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**Business Intelligence to support Sales and
Marketing: the case of Microbiscottificio
Frolla**

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ABSTRACT

Questo elaborato esplora il crescente fenomeno della Business Intelligence (BI) e l'importanza della raccolta e analisi dei dati con strumenti software avanzati. L'obiettivo è descrivere l'implementazione di un sistema di Business Intelligence (BI) che consenta di ottenere una panoramica completa delle dinamiche di vendita multicanale di una piccola azienda marchigiana. Questo sistema integrerà in modo efficace i dati provenienti da diverse fonti, utilizzando il software Power BI.

In un contesto economico instabile, le aziende necessitano di dati chiari e tempestivi per decisioni rapide. Gli strumenti di analisi e reportistica rispondono a queste esigenze, permettendo una gestione efficace delle informazioni.

La tesi è strutturata in quattro capitoli. Il primo capitolo analizza l'evoluzione del marketing e delle vendite, enfatizzando l'integrazione dei dati multicanale. Il secondo capitolo introduce la BI e la sua utilità nella reportistica aziendale. Il terzo capitolo si concentra sugli strumenti di visualizzazione dei dati e come questi siano legati alle dashboard e al cruscotto aziendale. Nel quarto capitolo, viene esaminato il caso del Microbiscottificio Frolla, esplorando la storia aziendale e il processo di implementazione di Power BI, in particolare come l'architettura di questo sia stata sviluppata.

Questo elaborato, quindi, intende mostrare come la BI possa potenziare le capacità analitiche e decisionali di un'azienda, contribuendo a migliorare la gestione aziendale e la performance.

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INTRODUCTION

This paper explores the rapidly growing phenomenon of Business Intelligence (BI), contextualising it within the increased focus on data collection and analysis, supported by increasingly effective and intuitive software. The main objective is to present a case of BI implementation in the sales area of a small, rapidly expanding company in the Marche ecosystem, using Microsoft Power BI, one of the leading BI solutions on the market.

In an economic environment characterised by instability and rapid change, companies, regardless of their size, increasingly feel the need for clear, timely and accurate data. This data enables managers and company player to make quick decisions in order to respond effectively to market dynamics. This need is met by analysis and reporting tools that, thanks to their high performance and effectiveness, allow anyone to interface with them and find answers to their questions.

The aim of this paper is to explain what it means for a company to develop a multi-channel sales strategy, highlighting both the benefits and the critical issues that emerge as business complexity increases. Due to this complexity, companies increasingly feel the need to develop a support system that allows them to integrate and analyse data in an agile manner, using Business Intelligence (BI) and data visualisation tools that are flexible and adaptable to their needs.

The thesis will be structured in four chapters: the first three will provide the theoretical basis for a full understanding of the fourth chapter, which is dedicated to an in-depth case study.

In the first chapter, the evolution of marketing and sales will be analysed, along with the tools used for sales and performance analysis. The concept of 'data-driven marketing' and the importance of integrating information from different sales channels will be explored, with a focus on the collection, organisation and integration of multi-channel data.

The second chapter will introduce the concept of Business Intelligence and its usefulness in corporate reporting, highlighting its potential. It will discuss how BI is comprehensively implemented within the company, focusing on its effectiveness in creating crucial reports for strategic decisions. It will also examine how BI supports the sales and marketing areas, outlining its goals and objectives.

The third chapter will focus on useful data visualisation tools, which are fundamental to the creation of the corporate dashboard. It will illustrate what it means to create a report and how data visualisation comes to its aid, outlining its objectives and the most commonly used tools. Finally, we will discuss dashboards and the management cockpit, very useful 'front-end' tools for reporting.

In the fourth chapter, the empirical case of the application of a Business Intelligence system within the Microbiscottificio Frolla will be examined. After delving into the history of the company and its current development, the structure and functionality of the Power BI software will be explored. The process followed so that the company, starting from a situation of total absence of a BI system, can benefit from its implementation will be delineated, outlining the state of the art. To conclude, possible future developments for such a fast-growing company will be suggested.

This thesis aims to demonstrate how the adoption of a Business Intelligence system can significantly transform a company's analytical and decision-making capabilities. Through theoretical analysis and the practical case of the Frolla Microbiscottificio, it highlights the importance of data collection, integration and visualisation to meet the challenges of a dynamic and competitive market. The work carried out provides a detailed insight into the achievable benefits and future potential, contributing to a deeper understanding of BI as an essential strategic tool for modern businesses.

1. Sales Analysis and Control in a Multi-Channel Perspective

With the development of Information Communication Technology, companies, from the largest to the smallest, have been faced with new ways to reach the market and their customers. This has led to the emergence of not only new opportunities, but also new challenges that are increasing as technology and the market evolve. Indeed, the points of contact with one's buyers are no longer only derived from the physical shop, but the development of the Internet and social networks has opened up a new dimension that increases the number of possibilities present. For these companies to perform optimally, they must be able to create a system that perfectly integrates their sales channels, generating a holistic and dynamic system through which they can expand their network of contacts and keep it under control to monitor the results obtained. Another element that grows in importance with the new online and offline sales channels is the feedback one receives, that is, the information one has, the data one develops to be analysed and from which the company can start to understand if its strategies are working and thanks to which new ones can be generated. What we will see in this chapter, is not only what it means to develop an integrated sales system to interface with the market, but also how the feedback we receive from the market itself can be analysed and kept under control, so that our company performs at its best.

1.1 Introduction to Multichannel Sales Context

The concept of multi-channel selling is an idea that has developed with the advent mainly of the Internet of Things (IOT), whose presence has increasingly encompassed everyday life and new consumer contact points have been created.

P. Kotler defines multi-channel marketing as:

*"a company that uses two or more marketing channels to reach different consumer segments."*¹

From this basic definition, we deduce that, companies allocate a product, service or information to the market by exploiting two or more channels. This perspective, which has developed with the advancement of technology, makes it possible to break free from the physical shop and its limitations, reaching more customers in an agile manner. The channel, in fact, takes on distinct characteristics depending on the expected result, fulfilling communicative, transactional or informational functions by exploiting the modes of contact with the consumer. Again Kotler, specifies that there are three macro-categories of 'marketing channels'²:

- *Communication channels*: these are all those channels through which the company can get its message, mission and values across. These channels can be varied, starting with newspapers, moving on to email and ending with social media;

¹ Kotler, Philip, and Kevin L Keller. Marketing Management. 14th ed., Pearson Education, 2012.

² IBIDEM

- *Distribution channels: these* are all those channels that are used to showcase one's products and boundaries, fulfil the same function; get them to the market. Sales and communication channels often overlap, e.g. e-commerce and social media, which, due to their blurred;
- *Service channels: refer to* all those ancillary services that serve to realise the actions seen above and can be warehouses, transport companies and banks.

These three areas must be combined to create the best marketing-mix that maximises performance and minimises costs. Delving deeper into the matter, Rangaswamy & van Bruggen give a more comprehensive definition of the multichannel sales phenomenon:

*"Simultaneously offering their customers and prospects information, products, services, and support (or any combination of these) through two or more synchronised channels"*³.

³ Rangaswamy, Arvind, and Gerrit H. Van Bruggen. "Opportunities and Challenges in Multichannel Marketing: An Introduction to the Special Issue." *Journal of Interactive Marketing*, vol. 19, no. 2, 1 Feb. 2005, pp. 5–11, <https://doi.org/10.1002/dir.20037>. Accessed 19 June 2024.

As we can see, three elements are taken into account that determine multichannel selling: there must be an offer of the product, information and services, there must be several channels in which the activity is carried out, and these must work in a synchronised manner. Furthermore, the ultimate goal for companies to develop a multichannel approach to their marketing is emphasised by Keller and Kotler:

*"In multichannel marketing, each channel targets a different segment of buyers, or different need states for one buyer, and delivers the right products in the right places in the right way at the least cost"*⁴.

Hence, multichannel marketing is simultaneously offering a product, a service, or information on two or more channels working synchronously, so that the company gets in touch with the largest number of customers interested in our offer, at the right time, in the right way and at the lowest price.

As already mentioned, communication and distribution channels often overlap, being complementary. K.L. Keller emphasises the importance of focusing equally on both distribution and communication for the construction of a strong brand identity in such a fragmented and complex environment. However, this view is often not shared by all in the literature, in fact a clear division is made between "*multichannel retailing*" and "*multimedia marketing*"⁵. The former, in fact, only includes product distribution while the latter promotes communication and distribution, understood with a broader conception of the term, encompassing the

⁴ Kotler, Philip, and Kevin L Keller. *Marketing Management*. 14th ed., Pearson Education, 2012.

⁵ Chen, Shan, and Lucio Lamberti. "Multichannel Marketing: The Operational Construct and Firms' Motivation to Adopt." *Journal of Strategic Marketing*, vol. 24, no. 7, 29 Feb. 2016, pp. 594–616.

values, mission and messages that the company wants to share. The line dividing these two activities, however, is a thin one and, initially, the multichannel retailing perspective was mainly taken into account, which is based on the development of activities such as brick-and-mortar shops, as businesses with physical shops, online business development and catalogues. Over time, all those activities that go beyond mere sales, bringing information to the market and influencing consumer behaviour, have also begun to be observed and recognised. As can be deduced, the increasingly discerning consumer will move nimbly between shops and the Internet, seeking to diminish the information asymmetry and increasing the convenience of purchase.

The following paper aims to give both a comprehensive theoretical approach to the analysis of multichannel sales and a practical approach through Business Intelligence and its application to an empirical case. Not forgetting this focus, the term "multichannel marketing", as we have seen, has increasingly taken on an all-inclusive meaning in the literature, indicating both the distribution and the informative and communicative side, and, for this reason, we will analyse it with respect to both perspectives, being so deeply intertwined. In the following paragraphs, we will provide a general analysis of the phenomenon and then delve into the issues related to sales and the analysis of the resulting data.

1.2 Evolution of the Multichannel Sales Concept

Multichannel marketing has evolved dramatically in recent years, as new ways to connect with consumers have appeared with the advent of the Internet and subsequently e-commerce and social networks. Because of this, companies had to adapt quickly to the changes in order to be competitive in their sales activities. Multichanneling, with its vast potential, has enabled companies to cope with the increasing diversity of demand by making the most of new digital technologies. The spread of these technologies and digital environments has broadened the options for channel management, while at the same time opening up new competitive fronts. The objective of the companies themselves today goes beyond mere sales, aiming to create a relationship of trust with the consumer, seeking to build their loyalty and improving the consumer's experience, taking care of aspects that were previously ignored, such as the benefits they could obtain, the information that makes them more aware during the purchasing process and enhancing after-sales support. The goal then of each channel is to reach and facilitate the interaction between customer and business, enhancing the contact experience on both sides. To intensify relationships with their customers, the literature has identified through various studies the following sales channels that are most exploited by companies⁶:

- Mass media are mainly used to provide practical information. Some forms of mass media may be part of transactional activities, such as ordering

⁶ Keller, Kevin Lane. "Brand Equity Management in a Multichannel, Multimedia Retail Environment." *Journal of Interactive Marketing*, vol. 24, no. 2, May 2010, pp. 58–70, <https://doi.org/10.1016/j.intmar.2010.03.001>.

catalogues or shopping on television. These are less and less means used by the masses to make purchases or take in product information.

- Sales points, on the other hand, have the task of completing transactions. They are also one of the main sources of product information due to the physical availability and/or presence of sales personnel. Certain forms of sales outlets (such as the sales force for B2B companies and sales staff for small local businesses) are important channels for maintaining customer relationships; mass-market outlets are experiencing a change in their role in customer relations as they have direct access to consumers and their information.
- The call centre usually handles practical communications such as customer enquiries, technical support, service appointments, and so on. In some cases, the call centre integrates channels such as the catalogue to complete transactions and carries out telemarketing activities. Although the call centre is an interactive channel, such interaction is mainly oriented towards problem solving rather than relationship building.
- Industry-specific initiatives are not primarily for transactions. They provide platforms for companies in the sector in question to showcase their products, technical details and advances, and so on. Through these platforms, companies also have the opportunity to interact with their existing and/or potential customers in order to strengthen or establish relationships.

- The website is one of the best tools in the hands of companies according to Keller. With it one is able to interact with the customer and carry a large amount of information. By now, almost all companies, in order to remain competitive, must have their own website with integrated e-commerce.
- Social networks are intuitively conceived as the main channel for establishing and maintaining customer relationships. Much practical information, although subject to the constraints of the characteristics of each platform, is also obtained on social networks. However, initially they were not seen as a tool for conducting transactions, but their evolution also allows selling 'in app', not via external channels.
- SMS and e-mails generally do not facilitate transactions but are most often used to provide practical information such as order status, news about promotions, and so on. Since the recipient of SMS and e-mails can be individually identified by the company, this offers the opportunity to tailor the information for relationship management and have a one-to-one relationship.
- Web applications are web-based services that are continuously being developed. Companies can exploit virtually endless possibilities for all three.

- The mobile channel, which is enabled through the Internet, has the same possibilities and constraints in conducting transactions. It has advantages in providing practical information due to technical possibilities such as mobility, location-based service, bar code scanning, and so on; on the other hand, it has constraints such as the screen size of the device, which require ad hoc design to optimise the provision of information. It is most often used for relational purposes due to features such as user intimacy, multimedia content, geographic positioning, and so on.

The exploitation of several channels at the same time has two implications: similar channels have similar marketing implications and allow the company to have a quantitative increase in performance. On the other hand, operating on different channels has different marketing implications with different qualitative implications. Furthermore, the distinction between transaction and communication is blurring, implying that a single channel, although subject to certain capacity constraints, usually performs, to a greater or lesser extent, all or part of these three activities. Therefore, instead of a dichotomous variable indicating whether a channel is used for transactions, providing practical information, relational communication or any combination of these, we rather observe degrees of intensity with which companies use a given channel to perform these activities, It means how much they are exploited for their effectiveness. Previous research suggests that while some channels are able to facilitate the search for information and the execution of transactions, their competence in performing these two activities may differ, influencing customer behaviour in a multi-channel environment.

In addition to this distinction, Keller recommends another one that groups the channels we have just described into two macrocategories: "*direct and interactive channels*" and "*indirect channels*". These two categories have as their discriminating factor the mode of interaction with the customer: specifically, direct channels encompass all those modes in which the company and its personnel are directly involved. Going back to the subdivision made above, we can identify the outlets, in particular the one the company owns, call centres, specific company initiatives, SMS and email, the Internet and the Web and Social Media as the means characterised by direct contact with the consumer on the part of the company that allow constant, almost daily interaction with the product through ad-hoc advertising. These, in fact, are all those channels that not only have the purpose of selling but also serve as a means of passing on information, such as their mission, values, news, and allow the customer to be engaged and retained. As we mentioned earlier, nowadays, the customer is increasingly demanding and has many more tools at his disposal to make an increasingly informed choice. This is why the various tools not only function as a means of distributing products but also as a valuable source of information that the company wants to convey. This makes it possible to give value to the brand, increasing its resonance and the profits on which it will capitalise.

Indirect channels differ in that the company has no direct control over them, and they act as mediators and third parties, such as retailers or websites, in particular e-commerce, for the specific market place, with respect to which they have no direct management and therefore no direct contact with the customer.

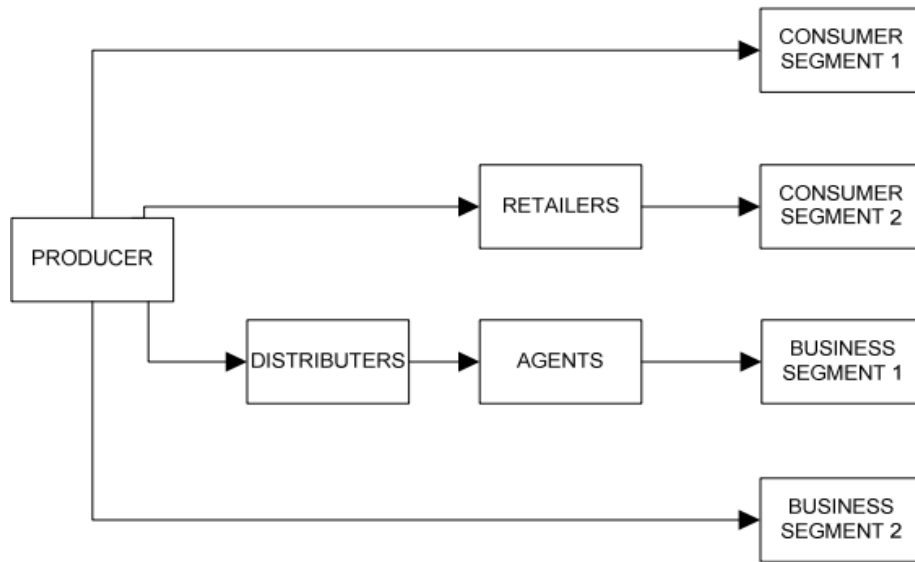


Figure 1.1 Example of a multichannel structure.

Source: Kotler, Ph.; Wong, Veronica; Saunders, J.; Armstrong, G.(2006): *Principles of Marketing*, Pearson Education Limiter, Prentice-Hall, 2005., Translation, MATE, Zagreb, p. 870.

Simplifying, we can define the former as direct sales channels to the customer, so that there is direct contact with the manufacturer, while for the latter there are 'trading companies' (such as retailers) or other figures who act as intermediaries before reaching the end customer. This multi-level distinction is the expression of multichannel marketing, where a single sales channel is no longer enough and, therefore, in order for the company to grow solidly and rapidly, a sales architecture must be built that controls, adjusts and covers as many market segments as possible while minimising costs.

In the next chapter, we will analyse the advantages and disadvantages of integrating multichanneling into one's business model, while also highlighting the problems the company will face in controlling the channels and analysing the resulting data.

1.3 Benefits of developing a multi-channel strategy

Increasing one's sales channels brings many benefits to the company, as was seen from the definition given in the first paragraph. We will now go on to analyse the reasons why companies should expand their points of contact with the consumer and then highlight the difficulties that can be encountered during this expansion process.

Three main types of motivations for companies to implement multichannel marketing have been identified:

1. increased customer satisfaction and loyalty,
2. low costs to access new markets,
3. creation of a strategic advantage.

Customer satisfaction, together with customer loyalty and value over time, are to be considered as higher-level objectives, which are achieved through various means at the discretion of each company. Hence, the means to improve customer value boil down to two aspects: utility experience and 'hedonic' experience, seeking to optimise the shopping experience. By using a combination of channels, retailers can better meet the needs of their shoppers by exploiting the advantages and overcoming the lack of each channel. For example, the shop channel offers some

unique benefits, including: the ability to use all five senses when evaluating products, personalised service, the option of cash payment, entertainment and social experiences, and instant purchase. However, in order to enjoy these benefits, consumers have to devote time and energy to visiting shops that, for example, may not be open at times convenient for consumers. In self-service formats, such as supermarkets and discount stores, consumers may find it difficult to locate competent staff to provide the necessary information. Non-physical channels overcome some of these shortcomings. Most offer the convenience of shopping for goods when and where consumers want, reducing the time and travel costs of shopping, offering a wider selection of goods, and providing a physically safe shopping experience at home or other locations of choice.

In addition to these benefits offered by most online channels, the Internet, through interactivity, allows consumers to obtain all the desired information before making a purchase and online information can be customised according to customer needs. By increasing the range of benefits offered through multi-channel operations, retailers can increase their share of customers' wallets. It has been noted that customers who take advantage of the various purchasing routes offered by companies tend to have a higher average purchase rate than those who only use one route to purchase. However, several studies have found that an increase in affluence towards e-commerce and other online tools causes a significant change in purchasing behaviour and loyalty towards the company, also due to the ease of

access to more information and alternative solutions⁷. On the other hand, this is closely linked to the discourse of reaching new markets, in fact, the advent of e-commerce and social media has made it possible to break down the barriers arising from physical shops. In fact, if previously the target audience was limited, now it is potentially limitless. So, the goal with respect to the customer, as mentioned above, will not only be to build the loyalty of the buyer, but also to reach the new consumer, who for reasons of space or time, will not have the opportunity to buy 'in presence'.

The 'multi-channel buyer' is a segment that is growing, that is a market segment that interfaces with the brand through various channels, thus having different contact possibilities, moving more easily to acquire the product. It is estimated that in 2022, some 46.3 million Italians will fall into the 'multichannel buyer' category, or 89% of the population⁸. It has been shown that they are on average more profitable and have a higher lifecycle value than single-channel consumers. At the same time, however, this empirical evidence risks becoming obsolete over time as the percentage of people buying across channels is drastically increasing.

Secondly, opportunities for multichannel retailers to develop a strategic advantage arise from the ability to develop resources that are not easily detectable or duplicated by competitors, such as accurate customer information and providing a seamless customer interface, which means exploiting online and offline services

⁷ Bhatt, Viral, and Jigar Nagvadia. -FACTORS INFLUENCING CONSUMER'S ONLINE BUYING BEHAVIOR: AN EMPIRICAL STUDY| Doctor of Philosophy in Management. Jan. 2021.

⁸ <https://www.osservatori.net/it/ricerche/comunicati-stampa/multicanalita-2022-cresce-maturita-digitale-italiani>

interchangeably at all stages of purchase. These resources can build customer loyalty and reduce transactional costs.

For many physical store-based retailers, it is difficult to develop extensive purchase databases due to their inability to link the customer to the transaction when paying with cash or using third-party credit cards. To address this problem, many physical store-based retailers encourage the use of loyalty cards or ask shoppers for identifying information (e.g. phone numbers). In contrast, all transactions through Internet and catalogue channels automatically collect customer information for billing and product shipment. Furthermore, the Internet channel offers the opportunity to collect data on a consumer's online search behaviour in addition to transaction data. Therefore, multichannel retailers have a greater opportunity to develop extensive information about their customers and can use it to target their marketing activities more effectively.

Another aspect is that consumers want a seamless experience when interacting with multichannel retailers. For example, they want to be able to purchase a product through the retailer's Internet or catalogue channels and pick it up or return it at a local shop; find out whether a product offered on the Internet channel is available at a local shop; and, when they cannot find a product in a shop, determine whether it is available for home delivery through the retailer's Internet or catalogue channels. As discussed in the next section, providing this interface is complex and challenging. A deep knowledge of sales processes is required to effectively provide these services, which cannot be easily copied by competitors.

On the other hand, when companies actively seek economic benefits and/or customer advantages through multi-channel marketing, they show a higher level of proactivity in their approach and a higher level of activity in the use of multi-channel marketing, manifested in different ways, such as continuous updates on various channels, creative use, dedicated resources, perceived usefulness, and so on. This allows them to evolve and always generate new ways of reaching the customer, providing increasingly specific services to meet the demands of their target segment.

1.4 Challenges in creating a multi-channel ecosystem

Creating the appropriate organisational structure is probably the biggest challenge facing any multichannel retailer. Most companies in the industry manage their channels in a decentralised manner, maintaining separate teams for inventory management, merchandising, marketing, finance, analysis and even product development within each channel⁹. However, this decentralised structure has generated increasingly complex problems, especially when it comes to creating synergies between different channels and offering a 'seamless' consumer experience in a multi-channel environment. Decentralisation has led to duplication of teams and inefficiencies in business processes, internal conflicts between channels (cannibalisation) and often inconsistent customer experiences due to lack of coordination in merchandising activities between different channels. Many

⁹ Zhang, Jie, et al. "Crafting Integrated Multichannel Retailing Strategies." SSRN Electronic Journal, 2009, <https://doi.org/10.2139/ssrn.1389644>.

companies fail to fully co-ordinate brand marketing and promotion planning across sales lines. This confronts them with two choices: *harmonise* the merchandising ecosystem by applying all pricing and promotion strategies across all channels or keep them separate by differentiating them. These are two extremes, but finding an effective balance is not always straightforward. Therefore, the need for more research into the most effective organisational structure to optimise the process has emerged. Some proposals include the creation of informal organisational structures that support a multi-channel environment, such as the formation of cross-functional steering committees and networks of cross-functional leadership and specialists. The decision on organisational structure is not a binary one but a question of the degree of integration versus standardisation of individual functions. There are no universal solutions, and each company must decide what to integrate and what to keep separate, considering its corporate history, branding strategy, existing distribution and information systems and the need to attract customers. Finally, retailers need to review and revise their compensation systems to promote collaboration between channels, also considering the challenges of performance evaluation.

Another major challenge in creating successful multichannel strategies is to build an integrated information technology (IT) infrastructure so that data across channels can be linked and analysed holistically. Although retailers differ in their preferences on whether to integrate or manage many key functions separately, there is a general consensus on the need to establish centralised data warehousing capabilities. There are two critical aspects to consider in addressing this challenge. The first is to

establish an IT infrastructure to collect and process purchase data from all channels, in particular the flow of incoming information. The second is knowing what insights to extract from the data and how to package and deliver only the relevant information to decision makers in each channel, It means the outflow of information. Many companies do not have the ability and capacity to properly track transaction information and have no way of analysing customer profitability across channels. This requires an appropriate structure of data integration and reporting. For example, direct channels lend themselves very well to the process of uniquely identifying a customer and monitoring its behaviour over time. However, when the same customer interacts with the company through a traditional physical shop, it is difficult for retailers to link this behaviour to their purchase history created in direct channels. A large number of retailers are unable to link these two separate databases and thus miss the true value of a multi-channel customer. Retailers who can accurately link the two databases can generate a data warehouse that enables them to measure customer value, target appropriate marketing resources, track customer evolution at different stages, etc. This integrated and unified view of customer purchasing behaviour is crucial for using customer transaction data in building customer relationship management (CRM) models and allocating resources.

Finally, for there to be proper management of incoming data and for it to be relevant, there is a strong need to develop and implement formal performance metrics that take into account the idiosyncratic nature of each channel and the cross-channel effects of decisions on the sales mix, and that motivate multi-channel collaboration. The difficulty is to exploit correct and timely estimates that return

meaningful values since the stability of the customer base, the accuracy of sales forecasting and the risk profile may also differ between channels.

In conclusion, in order to create an effective and well-balanced multichannel ecosystem that generates valuable data for the company, the figures who will be in charge of its implementation and management are indispensable, and they must have transversal skills that allow them to see the bigger picture. The other challenge facing the company is to properly educate and prepare the figures who will be in charge of marketing, providing them with adequate preparation to be comfortable in the new scenario they will face.

1.5 Role of data analysis for sales optimisation

Decision-making processes in sales and marketing are inherently complex due to the simultaneous presence of multiple objectives and numerous options resulting from the combination of the main decision-making levers available to managers. As we shall see, having an efficient reporting and analysis system is particularly important and, its necessity is further underlined by the vast availability of databases that record sales transactions and provide detailed information on the use of services and products by customers. Considering also the digital world related to sales and marketing, it is important to note that the available databases are remarkably extensive and allow for extremely detailed analysis, profiling and targeting. Recently, major social networks such as Instagram, Facebook and LinkedIn have also introduced tools for analysing promotional activity data, allowing business users to view pre-set dashboards with key performance indicators of their advertising campaigns. These tools, like the integrated analytics within social networks, offer immediate and intuitive access to information, simplifying the process of analysing and interpreting data for users. This integration between the advancement of technology, implying increasingly efficient data collection and filtering systems, increasingly cutting-edge analysis systems and, at the same time, new metrics that seek to explain as much as possible the phenomena occurring in the various communication and sales channels, and finally reporting systems for explaining the phenomena being analysed are increasingly oriented towards data analysis, giving rise to the phenomenon of 'data-driven marketing'¹⁰.

¹⁰ https://blog.osservatori.net/it_it/data-driven-marketing-significato

The main objective of data-driven marketing is to create customised content that resonates with the audience and ensure that these messages are delivered at the right time and place to improve customer engagement, conversion rates and turnover. To succeed in this landscape, marketers must gradually embrace data-driven decision-making. Multiple data sources, which consistently flow through online due to ease of use, including customer demographics, website traffic, purchase history and social media interactions, can be harnessed to provide insights for informed decision-making. This data allows companies to identify patterns and trends, such as product popularity, effective communication channels for specific customer segments, and preferred messaging styles¹¹. Crucially, data collection should be an ongoing process, as customers constantly provide valuable information that can be analysed to gain insights into their preferences and needs. Similarly, evolving technology provides companies with access to huge amounts of data to be analysed and interpreted, enabling data-driven decisions and refining marketing practices. In today's landscape of uncertainty and intense competition, companies must remain steadfast in their commitments to customers. This means offering relevant products through the appropriate channels and precisely when needed. Consequently, the collection and analysis of customer data becomes crucial, enabling a deep understanding of the target audience and facilitating the customisation of offers to ensure relevance. Thus, we can summarise the power of data in two hemispheres that cooperate with each other: not only do they act as informants for marketing strategies, but at the same time they evaluate their effectiveness. Companies can

¹¹ Kawada, Kentaro, et al. "Data-Driven Marketing to Accelerate Decision Making." *Fujitsu Scientific & Technical Journal*, vol. 55, no. 4, 2018, pp. 50-56.

closely monitor metrics such as website traffic, sales conversions and social media engagement to assess the impact of the marketing campaigns themselves and the channels exploited. Moreover, these metrics help identify the most productive marketing channels and strategies, facilitating the judicious allocation of resources. For example, if data reveals that a specific social media platform outperforms others in driving sales, the company can allocate more resources to boost its performance and amplify its return on investment. Furthermore, tracking data can reveal opportunities for refinement and expansion. Insights into competitors' activities, consumer behaviours and patterns, and market trends can trigger opportunities for the development of new products and services or the exploration of new market segments. By harnessing data-driven insights, companies can devise tailored marketing strategies aligned to these opportunities, ensuring positive results. What we then gain from this duality is a cyclical analysis of the information being extracted, the application of which generates performance data on which to base strategies. The opportunities thus arising from the correct channelling of information allows companies to generate greater personalisation, increasing engagement and brand awareness and, indirectly, increasing ROI. A.T. Rosario and J.C. Dias have identified several points in the analysis of this phenomenon that can be influenced by a more 'data-driven' approach¹².

¹² Rosário, Albérico Travassos, and Joana Carmo Dias. "How Has Data-Driven Marketing Evolved: Challenges and Opportunities with Emerging Technologies." *International Journal of Information Management Data Insights*, vol. 3, no. 2, 1 Nov. 2023, p. 100203.

Customisation

Personalisation is a major benefit. By analysing and integrating customer data into marketing strategies and business decisions, organisations can tailor their products and services to the unique preferences and behaviours of each customer. In today's competitive landscape, companies know that delivering personalised experiences is critical to gaining a sustainable advantage. Data-driven technologies help companies analyse customer behaviour and preferences, identifying patterns and trends. This information is then used to create personalised experiences through targeted marketing campaigns and tailored offers. For example, companies that take advantage of this approach can use customer feedback to develop products and services that meet their needs and expectations. Subsequent marketing campaigns to promote these products or services will use content that resonates with the target customer segments. This approach can improve customer experience and satisfaction, leading to greater loyalty and stronger relationships through more intense emotional connections. In simpler words: data-driven marketing allows you to get to know your customers in depth and create unique experiences for each of them. This leads to more satisfied customers, attached to the brand and inclined to purchase.

Customer relationship management (CRM)

As a second point, the customer relationship management (CRM) revolution was identified. CRM employs strategies, processes and technologies to optimise interactions with customers, increasing customer satisfaction and loyalty. Thanks to data and analytics, companies can develop more effective, one-to-one CRM strategies based on each customer's needs and preferences, allowing them to:

- *Know your customers inside out:* CRM allows you to gain insights into customer behaviour, preferences and purchase history through collection and analysis tools;
- *Targeted segmentation:* This data is used to segment customers based on common characteristics, such as demographics or purchasing behaviour;
- *Winning marketing campaigns:* Targeted marketing campaigns can be created that achieve better results: higher conversion rates, better customer experience, greater satisfaction and a higher return on investment;
- *Personalised customer experience:* CRM fosters a personalised customer experience. Marketers can tailor messages and offers to each individual, taking into account the different interests and characteristics that influence their purchasing decisions;

- *Accurate profiling*: Techniques help to profile customers by defining their individual and shared characteristics;
- *Creating tailor-made offers*: Analysis allows messages and offers to be customised according to the needs and sales potential of each customer. For example, by analysing data, companies can identify specific products or services of interest to each customer;
- *Loyal customers*: Developing targeted offers and recommendations makes customers feel valued and understood, improving their satisfaction and loyalty.

Mapping

Customer journey mapping visualises the stages and touch points that characterise interactions with the brand, from discovery to post-purchase engagement. Data-based practices allow data and analytics to be harnessed to gain insights into the customer journey and used to create more effective marketing campaigns. In addition, more precise mapping allows for a personalised experience as marketers understand interactions at each touchpoint. For example, by viewing and analysing past purchases or browsing history, interest in a product or service can be understood. This makes it possible to provide personalised recommendations and offers. As a second point, mapping creates opportunities for real-time decisions. Indeed, by analysing customer behaviour, companies can adapt marketing and communication strategies. Thirdly, it helps to identify areas of difficulty or frustration for customers, enabling targeted strategies to be developed, for example, a company might redesign its website to facilitate information searches or improve customer service to reduce waiting times. To summarise, through data-driven mapping, companies can understand how to improve products and services to increase satisfaction and experience

"Data-driven" decision making

Making 'data-driven' decisions means relying on concrete data and analysis and not relying on intuition or guesswork. Data-driven managers use analytical thinking to make business decisions. This approach uses data to define the course of action, make changes, and anticipate complexities or problems that could undermine the decision-making process. This approach to marketing results in more informed decisions through the collection and analysis of data on customer behaviour, market trends and other relevant factors. Relying on data to make decisions and plan strategies increases the likelihood of successful outcomes. One of the main benefits of data-driven decision-making is the increased ability to detect patterns and trends that may not be immediately apparent through intuition or observation. This can help organisations recognise emerging opportunities or threats and adapt their strategies accordingly. Furthermore, companies can leverage data-related technologies to measure the effectiveness of various marketing strategies and techniques. For example, big data and data analytics provide tools and procedures for monitoring and analysing key performance indicator (KPI) data. These KPIs can help marketers determine which marketing strategies and channels are generating results and make necessary adjustments in areas that require improvement.

Value co-creation

With new digital technologies, companies can co-create value with customers, actively involving them in the definition of new products or services. Through online platforms and social media, companies can better understand customers' needs and preferences, developing more effective and satisfying solutions. Data-driven marketing is crucial in this process, as it allows them to design truly customer-centric messages and promotions. A key advantage of data-driven co-creation is the ability to customise products and services according to real customer needs. By analysing market and individual customer data, companies can identify segments with specific needs and develop tailor-made solutions. In addition, this approach helps to increase customer engagement by fostering the co-creation of value. For example, online surveys, comments and reviews allow companies to gather feedback on new products or services. These insights allow customers to actively participate in innovation, driving the development, redesign or improvement of products and services.

The advantage that companies would gain by applying this data-oriented approach would not be sustainable if not supported by proper data management. This is very important for several reasons as Kusum L. Ailawadi and Paul W. Farris identify in their study: first, proper information management allows management to have an undistorted view of what is happening in the company and its channels. With the right metrics, a good balance between sales and marketing objectives can be

created¹³. No single metric, or even two or three metrics, are likely to provide managers with all the information they need about the performance of their channels. Marketers need to carefully build a portfolio of metrics that gives them what they need, and when they need it, about channel coverage, the contributions and performance of all partners in the ecosystem, and the sustainability of those partnerships. Quoting Neil Borden, Sir., coiner of the term marketing mix, we can say¹⁴:

"Several characteristics of the marketing environment make it difficult to predict and control the effect of marketing actions."

This quote is meant to imply that there are many factors that are difficult to control despite the creation of ad hoc metrics and in-depth analysis of the data obtained. This stems from the complexity of the environment against which one is operating: the variety of actions that can be taken into consideration is high (advertising, pricing, distribution channels) and because of this, the result is often not linear. Therefore, if we think about this complexity and all the potential inputs and outputs that can be had, each company will have to find the correct balance between understanding, effectiveness and efficiency in analysing its data and go on to create a 'marketing mix' that allows it to have an effective impact on management decisions, aware of the presence of a certain percentage of randomness. Secondly, the vast amount of data that companies are faced with today must be managed

¹³ Ailawadi, Kusum L., and Paul W. Farris. "Managing Multi- and Omni-Channel Distribution: Metrics and Research Directions." *Journal of Retailing*, vol. 93, no. 1, Mar. 2017, pp. 120–135, <https://doi.org/10.1016/j.jretai.2016.12.003>.

¹⁴ Borden, Neil. *The Concept of the Marketing Mix*. Sept. 1984.

effectively. Technology has made it possible to track more channels in a more frequent and increasingly specific manner, untangling increasingly complex scenarios. Third, there is a need for marketers, both upstream and downstream, to change their thinking about the extent to which different channels compete and complement each other. And, along with the change in mindset, comes the need for new data-centric approaches, so as to have certified results. As can be deduced, therefore, analysing and maintaining homogenous metrics for the analysis of the various sales channels is very difficult. In addition to this, as was written in the second paragraph, marketing is no longer just sales but also customer loyalty, traffic on social pages, the reactions of followers you have various products and many other values that are directly difficult to analyse because they are often qualitative and not quantitative in nature. This complexity must be accompanied by a proper reporting system in order to obtain a flow of information that serves managers, providing them with the tools for informed decision making based on empirical results.

Business Intelligence, which is the most appropriate tool for developing a sales control system, will therefore be introduced in the next chapter.

2. Business Intelligence and Reporting Systems in Sales Analysis

We have analysed what it means for companies to have to create a multi-channel ecosystem for sales development, the challenges they face and the benefits they can achieve by creating a well-integrated and functioning system that performs correctly. In order for this to happen, it is important that the underlying structure, which acts as an exoskeleton, is well-functioning and able to generate the useful information required by managers to make strategic decisions. This must be a process that starts with the continuous collection of data from the market, filters it and transfers it into the control systems, transforming the raw data into useful information. In this chapter, therefore, we will analyse what business intelligence is and what its objectives are. Next, we will see the structure that underpins the reporting system and what are the steps to create a long-term economic advantage for the company thanks to BI. We will understand how to integrate data from different sources and, later on, we will get into sales, understanding how these two worlds, BI and Sales, can be made to interact in order to have a complete 360° view of sales, highlighting how BI allows you to make more informed decisions.

2.1 Corporate reporting and the role of Business Intelligence

Today's corporate environment is characterised by complexity and constant evolution. Companies, both in the public and private sector, are under enormous pressure to respond to changing conditions and innovations. This requires the ability to make strategic, operational and tactical decisions that are often intricate and require prompt action. Effective decision-making increasingly depends on access to a rich variety of data, information and knowledge. Processing this information efficiently is crucial for making timely and informed decisions, driving the need for modernisation. Regardless of the size of the organisation, managing substantial volumes of data from both the internal and external business environment is a key aspect of business operations. This data, which includes internal operations, market dynamics, customer behaviour, supplier interactions, financial resources and more, forms the basis for addressing complex economic and financial challenges in organisational decision-making¹⁵. All this information that companies today have to process is part of what is referred to as a corporate information system. A business information system is a set of elements that collect, process, store and distribute data and information to support business process, including decision-making, coordination and control activities¹⁶. These systems help executives, managers and employees to analyse problems, visualise possible solutions, define strategies and create new activities, services and products. They contain information about people, activities, places and objects in the company or

¹⁵ Filofteia Tutunea, Mihaela, and Rozalia Rus. "Business Intelligence Solutions for SME's." *Procedia Economics and Finance*, vol. 3, 2012, [https://doi.org/10.1016/S2212-5671\(12\)00242-0](https://doi.org/10.1016/S2212-5671(12)00242-0).

¹⁶Torrini, Filippo. "Sistema Informativo Aziendale: Cos'è, a Cosa Serve E Perché È Importante." *UniverseIT*, 4 Feb. 2021, universeit.blog/sistema-informativo-aziendale/.

its environment. This system is fundamental to achieving the business objectives of any economic activity and is increasingly integrated with the company's organisational system. In recent years, it has been an essential tool for defining and streamlining business processes, monitoring and detecting inefficiencies and shortcomings. The main tasks of the corporate information system include the collection, storage and archiving of data, as well as their processing and transformation into useful information, to be distributed to the various professionals within the company.

Thanks to the economist Robert Anthony, we can relate the activities carried out by the corporate information system to the needs of the different actors in the corporate organisation chart. This theory, referred to as Anthony's Pyramid, classifies three main categories in corporate activity.¹⁷

- *Strategic activities*: these are all those activities that consist in defining the company's objectives and the best ways to achieve them. The main corporate body is *top management*, which needs information set out analytically and concisely, and supported by graphs that allow trends and deviations to be observed at a glance.

¹⁷ Anthony, Robert N. *Planning and Control Systems : A Framework for Analysis*. Boston, Harvard University Press, 1965.

- *Tactical activities*: these are all those activities that are developed for the effective and efficient allocation of resources to pursue the objectives set out in the previous point, taking care to monitor the achievement of these objectives. In this category we find the '*functional directions*', which need concise analytical data but the volatility of demands remains stable over time so that there is time for their development
- *Operational activities*: these are all those daily activities carried out by the *executive staff*, which will process data in detail and in real time.



Figura 2.1: Anthony's Pyramid – **Source:** Thakur, Dinesh. "Anthony's Framework for Understanding MIS." *Computer Notes*, 16 Nov. 2013, ecomputernotes.com/mis/information-and-system-concepts/anthonyframework.

This configuration is associated by A. Rezzani to the software present in the corporate information ecosystem, subdividing it into two macro categories, according to the purpose of use.

- *Management subsystem*, which includes strategic and managerial control activities, which will exploit the knowledge management system and Business Intelligence, the subject of analysis. The former will be used for consulting all information concerning the activities carried out in the company, while the latter, which will be explored in more detail shortly, will be used for decision making through reception, modelling and data visualisation
- The *operating subsystem*, on the other hand, will include all the applications necessary for everyday activities business such as Enterprise Resource Planning (ERP), SCM (supply chain management), Customer Relationship Management (CRM) and, again, Business Intelligence.

In today's highly dynamic and ever-changing business environment, only the most competitive companies will achieve sustained market success. To capitalise on business opportunities, these organisations will distinguish themselves through their ability to exploit information about their market, customers and operations. Moreover, the life cycle of businesses has shortened considerably in recent times. Therefore, gaining a competitive advantage requires quick and effective decisions. Decision-makers need quality data in order to make informed decisions in a timely

manner and in the right context, and for this, it is necessary for the company to equip itself with an information system that is able to make targeted use of the relevant elements in the mass of data being processed.

2.2 What is Business Intelligence

The concept of Business Intelligence (BI) dates back to the second half of the 1950s, theorised by Peter Luhn, a computer scientist working at IBM, identifying it as:

"The ability to understand the interrelationships of facts presented in such a way as to guide action towards a desired goal."¹⁸

After this initial theorisation, it took about twenty years of technological advancement to concretely develop Luhn's idea. In fact, technology entered the everyday life of companies in a predominant way, and in particular, increasingly innovative means of storing data were being developed. Since the early 1970s, we began to observe the spread of the first Decision Support Systems (DSS), as tools created to support business decision-making activities based on data that mainly facilitate the interrogation of historical databases and the production of periodic summary reports¹⁹. Over the years, data-driven DSSs have been referred to by various names, including data-oriented DSSs, retrieval-only DSSs, Executive

¹⁸ IBM. "What is Business Intelligence And How Does It Work? | IBM." [www.ibm.com, www.ibm.com/it-it/topics/business-intelligence](http://www.ibm.com/it-it/topics/business-intelligence).

¹⁹ Massaroni, Enrico, et al. *Analisi Dello Stato Dell'arte Sui Decision Support System (DSS)*. 2014.

Information Systems. The term Business Intelligence had not yet been coined and the technology was not yet mature enough to give birth to the first example of BI.

It was not until 1989 that one of the first definitions to be found was given by Howard Dresner, an analyst at Gartner Group, who described Business Intelligence as follows.

"Business Intelligence describes enterprise's ability to access and explore information, often contained in a Data Warehouse, and to analyse the information to develop insights and understanding, which leads to improved and informed decision making. Bi tools includes ad hoc query, report writing, decision support system (DDS), execution information system (EIS), and, often, techniques such as statistical analysis and online analytical processing (OLAP)".

From then on, there will be an explosion of BI solutions, which will be increasingly used by most companies, allowing them to have certified, readable and exploitable data for those who need to consult it.

This definition, effective as it is, aims to give a 360° view of the ecosystem that supports the tool, touching on all the elements that actually characterise it and make it effective.

Over time, both due to its development and the increased awareness of those who exploit it, different conceptions of business intelligence have emerged. In fact, BI is about the seamless integration of front-end operational applications with back-end operational applications. For some data warehouse experts, BI is just a new term for data warehousing; that is, providing decision support applications on a new

technology platform. To some data mining statisticians, BI represents advanced data mining algorithms, such as neural induction techniques.

Cindi Howson gives a less technical definition than the previous one, focusing on the purpose of the technology exploited:

"Business intelligence allows people at all levels of an organisation to access, interact with, and analyse data to manage the business, improve performance, discover opportunities, and operate efficiently"²⁰.

This is the utilitarian aspect of the system and its presence within the company, highlighting how people, through their interaction with the solution, are able to interact with the data and advance in their decision-making.

Therefore, as we have seen, the conceptions of Business Intelligence are varied, filtered by the perception of the individual and the various purposes for which it is exploited, going from a more technical and 'back-end' approach to a data consultation approach, which can be defined as 'front-end'. This is why the all-encompassing definition encompassing the various faces of such an articulated system is provided by Rezzani, defining it as follows.

²⁰ Howson, Cindi. Successful Business Intelligence : Unlock the Value of BI & Big Data. Emeryville, California, McGraw-Hill/Osborne, 2014.

“La Business Intelligence è un sistema di modelli, metodi e processi, persone e strumenti che rendono possibile la raccolta regolare e organizzata del patrimonio dati generato da un’azienda. Inoltre, attraverso l’elaborazione, l’analisi o aggregazioni, ne permettono la trasformazione in informazioni, la loro conservazione, reperibilità e presentazione in una forma semplice, flessibile e efficace, tale da costruire un supporto alle decisioni strategiche, tattiche e operative”²¹

With this last definition, which remains broader than its predecessors, it is understood that BI is knowledge management, enterprise resource planning, decision support systems and data mining. It is an indispensable resource for companies that need to move in such a volatile environment and find themselves in need of fast and as correct data as possible. An infrastructure built 'ad hoc' on the needs of the company will enable it to meet this need in a timely manner, helping it to adapt, and responding effectively to pressures, both internal and external.

²¹ Alessandro Rezzani. Business Intelligence. Alessandro Rezzani, 2012.

2.3 The architecture of a Business Intelligence system

The Business Intelligence system is extremely complex and involves all business areas, collecting information transversally from the entire organisation. Depending on the complexity of the business and the presence of skills required to develop such an infrastructure, the system may have within it the three macro areas listed below, which will evolve according to the maturity and needs of the business itself. Being transversal to the entire enterprise, the diversity of elements from which it is composed will be grouped into the following macro-areas²²:

- “*Data Source macro-area*”: this macro area includes the elements that provide information to the data warehouse, representing the sources of the BI system. They can also be defined as data sources, and can be one or more, depending on the business need;
- “*Data Warehouse macro-area*”: mainly composed of data warehouses and data marts, this macro-area is crucial for Business Intelligence. An efficient, clean and complete data warehouse is essential for any kind of analysis, providing 'certified' and accurate data. It is the most complex part but, if structured correctly, will lead the whole system to perform better;

²² Alessandro Rezzani. Business Intelligence. Alessandro Rezzani, 2012.

- “Data analysis macro-area”: this macro-area represents the final stage of the BI process, following the extraction, transformation, loading and storage of data. It includes OLAP tools, reporting and dashboarding tools, which form the front-end of the BI system, the contact point between business results and the end user.



2.2. *Business Intelligence Structure* – Source: Esteves, Márcia, et al. “A Proof of Concept of a Mobile Health Application to Support Professionals in a Portuguese Nursing Home.” *Sensors*, vol. 19, no. 18, 12 Sept. 2019, p. 3951, <https://doi.org/10.3390/s19183951>. Accessed 19 June 2024.

DATA SOURCES

Enterprise operating systems are the starting point for most quantitative data within a company. These systems can also be referred to as 'transaction processing systems', 'source systems' or 'enterprise resource planning' (ERP). These are categorised as²³ :

- *Production system*: When an article is produced, the production order is entered into the production system. The amount of raw material used and the finished product is recorded.
- *Sales system*: When a customer places an order, the order details are entered into the order entry system.
- *Supply chain management system*: When the product is available, it is shipped, and details of the order fulfilment are recorded.
- *Accounting system*: Accounting then issues the invoice to the customer and collects the payment. Invoices and payments can be recorded in a different operating system from the order entry system.

²³ Howson, Cindi. Successful Business Intelligence : Unlock the Value of BI & Big Data. Emeryville, California, McGraw-Hill/Osborne, 2014.

Those listed above are categories that are identified to categorise these data entry systems. In some companies, tending to be large ones, it may be the case that these systems are part of a single ERP software that encompasses them (e.g. Oracle, Microsoft Dynamics 365 and SAP), or one or more systems coexist. In the second case, we are faced with other companies, which for reasons of budget or running costs, find it convenient to carry out their operational activities using different instruments. Finally, we have the whole mass of data from external sources such as competitor information, geographic information and statistics, which are useful for the enterprise but bring a new level of difficulty for data consistency and uniformity.

The latter is in fact the biggest problem of exploiting different sources, that is, those data that will be incorporated into the data warehouse will be inhomogeneous and inconsistent with each other, if not duplicated, making their processing complex. Therefore, in order for the data that will be received by the DW first, and then by the BI, to be correct, it is necessary to have an ETL (Extract, Transform, Load) system that takes care of the quality of the data. This acronym stands for the entire process from the extraction of the data (*extract*), transformation through the cleaning process, standardisation, formatting and loading into the DW. The importance of the process just described is elevated as we have seen, and there are various factors that can influence it: the number and variety of sources, where data are categorised in different ways, the incorrectness of the data and their translation into each company's own language²⁴.

²⁴ Alessandro Rezzani. Business Intelligence. Alessandro Rezzani, 2012.

If these stages are not thoroughly conducted, a '*data quality*' problem arises. The quality of the data is one of the most important requirements of the whole process because if it were not, the error would be carried over to the next steps and the end user would read an incorrect data.

To avoid this problem, there are data quality rules that can be implemented in the ETL process. These are²⁵ :

- *Intrinsic quality factors of the data*: the three variables are accuracy, i.e. conformity to its true value, completeness, i.e. whether the given information is complete, and consistency, i.e. lack of contradictions between the data;
- *Data quality of service factors*: indicates the ease of use of the data and the security of the system that stores it;
- *Quality factors of the data structure*: these factors make the data easy to understand for the end user.

²⁵ Alessandro Rezzani. Business Intelligence. Alessandro Rezzani, 2012.

DATA WAREHOUSE

To explain DW, we take as a basis the definition given by Cindi Howson, an expert in Bi and management reporting, who describes it as:

*"A data warehouse is the collection of data extracted from various operational systems, loaded into an operational data store or staging area, then transformed to make the data consistent and optimised for analysis"*²⁶.

We see how the above lines take up the concept of ETL, a concept that cuts across the three macro-areas identified above. In fact, the Data warehouse represents a single storage of information from which the data come out in an unambiguous and certified manner, thus allowing visualisation software to interact with a single data management system, and thus extract data from a single source. Thus, the set of operational sources will provide the data that will be processed by the ETL system, feeding it into our storage. An essential feature of the information present is that it has historical depth, as there will be an automatic storage of the temporal development of this.

²⁶ Howson, Cindi. Successful Business Intelligence : Unlock the Value of BI & Big Data. Emeryville, California, McGraw-Hill/Osborne, 2014.

William Inmon, considered to be the father of the Data warehouse, pointedly identified the unique characteristics of the system in analysis²⁷.

1. *Object-oriented*: Can analyse data on a particular topic or functional area (such as sales)
2. *Integrated*: Create consistency between different types of data from disparate sources
3. *Non-volatile*: Once data are in a data warehouse, they are stable and do not change
4. *Time variant*: Data warehouse analysis examines change over time

Within the Data Warehouse, information is organised in tables, which are grouped into two large groups:

- *Fact tables*: Fact tables contain the concrete measures of the business, both quantitative and qualitative, such as total sales, number of customers, number of products sold, etc., which are the focus of our analysis. These tables are linked to the dimension tables via keys. These keys allow the data in the fact tables to be linked to the corresponding dimensions. These tables have a high depth of detail in order to provide as much information as possible. Fact tables are essential for analysis and reporting, as they provide the basic data on which to perform calculations and aggregations. For example, a fact table might contain data at the individual transaction level,

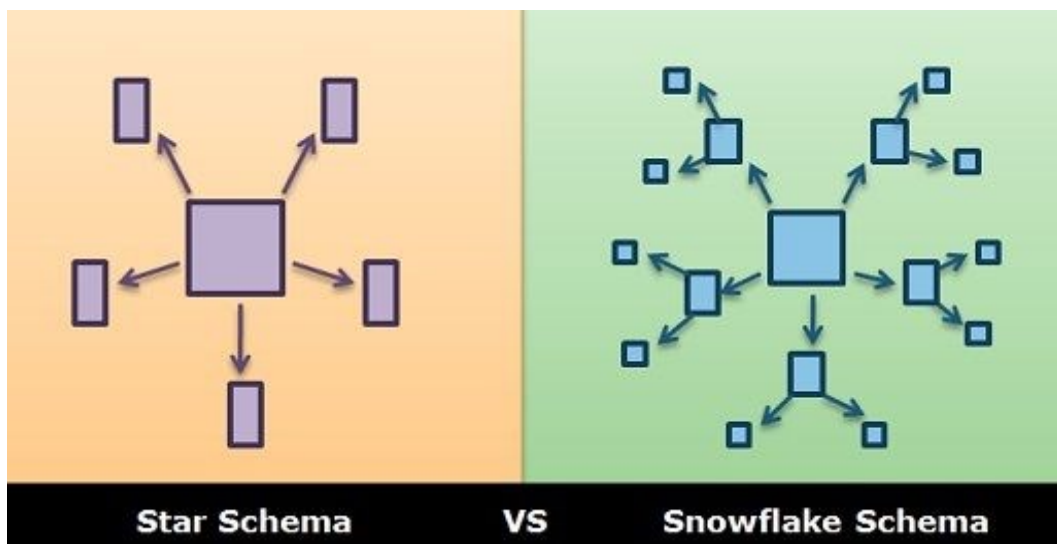
²⁷ Oracle Cloud Infrastructure. "Che Cos'è Un Data Warehouse?" Oracle.com, 2014, www.oracle.com/it/database/what-is-a-data-warehouse/. Accessed 25 May 2024.

or it might contain aggregated data at a higher level, such as total sales per day per shop.

- *Dimension Tables*: Dimension tables contain the descriptive information associated with data in facts. The dimension tables are linked to the fact table via foreign keys. This allows the measures or facts in the fact table to be correlated with the descriptive details in the dimension tables. This information can include various aspects such as time (date), geography, products, customers, suppliers and sales categories. The dimensions provide the context for the measurements in the facts. Dimension tables are generally smaller than fact tables and contain a limited number of rows. For example, a product dimension table might contain details such as product name, category and list price, while a fact table might contain measures such as the number of sales, revenues and costs associated with each product. Similarly, a table of customer dimensions might include information such as name, address and market segment, while a table of facts might contain the purchase transactions made by each customer.

The structure of the connections within the DW can be distinguished in two different ways which indicate how the various tables are linked together and how the exploration of the latter takes place. Modelling can take place via 'star schema' or 'snowflake schema' and their main difference lies in the difficulty of interrogating

the model, being easier in the former of the two²⁸. The star schema will have a central fact table surrounded by dimension tables to which it will be linked. On the other hand, we will have the "snowflake" which will start from a single fact table linked to dimension tables which will be subdivided into sub-dimensions. Obviously, the ease of exploration of the former is compensated for by a greater redundancy of the single information and a greater heaviness in storage, which the snowflake, on the other hand, optimises.



2.3 Star Schema vs. Snowflake – **Source:** Gupta, Nidhi. "Star Schema vs Snowflake Schema." Medium, 22 Apr. 2023, nidhi631.medium.com/star-schema-vs-snowflake-schema-78dc9424a8a2.

²⁸ Howson, Cindi. Successful Business Intelligence : Unlock the Value of BI & Big Data. Emeryville, California, Mcgraw-Hill/Osborne, 2014.

DATA MART

An honourable mention goes to a particular form of data analysis, namely data marts. As we have already seen, the DW has the characteristic of being unique precisely because it is based on the set of data coming from the data sources, which are made unambiguous by means of a proper data quality process and ETL procedures, thus obviating the problem of data irregularity and incompleteness. In contrast to DW, data marts are thematic databases that only concern a business process, containing data only on the dynamics of interest. However, it must be understood that the data warehouse and data marts are complementary tools, necessary for a complete analysis. In fact, the former provides reliable and stable data with a historical depth, something that operational systems cannot guarantee²⁹. Moreover, an integration of several sources may be necessary to have a degree of accuracy that only warehousing systems can provide. The data mart therefore derives from the mother system and can be exploited to scale down the amount of data to be processed, creating 'ad hoc' and thematic operational systems. These two realities, however, must co-exist in order for the entire BI system to have a long-term view and accurate dimensional accuracy.

²⁹ Alessandro Rezzani. Business Intelligence. Alessandro Rezzani, 2012.

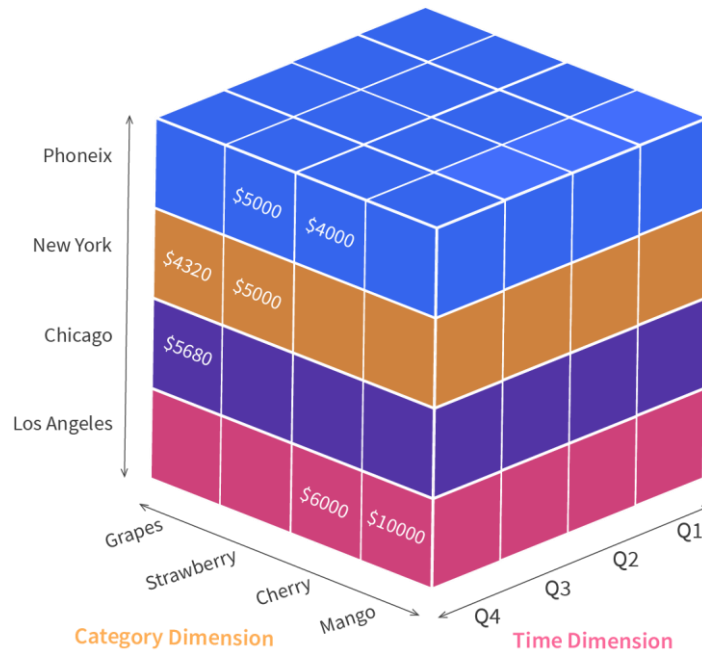
ANALYSIS

After sorting and organising our data, the final need is to interrogate them for the purposes. A. Rezzani, lists the three main ways of querying DW:

- Direct query via SQL language
- Using tools that access an OLAP engine
- Use of tools that directly access the Data Warehouse

The first of the three listed points refers to Structured Query Language (SQL), which is a language used by relational databases to query data or to create or modify database data.

The second point refers to what is known as Online Analytical Processing (OLAP), which is software that can interactively analyse large amounts of data from the DW. This is a dimensional analysis that also allows measurements to be viewed from other perspectives, exploiting its speed and computing power. OLAP also makes it possible to navigate within the information, facilitating data exploration actions such as drill-down, drill-through and slice-and-dice etc., thanks to its typical cubic shape. An example is shown in figure 5.



2.4 Olap cube – Source: Desai, Brahmajeet. “The Hitchhiker’s Guide to OLAP: What Is OLAP and Its Types.” *Kyvos Insights*, 21 Oct. 2021, www.kyvosinsights.com/blog/the-hitchhikers-guide-to-olap-what-is-olap-and-its-types/.

Finally, we can identify tools that interact directly with the Data Warehouse and enable effective visualisation of data. These tools play a crucial role in extracting and presenting the information contained in the Data Warehouse in a comprehensible and accessible way for end users. These data visualisation tools offer the user different ways of presenting the information, adapting to different needs and purposes of use. For example, for detailed and comparative analysis, tables or matrices can be used that organise the data in an orderly manner and allow relationships and trends to be quickly identified. For a more immediate and visually intuitive understanding, graphs of various types are used, such as histograms, pie charts, line graphs and scatter plots, which allow patterns and anomalies to be quickly grasped. Finally, Dashboards provide a comprehensive and interactive visual summary, allowing the user to monitor various performance indicators in real time and make informed decisions based on the data. These Dashboards can be

customised to show a combination of graphs, key performance indicators (KPIs) and other visualisations, thus facilitating effective monitoring and proactive information management. In essence, the variety of visualisation tools available enables the transformation of raw data into valuable insights, enhancing decision-making and optimising business processes.

Each method of interaction with the DW varies according to the needs of the user and especially the degree of complexity of the request being made. Maturity of use determines which route is best to take, carefully weighing the benefits and deficits of each tool.

2.4 Types of analysis using Business Intelligence

The analysis power of BI is very high, and in the hands of an expert it can explore data with great depth, supporting the company with specific data analysis. The analysis that is carried out can be of various types depending on the end purpose for which it is pursued, and with it the complexity of the analysis increases. Four main types of analysis are identified³⁰ :

- *Descriptive Analysis*: this is the most commonly used type of analysis. Descriptive analysis is based on criteria for collecting, classifying, summarising and representing data learned from the study of a population or part of a population, which may be a target customer or a specific market. The purpose of this type of analysis is to describe a situation, providing useful data on the trend of certain phenomena. They can be represented by summary dashboards, KPI reports and tables with graphs;
- *Diagnostic Analysis*: this analysis focuses on the analysis of a single phenomenon, looking for the causes of its occurrence. This analysis goes to identify the past causes of certain events and situations and is closely linked to descriptive analysis. This process, however, makes use of specific techniques that can be drill-down, data mining and correlation to get to the root cause. This tool allows for a more in-depth analysis, starting from

³⁰ Reddy, Chandan K, and Charu C Aggarwal. Healthcare Data Analytics. Boca Raton London New York Crc Press, 2020.

general data and arriving at the most specific case;

- *Predictive analysis*: this type of analysis is more complex than the previous one because it includes statistical techniques of predictive modelling, machine learning and data mining to analyse historical and current facts to provide possible future scenarios. What underlies this type of analysis is the identification of repeated patterns or 'patterns' that allow the assessment of potential risk in taking certain actions. These are very useful data for analysing trends and developments within a company and a market.;
- *Prescriptive Analysis*: this point is the most complex and is currently being developed within companies, with heavy investment to make it effective and efficient. This analysis of big data makes use of artificial intelligence by generating screens that allow not only to develop a predictive analysis, but also to provide objective criterion data, giving examples about what will happen and why it will happen, and then act based on its reading.

2.5 Business Intelligence to support marketing and sales

The adaptability of BI to business objectives is essential in order to create a data input, reception and processing process that is as reliable as possible. In the world of sales and marketing in particular, there are many data sources, given the fact that companies need to sell their products and services, and therefore need to keep track of transactions and the qualitative and quantitative data derived from these. Kimball and Ross identified four main steps to be taken in order to build a BI system that can be consistent with the needs of the business and the data made available, while adhering to the KPIs³¹ (Key Performance Indicators) set.

Select Business Process

The first step in design is to decide which business process to model (e.g. orders, payments, invoices) by combining an understanding of the business needs with an understanding of the available source data. This construction should start with the area against which you have the most data and which is easy to find. In sales, for example, it could help to understand which product was sold on a particular day by specifying the sales channel.

³¹ Kimball, Ralph, and Margy Ross. *The Data Warehouse Toolkit*. John Wiley & Sons, 8 Aug. 2011.

'Declare the grain'

This specific term indicates the level of detail with respect to which the fact table is desired. In particular, the grain is determined by the physical realities of the operating system that captures the events of the business process. The depth against which one can arrive depends on the detail of the data at hand. Dealing with data at its most granular and detailed level is advantageous for many reasons. Detailed, or atomic, data are rich in dimensions. The greater the level of detail of factual measurements, the more information one has at one's disposal. This information is transformed into dimensions. In this sense, detailed data fits perfectly with the dimensional approach.

Atomic data offers maximum analytical flexibility as it can be filtered and aggregated in any way possible. Data detailed in a dimensional model are ready to be analysed extemporaneously by business users. The less atomic they are, the less detailed and modelled the data can be. In the example given we have POS: the most detailed data concerns individual products in a POS transaction, considering that the POS system aggregates all sales of a given product within a shopping cart in one line. Although users are probably not interested in analysing individual items of a specific POS transaction, we cannot foresee all the ways in which they might want to examine that data. For example, they might want to compare sales between Monday and Sunday, assess whether it is useful to stock many different sizes of certain brands, etc. Although none of these queries require data from a specific transaction, they are broad questions that need detailed data analysed in precise ways. None of these questions could be answered by providing access to summary data only.

Identify the dimensions.

To create effective dimension tables, it is necessary to add a complete set of dimensions representing all possible descriptions that have individual values for each measurement. If the grain is clearly defined, the dimensions can be easily identified as they represent the 'who, what, where, when, why and how' of the event. For example, common dimensions are date, product, customer, shop, promotion and payment method. After correctly defining the grain, the dimension tables are easy to fill, determining a primary table of facts.

Identify the facts

Facts are what the process is measuring. Business users are deeply interested in analysing these performance metrics. Every candidate fact in the project must be consistent with the level of detail defined in the second step. If a piece of data is clearly associated with a different level of detail, it must be placed in a separate fact table. Usually, significant data are additional numerical figures, such as ordered quantities or dollar amounts. To make decisions on the four steps, it is essential to consider both the requirements of the business users and the characteristics of the source data at the same time, and to avoid modelling the data solely on the data sources, not involving the end users. Furthermore, they must be consistent with the grain indicated in the second point. On the sales side, they may include quantities, prices, total sales, etc.

The world of sales and marketing is one of those that benefits most from the massive use of business intelligence. It is easy to see how both the multitude of factors and the presence of variables and KPIs make it well worth using this tool to interrogate data. The data sources and consequently the information present in sales information systems are many and detailed, providing a substantial amount of insight that can be analysed and exploited for business development.

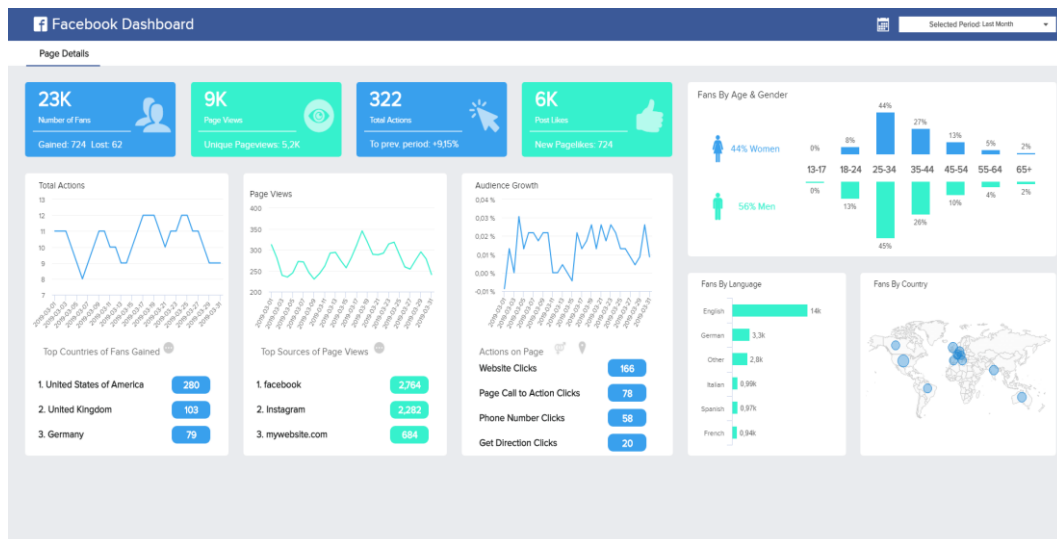
At the same time as the increasingly relevant presence of big data, we have a constantly evolving world that makes it necessary to have fast and accurate information so that managers and decision makers can have the necessary levers to steer the company correctly. We must also learn to react faster and faster, pooling knowledge, using new information and communication technologies, using decision support models, developing the ability to verify and interpret results directly, in their signalling capacity, without delegating the interpretation of data to calculation algorithms³².

Business intelligence meets these needs, being increasingly specific and customisable. The aim of this, will always be to move towards 'self-service' BI, which is fast and can be exploited by anyone quickly. Before BI, in order to get accurate data, it would have been necessary to go through IT staff, useful to implement reports and work with OLAP cubes. Now there are more and more tools

³² Marchi, Luciano. "Dalla Crisi Allo Sviluppo Sostenibile. Il Ruolo Dei Sistemi Di Misurazione E Controllo." *MANAGEMENT CONTROL*, no. 3, Oct. 2020, pp. 5–16, <https://doi.org/10.3280/maco2020-003001..>

that provide usable reporting for everyone, making the sharing of information easy and quick, avoiding delays.

This can be done through data visualisation tools, as 'front-end' tools that do not require programming or data science skills. These can be, for example, the Facebook or Instagram business suite, where we see real dashboards that can be customised and updated in real time, giving insights such as performance and competitor analysis and ROI measurement.



2.5 Example of dashboard with Social Media Data – **Source:** “Facebook Dashboards - Explore Great Examples & Templates.” *Www.datapine.com, www.datapine.com/dashboard-examples-and-templates/facebook.*

3. Corporate reporting and data visualisation

Corporate reporting is the final part of the Business Intelligence architecture, that is the product that is received by managers and decision makers, to guide the enterprise. We have previously seen the technical path leading to the development of the front-end part, how it can be developed, so that it can be used by the entire corporate audience. To do this, there must be a bridge between the technical and design part and the actual reporting and visualisation part. This part is essential if the task of Business Intelligence is to be carried out in the best possible way and the data is to complete its informative function quickly and accurately. In this chapter, we will see what it means to generate a complete and informative report, and which rules should be adhered to in order to convey the message correctly. Secondly, we will examine graphs and their meaning. Finally, we will see how to develop a dashboard, a management cockpit that is adaptable to the sales world.

3.1 The right report

Reports are the most immediate way to disseminate Business Intelligence as it is a document, either in electronic or paper format, that collects data and presents them to users in a searchable manner, using simple tables or graphical elements. Reporting was created for the purpose of communication by means of synthesis elements, which make the elements being analysed stand out to the eye. Other studies, refer to the reporting system as³³:

"The reporting system is a 'Communication Activity' aimed at producing 'just in time' information through the collection and processing of data to support the budgeting process and decision making".

This definition puts the focus on decision making, the ability of users to make decisions based on reading the data.

Reporting in the corporate ecosystem is an important organisational asset, so that information is correctly disseminated to the various levels concerned. In reporting, it is necessary to consider that the receivers have: expectations, information needs, their own semantics, specific responsibilities, prejudices and beliefs. All this must be taken into account in order to package information that is then received in the right way and responds to emerging needs.

³³ Serpelloni, Giovanni, and Elisabetta Simeoni. I SISTEMI DI REPORTING: PRINCIPI E CRITERI DI FUNZIONAMENTO.

In addition to this, the very nature of reporting encompasses general characteristics that are common to every reporting process, It means³⁴ :

- Spreading knowledge within the company
- Stimulating attention
- Making situations and phenomena understood
- Producing interventions

Then there are those that can be defined as specific³⁵ :

- *Knowledge*: it is important to provide structured and general information on the business context in which one operates, even if not strictly related to the specific area of responsibility. This also includes the sharing of knowledge common to all managers of the different sectors through reports that do not follow a standard format;
- *Control*: reports must be targeted at the variables for which managers are responsible, helping them to make decisions on specific issues. It is essential to provide knowledge specific to one's area of action and responsibility through standardised reports, thus ensuring consistency and accuracy of information;

³⁴ Serpelloni, Giovanni, and Elisabetta Simeoni. I SISTEMI DI REPORTING: PRINCIPI E CRITERI DI FUNZIONAMENTO. 2014.

³⁵ IDIBEM

- *Decision-making*: the information provided must be closely related to the decisions to be made, ensuring that managers have all the data they need to make informed and effective decisions.

Within the company, reporting also differs from the level of management to which it is addressed. In fact, the information contained goes into a level of detail suitable for understanding the variables to be governed, and therefore, the specificity will depend on the end user, also varying the mode of presentation. Three reference areas are identified³⁶ :

- *Strategic Reporting*: This level of reporting contains very aggregated information and exposes company trends in a general way by means of key figures. This type of reporting is often based on a graphical representation. Since these reports are aggregated and at a generic level, they are weekly and monthly. Examples are monthly reports on cost and sales trends.
- *Tactical reporting*: this category has a lower level of aggregation and the amount of charts present is smaller. It is aimed at monitoring by comparing it with set targets and previous years. These types of analysis are either weekly or monthly depending on the targets to be monitored.

³⁶ Alessandro Rezzani. Business Intelligence. Alessandro Rezzani, 2012.

- *Operational* reporting: this type of report is characterised by a minimum level of aggregation, while also providing data with a high level of detail and is often presented in tabular form. These can be reports of daily sales or reports of production costs per department.

So, as we see, the higher the hierarchical level, the greater the level of data aggregation. When creating reports, it will therefore be necessary to know the audience so that the degree of information is correct and information needs are met correctly. The passage of information must also respect characteristics of timeliness, so that quick saws can be captured for corrective action, reliability and relevance³⁷.

Finally, data can be provided in two different ways: pull and push. The first one stands for all those reports that the user can access when needed, by retrieving it in appropriate places such as a company portal. The other method, on the other hand, stands for all those reports that are sent to the user periodically and received by e-mail, without any activity on their part. The only way to obtain these reports is to be included in the recipients of the e-mail³⁸.

³⁷ Serpelloni, Giovanni, and Elisabetta Simeoni. I SISTEMI DI REPORTING: PRINCIPI E CRITERI DI FUNZIONAMENTO. 2014..

³⁸ Alessandro Rezzani. Business Intelligence. Alessandro Rezzani, 2012.

3.2 Data Visualisation

Graphics and visualisation are one of the cornerstones of reports, they are the way in which the message is conveyed. Data visualisation is the graphical representation of information and data. Using visual elements such as graphs, tables and maps, data visualisation tools offer an accessible way to visualise and understand trends, outliers and patterns in data³⁹ . Data visualisation can not only improve productivity, but also help people communicate and share information better. In the field of business intelligence, data visualisation is even more important, which can support business managers better understand how the company operates, market trends and customer needs, and provide strong support for decision-making.

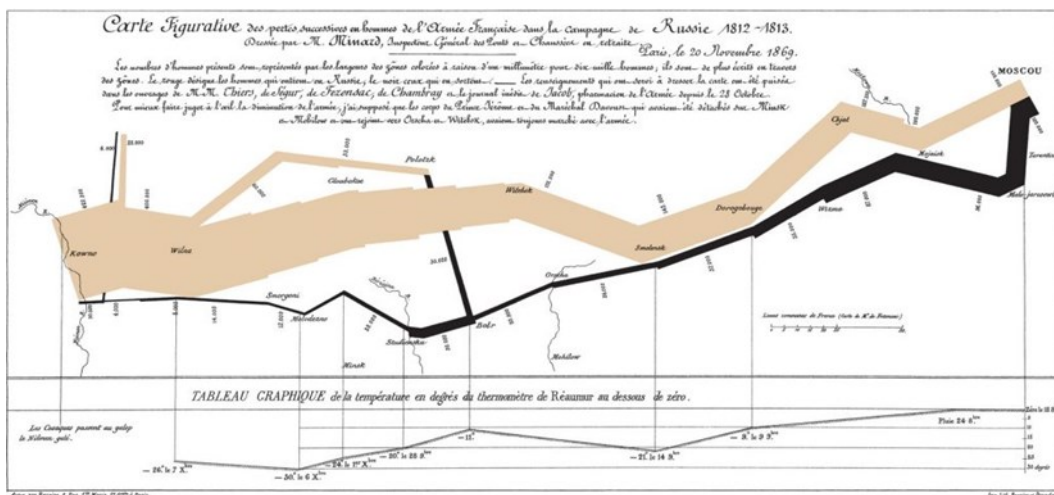
Before analysing data visualisation today, it is good to understand where it comes from and what processes have made it a subject of study. We need only think of the ancient civilisations that used images to narrate astronomical events or to draw maps to orient themselves on journeys⁴⁰ . A significant example of a representation of the Aristotelian-Thelemic cosmos is the illustration by Piero Apiano, a 15th-16th century German cartographer, mathematician and astronomer. This illustration fully embodies the conception of the cosmos that dominated Western culture for some 2,500 years. It is a powerful and enduring paradigm, a matrix of meaning that has allowed any phenomenon occurring in the universe to be framed for centuries. This example, along with many others, demonstrates how the evolution of

³⁹ Tableau Blueprint. "What is Data Visualisation? Definition, Examples And Resources." www.tableau.com, www.tableau.com/it-it/learn/articles/data-visualization. Accessed 2 June 2024.

⁴⁰ artofviz. "Art of Visualization." www.artofvisualization.com, 23 Oct. 2023, www.artofvisualization.com/blog/history-and-evolution-of-data-visualization.

knowledge and tools has enabled increasingly detailed and precise representations of the world. Subsequently, the Renaissance represented a turning point in this context. During this period, the first graphic representations were developed in which visualisation and statistics met, marking an important evolution in the representation of data and information. Over the following centuries, this evolution continued to progress, culminating in the work of Charles Joseph Minard, who, according to Edward Tufte, one of the leading experts in statistical visualisation, initiated what we know today as effective data visualisation.⁴¹ . This was a civil engineer in Napoleon's service who created a schematic but extremely faithful representation of the French leader's Russian campaign. His skill was to summarise six different variables in a single image: army size, latitude, longitude, troop path, temperature and time flow. Being able to represent such a large number of variables by hand makes this feat formidable, and this is why Mainard is considered the father of infographics, thanks to this virtuoso example of a graphic's ability to summarise and overall impact.

⁴¹ Tufte, E R. *The Visual Display of Quantitative Information*. Cheshire, Graphics Press, 1982.



3.1 Map of the Russian Campaign by Charles Joseph Minard – **Source:** Wikipedia. “File:Minard.png - Wikipedia.” Commons.wikimedia.org, it.m.wikipedia.org/wiki/File:Minard.png. Accessed 19 June 2024.

We then come to the beginning of the last century, where, according to the studies of C. Chen, W. Härdle and A. Unwin, we find the golden age of graphical and statistical representation. In fact, statistical offices were set up all over Europe, realising the importance of numerical information in various fields, from business to transport to industrialisation⁴². With the technological revolution first and the advent of the Internet later, graphical representation also underwent a strong evolution, despite the limited capabilities of the first computers. Arriving at the present day, we see how data visualisation plays the role of a major player in reporting, allowing a greater mass of data to be managed, becoming increasingly interactive and responsive. Finally, the last step was a democratisation of data visualisation thanks to the advent of the Internet. Data modelling was no longer the preserve of a few experts, and, thanks to an internet connection, anyone could have

⁴² Chun-Houh Chen, and Et Al. Handbook of Data Visualization. Berlin, Springer, 2016.

access to graphing tools such as PowerBI or Tableau⁴³. With the advent of 'big-data', the need for immediate synthesis visualisation of huge amounts of data became more and more pressing, generating increasingly high-performance systems capable of high data exploration via 'drill-down', 'drill up' or 'drill-through'.

Today, the world of data visualisation is very varied and intersects various semantic areas, from statistics to mathematics to design, but the terms Data Visualisation and Infographics are often used synonymously, whereas there is a substantial difference between these two types of representation. Indeed, data visualisation and infographics aim to visually present complex and irregular information in an organised and comprehensible manner but, despite this common goal, the two terms have different meanings. Infographics involve a visual and narrative presentation of a given topic that provides various pieces of information simultaneously, sometimes including processes. This visual presentation can make use of various elements such as images, illustrations, typography, maps and visualisations⁴⁴. Data visualisation can be defined as the visual representation of numerical values through the use of graphs, tables and diagrams. It is a transformation of raw data information into visual presentations. Its most important characteristic is its ability to communicate clear information based on measurable statistical data. They have a direct impact on the credibility and persuasiveness of information, as they provide clear and objective information based on numerical data. It is important to

⁴³ artofviz. "Art of Visualization." www.artofvisualization.com, 23 Oct. 2023, www.artofvisualization.com/blog/history-and-evolution-of-data-visualization.

⁴⁴ Elbashir, Mohamed Z., et al. "Measuring the Effects of Business Intelligence Systems: The Relationship between Business Process and Organizational Performance." *International Journal of Accounting Information Systems*, vol. 9, no. 3, Sept. 2008, pp. 135-153.

emphasise that data visualisations are part of the research and study of statistics and data analysis. Thus, data visualisation and infographics may coincide but do not always correspond, even though they are used in common jargon in the same way. This does not detract from the fact that infographics, closely linked to design and storytelling, with the ultimate aim of telling a story, and data visualisation, linked to the statistical analysis of data and its exploration, can be combined to tell viewers a story, visualising complex information and processes in a way that makes them easy to understand and arouses attention and curiosity, driving them to action.

To conclude, the main difference is that data visualisation allows the viewer to explore and relate to it in order to discover the data it communicates, by means of tools such as drilldown and drill through, whereas infographics are a passive concept of the user, who will be guided within a storytelling. The objective of a good report is not only to allow you to explore the data but to tell the story in it. The analyst or communicator must be able to bring the data to light and at the same time bring it to life⁴⁵, to transport the user into a story that is complete and compelling, but that can also highlight the message that one wants to get across.

⁴⁵ Knaflic, Cole Nussbaumer. *Storytelling with Data: A Data Visualization Guide for Business Professionals*. Hoboken, New Jersey, Wiley, 2015.

3.3 How to create an effective data visualisation

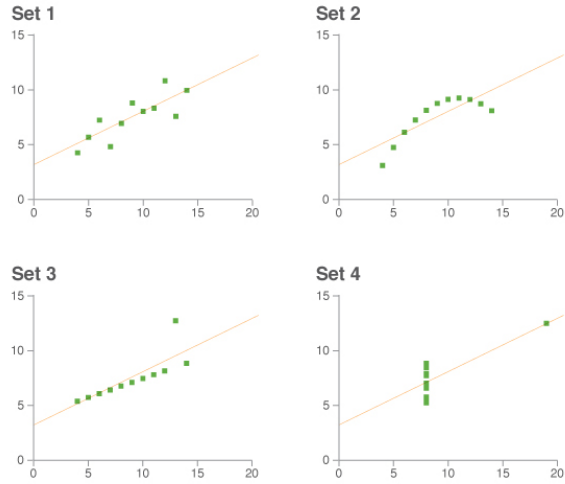
So far, we have seen what a report is and how it relates to data visualisation and how this has evolved over time. Now, however, we are going to demonstrate which good rules we must follow in order to make the formation of the report consistent with the objectives, starting with why we put numbers in graphs and providing a different point of view on the latter. The statistician F. J. Anscombe demonstrated the substantial difference there is in studying a figure in a table or from a graph⁴⁶. His experiment, called "Anscombe's Quartet", aimed to show this difference in a simple and intuitive way. In fact, he took four groups (A; B; C; D) with a series of coordinates (x;y) inside that would form, in each group, N groupings. These were first entered in table form and then placed in a Cartesian graph. This second representation shows us the relationships that are present in those numbers, which the former does not allow. How these numbers are related to each other, and their trends are not visible in the former because the representation is not very communicative.

⁴⁶ J, Anscombe F. "Graphs in Statistical Analysis." *The American Statistician*, vol. 27, no. 1, 1973, pp. 17-21, www.jstor.org/stable/2682899, <https://doi.org/10.2307/2682899>.

Anscombe's Quartet

| Set 1 | | Set 2 | | Set 3 | | Set 4 | |
|-------|-------|-------|------|-------|-------|-------|------|
| X | Y | X | Y | X | Y | X | Y |
| 10 | 8.04 | 10 | 9.14 | 10 | 7.46 | 8 | 6.58 |
| 8 | 6.95 | 8 | 8.14 | 8 | 6.77 | 8 | 5.76 |
| 13 | 7.58 | 13 | 8.74 | 13 | 12.74 | 8 | 7.71 |
| 9 | 8.81 | 9 | 8.77 | 9 | 7.11 | 8 | 8.84 |
| 11 | 8.33 | 11 | 9.26 | 11 | 7.81 | 8 | 8.47 |
| 14 | 9.96 | 14 | 8.1 | 14 | 8.84 | 8 | 7.04 |
| 6 | 7.24 | 6 | 6.13 | 6 | 6.08 | 8 | 5.25 |
| 4 | 4.26 | 4 | 3.1 | 4 | 5.39 | 19 | 12.5 |
| 12 | 10.84 | 12 | 9.13 | 12 | 8.15 | 8 | 5.56 |
| 7 | 4.82 | 7 | 7.26 | 7 | 6.42 | 8 | 7.91 |
| 5 | 5.68 | 5 | 4.74 | 5 | 5.73 | 8 | 6.89 |

| Property | Value |
|---|---------------------|
| Mean of X in each case: | 9 (exact) |
| Variance of X in each case: | 11 (exact) |
| Mean of Y in each case: | 7.50 |
| Variance of Y in each case: | 4.122 or 4.127 |
| Correlation between X & Y in each case: | 0.816 |
| Linear regression line in each case: | $y = 3.00 + 0.500x$ |



3.2 Anscombe's Quartet – **Source:** Qlik Community. “The Importance of Data Visualization.” *Community.qlik.com*, 10 Dec. 2012, community.qlik.com/t5/Design/The-Importance-of-Data-Visualization/ba-p/1465937. Accessed 19 June 2024.

Secondly, reporting a graph enables correct memorisation. Our short-term memory is not capable of storing many pieces of information at the same time. Most probably when we reach the fourth or fifth number, we forget the first. A representation allows the memory to retain at least the macro-information that is reported⁴⁷. This is known as pre-attentive information: it is information that we can process visually almost immediately, before sending it to the parts of the brain responsible for processing attention⁴⁸.

⁴⁷ Chun-Houh Chen, and Et Al. Handbook of Data Visualization. Berlin, Springer, 2016.

⁴⁸ Tableau Blueprint. "Why Visual Analytics?" [Help.tableau.com/current/blueprint/en-us/bp_why_visual_analytics.htm#:~:text=Pre%2Dattentive%20attributes%20are%20information.](https://help.tableau.com/current/blueprint/en-us/bp_why_visual_analytics.htm#:~:text=Pre%2Dattentive%20attributes%20are%20information.)

Data visualisation also depends on what our purpose is and to whom the message is addressed. There are two main questions one must ask oneself before starting to represent data graphically⁴⁹ .

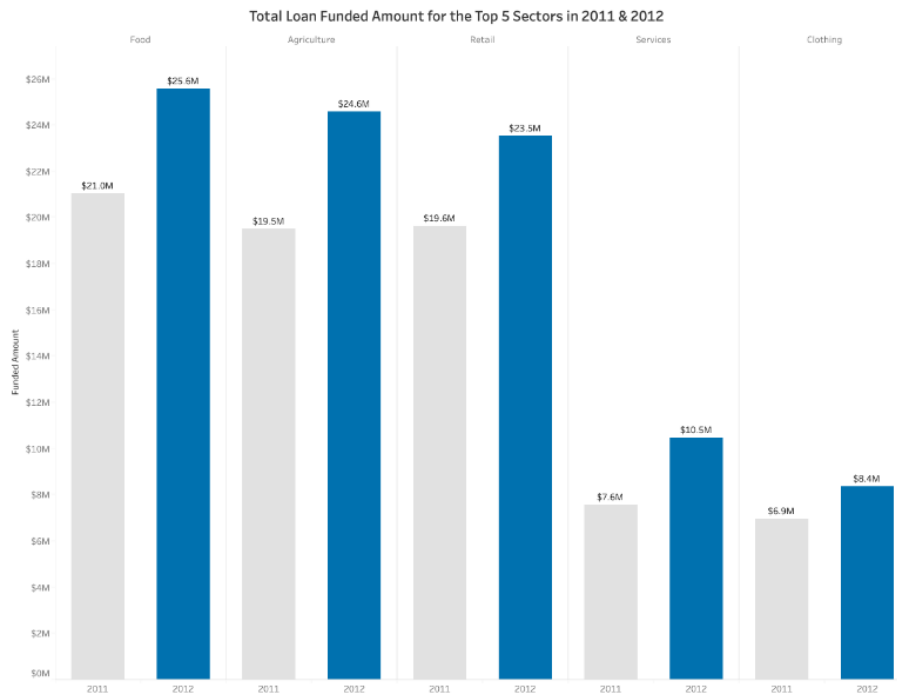
- *Data-driven* or *conceptual* information: the first question one should ask oneself is what kind of information one is going to represent, the typology. The question, of course, depends on whether our information is quantitative or qualitative, whichever way it comes. Indeed, one could represent qualitative information, even with graphs, which is typical of *'data-driven'* information, and vice versa.
- *Declarative* or *exploratory* information: this type of information depends on what you want to communicate. Managers most often work with declarative visualisations, making an assertion, addressing an audience in a formal context. On the other hand, if you are going to look for the motivation of a phenomenon, you are going to look for the causes by exposing the data in a way that may or may not refute the initial theory. If the initial hypothesis is confirmed, you can translate it into a declarative representation.

⁴⁹ Berinato, Scott. "Visualizations That Really Work." Harvard Business Review, June 2016

3.4 The graph and its and its many souls

The data representation tools that can be used in the various software are varied. They can be tables, textual descriptions, maps and graphs, and each of them, as mentioned earlier, has peculiarities that enable them to meet the information needs. Among these macrocategories, the ones with the greatest visual impact are precisely the graphs, which in turn will give a different analysis depending on the type chosen and used. In the following section we will delve into the most popular graphs in the various Business Intelligence software and what their purpose is within a potential report.

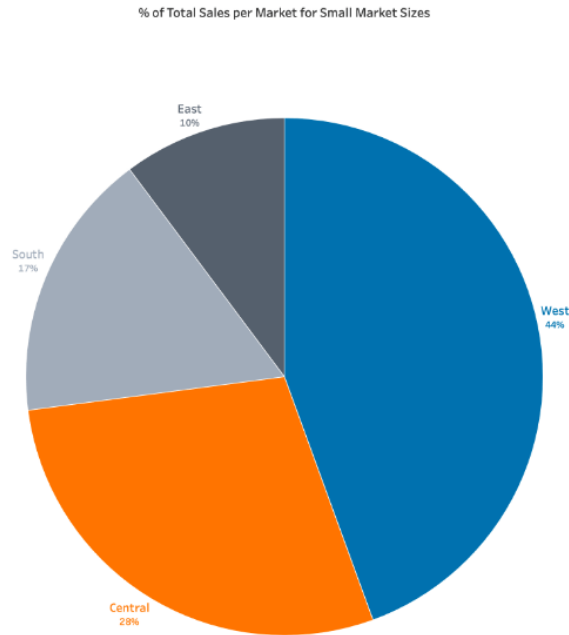
Bar graph



3.3 Bar Graph – **Source:** Tableau Blueprint. “A Guide to Charts: Definition, Examples, and Types.” Tableau, www.tableau.com/data-insights/reference-library/visual-analytics/charts.

These graphs can have horizontal and vertical bars. In the first case they are called histograms while in the second they are called bar graphs. They are used to analyse a grouped set of data over time or to compare two sets of data. In particular, bar graphs are particularly effective for representing data divided into categories and subgroups. Histograms, in particular, are useful for comparing discrete data or showing trends over time, using vertical or horizontal bars to compare individual values. In the latter case, they are displayed with two juxtaposed bars of different colours representing the same period. In addition, stacks can be created in the same bar to show the trend of a data distribution over time.

Pie chart

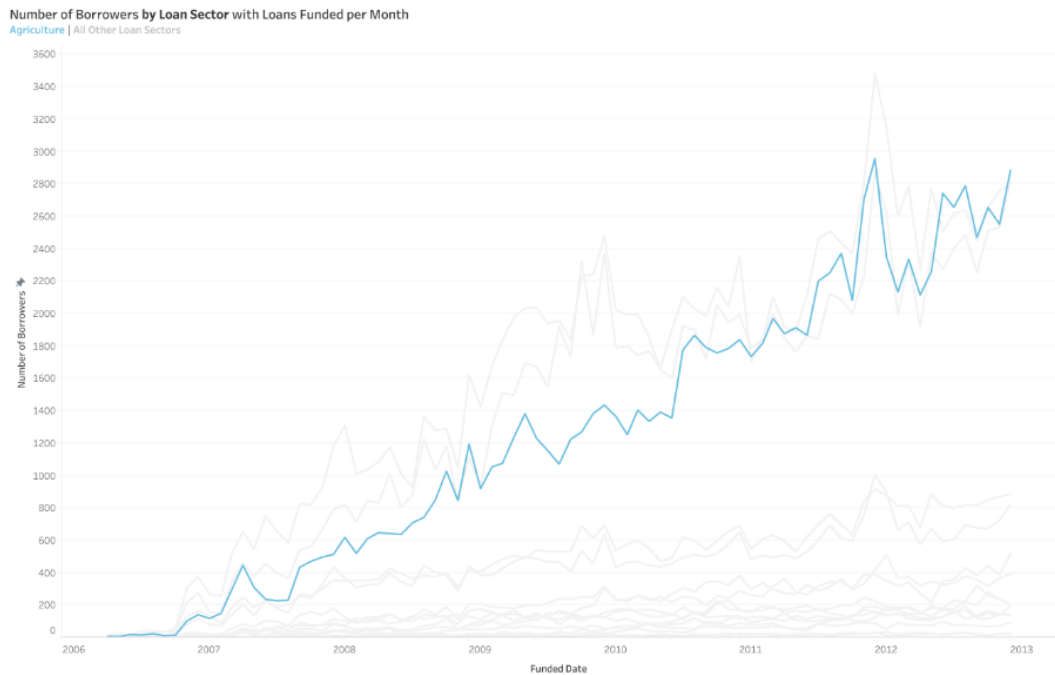


3.4 Pie Chart – Source: *Tableau Blueprint. “A Guide to Charts: Definition, Examples, and Types.” Tableau, www.tableau.com/data-insights/reference-library/visual-analytics/charts.*

The pie chart is exploited to represent a portion of the data in relation to the total. This type of chart helps the user to compare the relationship between different dimensions (e.g. categories, products, individuals, countries, etc.) within a specific context⁵⁰. These graphs are much exploited because they are easy and quick to read, but small precautions must be taken, such as, for example, exploiting them only if the categories are not large in number and the summation of the data to be represented gives the total (100%).

⁵⁰ Tableau. "Understanding and Using Pie Charts." Tableau, 2023, www.tableau.com/data-insights/reference-library/visual-analytics/charts/pie-charts.

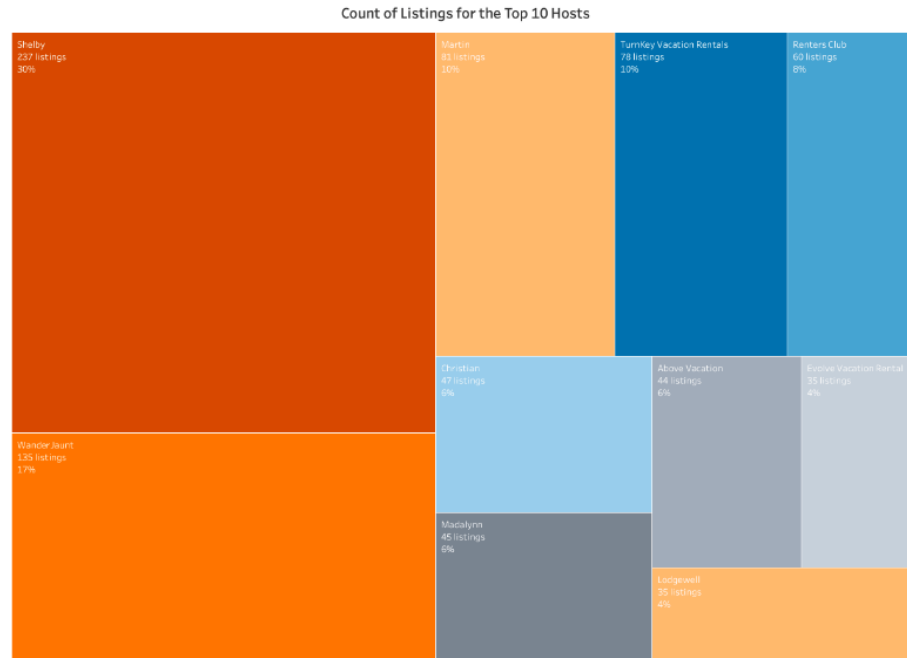
Line graph



3.5 Line Chart -- **Source:** Tableau Blueprint. "A Guide to Charts: Definition, Examples, and Types." Tableau, www.tableau.com/data-insights/reference-library/visual-analytics/charts.

Line graphs show the development of a data series by means of a line connecting the various points in the series. Usually, these graphs are used to analyse the trend of a quantity over time, as they highlight the evolution of the data series. In most cases, the x-axis (horizontal axis) represents a sequential progression of values. The y-axis (vertical axis) then shows the values of a metric selected through that progression.

Tree diagram



3.6 Tree Diagram — **Source:** Tableau Blueprint. “A Guide to Charts: Definition, Examples, and Types.” Tableau, www.tableau.com/data-insights/reference-library/visual-analytics/charts.

The tree map functions as a visualisation composed of nested rectangles. These rectangles represent certain categories within a selected dimension and are ordered in a hierarchy, or 'tree'. Quantities and patterns can be compared⁵¹ and displayed in a limited graphical space. Tree maps represent relationships between parts and integers. The composition of the latter causes the sum of the smaller rectangles to represent the rectangle containing them, that is the totality of the data model. Furthermore, they are represented in a hierarchical pattern from the top left, where

⁵¹ <https://learn.microsoft.com/it-it/power-bi/visuals/power-bi-visualization-treemaps?tabs=powerbi-desktop>

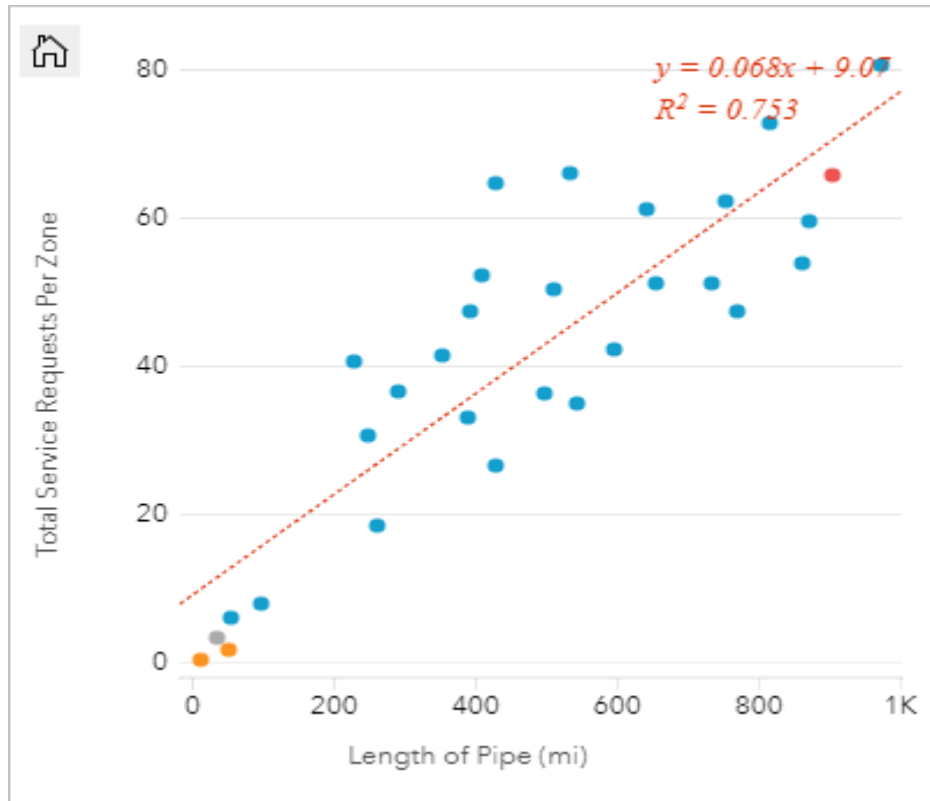
we will have the categories with the most weight, to the bottom right, those with the least weight.

It can be useful in the following situations⁵² :

- Visualise large amounts of hierarchical data.
- Present a large number of values that cannot be displayed effectively with a bar graph.
- Illustrate the proportions between each part and the whole.
- Display the distribution pattern of measures in each category level in the hierarchy.
- Display attributes using size and colour coding.
- Identify patterns, outliers, most important contributors and exceptions.

⁵²<https://learn.microsoft.com/it-it/power-bi/visuals/power-bi-visualization-treemaps?tabs=powerbi-desktop>

Scatter plot



3.7 Scatter diagram – Source: Tableau Blueprint. “A Guide to Charts: Definition, Examples, and Types.” Tableau, www.tableau.com/data-insights/reference-library/visual-analytics/charts.

A scatter plot displays the data points on a graph at the point where two measurements intersect. Scatter plots facilitate the analysis of the relationship between two numbers, as they display all data points in the same view. The x-axis (horizontal line) and y-axis (vertical line) each contain their own range. Scatter plots display data points as points or symbols along the x and y axes of a graph. They demonstrate the relationship between two variables and also show what are called 'outliers', that is a value that deviates significantly from the other values in the dataset.

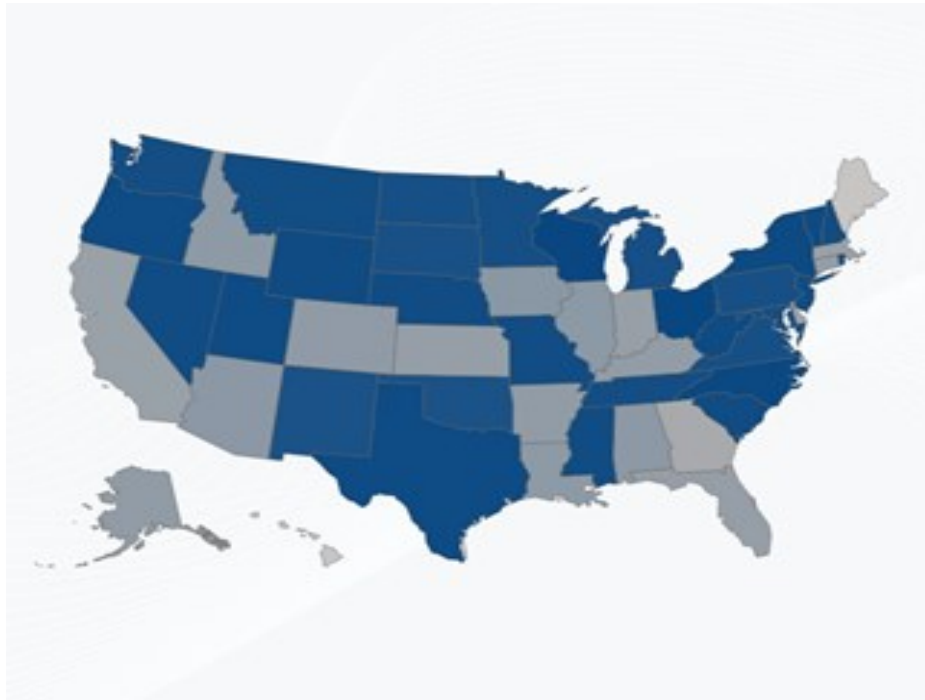
The graph can be described by means of three main indicators⁵³ :

- *Direction*: The direction of the relationship of the two variables can be positive or negative. If positive, there will be a positive linear relationship between the two variables while, if negative, there will be a positive linear relationship and therefore as one variable increases, the other will decrease
- *Form*: the form depends on the relationship that is present between the two variables. The relationship is not always linear and depends on how the variation of one causes the other to vary.
- *Strenght*: this indicates the inensity of the relationship between the two variables and is indicated by the slope of the curve.

In this graphical representation, it is possible to insert another variable that would be inserted into the graph and determine the size of the points, proportional to the size of that variable at that point. Thus, in addition to the two dimensions corresponding to the Cartesian axes, we will have the third magnitude represented by the bubbles.

⁵³ Moore, David S, et al. The Basic Practice of Statistics. New York, W.H. Freeman, 2018, p. 138.

Maps



3.8 Map - Geographical Representation – Source: Tableau Blueprint. “A Guide to Charts: Definition, Examples, and Types.” Tableau, www.tableau.com/data-insights/reference-library/visual-analytics/charts.

Maps are a type of functional graph to visually emphasise the values associated with cities, provinces, regions and states. They highlight geographical trends, created using countries on the X-axis and values on the Y-axis. The use of maps in the analysis of data serves to make the information displayed immediately stand out to the eye, also making use of colours or intensity bubbles. These types of charts are very useful as they allow the integration of geo-spatial dimensions, which companies have, with business data, such as sales, increasing the effectiveness of BI and reporting⁵⁴.

⁵⁴ Alessandro Rezzani. Business Intelligence. Alessandro Rezzani, 2012.

3.5 From Dashboard to Management Cockpit

What has been explained in the previous paragraphs with regard to reports, and the notions set out for data visualisation find their expression in dashboards and management cockpit. These tools are in fact part of the corporate reporting that will be used in CPM or Corporate Performance Management control systems. Gartner defines CPM as a “*generic term that describes the methodologies, metrics, processes and systems used to monitor and manage a company's business performance*”⁵⁵. This system is rooted in the identification of business indices and indicators to monitor business performance called KPIs (Key Performance Indicators).

Business intelligence dashboards are data visualisation and information management solutions used for analysing data. Creators can use interactive elements, such as filters and actions, to combine charts, graphs and reports on a single screen for instant overviews⁵⁶. They are, therefore, a simple and concise representation of corporate performance indicators through visual tools such as charts and graphs. Together with the corporate cockpit, they are mainly intended for strategic level users and are often the starting point for more in-depth analyses⁵⁷

The business dashboard or management cockpit, on the other hand, is used to analyse the operational and financial condition of the business, highlighting any

⁵⁵ Gartner. "Corporate Performance Management (CPM)." Gartner, www.gartner.com/en/information-technology/glossary/cpm-corporate-performance-management.

⁵⁶ Tableau. "BI Dashboard | Things to Know | Tableau." www.tableau.com, www.tableau.com/it-it/learn/articles/business-intelligence/bi-dashboards. Accessed 2 June 2024.

⁵⁷ Alessandro Rezzani. Business Intelligence. Alessandro Rezzani, 2012.

anomalies. It is called a 'cockpit' because it is reminiscent of a car's control panel, which shows the status of the vehicle and warns of any problems. The strength of the business dashboard is its ability to provide immediate feedback on the condition of the business. However, this tool is often limited to the financial area, using indicators such as ROI (Return on Investment) to display current value, alarm thresholds and indices representing investment performance.

These types of reports offer numerous benefits that can improve business decisions and the overall performance of the organisation. Here are some typical benefits of dashboards:

- *Understanding stakeholder needs:* to build an effective dashboard, it is crucial to understand what stakeholders are trying to solve or improve. Using the 'why' approach can help uncover the key factors driving the dashboard initiative, facilitating the development process;
- *Establish a connection to the data:* before building a dashboard, it is essential to ensure the connection to the data sources. Often the data may not be cleanly structured, requiring careful cleaning and organisation to create an effective connection;
- *Choice of Key Performance Indicators (KPIs):* KPIs are fundamental to dashboards. Once stakeholders' needs are understood, it is easier to choose the KPIs to be displayed. These indicators should help stakeholders achieve their goals, such as identifying operational efficiencies or tracking savings;
- *Selection of appropriate visualisations:* Choosing the right visualisations is critical to the success of a dashboard. Information must be presented as

concisely and effectively as possible, allowing users to make quick and informed decisions;

- *Building on momentum*: After a positive first impression, it is important that the dashboard continues to engage users with relevant and interactive data. A good dashboard allows users to explore the data further, discovering added value as they interact with it;
- *Continuous maintenance*: stakeholders' needs may change over time; therefore, the dashboard must be updated regularly. Maintenance is essential to ensure that the dashboard remains relevant and useful in meeting the evolving needs of users.

Management cockpits, and dashboards are therefore extremely efficient tools for monitoring business. They highlight the company's economic and financial performance in an immediate and effective manner, enabling managers to obtain a clear and integrated view of business performance. Thanks to their ability to synthesise complex data into intuitive visual representations, business dashboards facilitate the early identification of emerging trends and potential critical issues. This approach not only improves transparency and internal communication, but also improves decision-making, enabling the company to quickly adapt to market dynamics and strategically pursue its goals for growth and success.

This chapter has highlighted the 'front-end' part of Business Intelligence and it is the one that actually always gets highlighted because it is actually used by managers. In reality, as we have seen, it is only the tip of the iceberg. In fact, in order for data visualisation to be effective and to convey a useful message in the acquisition of awareness of business dynamics and the implementation of corrective actions, the underlying must be correctly constructed. If the two parts, 'front-end' and 'back-end' work nimbly and have been designed according to a careful analysis path, the BI, understood as a whole, will be extremely effective, and will respect the principles of correctness, timeliness and clarity, necessary for the end user. It is up to the various players, experts in the different areas of the chain, from data scientists to business controllers, to work correctly and in synchrony to create a holistic system that can bring added value to the company and a competitive advantage that can make a difference in the long run.

In the next chapter we will explore a practical case, introducing the operational context of Frolla and illustrating how a sales control system was adapted to its specific needs. We will apply the theoretical concepts discussed so far to provide a clear and detailed view of the practical implementation.

4. A tailor-made report with Power BI: the case of Microbiscottificio

Frolla

The following chapter will apply the concepts seen in the previous parts, combining the notions of sales and marketing in a multichannel perspective explored in the first chapter with the application of Business Intelligence in a small to medium-sized enterprise. The Microbiscottificio Frolla is an emerging business in the Marche region that needs a control system to monitor sales trends, integrating the various channels and highlighting business performance and trends.

In this chapter, we will first analyse the history and development of Frolla in order to better understand the current context and its specific reporting requirements. Next, we will illustrate how the BI system was developed using Microsoft Power BI software, explaining the integration of the various data sources from the different sales channels. Finally, we will discuss the potential future developments of Business Intelligence within a fast-growing company like Frolla, examining how the expansion of the business pool can be facilitated by the optimal use of such tools.

4.1 The Meeting of Skills and Civic Passion: The Birth of Frolla Microbiscottificio

The Microbiscottificio Frolla is a business project aimed at the labour inclusion of people with disabilities. Born in 2018 in Osimo (Ancona), it became a social cooperative the following year. Today, Frolla, is a growing reality that creates value for the entire territory. The main ingredients of its biscuits are flour, sugar, eggs and fruit, combined with the passion that has driven Jacopo Corona, pastry chef, and Gianluca Di Lorenzo, social worker, since the beginning. They were joined by Silvia Spagne, mother of a boy with disabilities, who decided to join the team. The cooperative does not simply offer employment opportunities isolated from the social context but integrates workers into the social environment of the area, creating alliances with companies, services and schools. This approach combats biases by concretely showing that disability is only a limitation when the environment is not structured to accommodate it.

How Frolla was born

The story of Frolla began in 2017, from an idea of founder Jacopo Corona, a young boy from the Marche region of Italy with the aim of having a social impact through the food sector. The idea came from the thought that young boys with disabilities held an enormous unexpressed potential, which if channelled correctly could give rise to something exemplary, having an impact on their lives and the lives around them. Jacopo, therefore, together with his co-founder GianLuca Di Lorenzo, who was already working in the social sector, decided to set up this project. On 12 May 2018, in Osimo, in the province of Ancona, Frolla Microbiscottificio was born, with a very clear objective: to offer a path of job placement to socially disadvantaged people.

The beginning, like all 'start-ups', was complex: there was a lack of funds and expertise to make the idea take concrete shape. Banks and lending institutions were reluctant to give the first loan, which would have allowed them to start developing the project. They therefore decided to turn to crowdfunding: this financial instrument is a private funding channel through which personal or professional projects by individuals and small businesses can be financed directly by a multitude of parties (even small savers). The match between demand (from those who need funds) and supply (from those who want to invest) takes place on online platforms that provide information on individual projects and manage the flow of money⁵⁸. The platform they relied on was Eppela. The latter was a business incubator where

⁵⁸ Banca d'Italia. "Crowdfunding." Economiapertutti.bancaditalia.it, economiapertutti.bancaditalia.it/chiedere-prestito/crowdfunding/.

they also managed to find the economic and management knowledge that the two founders lacked. With the support of Eppela's consultants, the Frolla team launched a crowdfunding campaign with an initial goal of 5,000 euros. They took advantage of social media, in particular Facebook, to share their idea. The campaign started with a Facebook page and a video shot in the kitchen of the parish in Jacopo's village, thanks to the availability of the parson. Despite limited technical skills and a small budget, the project received an immediate positive response from the local community. The campaign quickly turned into a shared community project, with people making personal contributions and sharing on social media.

Donations also arrived from abroad, and in just two days the initial target was reached. At the end of 40 days, the campaign had raised 12,000 euros, exceeding the target by more than 200%. This overwhelming success generated great enthusiasm in both the Frolla team and the Eppela staff. So, the dream of two friends began to come to life, giving shape to what Frolla would become in the future.

In 2019, they obtained the legal form of a Social Cooperative, officially operating as a third-sector enterprise with the objective of employing disadvantaged people. Their resonance on social media continued to grow, and with it, so did the support for their project. By posting photos of the young people grappling with their daily activities, their products and the projects they were developing, collaborating with local businesses, they managed to arouse empathy and move people's feelings.

In 2020, the first inclusion initiatives outside the cooperative reality were born, giving rise to the first cooperation with the football club SA Calcio Castelfidardo, again with the aim of increasing the social inclusion and wellbeing of employees through playful-sports practices.

In the same year, during the Covid, a time of one of the worst economic and social crises in our history, the guys at Frolla did not let themselves be discouraged and reacted in the best possible way. In order to face the challenges of operating predominantly in the physical shop, the company opened its own e-commerce, called 'FROLLALAB.IT'. This initiative was a strategic solution to overcome previous limitations, enabling the distribution of products directly to customers' homes. Furthermore, in order to overcome the difficulty of offering the breakfast service at its premises due to current regulations, the company acquired a minibus, called 'Frolla-Bus'. This vehicle was intended for the delivery of breakfasts to homes and continued to operate even after the end of the health emergency. The 'Frolla-Bus' extended the presence of Frolla products in various contexts, including squares, beaches, fairs and markets in the Marche region, thus consolidating the brand's presence in the territory.

The ever-growing company has won numerous awards and recognitions over the years, proving the social impact it generates, making a difference. Among them, the Frolla project was recognised by the European Parliament with the European Citizen Award in 2021, at the recommendation of Pietro Bartol, Member of the European Parliament. This prize is awarded to those who promote the values of the European Union, in particular the right of people with disabilities to autonomy and social and professional inclusion.

Currently, Frolla continues to innovate and grow, working on new projects to expand activities and increase work inclusion. In 2023, the cooperative has established an agreement with the High School Institute of Loreto to implement alternation school-work programmes and is collaborating with various local social realities to include new people with disabilities in the work environment. In addition, they have launched an ambitious business incubator project aimed at the third sector. Since February 2023, fifteen young graduates have been training to develop start-ups oriented towards a sustainable and socially responsible economy, including the employment of people with disabilities.

Shortbread today

The idea of Frolla was born with the aim of filling certain gaps in the labour market that can be summarised as follows:

- Lack of innovative social initiatives capable of increasing both the quantitative and qualitative level of bringing young people closer to the world of work;
- Lack of a cutting-edge model for increasing social inclusion initiatives in favour of disadvantaged people;
- Lack of a pioneering model for increasing social inclusion initiatives in favour of disadvantaged people;

The company is therefore pursuing the aim of promoting social inclusion through business activities aimed at the social and labour integration of disadvantaged or disabled people. Their activities are mainly aimed at young people under 30 with physical or cognitive disabilities and consist in the production and distribution of high-quality biscuits, made with a simple process that gives anyone the chance to work. In pursuit of their mission, they have modified their dough so that it can be worked by the youngsters without difficulty, while maintaining the taste and consistency, providing a very high-quality product.

The objectives that Frolla has set for itself are four:

- Contributing to the improvement of the quality of life of individuals with psycho-physical disabilities by promoting interventions that favour their inclusion in the labour market through the production and design of pastry and biscuit food products;
- Responding to the need for social integration and socialisation of disabled young people, with a view to building a life project that enhances their potential and capacity for autonomy;
- To strengthen the professional, occupational and relational skills of individuals with psycho-physical disabilities, thus increasing their employment opportunities both within the Cooperative and outside, thus favouring their full inclusion in society;
- Raising awareness in the community on the issues of disability and its relationship with able-bodied ability, not only to integrate the former into the latter, but above all to show how and how much the latter has to learn in terms of experiential and human growth from the former.

These objectives are pursued on a daily basis, distinguishing Frolla as a concrete project with a high social impact.

According to 2022 figures, the Microbiscottificio allows 18 young people with disabilities in the province of Ancona to work part-time, meeting their needs. In addition, in order for the cooperative to be as sustainable as possible, it aims to exploit local products that respect seasonality, weaving collaborations, as we shall see, with local players, thus increasing the resonance of their project. This respects what their motto states⁵⁹ :

“Cambiamo il mondo con la dolcezza!”

The change referred to in this slogan concerns both the production of social products in the strict sense and the social impact that this activity is able to generate when disabled young people put their hands to the dough. Production takes place through simple processes, facilitated by the use of special machinery, giving anyone, regardless of their specific disability, the opportunity to try their hand at the work.

The Cooperativa Frolla operates in both the B2B (Business to Business) and B2C (Business to Consumer) markets, thus guaranteeing itself the possibility of being present in a diversified and unrestricted market. The sales channels used are heterogeneous and make it possible to reach a wide audience of buyers, expanding the target audience from direct sales to the local community to the distribution of Frolla products throughout Italy.

⁵⁹ From this point they are reworked by: Frolla Società Cooperativa Sociale Impresa Sociale ETS. Social Report . 2022, frollalab.co.uk/wp-content/uploads/2023/11/balance-sheet-frolla-22_01_definitive-pages-single.pdf.

Frolla's main sales channels are:

- *Diversamente Bar*: In the Frolla bar there is always a shop where you can buy all the products made by the cooperative.
- *E-commerce*: Via Frolla's website, it is possible to consult the entire product catalogue and, with just a few clicks, have them shipped throughout Italy.
- *Great Distribution Organised (GDO)*: Frolla also distributes its products within a number of GDO outlets belonging to various brands.
- *Events*: Frolla sells its biscuits directly at festivals, events and various events.

This multi-channel sales strategy allows Frolla to expand its market and increase the visibility and distribution of its products, while supporting the cooperative's social mission.

In addition to the sale of packaged products, Frolla engages in the provision of breakfasts and aperitifs directly to consumers. This activity is carried out by the cooperative's disabled young people, giving them the opportunity to strengthen their confidence and self-awareness. By dealing first-hand with customers and ensuring proper service, the young people acquire valuable skills and increase their sense of responsibility, gratifying both themselves and the customers.

The main delivery channels used by Frolla are:

- *Diversamente Bar*: Breakfasts and aperitifs are served inside the Frolla bar, which offers both indoor and outdoor seating. The bar is located in the same building as the production workshop. In this context, disabled young people take on the role of bartenders, showing customers the assortment of brioches and savoury snacks, preparing coffees and cappuccinos, and serving at tables. This direct experience allows them to develop fundamental practical and interpersonal skills.
- *Frollabus*: this is a mobile bar on wheels, a food truck that allows Frolla to take its breakfasts, aperitifs and products to open spaces such as squares, beaches, events, markets and fairs all over Italy. The main objective of the Frollabus is to increase the involvement and working autonomy of Frolla's employees and collaborators, tackling new situations with different operating methods compared to the workshop and bar. Among the main activities performed by the vehicle were corporate catering and business breakfasts. These events were requested by businesses and companies that support Frolla's aims and initiatives, creating convivial and enriching moments for employees and customers. For Frolla, these occasions were important to get to know new realities, expand its network and talk about the events through its social channels, ensuring effective and engaging communication for both Frolla and the companies involved.

Through these delivery channels, Frolla not only expands its market presence, but also contributes significantly to the social and labour inclusion of people with disabilities, creating a stimulating and rewarding work environment. This multichannel approach has led to a strong growth of the cooperative, increasing and weaving more and more collaborations with companies and other social welfare organisations, such as local social services and Caritas of Senigallia. In addition to this, the opening of e-commerce has facilitated reaching regions that would otherwise have been difficult. In fact, Frolla sells throughout Italy, led by Marche and Lombardy. This has made it possible to achieve a turnover of around 350,000 euros in 2022.

Frolla is not just a biscuit manufacturer, but a social inclusion laboratory and a replicable business model that aims to make work synonymous with independence for all. The project demonstrates how the employment inclusion of people with disabilities can create economic and social value, changing the perception of disability and promoting an inclusive and sustainable work environment.

4.2 Power BI and its potential

As part of a Business Intelligence (BI) project, a centralised data warehouse is usually built where the organisation's various data sources are loaded, cleansed and then transferred to an online Analytical Processing Database (OLAP) for reporting and analysis. This approach aims to create a repository of historical data, to provide a unified version of data, to reduce data silos, separate storage and data management systems that are inaccessible to other areas of the company, to cleanse corporate data by ensuring that it complies with standards, and to provide insights into data trends through dashboards. Although these objectives are laudable and constitute good reasons to implement a centralised data warehouse, there are some disadvantages associated with this approach. The most obvious is the complexity in building the system and managing changes. Anyone who has tried to add new fields or measures to a corporate data warehouse knows how complicated this process can be, requiring IT involvement, review by data steward committees, development and test cycles. What is needed in small realities is a solution that enables agile data analysis without being overly dependent on IT and formalised processes. To solve these problems, many business analysts have used Excel to create pivot tables and perform ad hoc analyses on data sets from various sources. However, the use of isolated Excel worksheets presents problems such as conflicting versions of the information, data silos and data security issues⁶⁰.

⁶⁰ Clark, Dan. *Beginning Microsoft Power BI : A Practical Guide to Self-Service Data Analytics*. Berkeley, Apress, 2020.

The solution to this dilemma, where the centralised data warehouse is too rigid while the use of Excel is too flexible, is the BI tool provided by Microsoft: Power BI.

This tool is a business intelligence and analytics platform created by Microsoft for analysing, visualising and sharing business data effectively. It connects to a wide range of data sources, including Excel files, enterprise databases, cloud services and third-party data sources⁶¹. These data sources can be connected to each other for agile analysis, dashboards and reporting.

Secondly, this tool allows data to be processed and held outside the DWH, following the trend of storing data in the cloud and not in a data centre. This, according to Gartner, will be increasingly common for companies, claiming that more than 50 per cent of companies will need to store data in the cloud by 2025⁶². PBI gives this possibility, allowing the space available to be increased by increasing the licence, where it is needed.

Furthermore, Power BI was created with the aim of giving everyone the opportunity to process data via Business Intelligence. This is why, over time, the term 'self-service BI' has been coined, it means a tool that can be approached by anyone without in-depth knowledge of statistics and data analysis, but which can

⁶¹ Truzzi, Eleonora. "Analisi Dei Dati: Cos'è, Come Si Fa E Tipologie Esistenti." Nextre Srl, 10 July 2023, www.nextre.it/analisi-dei-dati/#:~:text=L. Accessed 14 June 2024.

⁶² (Gartner, "Gartner Says More than Half of Enterprise IT Spending in Key Market Segments Will Shift to the Cloud by 2025")

nonetheless be exploited for a correct and timely visualisation of dashboards and graphs to understand business trends.

Now, let us review the reasons why developing a Business Intelligence with Power BI system within a company as Frolla could bring benefits.

- *Intuitive interface:* Power BI has an intuitive interface that allows users to easily visualise and analyse data.
- *Data integration:* Power BI allows users to easily integrate data from various sources, including Excel, SQL Server and cloud-based sources such as Azure and Salesforce.
- *Customisable dashboards:* users can create customised dashboards and reports to visualise data in a way that is meaningful to them.
- *Real-time data:* Power BI supports real-time data processing, which means that users can view up-to-date data in dashboards and reports.
- *Collaboration:* Power BI allows users to share dashboards and reports with others, simplifying collaboration on data analysis projects.

4.3 Power BI interface

The Power BI interface is divided into three different visualisation stages, providing a different perspective and processing element. These three different interfaces are: dashboard visualisation, table visualisation and model visualisation. These three different visualisations are interconnected and serve to interact with the data in different ways, as required.

Dashboard Visualisation



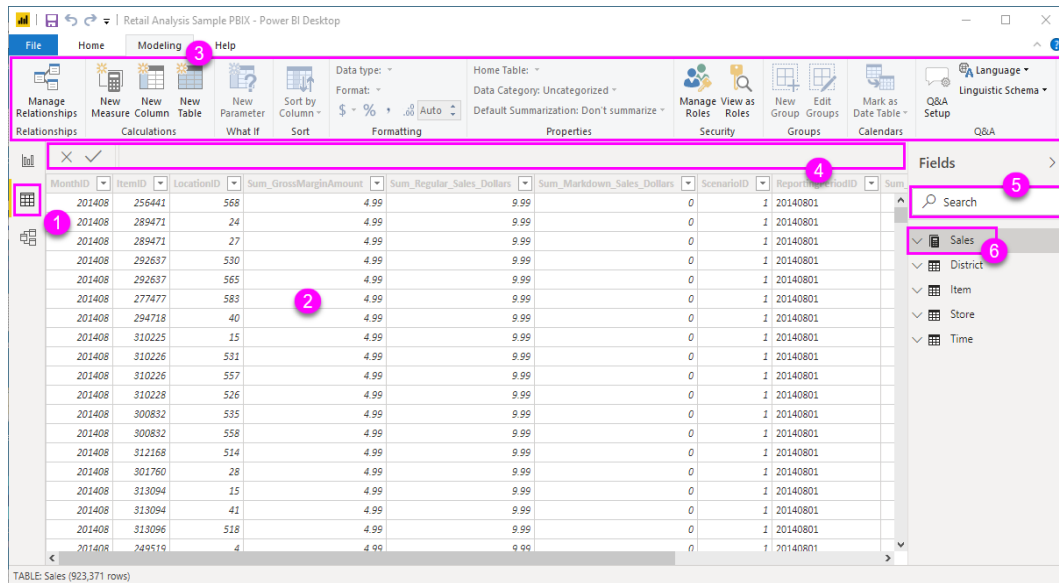
4.1 Dashboard visualisation – Source: Microsoft. “Power BI - Visualizzazione Dei Dati | Microsoft Power Platform.” www.microsoft.com, www.microsoft.com/it-it/power-platform/products/power-bi?market=it. Accessed 19 June 2025.

This type of visualisation provides data processing by means of graphs, tables and allows the input of filters to process data as required. In the context of Power BI, the visualisations displayed in a dashboard are called panes. Panels can be added to

a dashboard from reports, which in turn are based on a semantic model and thus serve as an introduction to the underlying reports and semantic models.

When selecting a pane within a dashboard, one is directed to the report and semantic model from which the pane was originally generated. This link allows users to explore data in more detail and better understand the analysis presented, making the dashboard not only a visualisation tool but also an access point to more in-depth and structured data. These are an essential tool for monitoring business trends and quickly visualising the most important parameters. Visualisations on a dashboard can be derived from one or more semantic models and one or more underlying reports, thus combining data from both local and cloud sources. This approach provides a consolidated and integrated view of the data. A dashboard is more than just an eye-catching graphical representation; it is highly interactive, and its panes update automatically as the underlying data changes. This interactivity allows users to explore data dynamically, always maintaining an up-to-date and accurate view of business-critical information.

Table Visualisation



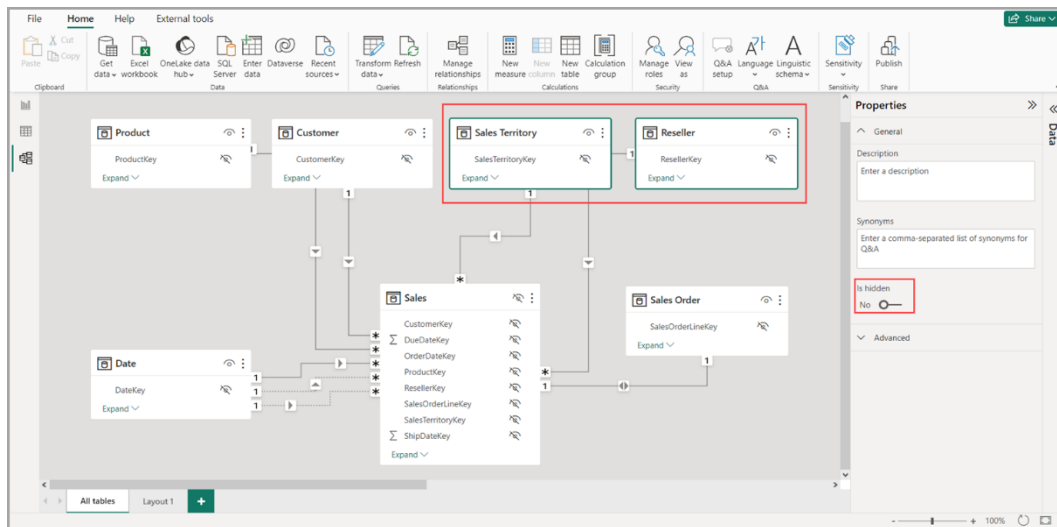
4.2 Table Visualisation – **Source:** Microsoft. “Power BI - Visualizzazione Dei Dati | Microsoft Power Platform.” www.microsoft.com, www.microsoft.com/it-it/power-platform/products/power-bi?market=it. Accessed 19 June 2025.

This view gives the possibility to see the table as it is in the data source. In addition, the possibility is given to edit and explore the data using editing tools. The tools in this view are listed below ⁶³

1. *Data Grid*. This area shows the selected table and all columns and rows in it. Columns hidden by the Report view are deactivated. You can right-click on a column for options.
2. *Formula bar*. Enter DAX (Data Analysis Expression) formulas for the calculated measures and columns.
3. *Search*. Search for a table or column in the model.
4. *Field List*. Select a table or column to be displayed in the data grid.

⁶³ davidiseminger. “Visualizzazione Dati in Power BI Desktop - Power BI.” Learn.microsoft.com, 31 Jan. 2024, learn.microsoft.com/it-it/power-bi/connect-data/desktop-data-view. Accessed 16 June 2024.

Data Model Visualisation



4.3 Model View – Source: Microsoft. “Power BI - Visualizzazione Dei Dati | Microsoft Power Platform.” www.microsoft.com, www.microsoft.com/it-it/power-platform/products/power-bi?market=it. Accessed 19 June 2025.

A data model consists of tables, columns, data types and relationships between tables. Generally, data tables are constructed to contain information about a business entity; for example, customer data is contained in a customer table and employee data is contained in an employee table. The tables consist of columns that define the attributes of the entity. For example, one might want to store customer information such as name, address, date of birth, household size, and so on. Each of these attributes has a data type that depends on the type of information the attribute contains: name will be a string, household size will be an integer, and date of birth will be a date type. Each row in the table must be unique.

Once the model tables have been identified, it is important to check whether they are organised in such a way as to ensure efficient operations. This process is called normalising the model. Normalisation is the process of organising data to make

query operations easier and more efficient. For instance, one should not mix attributes of unrelated entities in the same table: it would not be appropriate, for instance, to put product data and employee data together in the same table. Proper normalisation of the data model ensures that queries are fast and efficient, reducing data redundancy and improving database integrity⁶⁴.

In the next section we will see how this tool can be exploited by companies to achieve accurate reporting by conglomerating data from different sources in the programme, giving each company the possibility to develop its own reporting system to serve one or more areas of the company's business.

⁶⁴ Clark, Dan. *Beginning Microsoft Power BI : A Practical Guide to Self-Service Data Analytics*. Berkeley, Apress, 2020.

4.4 Power BI to support sales: the case of Microbiscottificio Frolla

Frolla is constantly growing and evolving. In a short time, the company has significantly increased its activities, volumes and turnover. Consequently, the need emerged to have a unitary sales control system, which would allow a global view of the business and its performance over time, also comparing the results of previous years. As it will be seen, this homogeneity of data allows managers to make strategic decisions based on an overall vision, determining the tactics to be applied for the future of the cooperative.

What must be taken into account is that the project concerns the creation and implementation of a BI system in a company that lacked one. Being an SME (small-medium enterprise), the data sources are limited and there is no need for a data warehouse system. This, in fact, would take over at an advanced stage of development, when the parts of the business analysed are numerous and the data processed larger.

The project was divided into three main parts: in the first phase, the state of the art of the business was analysed, investigating Frolla's sales structure and the tools to support these activities. The second phase involved the collection and unification of data, which was necessary to build an integrated Business Intelligence (BI). Finally, on the basis of the collected and structured data, a reporting system applicable at the business reality was developed, defining the key indicators to be monitored.

At every stage of the project, I was supported by Dr. Claudio Angeletti, external collaborator person from “Controller Associati” and the Frolla team, by Mirco Pugnali, CFO (Chief Financial Officer) and member of the cooperative

Step One: Understanding the Business and its Needs

This is the first phase, where the foundations of the project are laid and the company's needs are outlined; it is essential to get an idea of how the BI and reporting system should be developed. To do this, Frolla's sales structure was studied, which data sources were exploited and how they were managed.

Picking up on the above, Frolla is a cooperative that over time has ensured that its sales network in the territory is based on a multi-channel strategy, reaching out to a larger number of clients. To date, the Cooperative's sales channels are developed as follows:

- *Diversamente Bar*: In the Frolla bar there is always a shop where you can buy all the products made by the cooperative. This, in addition to serving as a retail shop, also functions as a bar. This is the first sales channel and is also one of the most important, being the focal point of the business.
- *E-commerce*: ecommerce, which is relatively recent, is exploited to reach consumers who want to enjoy Frolla's products but find it difficult to reach the cooperative's shop. This, in fact, despite being recent, is an extremely profitable channel for the company's business.

- *Great Distribution Organised (GDO)*: Frolla also distributes its products within a number of GDO outlets belonging to various brands of the most important market players, making it easier to reach end customers.
- *Events*: Frolla sells its biscuits directly at festivals, demonstrations and various events. Included in this category is the 'FrollaBus', a tool used to reach designated locations and carry out their activities.

These are the main channels against which Frolla develops its business and thus, from them, the data to be processed. Secondly, there is the need to understand where this data is stored and to what depth. In this case, there are two main sources:

- *Fatture in Cloud*: this is an online invoicing system where you can manage invoices, estimates, purchases, first notes, trend analysis, and scheduling. This software, with storage in the cloud, groups together all those transactions arising from "Diversamente Bar", GDOs and events. It also groups together all customer information, including the billing location, which is necessary to analyse the geographical development of the business

- *WooCommerce*: this tool, on the other hand, contains all information concerning Frolla's e-commerce sales. The extraction of data concerning online was less effective than the previous one because the degree of depth of the information is less.

What we can therefore deduce is that the two reference channels will be online and offline with *Fatture in Cloud*, thus basing the level of sales analysis on these two macrocategories, in order to have certified and certain data, with respect to a greater granularity.

In addition, in order to get an idea of the development of the business over time, historical depth is required. Therefore, all analyses will be based on a comparison with the previous year, with the two reference years being 2022 and 2023.

Step 2: Data extraction and processing

After outlining the multi-channel structure of the business and the process of aggregating data from various channels, the need emerges to extract and standardise this data to make it processable. Data extraction takes place via two main software packages, which produce workable Excel sheets as output.

The extraction of data from Fatture in Cloud generates a structured table, where each row represents a transaction. Each transaction includes the date, transaction number, customer name, some master information, a detailed geographic representation and quantitative information. This level of detail allows in-depth analysis of various aspects of the business, facilitating understanding of sales dynamics and customer behaviour. Extractions are made year by year and then merged, ensuring consistency and homogeneity of data between analysis periods, such as 2022 and 2023.

On the other hand, data extraction from WooCommerce is less detailed. The extracted data is indeed poorer in information than that obtained from Cloud Invoices. However, to ensure consistency and usability in the final model, the available information is harmonised with that of the previous extraction.

Given the small amount of data, the extracted Excel sheets will be used as databases. This approach, although less sophisticated than the use of a full relational database, allows the data to be managed and analysed effectively, exploiting the potential of Excel for data processing and visualisation.

In summary, the adoption of these data extraction and standardization processes is crucial to ensure that the analyses are accurate and reliable, providing a solid basis for strategic and operational business decisions.

Step three: construction and elaboration of the model

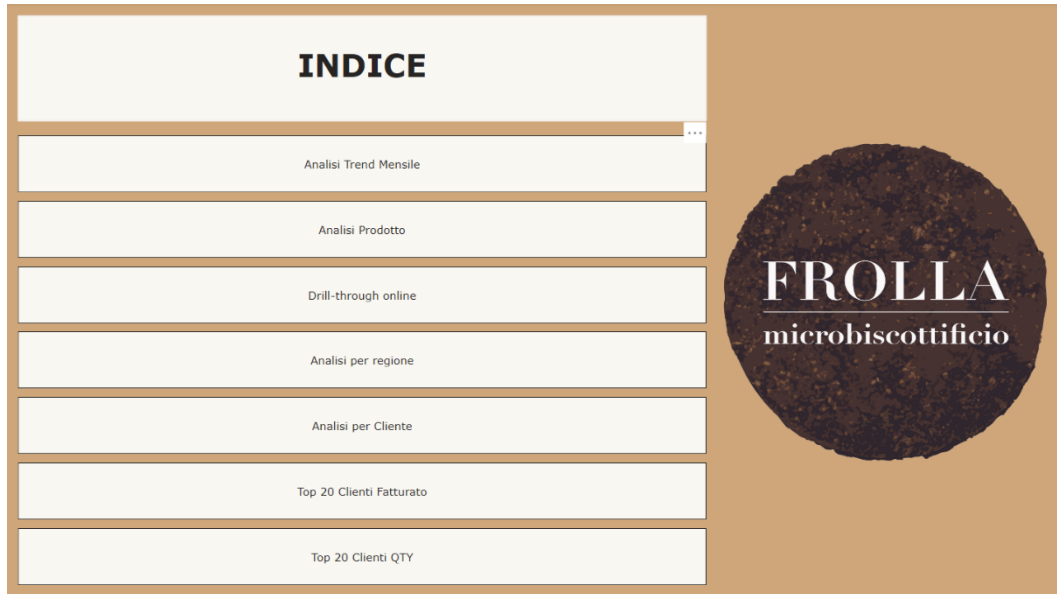
The third phase is the implementation of the data and the construction of the model. This phase is the output phase in which we will analyse how it was structured and the logic present in the graphical representation. After the data has been loaded, it must be uploaded to the software so that it can be processed.

There are eight dashboards created in the Power BI model and each one enclose a type of analysis, highlighting and shedding light on one aspect of sales. Excluding the first, which is an index for easy navigation, the others have two filters in common:

- *Filter "Fonte"*: With this filter you can select only one side of the business: "Cloud Invoices" or "Online". When nothing is selected, the metrics shown will be an aggregate of the two sources in the various dashboards, while using the filter will provide an analysis of the individual channel.
- *Filter "Anno"*: although many graphs and tables have the representation of the two years compared, it is possible to isolate only one of the two years when a filtered view of a single period is desired.

On the following pages, we will go into a detailed analysis of the various dashboards.

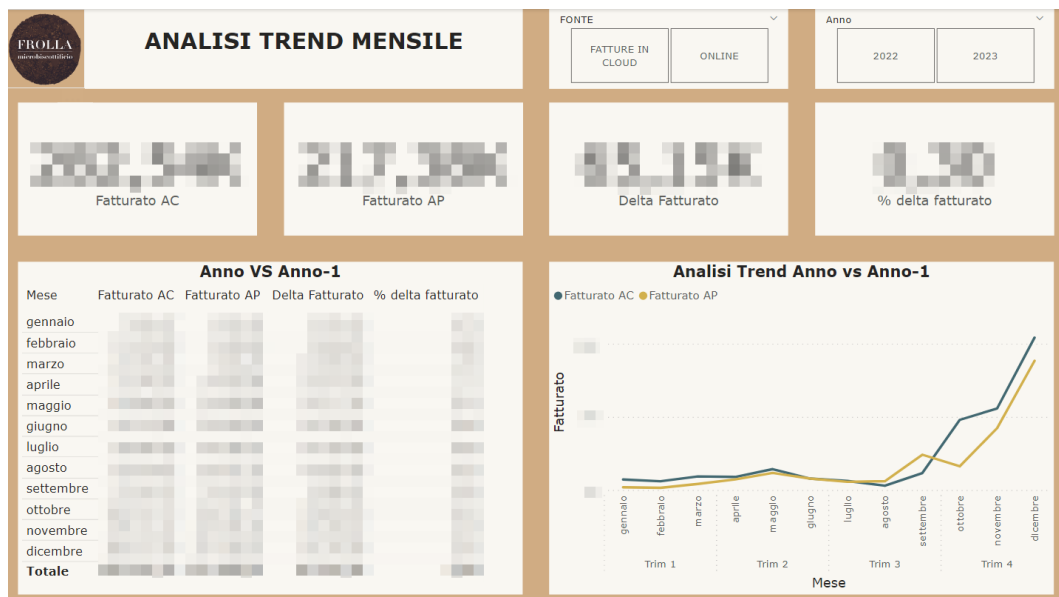
INDEX



4.4 Index

This is the first dashboard the user encounters in the model. This gives an overview of what he will find and how the dashboards are ordered. As we have already argued in the chapter on data visualisation, the graphic representation tells a story and like all stories, an introduction to what will be found is necessary. Furthermore, on the right-hand side we find the Frolla logo, an element that is also present in the other dashboards to always give a reference to anyone analysing the model.

Dashboard 1: MONTHLY TREND ANALYSIS



4.5 Dashboard Monthly Trend Analysis

This dashboard aims to provide a panoramic view of Frolla, comparing the two years. In the upper part of the dashboard is the logo, the title, related to what we will find below, and the two filters as mentioned in the previous part. In the central part we enter the analysis, where we will have four tools called "tabs" that will show the values we are going to analyse by drill-down, representing respectively: AC Turnover (i.e. the current year's turnover), AP Turnover (i.e. the previous year's turnover), the Delta Turnover, i.e. the difference between the two periods under analysis, and the percentage of the Delta Turnover, i.e. the percentage differential. At the bottom, there is a table in which an analysis of the four quantities listed above (columns), expressed by month (rows), is provided. Moreover, the table does not express the separate monthly turnover, but presents the data in cumulative form, making it possible to observe the progression of turnover over the year. In this way,

it is possible to monitor the accumulation of revenue month by month, providing a clear view of the annual turnover trend.

On the bottom right-hand side of the table, the turnover trend is analysed. On the x-axis is represented the time, divided into months, while the y-axis shows the turnover value. This graphical representation makes it easy to visualise the development of turnover over time, identifying patterns, seasonality and possible anomalies in the trend.

This dashboard, like the others, is dynamic and, when one of the filters is set, all the elements presents will adapt to it, showing the values and trends corresponding to the indicated filter. This gives the user freedom to move around in the exploration of the data, not being passive with respect to its use but active in its study.

Dashboard 2: PRODUCT ANALYSIS



4.6 Product Analysis Dashboard

This is the second dashboard, where the analysis moves from a global view of the previous one to a product view. Even here you have the logo, the title and the two filters. At the heart of the dashboard, however, we have four elements: a table with columns similar to the previous one, but the 'categories/accounts' and the turnovers for each are highlighted. This table is essential to know the trend of the products in the two reference years, being able to make a comparison and understand which ones to push on. In addition to this, 'traffic-light indicators' have been added, i.e. arrows on the right-hand side of the table that immediately give an idea of product trends over the two years being compared. The second graph is a bar chart comparing the turnover per product in the two years: in blue is 2023 and in yellow 2022. Also on this page is an investigation by sales channel: In the horizontal bar graph on the bottom right, the comparative performance of the two sales channels,

online and offline, compared over a two-year period is shown. This comparison makes it possible to analyse the evolution of sales in the different channels, providing a clear view of the growth dynamics and any differences between the channels.

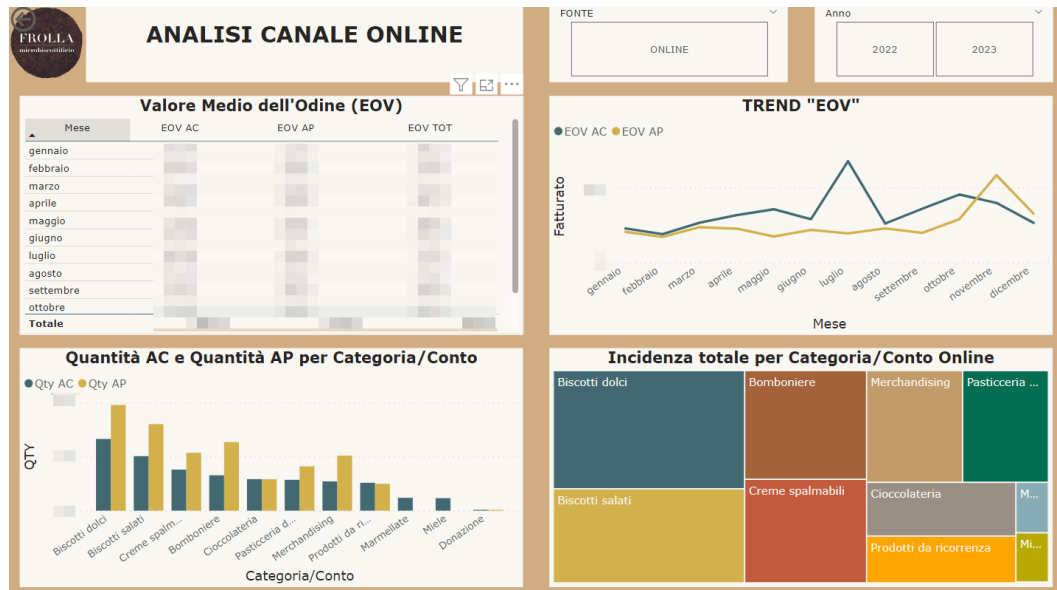
In addition, at the bottom left, there is a tree graph showing the total incidence of sales by 'category/account'. This graph provides immediate information on the best performing product macro-areas, with the largest squares representing the categories with the highest sales. This type of visualisation facilitates the identification of successful areas and those that may need more attention, offering an effective visual analysis of performance by product category.

Finally, it is possible to have a greater level of depth in this dashboard by drill-down. The table contains, for the rows, not only the product category but also the product name, a measure hierarchically lower than the first. This helps to go deeper in the analysis and exploration of the data.

| Categoria/Conto | Fatturato AC | Fatturato AP | Delta Fatturato | % delta fatturato |
|---|--------------|--------------|-----------------|-------------------|
| Biscotti dolci | | | | |
| Biscotti Cookies Aworld 200g | | | | ▼ |
| Biscotti dell'amore cacao e fragola 200g | | | | |
| Biscotti Gaia e Frolla 200g | | | | |
| Biscotti Vorreiprendereiltreno 200g | | | | |
| Biscotti-Cookies 120g | | | | ▼ |
| Biscotti-Sacchetto 1Kg | | | | ▼ |
| Biscotti-Sacchetto 50 qr | | | | ▼ |
| Biscotti-Sacchetto 80g | | | | ▲ |
| Biscotti-Sacchetto Amarene e Pistacchio 200g | | | | ▲ |
| Biscotti-Sacchetto Cacao e menta 100g | | | | |
| Biscotti-Sacchetto Cacao e menta 200g | | | | ▲ |
| Biscotti-Sacchetto Caffè e Nocciola 200g | | | | ▲ |
| Biscotti-Sacchetto Camomilla e albicocca 200g | | | | ▲ |
| Biscotti-Sacchetto Cocco e cioccolato al latte 200g | | | | ▲ |
| Biscotti-Sacchetto Cocco e Mango al latte 200g | | | | |
| Biscotti-Sacchetto Cookies 200g | | | | ▲ |
| Biscotti-Sacchetto Cookies 200g Packaging 200g con logo S&D | | | | ▼ |
| Biscotti-Sacchetto Cookies sbaigliati 200g | | | | ▲ |
| Biscotti-Sacchetto Passion fruit e Lampone 200g | | | | ▼ |
| Biscotti-Sacchetto Pere e Cacao 200g | | | | ▲ |
| Biscotti-Sacchetto Pistacchio e mandorle 200g | | | | ▲ |
| Biscotti-Sacchetto Tre Cioccolati 200g | | | | |
| Biscotti-Sacchetto Zenzero e limone 200g | | | | ▲ |
| Biscotti-Vasetto 200g | | | | |
| Biscotti-Vasetto pvc 200g | | | | ▲ |
| Biscotti-Vetro 200g | | | | ▼ |
| Totale | | | | |

4.7 Dashboard 2 - Drill-down by product name

Dashboard 3: ONLINE CHANNEL ANALYSIS



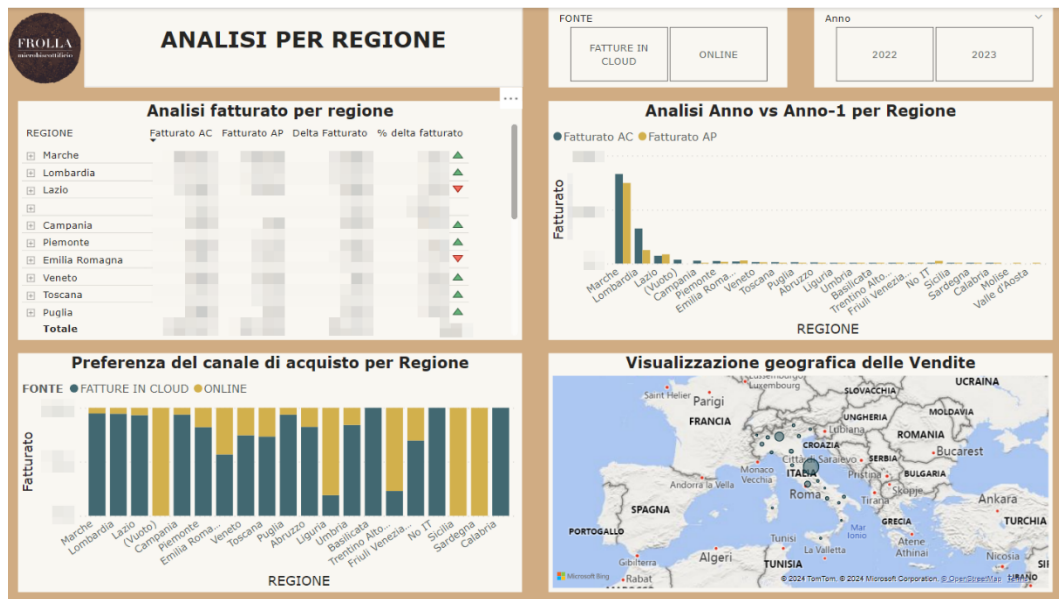
4.8 Dashboard 3 - Drill Though Analysis Online Channel

The third dashboard represents a drill-through of online sales. The use of drill-through functionality in Power BI reports allows the creation of specific landing pages within the report, focused on a particular entity such as, in this case, online sales. This functionality allows report readers to right-click on a data point in the report source pages and drill-through to the target page. In this way, the displayed details are automatically filtered according to the context of the selected data point. Configuration of the drill-through can be done either in Power BI Desktop or in the Power BI service, providing flexibility and insights for the end user⁶⁵.

⁶⁵ buttesMSFT. "Configuring Drill-through In Power BI Reports - Power BI." Learn.microsoft.com, 5 Mar. 2024, learn.microsoft.com/en/power-bi/create-reports/desktop-drillthrough. Accessed 14 June 2024.

In this dashboard, where the filter is set solely on online, the trends of this channel are specifically analysed. In fact, we find in the table, the Average value order (EOV) figure, which will give us an idea of the average spend of customers buying online. On the left-hand side we find the EOV trend, with 2022 and 2023 being compared. Below instead we will have two graphs showing, respectively, the online turnover compared between the two years by product category while, on the second, the overall incidence of the single category on the online, understanding which is the best seller.

Dashboard 4: ANALYSIS BY REGION

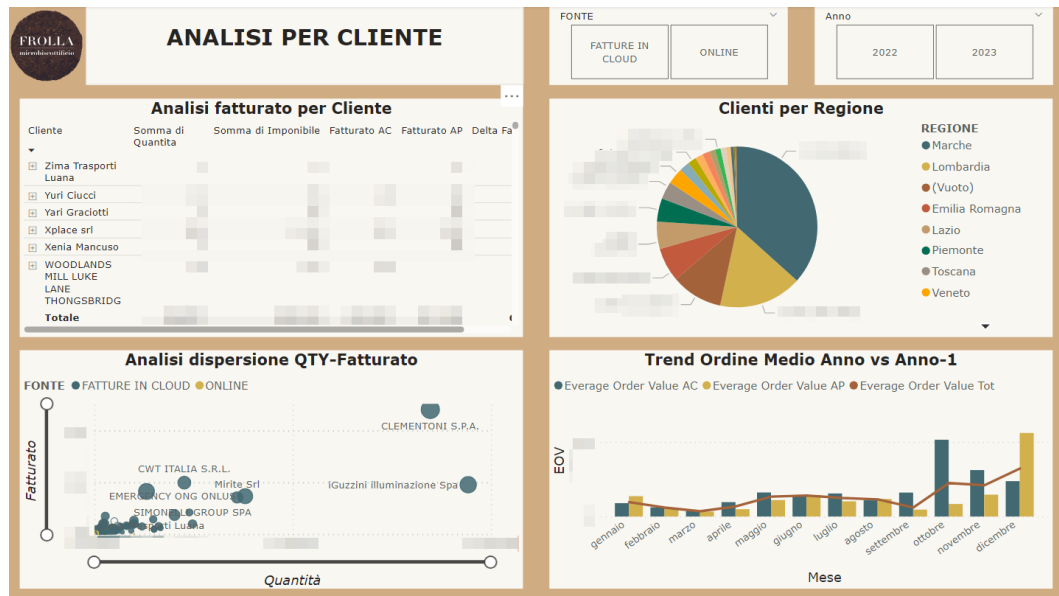


4.9 Dashboard 3 - Analysis by Region

This fourth dashboard shifts the focus to the geographical part. This means that, in addition to the table, similar to the one seen previously, we have on the right a bar graph showing us region by region the turnover of the two years in comparison. On the bottom right, however, we see a bar graph in the stack hundred. This is very useful if there are several clusters and you want to show the proportions between the values of each cluster, as well as the total of the individual groupings⁶⁶. In this case, what percentage buys online (in yellow) and on cloud invoices (in blue), by region. This is very useful to understand which strategies to adopt and which channel to push, region by region. Finally, the map is depicted by sales areas, to give a greater impact to the user. The bubbles on the map go according to overall turnover, becoming larger when turnover is higher. Here, too, it is possible to drill down into the table.

⁶⁶ (Salesforce)

Dashboard 5: CUSTOMER ANALYSIS

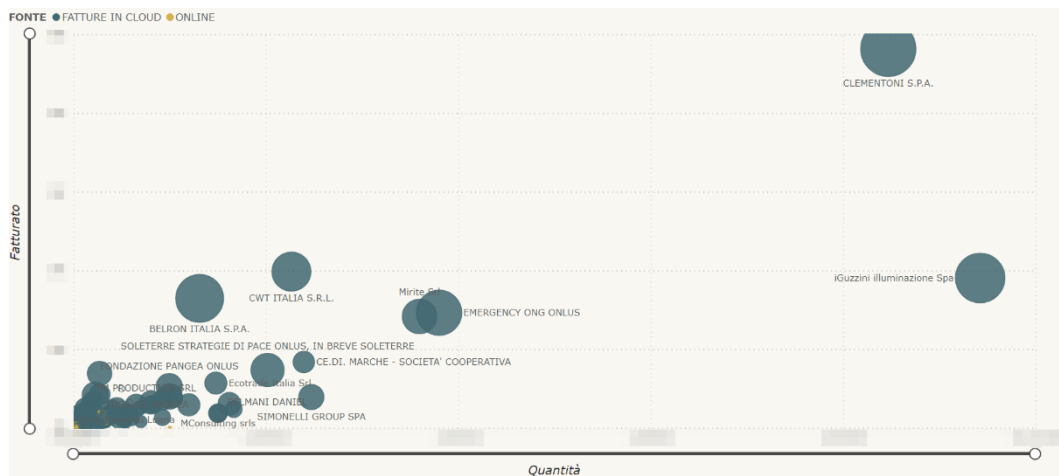


4.10 Dashboard 5 - Analysis By Customer

The dashboard depicted delves into customer dynamics, analysing both the quantities purchased by each customer, the turnover in the two years AP (Previous Year) and AC (Current Year), and finally the total. This approach makes it possible to identify the various customers and assess on which of them targeted campaigns can be implemented. For example, if a major customer had made purchases in 2022 but not in 2023, this analysis allows recontacting them to create new partnerships and strengthen existing relationships.

On the right, a pie chart offers an at-a-glance representation of the geographic distribution of customers, providing a complementary perspective to the dashboard's analysis by region. This makes it possible to quickly visualise the spread of customers in different geographic areas, facilitating targeted marketing strategies.

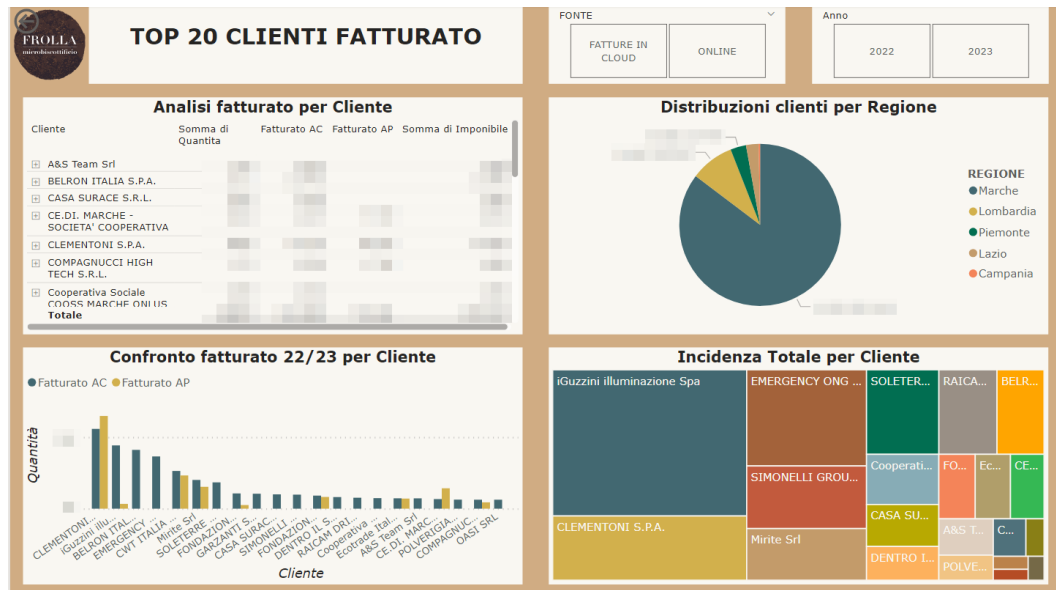
A scatterplot graph is shown at the bottom left. In this graph, the x-axis represents the quantity purchased, while the y-axis shows the turnover. The greater the quantity and the turnover, the greater the distance from the intersection of the axes. In addition, the graph includes two further dimensions: the data source, indicated in different colours, and the turnover, which determines the size of the bubbles. This type of visualisation is particularly useful for providing a detailed analysis of the concentration of quantity and turnover, making it easy to identify areas of greatest impact and opportunities for growth



4.11 Dashboard 5 - Scatter Chart

Finally, on the bottom left we find a bar graph representing the EOV of both online and offline, with the line representing the average total trend of this value. This graph is useful for understanding purchasing trends by comparing different months, highlighting when people tend to buy more.

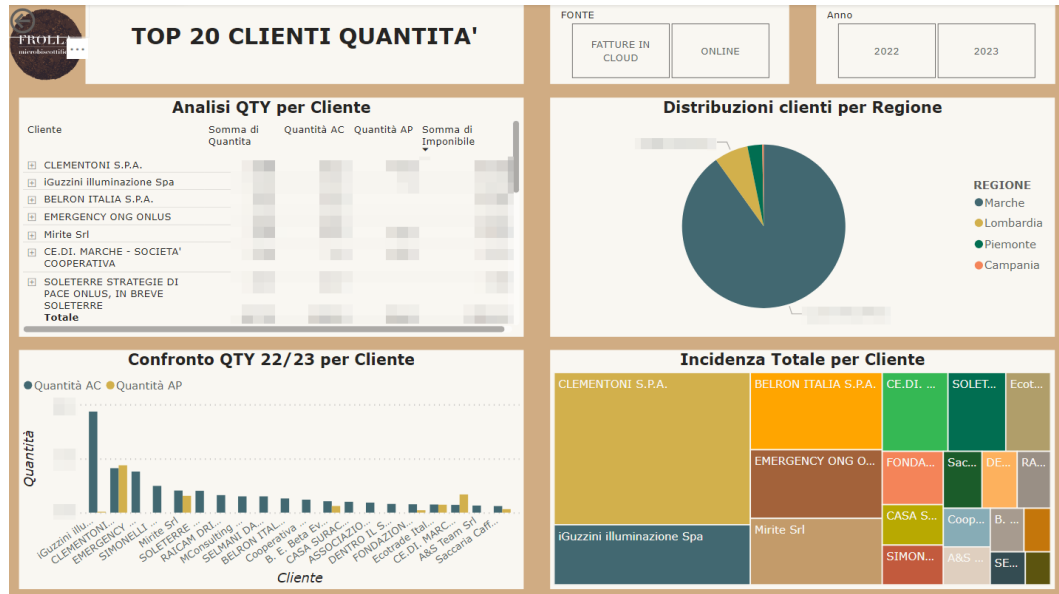
Dashboard 6: TOP 20 BILLED CUSTOMERS



4.12 Dashboard 6 - Top 20 Customers Turnover

This dashboard, together with the next one, can be described as a drill-through example, as it allows a detailed analysis of the top 20 customers by turnover. In addition to the graphs already described, which represent the geographical distribution, turnover comparison and incidence for the most profitable customers, this dashboard is crucial for identifying those customers on which to focus to increase partnerships. The information provided by this dashboard makes it possible to decide whether to contact a specific customer again or to try to retain them, perhaps by offering them advantageous conditions. The visualisation of geographical distribution also facilitates the expansion of the customer network in specific regions through proper networking. By using one of the top 20 customers as a reference point, it is possible to use it as a bridge to penetrate new local markets, thus improving the company's commercial presence.

Dashboard 7: TOP 20 QUANTITY CLIENTS



4.13 Dashboard 6 - Top 20 Customers/Quantity

This dashboard has the same functionality as the previous one, but highlights the quantities purchased by customers. The graphs are identical and the conclusions that can be drawn are similar. However, slight differences from the previous dashboard may emerge due to the change in purchase mixes.

For example, a customer who purchases a large number of products will fall into this category, but if the total value of purchases is lower than other customers, he may not be among the top 20 customers by turnover. Similarly, a customer who buys fewer products, but with a high unit cost, might not appear in the top 20 in terms of quantity purchased, even though they are in the top 20 in terms of turnover.

These variations in sales mix and the resulting top 20 are crucial for understanding the different purchasing dynamics and for identifying targeted marketing strategies.

The ability to distinguish between the most profitable customers in terms of quantity purchased and those in terms of turnover allows for more customised and effective approaches for each customer segment.

As we have seen, the corporate dashboard created with Power BI provides a 360° view of the sales ecosystem. Starting with a general analysis of turnover, it is possible to delve into more specific dimensions such as analysis by product, region and customer. Navigation through the various dashboards is smooth, offering more information through dynamic elements that adapt according to the filters selected.

The objective of this project is to develop an impactful yet intuitive business intelligence system that reflects the concept of 'self-service BI'. This system will be exploitable in the future by the Frolla team to interact with data and to communicate in a functional way with stakeholders. The tool is therefore congenial for the functionalities it has to fulfil, bringing a significant impact on the cooperative.

In the next section, we will examine possible improvements to make the software even more effective.

4.5 Power BI and Frolla: future developments

The analysis that has been implemented puts the microcosm of sales under the magnifying glass, which is essential for companies but, of course, is not the only aspect of the business that needs to be kept under control. Moreover, with Power BI itself, one can exploit additional functionality and manage data in a better way to develop a system that collects all the data from the various payment systems.

- *Adding Marketing data:* as we mentioned at the beginning, marketing and sales are very closely linked, and one is often influenced by the other. In this analysis, we have taken sales as the preponderant element, incorporating Marketing into it. Frolla was actually born in social media and got the necessary feedback there to be able to grow in this way. Therefore, ring-fencing sales with marketing data from various social media, such as Instagram and Facebook, could illuminate sides of sales dynamics that are hidden. Moreover, by embedding marketing dynamics within the software, it could shed light on how the brand is doing and how it is evolving, including through the partnerships it weaves during the sale.

- *Add 'operations' data:* this data can be defined as production data. These are also related to sales because they allow an estimate of the production of the various pastry products, also analysing past data from the sales side. This would help to avoid creating product stocks and limit food waste, thus reducing the environmental impact, one of the company's objectives.
- *Equip oneself with a Data Warehouse:* this integration is obviously long-term and not easy to implement but given the growth of the company and the objectives of developing the project, when the amount of data starts to increase, equipping oneself with a simple DWH system could be a solution. This would make it possible to always obtain certified and timely data, thanks to the ETL system. This would also obviate the overuse of Excel, which would serve as support.

CONCLUSION

The implementation of a Business Intelligence (BI) system such as the one described in this thesis, is a fundamental pillar on which companies, from the smallest to the largest, should focus. The previous chapters have shown that companies increasingly need a control system that focuses on the collection, processing and presentation of data in an immediate and accessible manner. Having certain and certified data, derived from a correct processing process, allows companies to monitor the progress and developments of their business, while also offering an insight into future developments.

Sales, by their very nature, are the heart of the business. Their analysis provides a general indication of the health of the company and how it is evolving over time. The complexity of sales, which spans online, and offline channels, direct and indirect sales, and other facets examined in the first chapter, makes it difficult to get a clear picture of the business without adequate support. A BI system such as the one described allows the overall context to be made clear and the business ecosystem to be easily explored. For this reason, Frolla felt the need to implement a BI system in its business, recognising the need to manage increasing complexity.

The case analysed, therefore, represents an example of how to create an effective and efficient corporate information system, capable of supporting managers and decision makers. The adoption of an ad hoc reporting system that evolves and improves over time, supported by effective data visualisation, must become part of the corporate culture of all companies. BI represents a significant change from the traditional methods used by many companies, both Italian and foreign, which often encounter difficulties in its daily application. However, the case of Frolla demonstrates how a virtuous and proactive approach by managers can lead to the implementation of a simple but impactful 'self-service' BI system in sales and marketing control.

Finally, the Business Intelligence (BI) approach and the importance of data should be extended to all business areas, developing a harmonious and well-structured system involving the entire organisation. The integration of BI into different business functions, such as production, logistics, human resources and finance, will allow for a holistic view of the business, improving coordination and operational efficiency. This approach will make it possible to quickly identify areas for improvement, optimise decision-making processes and exploit market opportunities in real time.

Implementing enterprise-wide BI also means promoting a data culture, where decisions are driven by accurate and timely information. This not only increases transparency within the company, but also responsibility and accountability, as every decision is based on verifiable data. Furthermore, a well-implemented BI system facilitates communication and collaboration between departments, reducing information silos and promoting greater knowledge sharing.

In today's fast-changing and increasingly competitive environment, an integrated BI system provides the company with a strategic advantage, enabling it to anticipate market trends, respond promptly to customer needs, and optimise resource allocation. Ultimately, a BI-based approach not only supports the achievement of business objectives more effectively, but also prepares the organisation to successfully meet future challenges, ensuring sustainable, long-term growth.

REFERENCES

- Ailawadi, Kusum L., and Paul W. Farris. "Managing Multi- and Omni-Channel Distribution: Metrics and Research Directions." *Journal of Retailing*, vol. 93, no. 1, Mar. 2017, pp. 120–135, <https://doi.org/10.1016/j.jretai.2016.12.003>.
- Al-Omouh, Razan, et al. "Design and Implementation of Business Intelligence Framework for a Global Online Retail Business." *2022 International Conference on Emerging Trends in Computing and Engineering Applications (ETCEA)*, Nov. 2022, <https://doi.org/10.1109/etcea57049.2022.10009688>.
- Alessandro Rezzani. *Business Intelligence*. Alessandro Rezzani, 2012.
- Anthony, Robert N. *Planning and Control Systems : A Framework for Analysis*. Boston, Harvard University Press, 1965.
- Bendle, Neil T, et al. *Marketing Metrics : The Manager's Guide to Measuring Marketing Performance*. 4th ed., Upper Saddle River, New Jersey, Pearson Education, Inc, 2021.
- Berinato, Scott. "Visualizations That Really Work." *Harvard Business Review*, June 2016, hbr.org/2016/06/visualizations-that-really-work.
- Bhatt, Viral, and Jigar Nagvadia. *-FACTORS INFLUENCING CONSUMER'S ONLINE BUYING BEHAVIOR: AN EMPIRICAL STUDY*|| *Doctor of Philosophy in Management*. Jan. 2021.
- Borden, Neil. *The Concept of the Marketing Mix*'. Sept. 1984.
- Chen, Shan, and Lucio Lamberti. "Multichannel Marketing: The Operational Construct and Firms' Motivation to Adopt." *Journal of Strategic Marketing*, vol. 24, no. 7, 29 Feb. 2016, pp. 594–616.
- Chun-Houh Chen, and Et Al. *Handbook of Data Visualization*. Berlin, Springer, 2016.

- Clark, Dan. *Beginning Microsoft Power BI : A Practical Guide to Self-Service Data Analytics*. Berkeley, Apress, 2020.
- Corsaro, Daniela. *Gestire La Sales Transformation*. FrancoAngeli, 20 Sept. 2018.
- Dur, Banu Inanc Uyan. “Data Visualization and Infographics in Visual Communication Design Education at the Age of Information.” *Journal of Arts and Humanities*, vol. 3, no. 5, 1 June 2014, pp. 39–50,
www.theartsjournal.org/index.php/site/article/view/460,
<https://doi.org/10.18533/journal.v3i5.460>. Accessed 21 Aug. 2020.
- Elbashir, Mohamed Z., et al. “Measuring the Effects of Business Intelligence Systems: The Relationship between Business Process and Organizational Performance.” *International Journal of Accounting Information Systems*, vol. 9, no. 3, Sept. 2008, pp. 135–153.
- Filofteia Tutunea, Mihaela, and Rozalia Rus. “Business Intelligence Solutions for SME’s.” *Procedia Economics and Finance*, vol. 3, 2012,
[https://doi.org/10.1016/S2212-5671\(12\)00242-0](https://doi.org/10.1016/S2212-5671(12)00242-0).
- Frolla Società Cooperativa Sociale Impresa Sociale ETS. *Bilancio Sociale* . 2022,
frollalab.it/wp-content/uploads/2023/11/bilancio-frolla-22_01_definitivo-pagine-singole.pdf.
- Heang, Rasmey, and Raghul Mohan. *LITERATURE REVIEW of BUSINESS INTELLIGENCE*. 2017.
- Howson, Cindi. *Successful Business Intelligence : Unlock the Value of BI & Big Data*. Emeryville, California, McGraw-Hill/Osborne, 2014.

- J, Anscombe F. “Graphs in Statistical Analysis.” *The American Statistician*, vol. 27, no. 1, 1973, pp. 17–21, www.jstor.org/stable/2682899,
<https://doi.org/10.2307/2682899>.
- Kawada, Kentaro , et al. “Data-Driven Marketing to Accelerate Decision Making.” *Fujitsu Scientific & Technical Journal*, vol. 55, no. 4, 2018, pp. 50–56.
- Keller, Kevin Lane. “Brand Equity Management in a Multichannel, Multimedia Retail Environment.” *Journal of Interactive Marketing*, vol. 24, no. 2, May 2010, pp. 58–70, <https://doi.org/10.1016/j.intmar.2010.03.001>.
- Kerzner, Harold. *Project Management Metrics, KPIs, and Dashboards*. John Wiley & Sons, 12 Jan. 2023.
- Kimball, Ralph, and Margy Ross. *The Data Warehouse Toolkit*. John Wiley & Sons, 8 Aug. 2011.
- Knaflic, Cole Nussbaumer. *Storytelling with Data: A Data Visualization Guide for Business Professionals*. Hoboken, New Jersey, Wiley, 2015.
- Kotler, Philip, and Kevin L Keller. *Marketing Management*. 14th ed., Pearson Education, 2012.
- Kotler, Phillip, et al. *Principles of Marketing*. 5th ed., Harlow, Essex, Prentice Hall, 2008.
- Marchi, Luciano. “Dalla Crisi Allo Sviluppo Sostenibile. Il Ruolo Dei Sistemi Di Misurazione E Controllo.” *MANAGEMENT CONTROL*, no. 3, Oct. 2020, pp. 5–16, <https://doi.org/10.3280/maco2020-003001>.
- Massaroni, Enrico, et al. *Analisi Dello Stato Dell’arte Sui Decision Support System (DSS)*. 2014.
- Moore, David S, et al. *The Basic Practice of Statistics*. New York, W.H. Freeman, 2018, p. 138.

- Rangaswamy, Arvind, and Gerrit H. Van Bruggen. "Opportunities and Challenges in Multichannel Marketing: An Introduction to the Special Issue." *Journal of Interactive Marketing*, vol. 19, no. 2, 1 Feb. 2005, pp. 5–11
- Reddy, Chandan K, and Charu C Aggarwal. *Healthcare Data Analytics*. Boca Raton London New York Crc Press, 2020.
- Rosário, Albérico Travassos, and Joana Carmo Dias. "How Has Data-Driven Marketing Evolved: Challenges and Opportunities with Emerging Technologies." *International Journal of Information Management Data Insights*, vol. 3, no. 2, 1 Nov. 2023, p. 100203.
- Rouhani, Saeed, et al. "Review Study: Business Intelligence Concepts and Approaches." 2012.
- Serpelloni, Giovanni, and Elisabetta Simeoni. *I SISTEMI DI REPORTING: PRINCIPI E CRITERI DI FUNZIONAMENTO*.
- Torrini, Filippo. "Sistema Informativo Aziendale: Cos'è, a Cosa Serve E Perché È Importante." *UniverseIT*, 4 Feb. 2021, universeit.blog/sistema-informativo-aziendale/.
- Truzzi, Eleonora. "Analisi Dei Dati: Cos'è, Come Si Fa E Tipologie Esistenti." *Nextre Srl*, 10 July 2023, www.nextre.it/analisi-dei-dati/#:~:text=L. Accessed 14 June 2024.
- Tufte, E R. *The Visual Display of Quantitative Information*. Cheshire, Graphics Press, 1982.
- Zhang, Jie, et al. "Crafting Integrated Multichannel Retailing Strategies." *SSRN Electronic Journal*, 2009, <https://doi.org/10.2139/ssrn.1389644>.

SITOGRAPHY

- artofviz. “Art of Visualization.” [Www.artofvisualization.com](http://www.artofvisualization.com), 23 Oct. 2023,
www.artofvisualization.com/blog/history-and-evolution-of-data-visualization.
- davidiseminger. “Visualizzazione Dati in Power BI Desktop - Power BI.”
Learn.microsoft.com, 31 Jan. 2024, learn.microsoft.com/it-it/power-bi/connect-data/desktop-data-view. Accessed 16 June 2024.
- Desai, Brahmajeet. “The Hitchhiker’s Guide to OLAP: What Is OLAP and Its Types.”
Kyvos Insights, 21 Oct. 2021, www.kyvosinsights.com/blog/the-hitchhikers-guide-to-olap-what-is-olap-and-its-types/.
- Esteves, Márcia, et al. “A Proof of Concept of a Mobile Health Application to Support Professionals in a Portuguese Nursing Home.” *Sensors*, vol. 19, no. 18, 12 Sept. 2019, p. 3951, <https://doi.org/10.3390/s19183951>. Accessed 19 June 2024.
- “Facebook Dashboards - Explore Great Examples & Templates.” Www.datapine.com,
www.datapine.com/dashboard-examples-and-templates/facebook.
- Gartner. “Corporate Performance Management (CPM).” Gartner,
www.gartner.com/en/information-technology/glossary/cpm-corporate-performance-management.
- . “Gartner Says More than Half of Enterprise IT Spending in Key Market Segments Will Shift to the Cloud by 2025.” Gartner, 2022,
www.gartner.com/en/newsroom/press-releases/2022-02-09-gartner-says-more-than-half-of-enterprise-it-spending.
- Gupta, Nidhi. “Star Schema vs Snowflake Schema.” Medium, 22 Apr. 2023,
nidhig631.medium.com/star-schema-vs-snowflake-schema-78dc9424a8a2.

IBM. “Cos’è La Business Intelligence E Come Funziona? | IBM.” [Www.ibm.com](http://www.ibm.com),
www.ibm.com/it-it/topics/business-intelligence.

maggiesMSFT. “Configurare Il Drill-through Nei Report Di Power BI - Power BI.”
Learn.microsoft.com, 5 Mar. 2024, learn.microsoft.com/it-it/power-bi/create-reports/desktop-drillthrough. Accessed 14 June 2024.

Microsoft. “Power BI - Visualizzazione Dei Dati | Microsoft Power Platform.”
Www.microsoft.com, www.microsoft.com/it-it/power-platform/products/power-bi?market=it. Accessed 19 June 2025.

Qlik Comunity. “The Importance of Data Visualization.” Community.qlik.com, 10 Dec. 2012, community.qlik.com/t5/Design/The-Importance-of-Data-Visualization/ba-p/1465937. Accessed 19 June 2024.

Salseforce. “Help and Training Community.” Salesforce,
help.salesforce.com/s/articleView?language=it&id=sf.chart_bar_stacked_100.htm&type=5. Accessed 14 June 2024.

Tableau Blueprint. “Why Visual Analytics?” Help.tableau.com,
help.tableau.com/current/blueprint/en-us/bp_why_visual_analytics.htm#:~:text=Pre%2Dattentive%20attributes%20are%20information.

Tableau Bluprint. “Understanding and Using Pie Charts.” Tableau, 2023,
www.tableau.com/data-insights/reference-library/visual-analytics/charts/pie-charts.

Tableu. “Dashboard Di BI | Cose Da Sapere | Tableau.” Www.tableau.com,
www.tableau.com/it-it/learn/articles/business-intelligence/bi-dashboards.
Accessed 2 June 2024.

Tableau Blueprint. "A Guide to Charts: Definition, Examples, and Types." Tableau,
www.tableau.com/data-insights/reference-library/visual-analytics/charts.

"Cos'è La Visualizzazione Dei Dati? Definizione, Esempi E Risorse."

www.tableau.com, www.tableau.com/it-it/learn/articles/data-visualization.

Accessed 2 June 2024.

Thakur, Dinesh . "Anthony's Framework for Understanding MIS." Computer Notes, 16

Nov. 2013, ecomputernotes.com/mis/information-and-system-concepts/anthonysframework.

Wikipedia. "File:Minard.png - Wikipedia." Commons.wikimedia.org,

it.m.wikipedia.org/wiki/File:Minard.png. Accessed 19 June 2024.