Development of a decision support tool for the operational management of cafeterias – BAGGA cafeteria chain of Sonae MC

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Abstract

Sonae is one of the biggest Portuguese food and specialized retail companies. In 2015, they launched a new brand of cafeterias, called BAGGA. In order to manage its nationwide chain of cafeterias, they need a team of operational managers who make daily management decisions, based on several indicators. Currently, obtaining these indicators and information is a long and inconsistent process, which complicates the management team's work and hinders the correct supervision of the cafeterias which they supervise. To improve this process, a decision support tool was developed, capable of achieving the following: easy access to indicators, minimum input to access additional information, and grouping Key Performance Indicators (KPIs) in an Excel spreadsheet, size A4. To achieve this, several concepts related to cafeteria management were studied, in order to select the most relevant indicators to implement on the decision support tool, to ensure it could be as simple and practical as possible. The tool was developed according to the specifications and deadlines defined by Sonae. Two cafeterias were analyzed and demonstrated its efficiency and usefulness for operational managers. Finally, the tool was shared with Sonae's management team, who recognized the tool's contribution to provide a better understanding of the cafeteria's performance, a faster analysis of indicators and a more efficient decision making process.

Keywords: Performance indicators; Decision support systems; Business Intelligence; Cafeterias; Sales; Shrinkage.

1 Introduction

Coffee is one of the most consumed products in the world, part of an industry that has an estimated worth of $20 billion (Wevio, 2015). It is estimated that 76% of the Portuguese market favors drinking coffee outside of home, drinking an average of 2.2 cups of coffee per day (Academia do Café, 2012). Starbucks opened its first coffee shop in Portugal in 2008, and by now, it has already 11 stores in total (Lusa, 2016). Padaria Portuguesa – a Portuguese company – started its activity in 2010, and has currently over 40 stores in Portugal, all of them located in Lisbon (Ferreira, 2016). In 2009, the category of food, beverages and tobacco registered, in Portugal, €7,340 million in sales, which corresponded to 70.2% of total sales of food retail establishments (INE, 2009).

The growth of this industry is one of the main reasons why Sonae decided to invest more on its cafeteria/coffee shop business, so it could become a relevant player and compete with companies like Starbucks, Padaria Portuguesa and Jeronymo (from Jerónimo Martins). As such, all of Sonae's cafeterias underwent a rebranding process, and they all have a new name: BAGGA.

There are currently over 180 BAGGA cafeterias in the country, and although there is an ongoing expansion project of the brand, managers need to ensure that all current cafeterias are working up to elevated quality standards. To achieve a consistent level of service over the chain, there is a team of operational managers, whose job consists of making daily decisions to ensure that the cafeterias which they are responsible for are working well. To achieve this, they need to obtain and analyze a variety of indicators, in order to address any possible problems that may arise from any given cafeteria.

However, accessing these indicators is one of the main challenges that operational managers face, because it is a very slow and confusing process. This is a well-known issue for many big companies, called "The Big Data Phenomenon" (Rouse, 2014), where large amounts of information stored in databases, in a variety of formats, negatively impact their access velocity, hindering data analysis. As such, companies invest in ways to better access and use this information, such as developing Decision Support Systems (DSS), to improve filtering of information and support data analysis, query/reporting and data mining (Reddy, Srinivasu, Rao, & Rikkula, 2010).

Therefore, the main goal of this work is to develop a tool that facilitates the access to information deemed relevant for operational managers, who may be responsible for over 25 cafeterias each. The tool must also be accessible (have only one format), simple to use and display all relevant information in a size equivalent to an A4 sheet.

2 Literature review

With the goals proposed in the previous chapter in mind, the following sections will provide further context with literature review about performance indicators, Balanced Scorecards, and the evolution of Business Intelligence and Decision Support Systems, in order to understand how technologies associated with the development of databases and decision support have evolved, and how companies use these technologies.

2.1 Key Performance Indicators

Key Performance Indicators (KPI) is a term used to describe both financial and non-financial indicators considered to be the most essential to evaluate a company's success – hence the term "key" (Ghalayini & Noble, 1996; Parmenter, 2007; Roy, Rey, Wegen, & Steele, 2003). Since it depends on the company's objectives, any indicator can be considered a KPI, as long as it has the following characteristics (Jackson, 2015):

- It must be quantifiable;
- It must be well communicated and understood by all staff or relevant departments;
- It must be, effectively, considered crucial to achieving the company's goals.

Companies use KPIs as a means to measure their performance, and to assess, control and improve their processes. There are different ways to assess what these KPIs might be, such as through surveying company employees (Alemanni, Alessia, Tornincasa, & Vezzetti, 2008) or utilizing

prioritization criteria and hierarchy processes (Shahin & M, 2007). Regardless of the methodology used, there is always a subjective component when defining KPIs; as long as there is a consensus as for the role those KPI play in achieving a company's goal, many approaches are possible.

2.2 Balanced Scorecard

The Balanced Scorecard (BSC) was first introduced by Robert Kaplan and David Norton, and consists of a methodology in which both financial and non-financial indicators are used to give managers a more complete picture of the company's performance (Hoque, 2014; Kaplan & Norton, 1992). The BSC suggests that managers should view the organization and set its vision and strategy based on four perspectives: the customer's; the business process; the learning & growth; and the financial. By taking these perspectives into account, managers can establish a clear vision and strategy, and set their KPIs accordingly. There is extensive research that shows benefits in adopting BSC: Davis & Albright (2004) provided evidence that bank branches who used BSC outperformed, on key financial measures, other branches within the same organization who did not; Papalexandris, Ioannou, & Prastacos (2004) observed a positive influence on KPIs of a Greek software development company and a better understanding of what creates value in a company.

2.3 Business Intelligence & Data Warehousing

The arrival of the internet and its mainstream adoption had a tremendous impact in the way companies worked and how they shared knowledge and information between its workers (Evaggelia, 2007). The term "Business Intelligence" (BI) was first coined by Howard Dressner in 1989 (Power, 2007; Watson & Wixom, 2007), and it refers to the set of technologies that companies possess and use to better manage and control information. BI includes: Tools used by workers (such as computers); Available software; Communication technologies; and databases.

One of the concerns companies have is in setting up a database that is capable of delivering all the information needed to help and support managers. As such, major companies – such as Sonae – invest in the creation of Data Warehouses (DW), which are capable of storing large amounts of data regarding a variety of indicators. Thus, databases and data warehousing are considered a core component of BI, and without them, the creation of this work's tool would not be possible.

Figure 1 shows a typical data warehousing architecture. The DW is located at the center, where it receives and stores all the information and data from several external sources. That data is transformed and loaded into a format that is compatible with the data warehouse. This data can be processed by Online Analytical Processing (OLAP) servers, which allow data to be analyzed in various dimensions and perspectives. For instance: the "sales" indicator of a store can be analyzed for one day, for a month, or any other time-related variable. OLAP allows a broader range of analysis possibilities, which are shown in the right half (Tools) of Figure 1. Managers can retrieve information from DW (through OLAP servers) and use it for query/reporting, data mining or analysis.

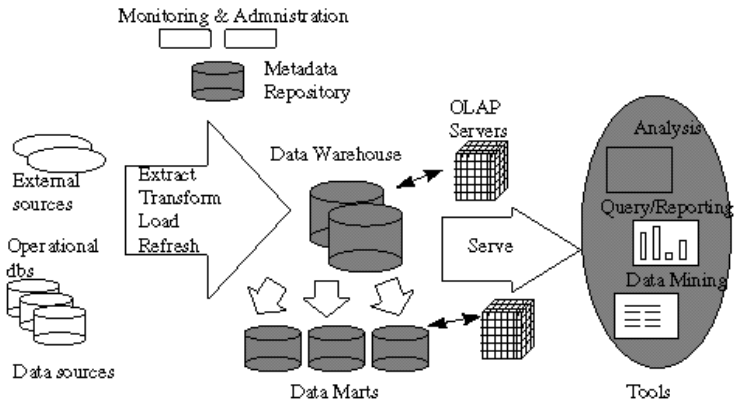

Figure 1 – A typical Data Warehousing architecture (Reddy et al., 2010)

This work focuses on the latter part (Tools), in particular the Analysis and Query/reporting aspect. This architecture also represents the groundwork from which Decision Support Systems function.

2.4 Decision Support Systems

Decision Support Systems (DSS) are systems supported by technologies that allow the processing and visualization of information (Antunes, 2006). DSS are focused on supporting and improving managerial decision-making, and several approaches into designing and developing a DSS are possible, depending on who will use them and what technologies will support them (Arnott & Pervan, 2005, 2008). DSS have been used for a variety of problems, such as portfolio management (Ragsdale, 2001) and site selection decisions (Ahmad, Azhar, & Lukauskis, 2004).

The main types of DSS include: Personal DSS (PDSS); Group Support Systems (GSS); Negotiation Support Systems (NSS); Intelligent DSS (IDSS); Knowledge Management-based DSS (KMDSS); Data Warehousing (DW); and Enterprise Reporting and Analysis Systems. The tool developed in this work can be considered a mix of some of these types of DSS. It can be considered a PDSS because it is aimed at a small team of managers, to aid in a specific task (cafeteria management). It depends on Sonae's data warehouses for data retrieval, and it also employs features that facilitates managers' ability to communicate results both to cafeteria staff and higher-ups.

3 Development of decision-support tool

This chapter will describe the development process and decisions taken to develop the decision support tool, such as the main KPIs chosen, and the configuration chosen and data-filtering and retrieval processes. The goal is to create a powerful tool that supports the existing DSS.

3.1 KPI selection

The KPIs to be included with the tool must be chosen by taking into account what the daily needs for an operational manager are. A meeting was set up with operational managers to assess these necessities, and in the end, it became clear that the most discussed topics pertained to **sales** and **shrinkage**. Operational managers analyze on a regular basis indicators such as: Net Value (NV) of products; Average sales per order; Profit margin; and Shrinkage in terms of volume and value.

For all these indicators, managers analyze not only their value for a specific day, but also the accumulated value for a month or a year (e.g.: average sales per order accumulated for the month of April). Given that these indicators are quantifiable and are analyzed on a daily-basis by operational managers to assess the needs of cafeterias, these indicators were considered as KPIs for this work's decision support tool.

3.2 Interface

The DSS tool developed for this project aims to provide operational managers the necessary information they need in simple, fast and easy-to-analyze form. As such, an Excel-based tool was chosen as the main development platform. It is a widely used spreadsheet software from Microsoft Corporation, and most workers – including operational managers – are accustomed to working with it. We developed a set of macros, using the programming language Visual Basic for Applications (VBA), and assigned those macros to a set of buttons. A macro is a set of rules, written with VBA, which allows for the automation of processes in an Excel file. When a button is pressed, something (that needs to be programmed) happens. This approach led to the "Homepage" design, as shown on Figure 2.

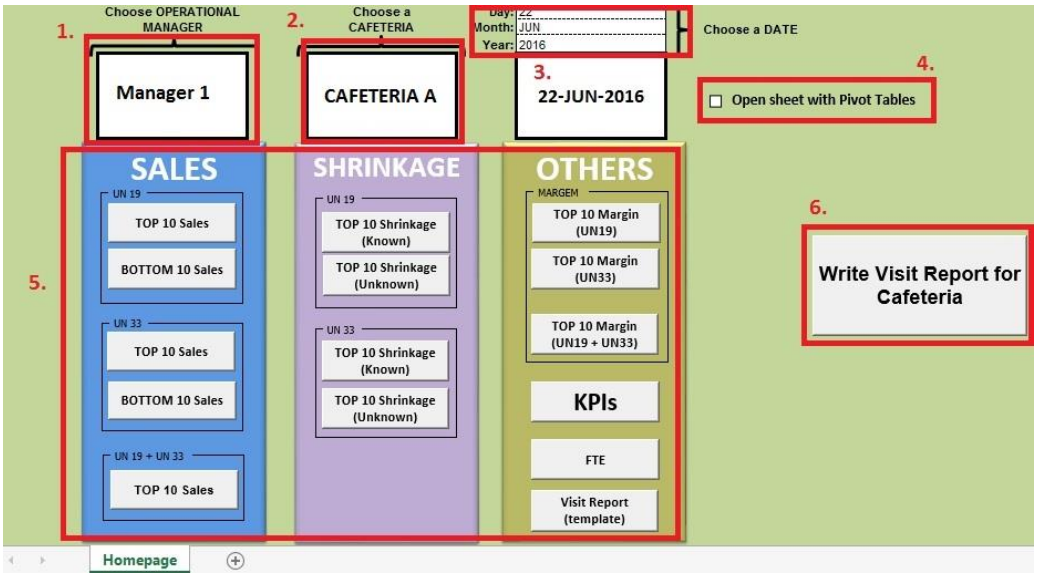

Figure 2 – This tools' Homepage sheet

With this configuration, a user can easily select an operational manager (1), one cafeteria in his care to be analyzed (2), and a date (3). After these three parameters are set, the user can select one of the buttons grouped in three different columns (5), which are "SALES", "SHRINKAGE", and "OTHERS":

- **SALES**: here, managers may view the TOP/BOTTOM 10 products sold in a cafeteria. KPIs shown include the net value of products and the average sales per order (for the day and accumulated values);
- **SHRINKAGE**: these buttons show the TOP 10 products in terms of shrinkage – both known and unknown causes. Values are shown in terms of volume and value (for the day and accumulated values);
- **OTHERS**: here, managers may find profit margin indicators, a summary of all the main KPIs, a table that calculates the Full-Time Equivalent (FTE) of a cafeteria, and a template for filling a visit report.

Many of these indicators' results can be compared to last year's results for the same time last year, to understand if the cafeteria is performing better or worse. This result is displayed as a percentage under an R/H column/line. Table 1 shows the 3 possible scenarios for these results (for product NV).

Table 1 – Description of 3 main possible results for R/H, in the case of product NV

Scenario	Description	Symbol
R/H > 100%	Product is selling more today than the same time last year	✔
R/H = 100%	Product is selling the same today as the same time last year	!
R/H < 100%	Product is selling less than the same time last year	✖

The user may also choose to click any button and view the pivot tables that provide the information retrieved from Sonae's database (4). Finally, on the right side of Figure 2, there is a button that, once pressed, automatically opens an email on Outlook with the fields "To…" and "Subject" already filled, and the main topics for a visit report already filled in the message body (6).

The idea is that every time a button from the Homepage is pressed, the desired sheet with indicators organized in tables pops up for the user. This process requires Excel to retrieve data from OLAP servers and filter the data in a specified way programmed in the macro assigned to the button. Figure 3 describes this process.

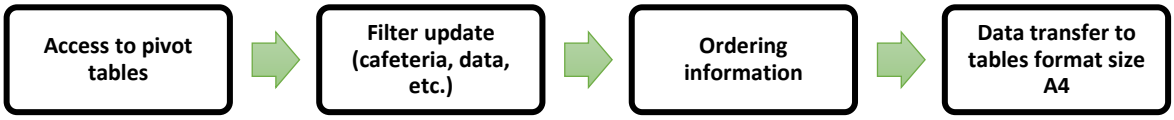

Figure 3 – Set of actions programed in a macro

4 Results

The tool was successfully developed, with all intended features functioning as expected. In order to test the tool's effectiveness as a DSS for operational managers, two cafeterias were analyzed. Real names and dates are omitted due to confidential reasons.

4.1 Case 1: Cafeteria A – day X of June 2016

For this case, we began the analysis by clicking the button "KPIs" from the Homepage, which returned a set of tables that contained a summary of the main indicators related to sales, shrinkage and margin. Starting with shrinkage: Table 2 shows how much it was registered for that day (and how much it had accumulated by month and year). Table 3 shows the categories of the products that contributed for that day's shrinkage. The values shown are not alarming, and fall into the usual daily numbers. If the operational manager wanted to have further detail on these values, clicking on the "TOP 10" button from the "SHRINKAGE" column would show which products most contributed for these values.

Table 2 - Shrinkage values, for cafeteria A (X of June)

Shrinkage TOTAL	Volume (units)	Value
Daily	-165.76	-32.10 €
Monthly	-2,277.33	-675.99 €
Yearly	-35,933.31	-7,800.90 €

Table 3 - Shrinkage values by subcategory of products, for cafeteria A (X of June)

	TOTAL	Hot drinks	Cold drinks	Bakery / Pastry	Light meals	Impulse products	Menus
R/H (%)	✔ 36.66	-	-	✔ 30.48	✔ 43.23	-	-
Value	-32.10€	-	-	-13.76€	-18.34€	-	-

The next step the manager may take is to analyze the TOP 10 products in terms of sales, by clicking a button from the “SALES” column in the Homepage. Table 4 and Table 5 are delivered by the tool, and display the 10 products that sold the most, sorted in descending order of NV of Day X, as well as the total of NV and average ticket.

Table 4 - TOP 10 values of sales for cafeteria A (X of June).Values are ordered in descending order for NV accumulated Daily for day X

Product Name	Quantity sold (units)	NV accumulated Daily		NV accumuated Monthly		NV accumulated Yearly	
		Day X	R/H (%)	Day X	R/H (%)	Day X	R/H (%)
Product 1	234	**114.15 €**	✘ 76	1,192.6 €	✘ 74	14,307 €	✔ 153
Menu 1	24	**98.70 €**		98.70 €		98.70 €	
Menu 2	45	**85.98 €**		149.02 €		149.02 €	
Menu 3	62	**50.41 €**		155.29 €		155.29 €	
Menu 4	45	**49.39 €**		126.21 €		126.21 €	
Menu 5	13	**39.59 €**		92.68 €		92.68 €	
Menu 6	22	**33.98 €**		88.05 €		88.05 €	
Product 2	22	**28.62 €**	✘ 86	221.13 €	✘ 70	1,803.7 €	✘ 97
Menu 7	5	**19.80 €**		66.87 €		66.87 €	
Menu 8	4	**19.35 €**		33.86 €		33.86 €	

Table 5 - Totals for NV and average ticket for cafeteria A (X of June)

Average ticket accumulated	Value	R/H (%)	NV accumulated	Value	R/H (%)
Daily	**2.02 €**	-	**Daily**	**988.72 €**	✔ **101.98**
Monthly	2.77 €	-	Monthly	10,286.92 €	✘ 89.12
Yearly	2.24 €	-	Yearly	122,704,25 €	✔ 167.16

While Table 5 shows a very slight increase of 1.98% for the total NV for the day compared to last year (R/H), the total accumulated for the month shows a decrease of 10.88%. Table 4 reveals that Product 1 – even though it is still the best selling product – is decreasing in sales, both for the day and for the month. These values may point the operational manager into discussing this topic with the cafeteria staff, to further investigate the reasons behind the lower sales performance of the month. Even so, it is still worth mentioning the high results in an annual perspective, with an increase of 67.16% compared to last year (R/H). Table 4 also highlights the success of menus, as eight of the TOP 10 products registered are menus. This may motivate the operational manager into finding ways of boosting sales with the creation of specific menu boards, or figuring out other ways to better expose menu boards for clients, so they are in plain sight of the customer’s field of vision.

4.2 Case 2: Cafeteria B – day Y of June 2016

For the second case, the same initial approach was taken. As shown in Table 6, sales values show a significant increase compared to the previous year (shown in the R/H column); the average sales per order also show a slight increase of 7.34% compared to last year. There is an indicator that is exclusive to this type of cafeteria because it is located either in the shopping arcade of a shopping center or integrated in its hypermarket – it is called Retention Rate. Its value is 20.56%, which means that 20.56% of all transactions made in this shopping center's hypermarket originated from the cafeteria. The only alarming indicator is the Shrinkage in value, as a percentage of the net value, which shows -14.63%.

Table 6 - Summary of various indicator totals from cafeteria B (Y of June)

KPI	Value	R/H (%)
NV Total (Day)	**977.90 €**	✔ **133.41**
NV Total (Month)	17,182.75 €	✔ 135.51
NV Total (Year)	142,535.29 €	✔ 122.06
Average ticket	**2.48 €**	✔ **107.34**
No. Of Items per ticket	2.15	
No. of Transactions	394	✔ 124.29
Retention Rate (UN 19)	20.56	
Profit Margin (as % of NV)	43.58	
Shrinkage in value (as % of NV)	-14.63	

This does not fall between the usual daily values (between -1 and -5 percent), in which case the operational manager can obtain further details by checking the TOP 10 products in terms of shrinkage from the Homepage. Table 7 reveals how Known Shrinkage (as % of NV) for the day was approximately double than the values registered for the month, and Unknown Shrinkage for the day was the same as accumulated month, which means that it first occurred on day Y of June.

Table 7 - Totals for known and unknown shrinkage (day, month and year) for cafeteria B (Y of June)

Shrinkage type	Accumulated Value	Value	% NV(*)
Unknown Shrinkage	**Daily**	**-79.42 €**	**-10.66**
	Monthly	-79.42 €	-0.60
	Yearly	245.00 €	0.22
Known Shrinkage	**Daily**	**-63.63 €**	**-8.54**
	Monthly	-552.74 €	-4.16
	Yearly	-4,437.44 €	-4.00

(*)Shrinkage value as a percentage of the Net Value (NV), in this case, for day Y of June

With these values in mind, the manager may rapidly contact Cafeteria B by clicking the "Send email" button, which is another feature that was implemented in this work that allows for managers to quickly

send emails with the information they want to the relevant parties. Analyzing the TOP 10 buttons for Shrinkage also reveals which products are the main contributors for these values.

5 Conclusions

This work's main goal was to develop a decision support tool aimed at operational managers from the BAGGA cafeterias that would show only the relevant Key Performance Indicators (KPI), be simple to work with and facilitate the analysis process of a cafeteria. This was achieved by developing a "Homepage" interface (the decision-support tool) in Excel with a set of buttons that, when clicked, would retrieve the relevant information from Sonae's database and show it in an easy-to-read format, namely with tables.

The tool was successfully developed and presented to the managers, who demonstrated a positive response. The results from the two cafeterias, obtained from the decision support tool, showed that the results could assist the operational manager in analyzing information and decision-making. For cafeteria A, the manager had enough information to discuss the sales of Product 1, for instance; while in cafeteria B, the manager found that a problem had occurred in terms of shrinkage. The tool allowed managers to quickly assess possible problems, and provided emailing features that allowed for quicker and easier communication between them and the staff at the cafeteria. The tool permitted managers to:

- **Have a better understanding of each cafeteria's performance**, as data is organized in tables in a succinct manner, and fit an A4 sized paper, avoiding too much complexity;
- **Analyze data more rapidly**, because data is quickly filtered and accessed with the click of a button, which allows for a quick analysis of the main KPIs of any cafeteria on any given date;
- **Make decisions more efficiently**, because both a better understanding and quickness in data analysis provide managers the ability to make decisions in a quicker and more informed way.

This work was able to show how Excel and VBA programming can be used to improve data retrieval and analysis from a company's Data Warehouse (DW), via OLAP servers, optimizing the existing Decision Support System (DSS). For companies with several business units – such as Sonae – creating an Excel macro-enabled file is a solution to filter and display only the relevant data stored in a DW, avoiding complexity and improving the efficiency in data analysis by managers from the respective business unit. This means that the previous DSS and data warehousing architecture employed by large companies does not need to be seriously revised or altered, which would bring high maintenance costs. However, some limitations were found, such as the data retrieval speed, which is dependent on Sonae's server stability. Therefore, the tool may not work properly if the servers are down. Another constraint was the nature of the KPIs, which were mostly financial. This is because it was not possible, at the time, to obtain qualitative indicators from Sonae's database.

For future work, it would be interesting to include qualitative indicators, to provide managers with additional information about customer satisfaction, for instance. To implement this and other qualitative indicators, a joint effort with Sonae's own IT department would be necessary, so this data could be successfully implemented in the company's DW. This would allow operational managers to have a more complete version of this work's tool, enabling an environment for better decision support.

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