

Review Paper

Enterprise Financial Project Management by Visual Analytics Tools

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ABSTRACT

Companies of all sizes and lines of business are already turning data into real value in many ways. All industries are covered: these are social networks, Internet companies, industrial enterprises, fast food chains, banks, industrialists, hotels, and many others. Scientific research reveals ways to increase productivity through data-driven decision-making. However, the human brain is designed in such a way that graphical display allows one to perceive and understand some features of quantitative data, and some quantitative tasks can be best performed. The article reveals a set of tasks for managing financial projects and the resulting visual analytics methods. Applying a systematic approach to managing financial projects and solving problems of visualization of complex data analytics is considered. The technological sequence of the visual solution of project management tasks for managers is given, and visual analytics methods are proposed to determine the necessary intervention in a problem situation that arises in the project management process. The importance of using modern analytical software is noted, which allows visualizing financial analytics using various models quickly or by combining them. Also, the article highlights the main advantages of using analytical software in financial project management and gives recommendations on using five strategies for effective visual analytics of enterprise financial project management.

HIGHLIGHTS

- ❶ Software for interactive data visualization and business intelligence allows carrying out in-depth and versatile analysis of large amounts of information quickly. With the help of these solutions, reports can be quickly generated from various sources, even for those employees who do not have excellent skills in working with BI applications or data warehouses.
- ❷ In the current flow of information, it is necessary to visualize data because the human brain can perceive specific quantitative characteristics and perform certain quantitative tasks most efficiently when the data is expressed graphically.

Keywords: Enterprise, financial project, management, visual analytics

The specificity of financial project management methods lies in the processing and analysis of a large amount of numerical and tabular information related to projects' cost, time, and resource parameters (Omelyanenko & Volodin, 2017; Tirto *et al.* 2020).

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Modern technologies instantly process terabytes of data and provide ample opportunities for their analysis. But the nature of computing technology is such that the final results of its processing are difficult for humans to perceive (Halkiv et al. 2022).

In this case, visual analytics systems come to the rescue, which form a graphical image of the situation with a project in diagrams, diagrams and graph structures. Moving from a textual or tabular view to a visual display enhances the manager’s decision-making ability based on machine-processed data. At the same time, the interactivity of the interface of visual analytics tools is capable of providing iterative step-by-step problem-solving (Sotnyk et al. 2013).

Financial project management is a complex process involving collecting and processing a large amount of data. If the data is interpreted or managed insufficiently or incorrectly, duplicate or lose financial data, and this can lead to incorrect decisions. Typically, most companies analyze financial transactions at the end of the month and use cash flow analysis software that relies on the accounting software to analyze financial and operating and investing activities (Golovchenko et al. 2022). The problem with this approach is that such software provides only a static view of the situation, and such knowledge quickly becomes outdated. It also ignores outliers in the data and re-accounting of financial transactions.

Even ten years ago, before big data took over the world, renowned clothing retailer Guess was using a Business Intelligence application based on Oracle DBMS to collect tons of sales and inventory data. And I used them to generate informative reports. But only a small group of advanced users who actively worked with reports enjoyed the benefits of this tool.

The enterprise needed to figure out how to enter increasingly valuable data into a BI environment and then hand it over to salespeople to decide which products and quantities to go to specific stores.

Most managers preferred to work with products and visually perceptible materials. Then the management of the enterprise forced analysts to upload information into spreadsheets and insert cut-out pictures into them. Guess’s experience confirms what many other companies are discovering today: Big data, BI and business intelligence don’t just feed each other; when used in tandem, they take data analytics to the next level. With a good BI / BA application, it is easier for users to work with big data, and the presence of big data technologies increases the value of the BI/BA system.

Business intelligence tools allow collect financial data from multiple sources, reduce the likelihood of problems gathering information at all levels, and conduct a thorough analysis.

Methods and models of visual analytics for financial project management

The steps of visual analysis of financial project management are based on geometric modelling and visualization of tasks. Creating a visual analytical model allows you to prepare an informed solution to problems and reduce the time to solve the problem. And the use of the electronic version of visual analytics allows for creating interactive models with detailed expanded information and cross-data links. Fig. 1 shows a diagram of the implementation of the stages of data visualization.

The so-called system of visual models is used for the visual analysis of problem situations and business models in project management.

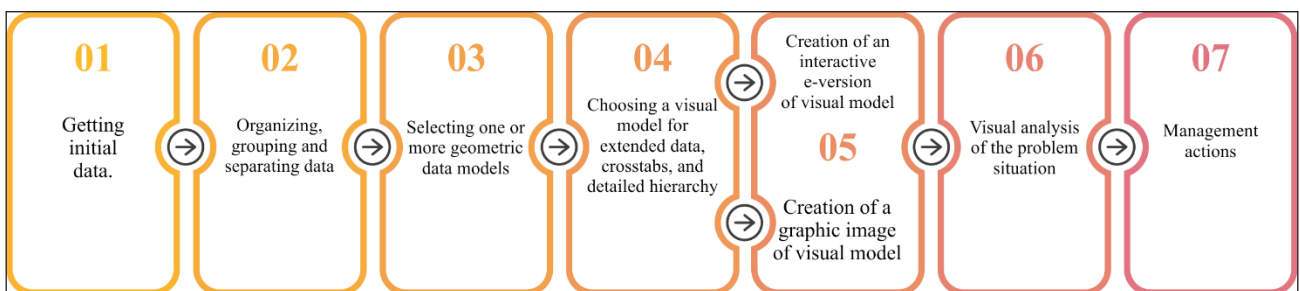


Fig. 1: Steps of visual analysis of the financial projects of the enterprise (Source: improved by authors based on (Kolychev & Rumyantsev, 2014)

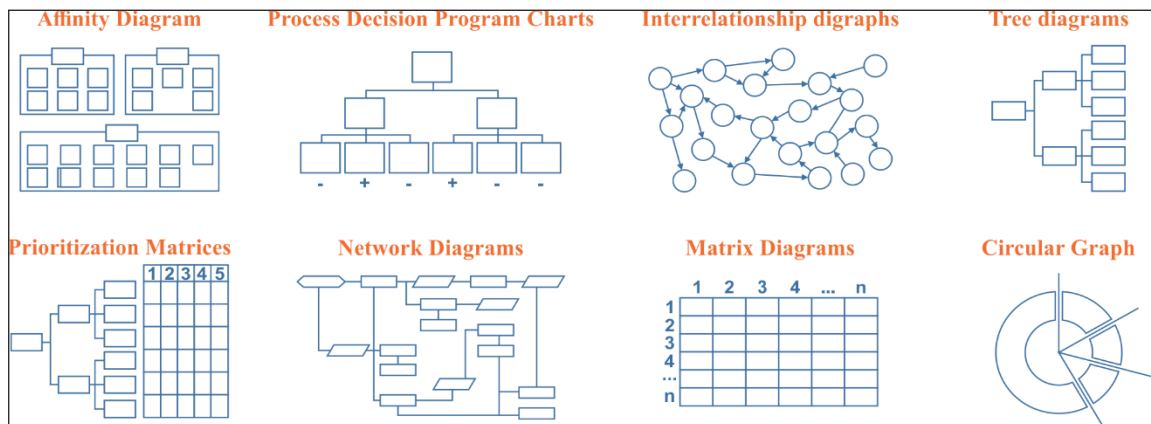


Fig. 2: Types of graphical business models in project management tasks

The complex graphic models are the basis of visual business modelling in financial project management. A systematic approach to studying a project as an object of analysis allows you to determine the optimal visual model or combine several models in a business graph.

Business graphics allow analyzing data and visually presenting information to managers quickly, and also allow checking the options for the provided data to choose the best one (Vytvytska *et al.* 2020).

A business graph is conditionally divided into two groups: visual models based on numerical data (tabular, numerical and symbolic-numerical charts, etc.) and visual models that are based on pre-developed templates (plans, business diagrams, organizational charts, etc.)

Modern programs and services for computer data processing have greatly facilitated the visualization of business graphics.

The most common visualization model for business graphics was the graph theory model, which is a set of nodes connected by edges. A graph is a pair of sets (Kudzh *et al.* 2020):

$$G = (V, E)$$

where V is a subset of any countable set;

E is a subset of $V \times V$.

But the financial and economic indicators of investment projects and project management, in general, most often use large amounts of data, different in structure and quality, which implies the use of visual control and analysis tools focused on the visualization of multidimensional data.

For visual analysis of project management tasks, such models are used as affinity diagrams, process decision program charts, interrelationship graphs, tree diagrams, prioritization matrices, network diagrams, matrix diagrams, circular graphs etc. (Fig. 2).

When creating and implementing a project, the manager is faced with certain project management tasks (Fig. 3). Depending on the project type and analysis of its stages, content and integration, the manager operates with certain initial data.



Fig. 3: Project management knowledge areas

Each stage of the classic project life cycle requires the selection of initial data about the project, starting with the definition of the project's subject area. Such data, as a rule, are presented in tabular, numerical or symbolic-numerical form of presentation (Fig. 4).

At all stages of a business project, the variety and amount of initial data for visualization are great. For example, for the “Concept” phase, these are goals, tasks, specifications, team, and responsibilities.

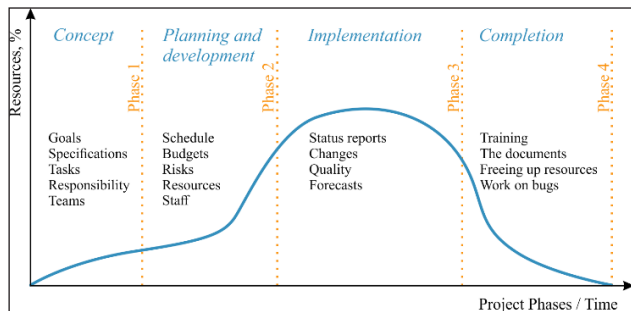


Fig. 4: Initial data for visualization at each stage of the project life cycle (Source: improved by authors based on (Kolychev & Rumyantsev, 2014))

This data is necessary for visualization and analysis by all project participants and directly depends on the size of the project and the complexity of solving problems. An increase in project participants or the project itself leads to an increase in the dimension of tabular-numerical and symbolic data parameters for visualization and an increase in the number of operations included in the project (Fig. 5).

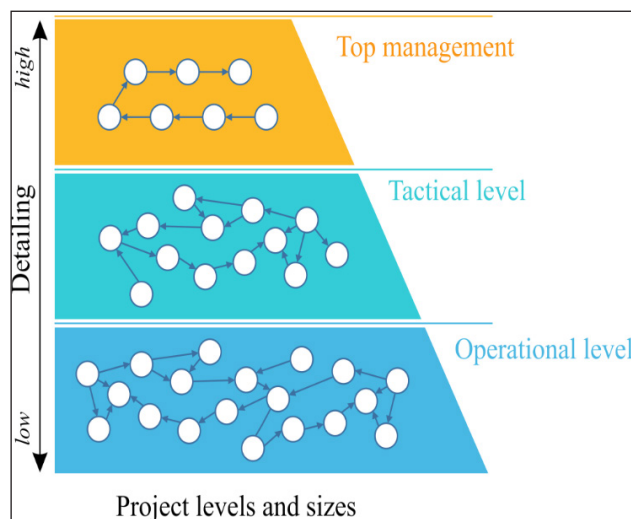


Fig. 5: Visualization of management levels and project sizes at each level (Source: improved by authors based on (Kolychev & Rumyantsev, 2014; Tirto et al. 2020)).

Management of financial projects of an enterprise based on visual models

Visual analytics tools are widely used in the field of geometrizing the results of business projects. Finance teams use modern business intelligence visualization tools to save significant time by

integrating data, efficiently delivering analysis and reporting, and securely sharing information that supports business strategy.

Finance departments free themselves from manual spreadsheet processes and provide all organizations with powerful analytics, from local to global.

The initial data for constructing visual models of financial and investment planning are pretty diverse. However, they are mainly numerical and are set, as a rule, in a tabular form (Fig. 6).

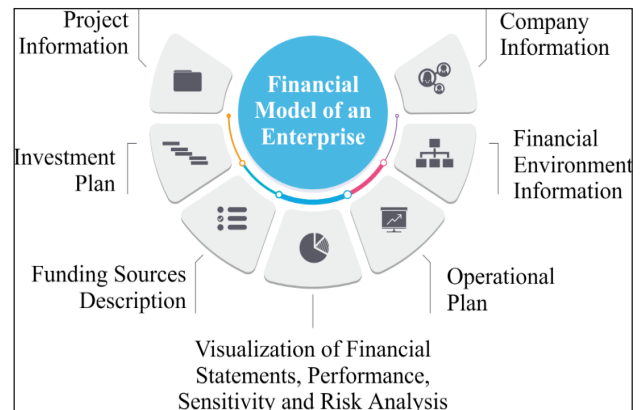


Fig. 6: Initial data for building a visual model of financial information about the project

An important task of business analytics in projects’ financial and investment planning is constructing visual models of integral financial criteria. According to UNIDO technology, the main criteria for assessing the effectiveness of financial results are the following integral financial indicators: NPV, IRR, PI, DPB, MIRR. Visual models of integral financial performance indicators of project activities are flat drawings or spatial scenes, which are additionally determined by the initial business data, and used to make investment and financial decisions regarding the return on investment in project implementation (Tableau for Finance 2019). Fig. 7 provides an example of a visual model of Bitcoin price evolution and how the market interprets them. These visual analytics was created using modern computer business intelligence tools and interactively provide more detailed information about the financial indicators used when choosing a specific period.

With the help of modern analytical software, financial analytics can be visualized in the shortest possible time using various models or by combining them.

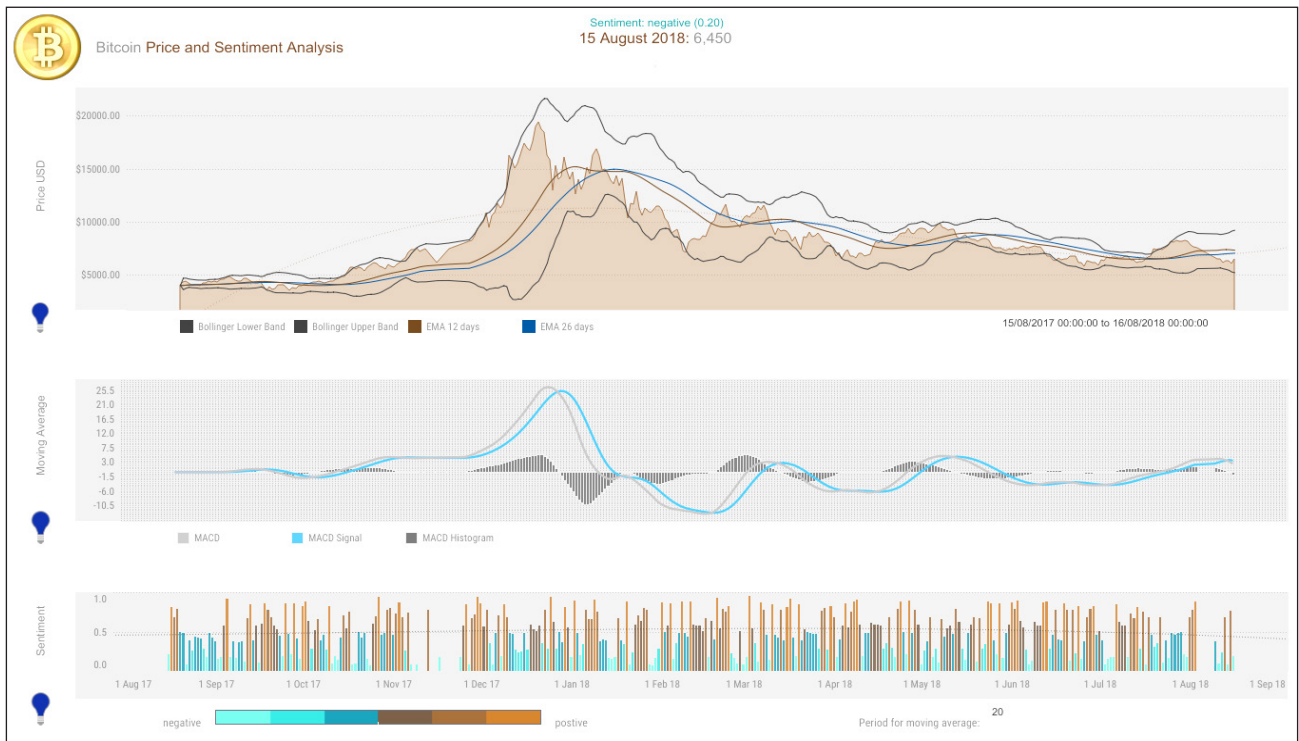


Fig. 7: An example of a visual model of Bitcoin price evolution

The following can be used as visual models:

- ◆ visual model of sensitivity analysis of the integral indicator of project efficiency depending on uncertain factors, such as sales volume, sales price, tax rates, and initial costs;
- ◆ visualization of the payback process in the form of a spatial scene model;
- ◆ a visual model of a flat drawing in the format of a linear Gantt chart, displaying the schedule for the implementation of work on the project;
- ◆ a visual model for analyzing the sensitivity of net present value, which allows for visual, quantitative analysis of risks and potential prospects of the project in alternative scenarios of its implementation;
- ◆ visual model of sensitivity analysis of the discounted payback period depending on changes in uncertain data.

Using the visualization method, it turns out to be possible to analyze, for example, the dependence of an increase in NPV on an increase in product prices, or *vice-versa*, how a decrease in prices leads to the appearance of an adverse effect from the implementation of the project and a drop in reduced income to an unacceptable level. Cognitive

visualization of risk modelling results using the statistical test method allows for visual analysis of the business situation associated with risks.

Benefits of using analytical software in financial project management

- ◆ strengthening ties and collaboration with financial partners. Using modern software, the company can be sure that the data collected from the bank statement has not been changed. Working with data takes place almost in real time.
- ◆ reducing risks for issuers, countries, counterparties and businesses - thanks to a 360-degree view of financial threats. Dashboards of programs display a picture of financial transactions for all open bank accounts. Comparison of this data allows you to detect dormant or low activity accounts and take the necessary measures based on this information (Skibina *et al.* 2021).
- ◆ more reliable financial forecasts. Understanding trends and identifying patterns of financial transactions is a complex process, especially when there are many sources. Using visual analytics, you can look at the data by month-

to-month, quarter-to-quarter and year-to-year breakdowns, changing the level of detail in the report in seconds.

- data performs better and is more valuable when all sources are collected and analyzed together. The aggregated picture of financial transactions is calmness and confidence in what is happening with the enterprise's money. Continuous data collection and analysis of financial transactions using business intelligence platforms is the shortest path to the truth.
- substantial time savings.
- deeper analysis by combining various data sources, including information about bank statements, investment activity, the impact of exchange rates, corporate credit cards, etc.
- better understanding by business participants by seeing the most meaningful information and going down to the level of individual transactions.
- stricter monitoring to detect duplicate or missing data, trends in transactions, low activity accounts, and outliers in data.

It has been proven that facts presented together with illustrations are twice as memorable. After testing 120 different ways of visualizing data, the

visualized information was remembered better than the “naked” facts in all but a couple of cases. Consequently, almost any illustrative material makes the fact more memorable. But do not forget that the excess of information reduces the memorization of facts. There is a threshold when visual information becomes redundant, making it difficult for the brain to navigate it. Modern visual analytics software uses a combination of models and data filtering (Fig. 8).

Results: Strategies for effective visual analytics for managing enterprise financial projects

Today, one of the critical areas for corporate leaders is working with data. Nearly nine in ten financial professionals believe that data can change how we do business. Research has shown that over half of corporate leaders rank big data and analytics as the top 10 corporate priorities. All this suggests that after the revolution of recent decades, business is entering an era when data is becoming a driving force.

The amount and variety of data available for analysis are growing exponentially. Meanwhile, more powerful technologies are emerging to manage complex data and perform higher-level analytics. Today, many data sources exist: call centre records, external channels, machine data, social

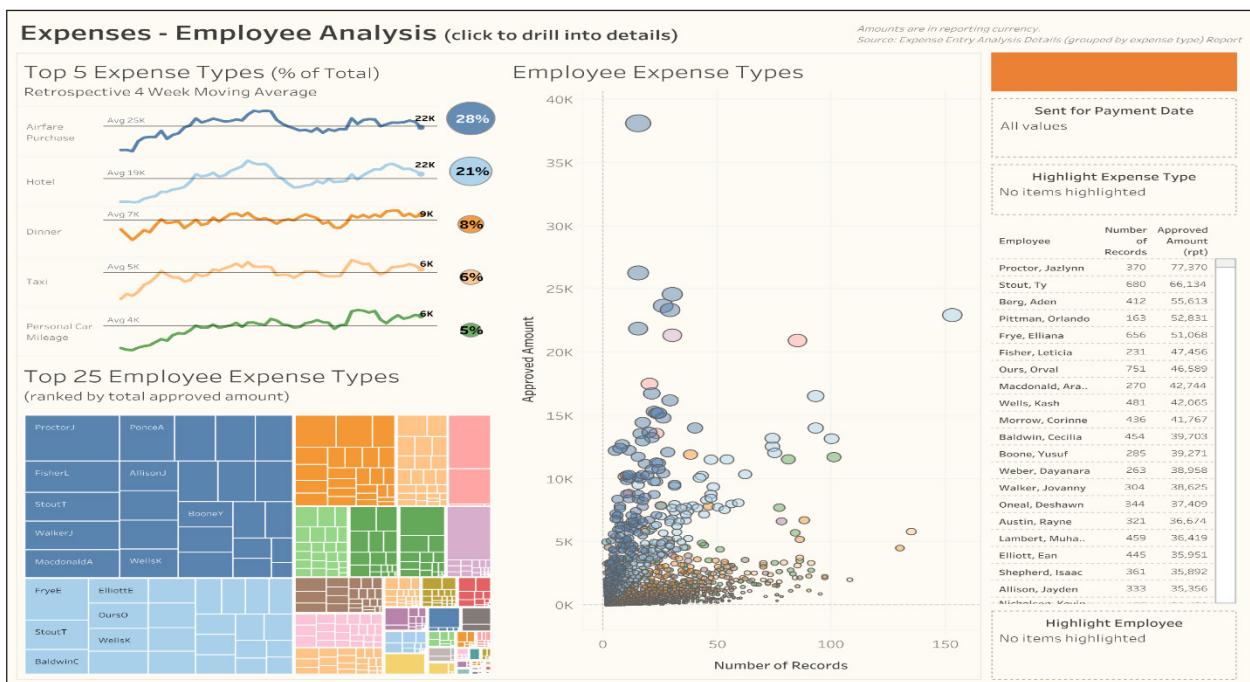


Fig. 8: A sample dashboard showing employee expenses of a fictional enterprise (Source: Tableau for Finance 2019)

networks, and much more. These interconnected streams (called “big data”) are combined in modern organizations to open up new sources of unique information and profit.

To reap the benefits of working with data, companies will have to tackle several challenges as they inevitably need new skills, tools, and a different way of thinking.

Here are five strategies for successful visual analytics for managing enterprise financial projects:

1. Use a crosstab whenever needed

Most financial professionals want to see tables with numbers with four or more decimal places or coloured in different colours because they are used to this format. Crosstabs must be included in the rendered report with accurate numbers they can trust.

Charts and graphs in the dashboard can serve as filters for crosstabs. And as trust in technology grows, you can simplify this method and end up hiding the numbers in the expanded views, leaving them only in the detailed views.

2. Inclusion of detailed hierarchy from parent accounts and integration with external systems

Modern analytical software allows synchronizing data from external sources, automating processes

to save time.

By aligning account IDs with parent account IDs and accounting centres, you can quickly aggregate data to the level required for precise and predictive analysis. At the same time, the team can look at the individual log entries that affect these aggregated numbers and determine what drives the variance. Stakeholders can view the income statement in the most simplified or detailed format in the same place, depending on their needs.

3. Combining financial planning data and actual data into one view

Many financial groups struggle to improve forecast accuracy through complex, time-consuming, manual work. As a result, it can be increasingly difficult to understand how these projections change over time. Analysts can quickly avoid repeating the same steps manually by allowing users to add new financial planning datasets and select them from drop-down menus. Instead, it would help if you compared similar periods in the past, present and planned.

4. Visualization of the difference between budgets, actual data and forecasts

Another strategy to help create more successful dashboards is to visualize the discrepancy between budgets, actual data, and forecasts. It’s simple

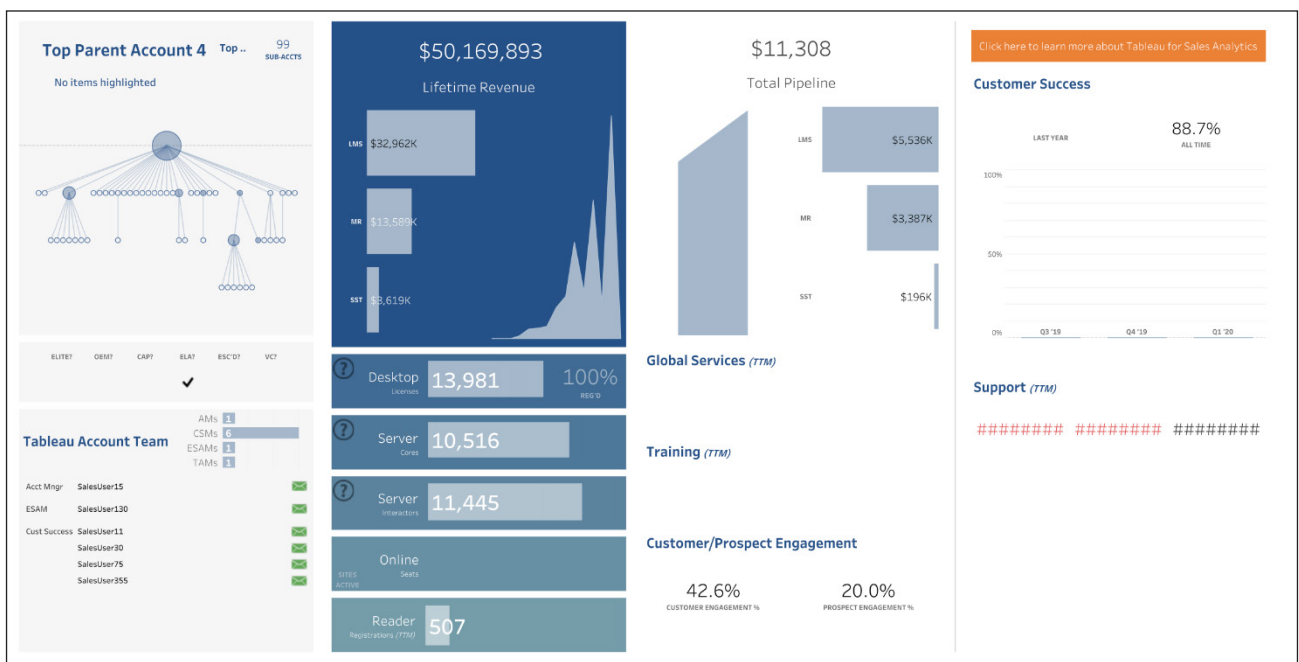


Fig. 9: Sample dashboard providing a 360-view of customer activities (Source: Tableau for Finance 2019)

math, but it makes a tricky visualization problem: when two numbers are compared, the difference between them becomes the “third number.” Bulleted charts and unstacked histograms are two of the most compelling ways to visualize three numbers effectively.

5. Digging into the details of the data

One of the main advantages of visual analytics systems is working with large data sets.

Finance teams use two main methods to get around table limitations:

- ♦ they aggregate data;
- ♦ they create sample data as a means to perform testing.

Aggregating data can interfere with exploring patterns and trends that drive results. Aggregation is essential for a comprehensive understanding but becomes more powerful when basic details are available simultaneously. Summary data can almost always answer questions such as “What was the average deal size and discount rate last year?” but it rarely helps with questions like “How is the deal size related to the discount strategy?”

Similar to the constraints created by aggregation, sampling can also lead to missed opportunities for identifying patterns and trends. Still, selection also carries the additional disadvantage of introducing errors or data distrust.

Fig. 9 provides an example of a visual dashboard that provides a complete overview of customer activity, not just a specific metric.

CONCLUSION

Business rules continue to change under the influence of technology. By focusing on the computerization of the workplace, which began in the late 1980s and continues to this day, companies have entered the digital dominance era in business. The widespread adoption of enterprise resource planning systems, electronic point of sale, e-commerce and other Internet-based systems has led to more and more organizational data being collected and processed digitally.

Software for interactive data visualization and business intelligence allows carrying out in-depth and versatile analysis of large amounts

of information quickly. With the help of these solutions, you can quickly generate reports from various sources, even for those employees who do not have excellent skills in working with BI applications or data warehouses.

Thus, companies have access to fast analytics without attracting additional resources.

Modern visual analytics systems have ready-made tools that can visualize any form and amount of data. The solution can turn large amounts of data into interactive reports in graphs, charts and intelligent dashboards for better information perception. Since 2000, businesses have been able to use new volumes of data for their purposes, which are showing exponential growth.

Data must be visualized in such a flow of information. The human brain can perceive certain quantitative characteristics and perform specific quantitative tasks most efficiently when the data is expressed graphically. Visual data processing provides optimal support to:

- ♦ See the big picture of a financial project
- ♦ Easily and quickly compare values
- ♦ Find patterns among values
- ♦ Comparing models in a visual representation.

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