial role in building stable infrastructure, promoting sustainable industrialisation and fostering innovation by developing infrastructure, engaging in research and development, investing in sustainable infrastructure, supporting small businesses and promoting innovation and technology access.

There is a goal of reduction of inequalities both within countries and between them. To achieve it, businesses should strive to increase the incomes of the poorest 40% of the population above the national average level and promote social, economic and political inclusivity for all people, regardless of differences such as age, gender, disability, race, ethnic origin, nationality, religion or economic status. Businesses should also work towards eliminating discriminatory laws, policies and practices and promote appropriate legislation to ensure equal opportunities and reduce existing inequalities. The implementation of fiscal policies, social protection and fair wages can contribute to greater equality. Businesses should also cooperate with financial institutions and markets to improve regulations, monitoring and enforcement, leading to a more sustainable and just financial system. Strengthening the representation of developing countries

in international economic and financial institutions is also important for building more effective and accountable institutions. Businesses can also contribute to reducing inequality by creating fair employment, eliminating unfair employment practices, combating discrimination, ensuring financial transparency and engaging with local communities and partnering with local organizations to empower local entrepreneurship.

Businesses perform a key role in making cities and human settlements safe, resilient, sustainable and inclusive. By providing innovative solutions in areas such as energy-efficient buildings, sustainable urban transport, road safety and waste management, businesses contribute to improving the living conditions of residents. It is also important to ensure safe and affordable housing and basic services, particularly for less affluent individuals. Businesses should engage in balanced urbanisation, invest in sustainable infrastructure and integrate their business strategies with urban policies for sustainable development. By collaborating with local communities, promoting social participation and taking care of environmental protection, businesses can support the creation of safe and friendly urban environments for all.

Goal 12 focuses on ensuring sustainable consumption and production patterns. Businesses should implement ten-year programs for sustainable consumption and production, with developed countries taking the lead in these efforts. It is also important for businesses to promote sustainable development practices by including relevant information in their periodic reports. Furthermore, they should work towards efficient use of natural resources, waste generation minimisation and sound and environmentally-friendly management of chemicals and waste. Implementing innovative business models, eco-designing products, measuring environmental and social footprints and stakeholder education are also important aspects of business actions to promote sustainable consumption and production. Businesses should engage in partnerships with local organizations, strengthen local entrepreneurship and contribute to the development of sustainable tourism that creates jobs and promotes local culture and products. All of these actions aim to reduce the negative impact of production and consumption on the environment and combat resource waste.

Goal 13 partly shifts the responsibility for actions on climate change and its impacts to businesses. Companies should primarily integrate climate change mitigation actions into their policies, strategies and plans. It is also important to invest in the development of new products and services that reduce greenhouse gas emissions, increase climate resilience and mitigate natural disasters.

Companies can improve energy efficiency, utilise renewable energy sources, invest in energy-efficient innovations and take care of forests while replacing wood products with more environmentally friendly alternatives. Furthermore, companies should strive for sustainable transportation and logistics, enhance resilience to climate risks and engage in broad cooperation to address climate change. Educating stakeholders and participating in actions to adapt cities to climate change are also essential aspects of corporate efforts in this regard. Companies have the opportunity to introduce innovative solutions, invest in renewable energy and energy efficiency technologies, and contribute to the global effort to limit climate change and minimise its adverse effects.

Businesses perform a significant role in protecting oceans, seas, marine resources, and their sustainable utilisation. Within this goal, companies should work towards preventing and reducing marine pollution, including waste and food waste discarded into the sea. Sustainable management and protection of marine and coastal ecosystems are important to avoid adverse effects and restore their health and productivity. Companies also have a task to minimise the impacts of ocean acidification through scientific collaboration and effective fisheries regulations, including eliminating overfishing, illegal fishing, and destructive fishing practices. Additionally, companies should engage in coastal and marine area protection, share scientific knowledge and develop research capacity to improve ocean conditions and enhance the impact of marine biodiversity on the development of developing countries. Supporting local fishermen, ensuring a sustainable supply chain and implementing international law for the protection and sustainable use of oceans are also crucial actions for businesses under this goal. Companies should design, manufacture, and deliver products with marine environmental protection in mind, using environmentally friendly materials and chemicals. Raising consumer awareness about marine protection and choosing sustainably sourced products are additional aspects that companies should consider.

These actions are also taken in the protection of terrestrial ecosystems and combating desertification, soil degradation and biodiversity loss. Through activities such as sustainable forest management, restoration of damaged areas, promoting fair benefit sharing from genetic resources and reducing the impact of invasive species, businesses contribute to environmental protection. It is also important to incorporate biodiversity and ecosystem issues into development plans and mobilise financial resources for their conservation. Companies should conduct assessments of their activities' impact on ecosystems, engage in the protection of endangered species, and invest in more sustainable practices,

such as reducing water consumption and developing environmentally friendly products and services. Through these actions, companies can contribute to the preservation of biodiversity, reduction of deforestation and land degradation and building a more sustainable future.

Businesses perform a crucial role in promoting peaceful and inclusive societies and building effective and responsible institutions at all levels. In the context of this goal, businesses are tasked with reducing violence in all forms and combating abuse, exploitation and human trafficking, especially against children. It is also important to promote the rule of law at the national and international levels and ensure equal access to justice for all. Businesses should engage in actions aimed at reducing illegal financial flows, arms trafficking and combating organised crime. Moreover, reducing corruption in all forms and developing effective, responsible and transparent institutions at all levels are important tasks. Businesses should also support flexible, inclusive and representative decision-making processes and expand the participation of developing countries in global institutions of international law. Providing legal identity and universal access to information are additional aspects that businesses should pay attention to. Businesses also have the task of strengthening national institutions through international cooperation and capacity-building in the areas of violence prevention, counterterrorism and crime, especially in developing countries. Compliance with legal regulations and international standards in the supply chain, elimination of forced labour and child labour, as well as promoting non-discrimination and sustainable development, are further aspects that businesses should consider in their actions.

Businesses perform a key role in achieving Goal 17, which is related to strengthening implementation mechanisms and revitalising the global partnership for sustainable development. By engaging in various activities such as responsible investments, knowledge and technology transfer, trade development and business-to-business (B2B) cooperation, businesses contribute to actions for developing countries. Businesses also support non-governmental organizations that provide assistance to developing countries and develop and strengthen public-private partnerships (PPPs) to achieve the Sustainable Development Goals. Cross-sector partnerships perform a crucial role, and businesses engage in global, cross-sectoral and industry initiatives aimed at promoting sustainable development. Businesses also support the development of statistical capacity in developing countries and the engagement of civil society in actions to achieve the Sustainable Development Goals.

In summary, businesses perform a significant role in implementing Goal 17 through their engagement in actions for developing countries, cross-sector initiatives, the development of public-private partnerships and support for civil society. Businesses act as important actors in the global partnership for sustainable development.

In conclusion, it can be observed that the 2030 Agenda shifts a significant portion of the tasks from the public sector to the private sector. This can be viewed, on the one hand, in terms of the lack of effectiveness of the public sector in achieving the above goals but, on the other hand, the private sector is largely responsible for the negative impact on the natural environment. Transferring some of the responsibilities to businesses strengthens the role of local communities, which ultimately bear the costs of achieving sustainable goals. However, it also provides an opportunity to control the actions of businesses in this regard. Already, the largest companies are required to disclose sustainability reports. Some other entities are also expanding the scope of such disclosures, perceiving these changes as an opportunity rather than a threat.

10.2. Sources of information on sustainable development

In these reports, the company should present its actions and achievements, value creation approach and its impact on the environment, employees and the community, as well as how the external environment affects its operations. Currently, there is a strong emphasis on the publication of non-financial information alongside financial information. These solutions stem from years of research, studies and legal regulations. Several stages of reporting evolution are distinguished in the literature. In the 1970s and 1980s, due to the growing role of human factors, human resource accounting and human capital reports emerged. This, in turn, served as a starting point for the development of a broader concept of the company's intellectual capital. Earlier, in the late 1950s and 1960s, the concept of corporate social responsibility was presented in the United States, which has influenced corporate communication with the environment from the 1970s to the present. Companies are increasingly preparing and publishing reports on social responsibility, using standards developed by the Global Reporting Initiative (GRI), the Sustainability Accounting Standards Board (SASB), Accountability (AA), the United Nations

Global Compact (UNGC), the Organisation for Economic Co-operation and Development (OECD) for multinational enterprises, the European Federation of Financial Analysts Societies (EFFAS) and the Reporting Standard for Non-Financial Information (SIN, 2023). As a result of changes in the environment in the 1990s and the emphasis on ecological issues in accounting, such as environmental protection and restoration, as well as corporate social responsibility (broadly understood as responsibility towards the local community, employees and society), there has been an evolution in the form of sustainable development reports. Separate reports, often attached to financial statements, partially met the information needs of stakeholders but were often incomplete and inconsistent (Fijałkowska et al., 2019).

According to The KPMG Survey of Sustainability Reporting (October 2022), which examined the sustainability reporting practices of the top 100 companies in 17 European Union countries, it was found that 68% of these companies voluntarily choose to report using the Global Reporting Initiative (GRI) framework. This highlights the popularity and widespread adoption of GRI as the preferred standard for sustainability reporting among European companies. The GRI framework provides a comprehensive and internationally recognised set of guidelines for organizations to report their economic, environmental, and social performance, enabling transparency and comparability in sustainability reporting practices.

When preparing a sustainable development report, according to the GRI Standards 2021, there is a requirement to adhere to eight reporting principles, compliance with which is extremely important for ensuring the quality of the presented information and the entire report. Here is a description of these principles:

1. Accuracy: The information presented in the report should be accurate, meaning it must be true and sufficiently detailed to allow for an assessment of the organization's impact.
2. Balance: The information should be balanced, meaning it should be presented in an unbiased manner and provide a fair description of both positive and negative impacts of the organization.
3. Transparency: The information should be presented in an accessible and understandable manner to ensure transparency of communication.
4. Comparability: The information should be comparable, which means it should be based on widely accepted measures and methodologies

for calculating indicators, enabling data comparison across different organizations and comparing data over time for the same organization.

5. Completeness: The information should be sufficient to assess the organization's impact during the reporting period and, therefore, it must be comprehensive and complete.
6. Sustainable development context: The information should reference recognised documents and guidelines related to sustainable development, such as greenhouse gas emission reduction targets in line with the Paris Agreement or ways in which diversity-promoting actions contribute to achieving Goal 5 – Gender Equality from the Sustainable Development Goals list.
7. Timeliness: The information should be provided in a timely manner to allow recipients to make decisions based on current data.
8. Verifiability: The information should be collected, recorded, compiled and analysed in a way that allows for qualitative verification.

Adhering to these principles ensures high-quality sustainability reporting and enables credible reporting on an organization's impact on social, environmental and governance aspects.

An alternative initiative, popular especially outside the European Union, is the concept of Integrated Reporting developed by the International Integrated Reporting Council (IIRC). It includes the combined presentation of financial, environmental and social results. An integrated report is defined as a concise communication that presents how an organization's strategy, management, performance and prospects, in the context of its external environment, contribute to the creation, preservation or erosion of value in the short, medium and long term (IIRC, 2021, Part 1, paragraph 1A, p. 10).

The objectives of integrated reporting are as follows:

- Improving the quality of information available to providers of financial capital to enable more efficient and productive capital allocation.
- Promoting a more consistent and efficient approach to corporate reporting that encompasses various reporting aspects and communicates the full range of factors relevant to an organization's ability to create value over time.

- Enhancing accountability and management of a broad range of capitals (financial, manufacturing, intellectual, human, social, relational and natural) and promoting understanding of their interdependencies.
- Supporting integrated thinking, decision-making processes, and actions focused on value creation in the short, medium and long term (IIRC, 2021, p. 10).

An integrated report consists of the following elements, which closely align with each other and are not mutually exclusive:

- The organization's business and external environment: presenting the scope of the organization's operations and the context in which it operates.
- Organization management: describing how those responsible for the organization support its ability to create value in the short, medium and long term.
- Business model: presenting the organization's business model.
- Risks and opportunities: identifying specific risks and opportunities that affect the organization's ability to create value in the short, medium, and long term and how the organization manages them.
- Strategy and resource allocation: defining the organization's objectives and how it intends to achieve them.
- Performance: assessing the extent to which the organization has achieved its strategic objectives within a specified period and how they have affected the capitals.
- Outlook: identifying challenges and uncertainties the organization may face in implementing its strategy and their potential implications for the business model and future performance.
- Basis of presentation: how the organization determines the matters included in the integrated report and how they are quantified or evaluated (IIRC, 2021, p. 8).

When preparing and presenting an integrated report, the following principles are essential for its usefulness and credibility:

- Strategic and future orientation: the report should reflect the organization's strategy and its relationship to value creation in the

short, medium and long term, as well as its utilisation and impact on the capitals.

- Connected information: the report should provide a holistic view of the connections and relationships between the factors influencing the organization's ability to create value over time.
- Stakeholder relationships: the report should consider the nature and quality of the organization's relationships with its key stakeholders and how the organization understands, considers and responds to their needs and interests.
- Materiality: the report should disclose information concerning matters material to the organization's ability to create value in the short, medium and long term.
- Conciseness: the report should be concise.
- Reliability and completeness: the report should include material matters, both positive and negative, in a balanced and materially accurate manner.
- Consistency and comparability: the presented information should be comparable over time, enabling comparison with other organizations on matters material to the organization's ability to create value over time (IIRC, 2021, p. 8).

In summary, a sustainable report developed in accordance with the presented principles and based on integrated thinking performs a crucial role in the effective allocation of capital, ensuring financial stability, and achieving sustainable development for an organization. However, as emphasised by K. Kobiela-Pionnier (2021), this report has a unique character.

10.3. Key efficiency indicators in a sustainable reporting practice

The CD Projekt Group is obligated to create sustainable reports based on the Accounting Act. According to Polish legal regulations (Accounting Act, Art. 49b) a sustainable report includes at least:

- Concise description of the entity's business model;
- Key non-financial efficiency indicators related to the entity's activities;
- Description of policies applied by the entity in relation to social, employee, environmental, human rights and anti-corruption issues, as well as a description of the results of implementing these policies;
- Description of due diligence procedures: including a description of applied policies or a description of significant risks related to the entity's activities that may have an adverse impact on sustainable development issues in the context of the entity's products or its relationship with the external environment.

The report focuses on managing environmental (E), social (S) and governance (G) issues in CD Projekt and the CD Projekt Group. Financial data information is presented in accordance with the requirements of the Accounting Act, and non-financial issues information is presented in accordance with the Global Reporting Initiative (GRI - 20162) international standard at the basic level, as well as through selected sector-specific indicators established by the Sustainability Accounting Standards Board (SASB).

The report is the first separate document dedicated to non-financial issues and describes how CD Projekt and the CD Projekt Group manage these issues. Information regarding the management of ESG issues in CD Projekt and the CD Projekt Group will be published annually along with the publication of the CD Projekt Group's annual report as a separate sustainability development report or as part of an integrated report.

The informative section of the report contains information about the CD Projekt Group. The group's actions and game portfolio are presented. The report also informs about the values that guide the company's operations. The ownership structure of CD Projekt, as well as the management and supervision of the company, is described. This section also discusses the group's business model and the growth strategy of the CD Projekt Group.

Mission of CD Projekt is to create revolutionary story-driven RPGs, which go straight to the hearts of gamers from around the world. Secondly, to be counted among the world's top three video game developer. Thirdly, to ensure a lasting place for their brands in the global popular culture.

Core values are quality as top priority, passionate team as greatest strength, tolerance, fairness and openness, independence and gamer-centric approach.

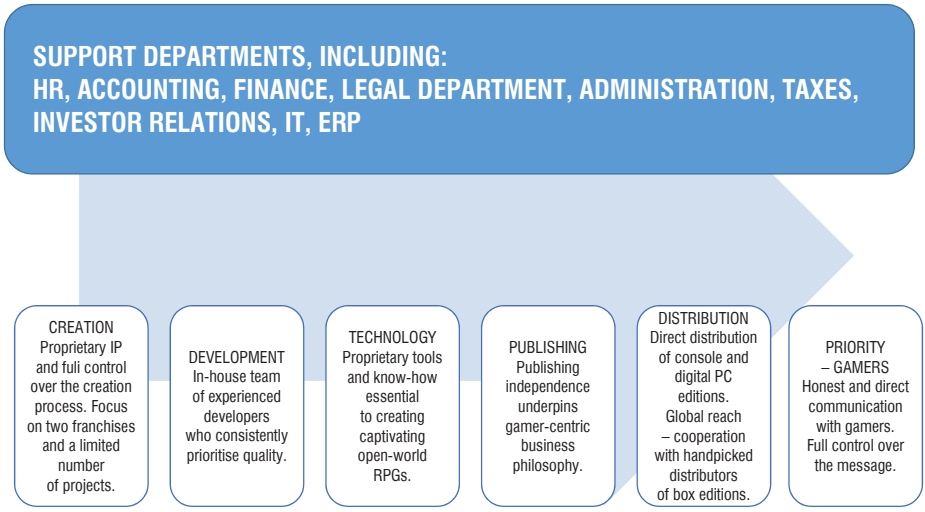
Analysing the strategic priorities and core values in the context of the Sustainable Development Goals (SDGs) CD Projekt's core values of tolerance, fairness and openness align with Goal 5 (Achieve gender equality and empower all women and girls). They can contribute to this goal by promoting gender equality within their company and the gaming industry. This can be achieved by ensuring equal opportunities for women and girls, addressing any forms of discrimination and fostering an inclusive and diverse work environment. CD Projekt can also promote positive representation of women in their games and empower women and girls through their gaming experiences.

CD Projekt's mission of creating revolutionary RPGs and being among the top video game developers can also indirectly contribute to reducing inequalities. By providing equal access to their games for people from different backgrounds and countries, CD Projekt can bridge the gap in entertainment opportunities. Additionally, CD Projekt can promote inclusivity and diversity within their games and actively support initiatives that aim to reduce inequalities in society. They can also consider ethical business practices that promote fairness in the gaming industry, such as fair wages and responsible supply chains.

The business model is presented in a manner consistent with the value chain model developed by M.E. Porter. This model serves as a comprehensive tool for analysing and managing organizational activities. It depicts the organization as a systematic sequence of actions aimed at delivering the end product to the final user, considering both primary and support functions. By identifying cost sources, profits and potential competitive advantages, this model enables organizations to better understand and optimise their value added.

The core activity, consisting of pre-production, production and sales functions, is divided into specific sub-functions that encompass various stages of the activity process. On the other hand, support activity focuses on enterprise management processes at both strategic and functional levels. Enhancing the efficiency of the value chain is crucial for achieving competitive advantage, and Porter's model suggests methods such as optimising individual functions, improving internal and external coordination, and establishing more efficient links with suppliers, customers and other chain participants. Figure 10.1 presents the CD Projekt business model in a manner consistent with M.E. Porter's version.

Figure 10.1. CD Projekt business model in a form consistent with M.E. Porter's version



Source: own calculations based on CD Projekt's consolidated financial statements for 2018-2021.

Analysing the business model, it can be noticed that the group did not present in it units directly involved in sustainable development in the context of the environment or the local community. The unit that can pursue sustainable development goals is undoubtedly the human resources department. This provides some information about the actions taken by the CD Projekt capital group. Activities in the environmental and social goals are not pursued separately but are part of the strategy implemented in various departments, for example, in the human resources area. Another area in which the group can pursue sustainable development goals is the gamers' priority department. They serve as a communication bridge between the capital group and their product recipients – gamers. Through this communication, the group directly engages with key stakeholders and seeks to respond promptly to emerging challenges. This mode of stakeholder communication is a model example in light of research on their needs (Bebbington, Brown, Frame, and Thomson, 2007; Brown and Dillard, 2014). Stakeholders not only expect information but also direct communication and influence over the conducted activities, even if it is not significant (Crovini, Schaper, and Simoni, 2022). Such a communication tool can also serve as a channel for promoting transformative actions and social changes (Bebbington et al., 2007; Dillard and Brown, 2012).

Table 10.1. Selected KPIs illustrating key issues* of sustainable development

Selected non-financial KPI's	Structure			Dynamics		
	2021	2020	2019	2021/2020	2020/2019	2021/2019
People employed in the Group	1196	1177	1080	1.61%	8.98%	10.74%
Percentage of developers in the total number of people employed in the Group	64%	62%	64%	3.19%	-2.50%	0.61%
Percentage of women in the total number of people employed in the Group	29%	27%	26%	7.41%	3.85%	11.54%
Nationalities represented in the Group	43	45	44	-4.44%	2.27%	-2.27%
Average age of the people employed in the Group	32	32	31	0.00%	3.23%	3.23%
T CO2e/employee carbon footprint in scope 1.27 per employee	1.39	-	-			
T CO2e/m^2 carbon footprint in scope 1 and 27.8 per m^2 of occupied space	0.12	-	-			

* According to the CD Projekt Group Sustainable Report for 2021
Source: own calculations based on CD Projekt's consolidated financial statements for 2018-2021.

Employment in the CD Projekt capital group originally amounted to 1080 people in 2019. Over the course of two years, employment increased by almost 11%. The highest growth can be observed between 2019 and 2020 when employment increased by 9%. Between 2021 and 2020, employment increased by 1.61%. It can be said, therefore, that the number of employees is growing, and the capital group takes care of their well-being. Among the employed, approximately 64% are programmers who are engaged in game development, while the remaining 36% are administrative staff and employees associated with other areas of business operations.

Diversity is a strategic priority for the group. This aligns with Sustainable Development Goal 5 in the area of gender equality. Initially, in 2019, 26% of employees of the capital group were women. The proportion of women among all employees significantly increased during the analysed period. Ultimately, in 2021, women accounted for 29% of all employees.

The group also understands diversity in an international aspect. It seeks to reduce differences between countries by hiring employees of various nationalities. CD Projekt's employees come from approximately 43-45 countries. There are slight differences between the years. This supports the achievement of Goal 10.

Exclusion of older people poses a problem for the group. The average age of the group's employees was 32 years in 2021 and 2020, while in 2019, the average age of employees in the capital group was 31 years. Such a young age of employees is primarily related to the profile of the business conducted. The capital group is engaged in the production of computer games and

entertainment in a broad sense. Young people constitute the main customer group. An additional problematic element may be technological exclusion experienced by the older generation. Technological changes within the group occur very quickly. The pace of change in the average age of employees is very slow, but it is heading in the right direction.

Another direction of analysis can be carbon dioxide emissions. The group has set goals for CO2 emissions per employee and per office space. That data has been disclosed starting from 2021. In previous years, the sustainability report was part of the management report on the company's operations. It can be inferred that apart from aspects related to people, the group takes actions to minimise the impact of its activities on the natural environment. The implementation of sustainable development goals is, therefore, expanded to include actions to combat climate change and reduce its effects (Goal 13). It can be expected that in the future, this information will be published and thus be subject to further analysis.

Chapter 11

Visual financial analysis using Power BI A case study

11.1. Aesculap Chifa

Aesculap Chifa, existing for nearly 80 years, is a leading medical tools manufacturer on the Polish market. It specialises in delivering high-quality specialised tools, sets for vascular therapy and other medical products for various medical fields. The product range also includes medical equipment, infusion pumps, laparoscopic probes, sutures, container systems and disinfection products. Aesculap Chifa operates in Nowy Tomyśl and Radzyń Podlaski, employing over 2000 workers. They contribute to the company's mission by raising health standards. The company is part of the international B. Braun Melsungen AG group, which operates globally in over 40 countries with more than 66 thousand employees. Quality certification of products is evidence of Aesculap Chifa's commitment to delivering medical products that meet the highest standards of quality, performance and reliability, ensuring patient safety.

11.2. Changes associated with Power BI implementation

Analysis using the Power BI tool constitutes an advanced Business Intelligence process. This software allows real-time collection, integration and visualisation of data from various sources. It creates dynamic and interactive reports and charts, enabling users to analyse data in a more visual and accessible manner. Through this technology, the company gains the ability to make decisions based on detailed information.

Despite the use of modern tools such as Power BI, classical methods still perform a crucial role in financial analysis. Knowledge of traditional financial analysis methods and tools is essential for both organizational managers and financial analysts. Financial analysis allows for a deeper understanding of an entity and its financial condition. It helps identify strengths and weaknesses in operations, assess achieved results considering profitability and efficiency and forecast future achievements.

Classical financial analysis tools enable in-depth monitoring of financial results, assets and sources of funding. This allows answering key questions such as whether the company is generating profits or losses, and whether it has sufficient financial resources to conduct its activities. Through financial analysis and controlling, it is also possible to identify areas where the company has a competitive advantage, such as products with high margins, as well as areas needing improvement, such as reducing excessively high costs. This, in turn, allows focusing efforts on enhancing strengths and addressing weaknesses, which is crucial for a company's success.

The introduction of the Power BI tool for data analysis in the company resulted in a profound and positive impact on information processing and report generation. Prior to this step, the company relied on traditional analysis methods that were time-consuming and had certain limitations. However, since the adoption of Power BI, the data analysis process has been completely transformed. Previously, data analysis involved using spreadsheets, databases and specialised accounting and reporting software. This process required many manual calculations, filtering, sorting and data merging, introducing certain limitations. Generated reports were often static and challenging to update in real time. When creating more complex analyses, reliance on dedicated controllers was often necessary, further complicating the process.

The introduction of Power BI broke through these limitations, making data analysis much more advanced. With this tool, it became possible to combine data from different sources for current analyses, significantly enhancing the precision and credibility of analyses. Table 11.1 presents a comparison of changes in analytical processes before and after the introduction of Power BI in the company.

Previously, the company faced challenges accessing data, which was scattered across different systems and formats. Analyses were conducted periodically, such as once a month, leading to less up-to-date information. The analysis process was semi-automated but time-consuming, and generated reports were not always easy and straightforward to interpret.

Table 11.1. Comparison of changes in analytical processes before and after the introduction of Power BI in the company

Criterion	Before	Now
Data Source	Data was harder to access, dispersed in different systems and formats.	Easy collection and integration of data from various sources, enabling real-time analysis.
Analysis Period	Analyses were periodic, done e.g. once a month, resulting in outdated data.	Analyses are available in real-time, allowing users to track events day-to-day and make quick decisions.
Method of Analysis	Semi-automated process, long report generation times.	Fast, interactive data analysis, dynamic and engaging visualisations.
Scope of Analysis	Analysis was done in a limited scope, considering a restricted number of criteria.	The multidimensionality of analysis allows for examining data from various perspectives.
Precision and Measurement Efficiency	Prior to computerization, the financial analysis process was time-consuming and inconsistent. Lack of a unified data source and tools led to differences in interpretations and complications in inter-departmental communication.	The utilisation of modern IT tools made financial analysis more precise, as it is based on the same financial data model.
Information Noise	There have been instances of duplication of information/reports.	Cases of duplication of information/reports have been eliminated and thus information noise and information inconsistencies have been eliminated.

Source: own.

After the introduction of the Power BI tool, the situation changed. Now, data is easily accessible, collected from various sources, and analyses are available day-to-day. This enables users to track events in real-time and make quick decisions. The analysis process became more efficient and precise.

In the past, data was analysed within a limited scope, hindering a comprehensive understanding of the company's situation. Currently, multidimensional analysis allows for examining data from different perspectives, leading to a better comprehension and more informed decision making. Moreover, the implementation of Power BI has made financial analysis rely on a unified data source, eliminating errors and facilitating communication between departments.

11.3. Power BI as an enterprise information system

By skilfully integrating information from diverse systems, analysts create a bilateral ring capable of not only shaping a coherent enterprise information system but also constructing a financial-economic model illustrating its

economic structure. Power BI as an enterprise information system performs a crucial role here, illustrating the organization's operational methods. By transforming information into a valuable strategic asset, this tool can influence strategic goal achievement and effective task execution.

As a central source of reliable data, the Power BI information system serves as a space from which analysts, management and other involved organizational structures draw. It is a significant integrating factor that allows for a coherent perception of information and its utilisation for decision making. Ensuring data unity and completeness seems pivotal for effective analysis, where precision and reliability are paramount. Analysts, guided by professionalism, responsibly transform data, creating networks of diverse information sources to ultimately reveal a complete and transparent organizational depiction. It is worth noting that the key to obtaining a comprehensive picture of the company's functioning lies precisely in this skilful data amalgamation operation.

The information system is a living organism that requires constant updates to not only present consistent and comprehensive information but also to adapt to constantly evolving user needs. This adaptation serves a dual function: firstly, it guarantees that information presented is consistent and complete, and secondly, it tailors content to specific situations and user expectations. Thus, the use of innovative systems like Power BI aligns with this dynamic necessity of direct adaptation to the information environment. By avoiding the need for detailed optimisation of information resources, these modern solutions introduce a new dimension to data management. The past focused on accumulating vast amounts of data, but only key information for achieving strategic goals or operational tasks underwent an analysis.

The modern era, propelled by IT solutions like Power BI, transforms this traditional practice. Presently, the ability to analyse massive amounts of data appears as liberation from the constraint of selecting only the information that seems crucial. Nonetheless, the reporting process remains unchanged: the structure of reports still reflects key information that forms the basis for management decisions.

This does not mean that the system lacks more detailed data. It functions in parallel, but its handling is directly managed by the controlling department. This way, the Power BI system enables flexible and versatile information utilisation while maintaining a clear hierarchy of data and its presentation, which is immensely valuable for decision making.

Currently, the controlling department's main priority is not only financial analysis but also the active adaptation of the information system to evolving needs and adjustments to changes in the business and technological environment. In today's dynamic reality, where new challenges arise continually, a strategic approach based on well-thought-out information strategy becomes a crucial tool. This approach enables flexible responses to changes by adapting to new conditions, technologies and market expectations.

It is worth emphasising that an information system based on tools like Power BI contributes to actively shaping and efficiently using information. The strategic approach opens space for purposeful creation, collection and utilisation of information serving specific goals. Utilising already possessed information as well as actively participating in its creation allows for building a valuable knowledge resource.

By saving time and effort on searching for and interpreting data, a system based on Power BI becomes a primary source of information for all responsibility centres within the company. This source consistency enables decision makers to use the same accurate information, leading to consistent and balanced decisions. Effectively managed information, as it turns out, has a significant impact on the quality of decision-making processes, creating a solid foundation for organizational action.

As a result, Power BI as an enterprise information system allows for:

- Adaptation to Changes: The business and technological environment is subject to continuous changes. Information strategy and systems like Power BI enable flexible adaptation to new conditions, technologies and market demands.
- Creation and Utilisation of Information: The strategic approach is based on purposeful creation, collection and utilisation of information. Systems like Power BI allow analysis of massive amounts of data without the need to select only the most relevant ones, thus creating a valuable knowledge resource.
- Ensuring Data Consistency and Completeness: The Power BI-based information system contributes to a consistent information source for all responsibility centres within the organization. This ensures data consistency and completeness, leading to more balanced and accurate decisions.

Managing information in the context of modern tools like Power BI becomes a key element of effective organizational functioning. It enables adaptation to changes, efficient creation and utilisation of information, and provides a solid foundation for coherent and accurate decision making.

11.4. Power BI as a financial and economic model for the company

The Power BI system is suitable for comprehensive modelling of a company's finances. Unlike traditional approaches, it is not a tool for creating financial forecasts. A financial model is a versatile tool that generates advanced financial forecasts for a company. It is a crucial component in budgeting, annual planning, long-term strategies, and an integral part of business plans and feasibility analyses.

In the context of a company, the Power BI system's role is not to create financial forecasts. Traditional methods of budgeting and financial forecasting are still used to create plans and budgets. However, Power BI combines economic and financial data and presents financial plans. This directs decision makers' attention to financial plans and reveals the connections between economic and financial variables. This allows managers to better understand the impact of decisions on financial results. Power BI introduces flexibility into the financial modelling process, enabling a more focused analysis of current deviations and quicker responses to deviations monitored in real-time, rather than periodically as before. Furthermore, Power BI allows identifying the causes of events, not just analysing the effects, enabling effective corrective actions. This eliminates previous delays, leading to immediate responses to economic events and their causes.

With this tool at hand, managers have the ability to discuss the feasibility of the adopted plan. During the budgeting process, they can provide feedback, doubts and suggestions for modifying the assumed plan, as they are responsible for achieving the results. By serving as an information system and financial-economic model, Power BI enables assessing progress in plan execution and its suitability in the context of the company's operational conditions.

As a financial modeling tool, Power BI creates conditions for a more inclusive process of creating financial plans. Even if budget assumptions

are not always generated by managers, they ultimately accept and implement budgets. Thanks to the role of the information system, Power BI provides essential data needed for substantive and reliable discussions on individual budgets. This significantly limits the possibility of "budget games" conducted by various responsibility centres, making the whole process more transparent. Access to common information allows detecting cases of budget overestimation. If the financial services do not notice it, managers themselves have the ability to take steps in this direction.

The Power BI system also opens new perspectives for analysing emerging deviations. Summarising the financial results of a given period is no longer based on delayed analyses. Thanks to a single data source, they are available much earlier before such meetings, allowing thorough preparation for discussions on the achieved results. By focusing not only on deviations and their sources but also on possible future actions and drawing lessons, Power BI directs attention to analysing the impact of the achieved results on future plans.

As a result, Power BI contributes to a more flexible approach to budgeting. Cases of adjusting financial plans after their approval due to unexpected economic events become more frequent. Moreover, in a dynamically changing environment, it is possible to more accurately align actions with the adopted plan, helping to maintain balance in an unstable environment.

11.5. Changing the financial analysis process

With Business Intelligence tools like Power BI, both controllers and analysts, as well as managers (and even employees), have access to detailed data. However, the nature of their respective actions has changed.

Previously, analysts-controllers' key tasks were to compile analysis results and present conclusions. Now, the primary task of an analyst is not an analysis. They oversee the Power BI system, where data from various sources is integrated and its functionality is developed. They also ensure its proper functioning. Of course, they still perform current financial analyses, but these actions are no longer in the foreground. Analysts now possess technical knowledge and skills to create advanced reports. The reporting process itself is largely automated, while drawing conclusions has been delegated to managers. The scope of analyst's professional duties has significantly evolved.

Currently, the greatest emphasis is on skilfully selecting data for analysis, choosing selection criteria and evaluations, selecting adopted measures or reference bases, as this contributes to the reports.

By structuring the report, the analyst suggests to the manager what to associate with what, what is worth analysing and what data to use. However, the manager independently poses questions and hypotheses, to which they often seek answers themselves in the available data. They later draw conclusions and implement recommendations.

11.6. Changes in analyst's competencies

Changes in analysts' competencies are linked to increasing requirements for technological proficiency in Power BI and the need to adapt to a dynamic business environment. The introduction of new tools has influenced the evolution of competencies among those involved in financial analysis.

Firstly, there are significantly higher requirements for advanced use of Power BI-related solutions. The introduction of data analysis tools means that analysts must possess a more advanced technical knowledge. They must understand how to use these tools, create complex financial models, and utilise visualisation features. These are primarily IT skills. On the one hand, companies train controlling department employees in the use of Power BI; on the other hand, during recruitment, emphasis is placed on candidates who already possess such skills. Competency development relies on controlling operations and human resources, primarily within this department.

Additional competencies are related to design. Analysts, as authors of reports, should possess advanced knowledge on creating readable and useful managerial dashboards.

Furthermore, competencies related to knowledge have also increased. More detailed data, not limited to financial aspects but also involving economic phenomena and processes, is subject to analysis. Understanding and interpreting this data require more detailed knowledge in related fields. Analysts are expected to be flexible and adapt to various requirements of economic analysis depending on current needs. This also supports business understanding. Analysts need to delve even deeper into understanding business mechanisms to precisely analyse data in the organizational context.

Access to a shared information system has also significantly increased interpersonal competencies in the controlling department. Despite the development of technological tools that seemingly do not require direct contact with people, interpersonal skills remain important. Analysts, as before, must be able to convey analysis results and recommendations to managers and other stakeholders in an understandable manner. Financial information is not fully comprehensible to everyone. The role of an analyst also involves training and advising, which requires additional interpersonal and pedagogical competencies.

Further competencies also have a soft nature. Currently, analysts are expected to quickly adapt to changing conditions. In an environment where data analysis is more dynamic, analysts must be capable of quickly responding to changing requirements and situations. This might involve greater stress resilience, the ability to act under pressure and a broad perspective stemming from deep knowledge and business familiarity.

11.7. Changes in manager's competencies

As the competencies of analysts evolve, the skills of managers also transform. In the current reality, a significant share of analysis is shifting onto the shoulders of managers, who must demonstrate capabilities in several key areas.

Contemporary managers must master the skill of effective interpretation of data presented in data analysis tools. This entails the ability to decipher various indicators and trends, extracting accurate conclusions from them that will serve as the basis for more effective decision-making processes. Moreover, rather than relying solely on prepared reports, managers must become more engaged in independently utilising data analysis tools, which requires the skill of selecting appropriate filters, parameters and analysis models.

Managers must also recognise the connection between analysis results and the business goals of the company. It is crucial to effectively shape strategies and action plans, utilising analysis insights as a foundation for specific forward steps. In this context, competencies in effectively conveying analysis results become essential, enabling managers to communicate vital information to both their teams and other stakeholders of the organization.

This requires additional skills in the following areas:

- Skill in data interpretation. Managers must now be capable of analysing and interpreting data presented in analysis tools. They must be able to understand various indicators and trends and draw conclusions from them, allowing for better decision making.
- Active role in analysis. Instead of relying solely on reports prepared by analysts, managers must be more engaged in independent use of data analysis tools. They need to be able to select appropriate filters, parameters and models for analysis.
- Skill in setting analysis goals. Managers should be able to define specific goals for data analysis. This enables focus on crucial areas and obtaining specific answers to business questions.
- Understanding technology. Managers do not need to be technology specialists, but they should have sufficient understanding of data analysis tools to effectively use them and know what questions can be asked using them.
- Data-driven decisions. The introduction of data analysis enables more fact-based decision making. Managers need to be ready to rely on available information and analyses, instead of relying solely on intuition.
- Focus on business goals. Managers should be able to link analysis results to the business goals of the organization. This means they need to know which indicators are crucial for achieving the company's strategic objectives.
- Skill in conveying analysis results. Managers must be effective in communicating analysis results to both their teams and other stakeholders. They need to know how to present essential information in an accessible way.
- Building strategies based on analysis. Managers need to be capable of using analysis results to build strategies and action plans. They require the skill of transforming analysis insights into concrete steps.

In the modern business environment, managers are gradually taking on the role of analysts, entering the realm of data analysis, which signifies a significant change in their traditional responsibilities. Consequently, their tasks evolve from management to active participation in decoding complex sets of information, leading to a deeper view of analysis as a tool shaping decision-making processes.

As managers penetrate the realm of analysis, their role becomes more demanding and multifaceted. By demonstrating data analysis skills, they are now capable of deciphering intricate patterns and hidden trends, which transforms into a crucial tool enabling more accurate forecasts and better decision making. This dynamic shift in competencies places them in an interactive sphere, where they become not only recipients of reports but active participants in the knowledge creation process, adapting analyses to the organization's current needs.

The new era of manager competencies reflects the gradual transformation of their role in the information society. As data becomes the leading capital in today's business landscape, managers, as "analysts," gain significance. Their ability involves not only interpretation but active participation in analyses, which is crucial for generating value from information. This change contributes to better alignment across departments, reinforcing the strategic vision and fact- and data-based decision-making approach.

11.8. Learning process

As competencies develop, managers and analysts become leaders of organizational learning. The rapid pace of change and growing competition require managers to be open to experiments, adaptable to new challenges and focused on continuous improvement. Through skilful utilisation of data analysis and a commitment to creating a learning organization, managers can steer the organization towards long-term success in a dynamic environment.

A learning organization is a system that constantly expands opportunities for achieving goals by developing employee skills and creating new thought patterns. This concept reflects a shift from static planning to dynamic adaptation to changes in the environment. Learning organizations, inspired by works such as Peter Senge's "The Fifth Discipline," cultivate the ability for shared thinking, personal mastery and crafting a shared vision of the future. Equally crucial is creating favourable conditions for employee development and constructing structures that support knowledge management.

Different levels of organizational learning encompass individual, team and overall organizational aspects. Developing individual competencies, forming effective teams, analysing and refining processes are just parts of the organizational learning process. Achieving the status of a learning organization requires strong leadership engagement, openness to experimentation, learning from mistakes and developing an infrastructure that supports knowledge management. Analysing the role of the Power BI environment, one can deduce that it serves as the foundation for such a process.

In today's dynamic business environment, where information is a valuable asset, supporting an effective information strategy is essential for organizations. One of the effects of this process is the cultivation of an information culture that becomes the cornerstone of efficient knowledge management and communication within the enterprise.

The Power BI environment contributes to enhancing information quality throughout the organization. Information quality is a crucial element in building trust both internally among employees and externally in relationships with customers, business partners and stakeholders. An organization that emphasises information quality builds its credibility and is perceived as a reliable partner.

Fostering an information culture through an information strategy also supports the ability to effectively share knowledge among employees. An open and regular flow of information creates conditions for collaboration and innovation. Employees who feel free to share their knowledge and experience can contribute more effectively to the company's development and better cope with challenges posed by changing market conditions.

Furthermore, Power BI promotes effective utilisation of available tools and sources of information. Modern organizations have a vast technological potential that can be harnessed for data collection, processing and sharing. By designing a suitable system, an organization can provide its employees with access to the right tools and knowledge bases, which translates into work efficiency and the effectiveness of decision making.

This information culture becomes the foundation for innovation, efficiency and competitiveness in organizations within today's information-driven business environment.

11.9. Examples of Power BI application in the sales domain

A key area of analysis involves examining product sales and the margins on their sales. Sales analysis provides essential insights into trends and patterns, which are crucial for decision-making processes related to production, orders, procurement, marketing and other operational activities. Through this analysis, precise demand planning for products and services in the future becomes possible, helping to avoid excessive inventory or shortages and better align with customer expectations. In-depth analysis of sales data enables an understanding of customer preferences and purchasing behaviour, vital for effectively meeting their needs and devising relevant marketing strategies. This enables the allocation of resources to the most effective actions.

Sales analysis is closely linked to analysing the profitability of products. Sales margins reflect the profitability level of the company, and analysing these margins provides a clear understanding of the profit generated at various stages of the sales process. When margins are too low, there is a risk that production might become unprofitable as costs exceed revenues. Understanding margins allows for prudent and effective shaping and development of the product and service offerings.

Margin analysis also affects the control of production costs for individual products by identifying areas where costs are disproportionately high. This enables taking optimisation measures to adjust the costs to the economic outcomes resulting from sales.

Sales and margin analysis also serves as the foundation for pricing strategies. This strategy not only defines profitability requirements, informing about the minimum price that will allow achieving the expected profit, but also considers customer financial capabilities. The pricing strategy is thus a subtle compromise between what the customer is willing to pay for a product and what the company needs to achieve to sustain operations and develop the range of controlled products.

Sales and margin data analysis allows for comprehensive data analysis. Users can analyse sales based on different criteria, such as sales channels, regions or sales representatives, in the context of margins and profitability.

Sales analysis enables real-time monitoring of salespeople's achievements and representatives. This identification process helps pinpoint positive trends as well as areas that need improvement.

Power BI allows for customer segmentation based on data analysis. This enables the company to tailor its marketing and sales actions to the needs and preferences of different customer groups.

Analysis reveals sales trends, such as seasonal changes or customer preferences, allowing for adjustment of sales strategies to changing market conditions.

Sales and margin analysis performs a crucial role in other areas of business activity as well. With Power BI, collaboration across different departments of the company, such as sales, finance or marketing, is possible, greatly strengthening the activities of these units. With access to shared, integrated data, the company can take more consistent and coordinated actions, resulting in multi-faceted operational efficiency.

Data analysis of sales and margins is essential for building an effective product strategy. Information about achievements and financial results provides a solid basis for making key strategic decisions. This allows the company to adjust to changing market conditions and maximise benefits from potential opportunities.

Power BI-based analysis allows for rapid response to dynamically changing market conditions. Access to current data enables swift decisions to minimise the risk of losses and potential benefits. This especially applies to the effectiveness of sales activities. Sales data analysis is an indispensable tool for evaluating the effectiveness of sales initiatives. It enables monitoring which initiatives yield the best results, focusing efforts on those areas and striving for even better outcomes.

Utilising tools like Power BI facilitates clear and transparent data presentation. This, in turn, aids understanding and interpretation of data by employees at various organizational levels, which is crucial for making accurate data-driven decisions.

11.10. Examples of Power BI application in inventory management

Contemporary enterprises, evolving markets and increasing competition call into question traditional resource management strategies. In the context of this dynamic environment, optimal inventory management proves to be an

extremely significant factor. Effective inventory management has wide-ranging implications for a company. Primarily, it is a key element affecting the company's financial liquidity. Control over the quantity and structure of inventory can significantly impact the company's ability to manage its monetary resources effectively. Inventory data analysis is conducted with numerous search criteria in mind. The multidimensionality of data, such as quantity, value, product type or availability, allows for a more comprehensive analysis.

Furthermore, utilising appropriate filters enhances data granularity.

Inventory analysis facilitates monitoring trends in product demand and seasonal changes, enabling proper adjustment of inventory levels to changing market conditions and more accurate forecasting of product demand.

Inventory analysis allows for assessing the profitability of individual products. This enables the company to focus on products generating higher profits.

Using analytical tools provides flexibility in conducting various inventory analyses. The ability to quickly switch between different parameters facilitates identifying potential issues.

Efficiency indicators, such as inventory turnover or stock service level, are still used. These indicators help assess the effectiveness of inventory management actions, but in the Power BI environment, their analysis looks slightly different.

These examples showcase how Power BI can be effectively utilised in analysing sales and inventory management, providing insights that aid in making informed decisions, enhancing operational efficiency and responding swiftly to dynamic market conditions.

Conclusions

Analyzing how the implementation of BI solutions changes the organization, analysts primarily appreciated the quality of data and quick access to it. They also agreed that such data can enhance the decision-making process, as decisions are based on detailed information. However, it's crucial to note that the quality of decision-making also depends on various factors. This essentially confirms the findings in the existing literature, where issues like quick access to information (Maditinos, Chatzoudes & Tsairidis, 2011, p. 61) and increased data detail and accuracy (Otto & Schlager-Weidinger, 2014) have also been highlighted. Nevertheless, the key focus is not solely on the quality of the decision-making process. Improvements in this regard are dependent on multiple factors, and observed changes may not always be of a fundamental nature.

Furthermore, analysts noted an intensification of analytical processes. The analysis process has become faster, and the results are readily available. Additionally, analysts observed that these analyses are more multidimensional and require interaction between analysts and managers, making them less prone to errors and misunderstandings as they all rely on the same data source. From an employee's perspective, this certainly contributes to the improvement and reorganization of communication within the organization (Umble & Umble, 2002; Nah, Zuckweller, Lau, 2003; Sumner, 1999; Singla, 2008). Additionally, it can lead to a congenial, collaborative, knowledge-sharing culture, and self-motivation (Mathrani, Mathrani & Viehland, 2013). Improved communication also facilitates the improvement of coordination between functional departments (Wagner, Newell & Piccoli, 2010). Therefore, the interviews helped identify the sources of effects described in the literature.

From a manager's perspective, BI solutions enhance organizational regulatory compliance (Singla, 2008). This is possible due to the elimination of information noise. Different reports and various positions can no longer explain failures; instead, they become sources of improvements.

Cost reduction is also a common change and effect of implementing BI solutions. Research has confirmed that the intensification of such solutions

primarily focuses on key areas of the business. These areas align with the results of existing literature and largely involve sales and inventory management (Shang and Seddon, 2000). However, the motivation for implementing BI solutions in these areas is not solely cost optimization but rather emphasizes the development of control functions, resulting in cost optimization.

Answering the question of how BI can be considered an information system, it should be noted that it serves as a central source of reliable data. This centralization occurs because it enables the consolidation of information from multiple information systems (Otto & Schlager-Weidinger, 2014). However, unlike standard solutions that reflect "best practice patterns" (Gosain, 2004), analysts emphasize the flexibility of the system, which is tailored to users' changing needs. Analysts also highlight the importance of constant updates for the system to function as a central information system.

Regarding how BI can be considered an economic model of an entity, it should be emphasized that Power BI combines economic and financial data and presents financial plans. This directs decision-makers' attention to financial plans and reveals the connections between economic and financial variables, presenting a holistic view of the company (Ifinedo and Nahar, 2006, p. 1554).

The description of the financial and economic analysis process proposed in the first chapter has proven to be accurate. With the introduction of Business Intelligence (BI) tools like Power BI, controllers, analysts, managers, and even employees have gained access to comprehensive data. However, this transformation has brought about a shift in their roles and responsibilities.

In the past, analysts and controllers primarily focused on compiling analysis results and presenting their findings. Today, their roles extend far beyond traditional analysis. They are now responsible for overseeing the BI system, integrating data from various sources, and maintaining its functionality. While they still conduct financial analyses, these tasks are no longer at the forefront. Analysts now possess the technical expertise to create advanced reports, and much of the reporting process has become automated. The responsibility of drawing conclusions has been passed on to managers. This transformation has significantly broadened the scope of an analyst's professional duties. Their focus now lies in skillfully selecting data for analysis, determining selection criteria and evaluations, and choosing appropriate measures or reference points, all of which contribute to the creation of insightful reports.

Analysts guide managers in structuring reports and connecting various pieces of information. Managers independently formulate questions and hypotheses, often seeking answers within the available data themselves. They

subsequently draw conclusions and implement recommended actions. This collaborative approach leverages the capabilities of both analysts and managers to make informed decisions based on the wealth of data at their disposal.

Expanding the competencies of analysts is essential, including knowledge and skills in data technology (Mathrani, Mathrani & Viehland, 2013, Lukman et al., 2011). Analysts have also noted an increase in knowledge about their own business (Otto & Schlager-Weidinger, 2014). Social competencies have also gained importance in shaping organizational culture, as mentioned in the literature (Mathrani, Mathrani & Viehland, 2013). However, social competencies in this context have not been widely recognized in the research or literature, and this topic requires further exploration.

Answering how the digitization process leads to the improvement of the organizational learning process is not straightforward. BI systems can serve as a form of codified organizational memory. Organizational memory refers to a repository of knowledge for future use (Walsh and Ungson, 1991). It is also referred to as corporate knowledge or corporate genetics (Prahalad and Hamel, 1994). However, such systems are imperfect as they typically contain hard economic data or information. Qualitative information requires additional development in such a system. According to this knowledge management model, the primary challenge for organizations is making sense of the collected information. This process involves interpreting gathered information (dialogue, critical reflection, verification, taking action, organizational forgetting) and analyzing it (deduction, problem-solving, extrapolation from past events, supporting decision-making, and formulating strategies) (Dixon, 1992). The process of organizational learning can be induced by a culture of participation and intra-organizational knowledge transfer (Otto & Schlager-Weidinger, 2014). However, this phenomenon requires further research.

In summary, the study explores financial analysis and its evolution, particularly in the context of Business Intelligence (BI) and visual analysis. The digitization process introduces new possibilities for improving the organizational learning process through the use of BI systems as a form of codified organizational memory. However, there are challenges related to interpreting and utilizing qualitative information in such a system. The process of organizational learning can also be supported by a culture of participation and intra-organizational knowledge transfer. It's worth noting that the topic of analyst competencies and the impact of the digitization process on organizational learning requires further research to gain a deeper understanding of these complex processes.

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