

THE RISKS AND BENEFITS OF SPREADSHEET-BASED FINANCIAL REPORTING AS A FORM OF SHADOW IT IN COMPLEX INFORMATION SYSTEMS: An Action Design Research leading to the FRASIT-framework

FRASIT-FRAMEWORK:

FINANCIAL REPORTING ARCHITECTURE WITHOUT SHADOW IT

A FOUR PHASE FRAMEWORK THAT AIDS IN ANALYZING A FINANCIAL REPORTING ARCHITECTURE AND ARRIVE AT A REPORTING ARCHITECTURE WITHOUT SHADOW IT.



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MANAGEMENT SUMMARY

FoodCorp (pseudonym) experiences problems with the process of generating the required financial information out of the available data. Problems regarding efficiency in terms of finding the data, transforming data into the required reports and the assurance that the data is complete and correct. Both for financial accounting and managerial accounting. The organization uses one Enterprise Resource Planning system for all financial administration, a Business Intelligence (Cognos) system for data aggregation and reports and further, lots of spreadsheets (Microsoft Excel) for creating finalized reports.

Spreadsheets are actually software applications in itself at FoodCorp, serving three major functions:

- 1. Storing financial data (trial balance and additional report structures) in Excel databases, either as standalone flat file databases or connected with a Microsoft SQL Server.
- 2. End-reporting, either using SUM and IF functions referencing to multiple Excel databases or manual calculations for recurring reports.
- 3. Ad-hoc analysis of datasets using pivot tables.

Although Excel-reporting is very flexible for the end-user, it has a fundamental limitation. Excel is in essence a spreadsheet program and not a completely managed and secured reporting and Business Intelligence solution.

The goal of this research is twofold. First, this study aims at solving a practical problem for FoodCorp. Second, a four phase framework is designed using the method Action Design Research that aids in analyzing a financial reporting architecture and arrive at a reporting architecture without shadow IT. This framework is called the 'Financial Reporting Architecture without Shadow IT (FRASIT)'-framework. This framework is further developed to include four design principles which can be applied to other organizations to improve the financial reporting process, where ERP, BI, spreadsheets and/or end-user financial reporting software is present to transform data into reports.

Two research questions are formulated:

1. What are the risks and benefits with spreadsheet-based financial reporting as a form of shadow IT at FoodCorp?

2. What are design principles leading to a financial reporting architecture without shadow IT?

In order to improve the financial reporting process at FoodCorp, the risks and benefits with spreadsheet-based financial reporting as a form of shadow IT were investigated. Shadow IT is a term found in the literature for all corporate IT that does not receive any formal IT maintenance and approval. For the most part, shadow IT fills the blanks left by IT, such as specialized reporting and modelling, analytics and planning. Shadow IT may result in hidden cost for companies, comprised of non-IT workers in departments such as finance, who all spend a huge amount of time finding and transforming data. Further, increased risks of data loss or leaks and inconsistent business logic are other potential risks that companies may face when shadow IT systems are present.

In contrast to results on other research on shadow IT, shadow IT was not a result of a lack of understanding between the IT department and the end-users at FoodCorp. Shadow IT emerged because former end-users purchased and installed specific reporting software on their own. In addition, when new people enter the organization, knowledge about that software is lost and new end-users have to find a quick solution to be able to create reports. Excel is often a convenient answer to that short-term need and slowly the spreadsheet environment got expanded by the end-users. In addition, shadow IT emerged at the FoodCorp because end-users have a general feeling that corporate IT is not sufficient for their finance needs.

To arrive at a practical solution for FoodCorp, multiple stakeholders were interviewed including the Supervisor Information & Applications, the Corporate Controller and the Commercial Controller. In addition, the architecture of each shadow IT system was analyzed by means of a framework. Further, a software selection process was initiated to evaluate possibilities of (partially) replacing spreadsheet-based reporting.

FoodCorp is now transitioning from spreadsheet-based reporting to financial reporting in the new financial reporting-software. The annual (consolidated) report of 2014 is already being created in the new reporting tool. In addition, several changes were made to the ERP and the BI software.

The main advantage over spreadsheet-based reporting of this software is that it must work in conjunction with a database. 'Out-of-date data snapshots' are not possible anymore, compared to the old situation. In addition, it still gives the flexibility of adding new data. The new software tool separates data (e.g. journal entries or other numbers) entered in the source (ERP data) versus data entered in the reporting software (e.g. additional adjustment entries or other numbers).

Another change took place in the ERP system. In the future it will be easier to directly trace Intercompany relationships by using a certain dimension for these type of transactions. The Business Intelligence solution is now storing and aggregating all report structures in one new SQL view maintained by the Supervisor Information & Applications. These report structures were formerly maintained in several spreadsheets by the end-users. New report structures that are created in the new reporting tool can be exported back to the centralized Data warehouse and added to the SQL view. This SQL view dataset can be connected to Excel for drill-down analysis with the pivot table. In addition, the new reporting software has a built in Excel export option. Excel is used for its rich text formatting and presentation capabilities, also an important aspect of creating financial reports for external stakeholders.

To conclude the solution, the new financial reporting architecture at FoodCorp consists of one integrated (e.g. connected databases) financial reporting architecture, consisting of the ERP, BI, Financial Reporting tool and spreadsheets, maintained by both the IT department and the end-users in the finance department.

The FRASIT-framework is further developed into four concrete design principles for a financial reporting architecture:

- 1. Communicate reporting standards with the IT department
- 2. Maintain mappings of source data centralized and not in a spreadsheet
- 3. Use spreadsheets for analysis and end-reporting, but not for maintaining or adding new data
- 4. Introduce a reporting tool in combination with a dedicated database to replace spreadsheet- reporting

Future research should further investigate the validity of the FRASIT-framework and the four design principles, either in scientific research or practically by software consultants. For example, the framework assumes that the end-users and corporate IT are able to communicate directly with each other, but what are the consequences when corporate IT is not physically nearby, such in larger multinationals? In addition, some organizations may have more strict reporting standards than FoodCorp, because multiple finance departments need to work with the same reporting standards instead of a handful of centralized corporate accountants. In such situations, choices on who is responsible for data governance and reporting standards may be much more important and consequently influence the actual architecture more than the most practical solution for the end-users.

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LIST OF ABBREVIATIONS AND TERMS

BI	Business Intelligence: software to analyze and aggregate data
COGNOS	The brand of the Business Intelligence software used at FoodCorp
ERP	Enterprise Resource Planning
EXCEL/SPREADSHEET	Used interchangeably to describe Microsoft Excel sheets
FRASIT	Financial Reporting Architecture without Shadow IT
ICO	Intercompany
RDBMS	Relational Database Management System
SQL	Structured Query Language: language to manage data in a RDBMS
SUPERVISOR I&A	Supervisor Information & Applications

1. INTRODUCTION

1.1 BACKGROUND

Since Microsoft Excel was released in 1985, it has become the standard for business reporting and analysis. With each new version, Microsoft has added new features and capabilities that have contributed to ensure its position as a market leader such as the pivot table option, powerful statistical analysis and the possibility to make connections with external databases such as Microsoft SQL Server. Further, Excel is very flexible so user-made reports can be customized with color pallets, adding comments and built in graphs and charts. Virtually all office employees are familiar with Excel and therefore it is an excellent standard for exchanging reports and information with colleagues, customers and other business partners. Eliminating Excel in an organization is not a practical option, because many important business process are rooted in this piece of software.

However, Excel has a fundamental limitation. Excel is in essence a spreadsheet program and not a completely managed and secured reporting and Business Intelligence solution. In larger organizations, Excel is often a part of a completely managed reporting solution. A reporting solution consisting of an Enterprise Resource Planning (ERP) system and other Business Intelligence (BI) and Data Warehouse solutions.

The result of this limitation is that Excel reporting is often surrounded with a lot of inefficient and unstructured processes. People spend too much time wrangling data and fine-tuning reports instead of making actual informed decisions based on these reports. Therefore, the use of Excel, although very flexible, can result in hidden costs for organizations because of wasted time and effort (Whitepaper Apesoft, 2010).

1.1.1 PROVIDING MORE AND TIMELY FINANCIAL INFORMATION

It is estimated that 95% of U.S. firms and 80% of European firms use spreadsheets for financial reporting in some form (Panko, 2006). More specifically, 53% of companies with between 100 and 1000 employees use spreadsheets to manage the financial consolidation process (Ventana Research, 2014).

Since several years, finance departments face increased pressure from stakeholders to provide higher quality and more transparent financial information faster and more efficiently (PricewaterhouseCoopers, 2007). For example, banks require more often reports in the form of monthly updates about the financial position of an organization in a specific format. In addition, internal stakeholders such as management require timely financial information. Information which plays a critical role in taking informed decisions and to gain an understanding in the performance of the company.

Instead of periodically recurring reports, there is an increasing need for ad-hoc reports and analyses, resulting in additional challenges for the finance department of an organization to find the required data and transform it in the required format.

Regarding the annual report in the Netherlands, compliance will be a further challenge considering the shift to (eXtensible Business Reporting Language). At this moment, a bill pending requires that the annual report of 2016 can only be filed in XBRL format to the Chamber of Commerce for mid-sized and large companies, meaning that printed papers or pdfs are not allowed anymore (www.nba.nl). Credit reports to the three large banks can be filed in XBRL format voluntarily, however, in the future it may become mandatory. By January 2017, ING bank will only accept credit reports in XBRL format from Small and Medium-Sized Enterprises, so the shift to XBRL-reporting is already happening (source: www.ing.nl).

1.2 INTRODUCTION OF FOODCORP

FoodCorp (pseudonym) is a multinational in the Fast Moving Consumer Goods industry with factories in the Netherlands and other European countries. FoodCorp consists of more than twenty legal entities, including several production and sales divisions. There are approximately 250 employees in the Dutch subsidiary and the workforce is around 500 FTE. The annual revenue of the group is between € 200m-250m.

The finance department of FoodCorp consists of the Chief Financial Officer, Corporate Controller, Plant Controller, Commercial Controller, and about eight assistant controllers and other office employees.

The bookkeeping of all entities in the group is centralized at the Dutch head-office and recorded in one ERP system.

1.3 THE PROBLEM

FoodCorp experiences problems with the process of generating the required financial information out of the available data. Problems regarding efficiency in terms of finding the data, transforming data into the required reports and the assurance that the data is complete and correct. Both for financial accounting (reports for external stakeholders, such as banks and the Chamber of Commerce) and managerial accounting (reports and analyses for internal stakeholders, such as management).

1.3.1 INFORMATION TECHNOLOGY OF FOODCORP

FoodCorp uses one Enterprise Resource Planning System (ERP) of a well-known software vendor. In short, the finance department uses the finance module of this ERP system for bookkeeping purposes (e.g. transaction recording). This ERP system can record an economic event (e.g. journal entry) in seven dimensions. Dimensions can be seen as a way of categorizing transactions. For example, expenses can be distinguished and allocated to a cost center and product groups can be assigned to revenue streams. Dimensions are not predefined by the ERP system.

In addition to the ERP system, FoodCorp uses Business Intelligence (BI) software Cognos from IBM. It is possible to create all kind of reports including clickable graphs and tables with the BI software, based on the data stored by the ERP system. Further, the BI tool is used to group or 'map' datasets using Extract, Transform and Load (ETL) into the Data Warehouse.

One of the functions of the BI tool is to group (i.e. mapping) a range of cost centers and give a specific name to this group, resulting in five cost center groups, instead of dozens of single cost centers, enabling quick analysis of costs associated with Direct Production for example. In addition, at FoodCorp the BI tool is used (but not limited) to map ledger accounts to several report structures, map division types and the BI tool is used for maintaining budget lists based on cost centers. Furthermore, functional P&L statements are generated in the BI for each individual entity.

The BI software is not just used by the finance department. For instance, customer complaint reports in the form of clickable graphs are created for the sales department. Maintenance of the data in the ERP and the BI is the responsibility of the IT department. More specifically, it is the responsibility of the Supervisor Information & Applications (Supervisor I&A). In addition, the Supervisor I&A is responsible and possess the knowledge for creating BI reports in the BI tool with the help of the BI Report studio, based on requests by departments.

Creating financial end-reports and the analysis of financial data is done in Microsoft Excel by the Corporate Controller. Basically, data is recorded in the ERP, grouped to a more aggregated level at trial balance in the BI system and then send to a large spreadsheet database containing over 100.000 cells using the built-in Excel connector to a Microsoft SQL Server. Excel is the primary tool for the Corporate Controller to create finalized reports of the data stored by the ERP.

1.3.2 THE ROLE OF EXCEL

The Excel database, which plays a central role for the Corporate Controller in order to create recurring reports and to perform ad-hoc analysis, contains approximately 5000 rows and over 20 columns. This database is linked with other spreadsheets, either using multiple Excel formulas referencing this database, such as:

=ALS(\$G\$120<=\$E\$2;SOM.ALS(data!\$A\$6:\$A\$5000;"="&AP134;data!\$S\$6:\$S\$5000);0) 1

or the Excel pivot table function for drill-down analysis and the creation of ad-hoc reports.

For each entity in the group, monthly Balance Sheets, Profit & Loss statements and Cash Flow statements are generated with Excel functions like the example presented above, extracting, transforming, adding and subtracting the data of the trial balance contained in the Excel database. This is a fairly automated process. As long as the formulas and cell references are not changed, Excel 'creates' these reports. However, monthly consolidation of all the entities into a consolidated group report is manually done in Excel, according to the Corporate Controller.

The role of Excel as a mapping database

In order to do various other financial analysis, Excel is also used as a second database, which serves as a mapping table. Mappings for the Chart of Accounts, Cost Centers, Division Types, Budget Holders and so on. This sophisticated Excel database uses VLOOKUP functions, such as:

=ALS(\$AK2787="B";"";ALS(\$AO2787="P";VERT.ZOEKEN(\$E2787&\$G2787;lookup!\$M:\$U;5;ONWAAR);VERT.ZOE KEN(\$E2787&\$G2787;lookup!\$M:\$U;8;ONWAAR)))²

in order to further categorize the Profit & Loss ledger accounts and their associated balances, which reside in the main Excel database described earlier.

This categorization (mapping) of ledger accounts, based on division type and cost center, results in a Profit & Loss statement, based on a more functional arrangement for management purposes. For example, the ledger account Gross Wages is mapped as either Direct Labour, Salaries or Overhead, depending on the cost center and division type. Whereas the ledger account Gross Wages would always appear under Salaries in a traditional P&L.

The purpose of this Excel mapping is to analyze and compare differences between the traditional four week P&L, where a ledger account number is mapped to one place in the report, with the weekly management report.

¹ Dutch Excel: ALS=IF, SOM.ALS = SUMIF

² Dutch Excel: VERT.ZOEKEN = VLOOKUP, ONWAAR = FALSE

The role of Excel in creating the annual report

The preparation and creation of the (consolidated) annual reports is done in Excel, because the dedicated software, intended to automate the consolidation process, is not user-friendly, lacks functionality and most important, is not reliable because it lacks any form of version control, according to the Corporate Controller. This software was purchased by the former Corporate Controller and is only installed locally at one computer.

The drawback of doing the group consolidation in a spreadsheet is that it is a very laborious process. The consolidation tree of FoodCorp consists of multiple divisions and multiple sub-consolidations. The elimination of intercompany relationships, contributions and charges is often based on additional spreadsheet tables. Another problem with the spreadsheet situation is that it is impossible to see where the individual ledger account numbers are positioned, making it hard to know what adjustments have been posted in the general ledger in the ERP system and what adjustments are already made in the spreadsheet trial balance.

Furthermore, many other specifications and notes to the annual accounts reside in multiple spreadsheets, or information for these specifications is not readily available. A small example is the specification of revenue divided by domestic and foreign country, this information is extracted from the ERP system by the supervisor I&A, based on an SQL query accessing the data warehouse. Then the Supervisor I&A sends the table in a spreadsheet to the Corporate Controller.

1.3.3 NEW FINANCIAL REPORTING SOFTWARE

Besides doing research to the current problems arising from the spreadsheet environment and ultimately, make recommendations for improvement, FoodCorp would like to evaluate the possibilities of replacing the software for creating the annual report. This annual report software is not used at all by the current Corporate Controller. The Corporate Controller entered the company over a year ago. The former Corporate Controller used this annual reporting software, he even used it to deliver monthly and quarterly reports. However, the tool is mainly used at audit firms and not at production companies. The major drawback of this reporting software is that it lacks any type of version control and it is simply not safe to work with, according to the current Corporate Controller.

Ideally this new software should not only be used for the annual report, because that is an exercise performed only one time per year, but it should also be useful for creating the monthly reports for the banks, the weekly management reports based on a functional arrangement of the general ledger, and any other type of ad-hoc analysis. In other words, this new reporting tool should ultimately completely replace the current Excel environment consisting of databases and multiple reporting spreadsheets.

However, at this time it unclear for FoodCorp if a complete replacement of their spreadsheet environment is even possible or whether this new software will actually solve the issues currently faced. In addition, it may be possible that the process of transforming data into end-reports can be improved by making changes in the ERP system, reshape the role of the BI software or change things in spreadsheets.

1.3.4 CONCLUSION

To conclude this section, the problem of FoodCorp can be summarized as follows:

FoodCorp experiences problems with the process of generating the required financial information out of the available data. Problems regarding efficiency in terms of finding the data, transforming data into the required reports and the assurance that the data is complete and correct. The organization uses one ERP system for all financial administration, a BI system for data aggregation and the possibility to create reports and lots of spreadsheets for creating finalized reports. In the current situation:

- Spreadsheet-based reporting is inefficient in terms of labor hours spent on creating the reports, finding data and transforming data. Time which cannot be used for analyzing the reports.
- Spreadsheets are used for critical business processes, such as the consolidated financial statements of the group.
- Spreadsheets are used as additional databases maintained by the end-users, besides the official data warehouse solutions supported and maintained by IT.
- Spreadsheets replace 'single use license' software in the case of the software for the annual report.



1.4 RESEARCH GOAL

In order to give direction to the research, a one sentence research goal is formulated:

Investigate the risks and benefits with spreadsheet-based financial reporting at FoodCorp and investigate the possibilities of a new financial reporting architecture including new reporting software, in order to improve the financial reporting process.

1.4.1 RISKS AS WELL AS BENEFITS

It is important to emphasize the fact that spreadsheets are a part of the financial reporting architecture at FoodCorp. The ERP, BI, and spreadsheets together form the reporting process. For example, some Excel sheets are 'connected' with the data stored by the ERP system using Microsoft SQL Server.

The research goal aims to identify the risks as well as the benefits of using spreadsheets as a form of shadow IT for financial reporting. The risks are concerned with the assurance that the data is complete and correct. Risks can expose the problems which (potentially) arise because of the use of these spreadsheets.

Examples of spreadsheet risks are for example: manually rekeying of data and separation of data in the spreadsheet from the source system (PricewaterhouseCoopers, 2004). Different type of risks will be further elaborated on in chapter four.

However, only focusing on the risks is a too narrow view. If the research only exposes the risks, it cannot explain why spreadsheets are so widely used as a component of the financial reporting architecture.

The benefits explain why spreadsheets are so prevalent and why there exists such a spreadsheet environment at FoodCorp. Spreadsheets may be necessary because end-users need to overcome the limitations of official software, which is currently the case with the annual reporting software, as stated before. Or that spreadsheets are used instead of the BI software, but that the BI tool can do that task as well, or the BI can do it even better or smarter. However, it is also possible that spreadsheets are used because of other reasons, unknown at the start of this research.

1.4.2 SHADOW IT

As stated earlier, Excel is used to replicate in part or full several functionalities of the official supported IT environment which consists of the ERP system and the BI software. In fact, the Excel databases and report generators can be considered as software applications in itself, operated and maintained by the end-users.

The term found in the literature for software applications which are not supported and maintained by the IT department in organizations is shadow IT (Sillic & Back, 2014). This research will view the current situation through the lens of shadow IT, because this provides the researcher a theoretical base and direction to approach this type of practical problem at FoodCorp. For example, the literature can explain why end-users have a need to start creating solutions for themselves, without any formal IT support. The available shadow IT literature may not be specifically aimed at ERP systems, BI and spreadsheets for financial reporting, but general aspects of why shadow IT exists and the associated risks, are applicable.

It is also important to note that spreadsheets are not by definition shadow IT. IT departments can develop and maintain complicated spreadsheets for end-users and incorporate them in the official IT environment.

Examining a practical problem at FoodCorp through the lens of Shadow IT is a recommended approach by earlier research. Grabski et al. (2011), investigated by means of a thorough review of ERP research (A Review of ERP Research: A Future Agenda for Accounting Information Systems), that the relationship between ERPs and BI is an under-researched area that deserves more attention. A way to examine the impact of BI software is to investigate whether there is a reduction of shadow systems after a BI implementation.

The available research on ERP and BI integration is either conceptual (e.g. development of a conceptual integration model) or too technical. Many questions remain in this ERP and BI integration area. For example: what are the ERP and BI issues faced during implementation and use of these tools? What are the strategic benefits of integrating ERP with BI? How frequently does the use of ERP systems lead to usage of a BI system? There is limited research, either case study or cross-sectional on these topics.

1.5 RESEARCH QUESTIONS

Based on the research goal, two research questions are formulated:

- 1. What are the risks and benefits with spreadsheet-based financial reporting as a form of shadow IT at FoodCorp?
 - 2. What are design principles leading to a financial reporting architecture without shadow IT?

1.6 PRACTICAL AND ACADEMIC RELEVANCE

1.6.1 PRACTICAL RELEVANCE

This research will help the management accountants and the IT department at FoodCorp to understand the problems in detail, arising from the current situation where spreadsheets play an important role in the financial reporting architecture. The outcomes of this research may result in changes to the current ERP, BI or spreadsheets, shed new light on organizational working styles and in addition, may or may not, introduce new reporting software to the organization.

1.6.2 ACADEMIC RELEVANCE

The academic relevance of this research is threefold. First, this study will design a four phase framework (the IT artifact) that aids in analyzing a financial reporting architecture and arrive at a reporting architecture without shadow IT. Throughout the rest of the thesis, this framework is abbreviated as: FRASIT-framework (Financial Reporting Architecture without Shadow IT). This framework will be further developed to include design principles which can be applied to other organizations, where ERP, BI, spreadsheets and/or end-user financial reporting software is present to transform data into reports. The FRASIT-framework is presented in detail in chapter 7.

Because this is a design type of study, Action Design Research (ADR) is chosen as the research method and it is a relatively new research method emerging in the field of Information Systems research (Sein et al., 2011).

Second, this study will deepen the understanding of the phenomenon shadow IT and why it exists in a financial reporting architecture. Third, this study will contribute to knowledge of spreadsheet risks and benefits for financial reporting, especially when spreadsheets are used within a larger IT environment consisting of an ERP and a BI tool. Third, this research will contribute to the knowledge of Action Design Research (ADR). ADR is chosen as the research method and it is a relatively new research method emerging in the field of Information Systems research (Sein et al. et al., 2011). More about ADR in the Method part, chapter three.

Action Design Research

This research is using the method: Action Design Research (ADR), a relatively new research method in the field of Information Systems (IS) research. ADR combines Design Research (DR) with Action Research (Sein et al., 2011), overcoming the limitations of pure DR. The main criticism of DR in the field of IS research, is that it has little influence on practice and that it was too artificial, only focusing on designing the IT artifact and not evaluating the design in practice. The main argument for ADR was, that IS research must make a dual contribution to academia and practice (Hevner & Chatterjee, 2010). The IT artifact (FRASIT-framework) that will be designed is a four phase framework that aids in analyzing a financial reporting architecture and arrive at a reporting architecture without shadow IT. The FRASIT-framework is presented in detail in chapter 7.

The method of ADR, including its four stages and seven principles, will be elaborated in the method part, chapter three. The rest of structure of this thesis is based on the four stages of this ADR framework.

Shadow IT

Shadow IT systems (or sometimes called rogue IT, grey IT) are IT solutions which are not embedded in the organizational IT service management (Zimmermann & Rentrop, 2014) and are generally considered as an undesirable phenomenon, adding hidden costs and information security risks to organizations (Behrens & Sedera, 2004) (Györy et al., 2012).

However, the current literature is not clear about the benefits or value it may bring for the end-users of these shadow IT solutions. For example, Jones et al. (2004) recognized that shadow IT systems are more than just undesirable, and that shadow IT can offer value to an organization, but this was not supported with practical evidence. In this specific case study, the benefits of these shadow IT systems will be investigated. Maybe these spreadsheets do offer significant benefits over these official BI/reporting tools, filling the gap between the end-users needs and the capabilities of these types of software.

Furthermore, the current shadow IT literature is only concerned with researching IT departments. For example, Sillic & Back (2014) identified four research papers, in which surveys were sent to IT departments as part of shadow IT research. All these surveys were sent to IT departments asking about shadow IT risks and motivations of using it. The end-users of shadow IT were not involved. Another survey by Smyth & Freeman (2007) among 650 people responsible for IT in large organizations also focused on the negative impacts it may have on organizations, from the perspective of the IT manager.

This research, although a relatively small case study contributes to this knowledge gap about the benefits of shadow IT, by researching the motivations why end-users are creating solutions for themselves.

Spreadsheet risks and benefits for financial reporting

The European Spreadsheet Risks Interest Group is a web based source offering students, researchers and companies information on the current state of the art in spreadsheet risk management. In other words, research on spreadsheet risk is relevant.

In addition, this research will contribute to the current literature about spreadsheet risks and benefits, especially in larger organizations where spreadsheets are part of the larger IT environment, consisting of ERP and BI systems. Most spreadsheet research has focused primarily on quantitative errors that occur during the development, or quantitative errors that arise because of the wrong use of Excel formulas. These types of research often suggest using a formal software engineering technique during development, or using a (commercial) software tool to analyze the formulas in a spreadsheet, to mitigate spreadsheet risks (Coster et al., 2011).

This type of research is different, because this spreadsheet research is also considering the surrounding IT architecture consisting of an ERP and BI tool. This research provides new insights in the risks these spreadsheets bring to organizations, because of specific spreadsheet features.

At this moment, literature about the benefits of spreadsheets compared to other tools such as specialized BI is very limited. Raiden (2005) identified six qualities of spreadsheets that make them indispensable compared to BI or other reporting tools, but these benefits are very generic. Watson (2009), stated that Excel is by far the most popular BI tool, and that this is very likely to stay so in the future, but actual research supporting this statement is very limited. The drawback of defining spreadsheet benefits is that it is fairly subjective, hence the reason why there are not many concrete benefits available in the literature.

1.7 RESEARCH SCOPE

This research is mainly focusing on the reporting process and architecture used by the Corporate Controller. The Commercial Controller and the Plant controller also have all kind of reports in the BI layer and in spreadsheets. However, the main problem arises because of the spreadsheet environment of the Corporate Controller. The Corporate Controller only works for over a year at FoodCorp, he is the initiator of this project and is looking forward to the results of this research.

Regarding the research of spreadsheet risks and benefits, it is important to emphasize the fact that spreadsheets are part of the IT environment at FoodCorp. The ERP, BI and spreadsheets form together the reporting process. Spreadsheets are not just used to support a simple calculation in another program. Spreadsheets are actually software applications in itself, serving three major functions:

- 1. Storing data in Excel databases, either as standalone flat file databases or connected with data warehouses using SQL.
- 2. End-reporting, either using SUM and IF functions referencing to Excel databases or manual calculations for recurring reports.
- 3. Ad-hoc analysis of data using pivot tables.

The reason why it is important to note that spreadsheets are a part of the financial reporting architecture is because this makes the research scope less narrow. This research looks to the broader picture, also taking into account the role, capabilities and limitations of the financial reporting architecture, consisting of the ERP and BI systems. For example, what data is recorded and available in the ERP, how is this data 'transformed' in the BI tool and what kind of adjustments or additions occur in each system.

The broader picture of spreadsheet risks and benefits is reflected in the shadow IT term in the research question. Shadow IT literature can explain why end-users work around the official supported IT. The literature may not be specifically focused on ERP and BI for financial reporting, but the basic concepts of shadow IT can be applied to this particular problem.

Because spreadsheets have different functions at FoodCorp, this research will not purely focus on how certain Excel formulas are used, like most other spreadsheet research. Instead, spreadsheet risk will be based on three broad categories, derived from the shadow IT literature. Each risk category is divided into multiple spreadsheet features: (An in-depth definition of these spreadsheet risks can be found in the method part, chapter three)

- 1. Security risks
- 2. Version control risks
- 3. Data integrity risks

Investigating spreadsheet risks when a spreadsheet is used as a database is different than a spreadsheet used for the annual report. A database may not contain formulas, as opposed to spreadsheets used for end-reporting. For example, the first is more concerned with data integrity risks and dependency risks because of information silos, while the latter is more concerned with specific finance risks, such as a good audit trail and materiality errors.

Regarding specific finance risks, this research will not go into much detail. For example, spreadsheets are used to create the annual reports for individual entities and consolidated entities. All additional tables and numbers found in the annual report are somewhere created in worksheets (each annual report has one large spreadsheet with multiple worksheets containing additional tables). It would be possible to explain and identify virtually unlimited specific risks for each additional table, number or note found in the annual report. However, this research is concerned with the IT side of the financial reporting process (e.g. where is data coming from

and how is it transformed). Therefore, in the case of the annual report, risks are concerned with the process of creating the consolidated and individual Balance Sheets and P&Ls, because those reports are directly related to the ERP and the BI system data.

1.8 OUTLINE OF THE THESIS

The rest of this thesis is as follows. Chapter two will elaborate on existing literature about shadow IT. It elaborates on why shadow IT exists in many organizations after an ERP and BI implementation and what the positive and negative aspects of shadow IT are. In addition, literature is elaborated on ERP and BI systems and the integration of these two, including a model of a typical end-to-end financial reporting process found in many larger organizations.

Chapter two then continues with specifically looking to spreadsheets as a form of shadow IT. For example, why are spreadsheets so prevalent? Further, it discusses the associated risks these spreadsheets bring to end-users and the organization. Benefits of these spreadsheets in general and compared to BI software are also discussed, but the research available on spreadsheet benefits is limited. This is most likely due to the fact the benefits are highly subjective. Furthermore, hidden costs of using spreadsheets for financial reporting are discussed, as well as two models of investigating and controlling spreadsheet risks. These models of controlling spreadsheets are used to systematically analyze each shadow IT system.

Chapter three will elaborate on the methodology, including the interview technique as well as defining spreadsheet risks and benefits. In addition, a shadow IT analysis framework is created to be able to systematically analyze each shadow IT system during the empirical part of the study.

As stated earlier, this research is of the type of Action Design Research (ADR). ADR consists of four stages. Therefore each stage is presented as a separate chapter in this thesis. Consequently, in chapter four (Stage one of ADR) the first research question is answered and a conclusion is drawn in the discussion. The first research question is aimed at the specific situation at FoodCorp. Chapter five then continues with stage two of ADR: the Building, Intervention and Evaluation of the IT artifact. The IT artifact is a four phase framework that aids in analyzing a financial reporting architecture and arrive at a reporting architecture without shadow IT.

Chapter six comprises stage three of ADR: reflection and learning and chapter seven will elaborate on the final stage of ADR: Formalization of learning. Formalization of learning is concerned with the learning from an ADR project. The framework will be further developed to include design principles which can be applied to other organizations, where ERP, BI, spreadsheets and/or end-user financial reporting software is present to transform data into reports.

2. THEORETICAL FRAMEWORK

The theoretical framework supports the empirical part of this study by elaborating on three main topics: shadow IT, risks of using spreadsheets for financial reporting and the benefits of using spreadsheets for financial reporting.

2.1 SHADOW IT

This section of the theoretical framework investigates why shadow IT is so prevalent within organizations. In short, shadow IT represents all software of hardware or any other solution used by employees which have not received any formal IT department approval (Sillic & Back, 2014). Usually, shadow IT fills the blanks left by formal IT, such as specialized reporting and modelling, analytics and planning (Raiden, 2005) (Behrens & Sedera, 2004).

Because shadow IT is part of the IT environment of an organization, literature on ERP and BI systems is also elaborated in this section. These systems together: ERP, BI and spreadsheets enable end-to-end financial reporting, and are found in typical large organizations (Patterson, 2013). A typical end-to-end financial reporting process, including an ERP, BI system and end-users is presented in paragraph 2.1.5 End-to-end financial data flow in complex information systems).

2.1.1 ENTERPRISE RESOURCE PLANNING SYSTEMS

ERP systems are a type of business software that enables an organization to efficiently and effectively manage its resources. Generally speaking, ERP systems are designed for integrated enterprise recordkeeping (Shafiei & Sundaram, 2004). Often, ERP systems are integrated systems containing selectable modules. Modules that address operational activities such as accounting and finance, manufacturing, supply chain and human resources.

The ERP adoption by an organization is often motivated by management's need for timely access to information scattered across several functional areas of the company. Other motivations for ERP adoption include upgrading legacy systems or the integration of operations. In the 1990s, ERPs were widely implemented in multinational companies to integrate diverse corporate operations. The early accounting systems formed the basis for contemporary ERP systems. From the perspective of the firm, ERPs are the most demanding software systems to implement and typically, ERP implementation is the largest IT investment for an organization (Grabski et al., 2011).

Impact of ERP systems on management control systems and management accountants

Research has shown that the introduction of ERP systems reduced the routine management accounting work, gave management access to more forward-looking information and provided line managers with more and accurate accounting information (Scapens & Jazayeri, 2003). Granlund & Malmi (2002) concluded, based on a field survey, that only a small number of corporate accountants had more time to spent on business supporting decision making after an ERP implementation. Three possible reasons were given: (1) the time needed to implement ERP systems means that other impacts may be slow to emerge; (2) the complexity of ERP systems can hinder other sophisticated accounting developments; and (3) ERP systems may play a stabilizing role, reinforcing the existing management accounting routines.

A longitudinal study at the European division of BM Inc., a US-based manufacturer of building materials, revealed that the implementation of ERP system SAP has not led to the introduction of a new, more sophisticated management accounting system. However, it was the intention to replace the current accounting

systems with something similar. The current accounting information system at that time existed of several legacy financial software suites which did not communicate with each other (Scapens & Jazayeri, 2003). At BM, SAP is used for routine information processing, it is not used as a major source of management information. A management accountant at BM said for example that a certain level of manager, for example a plant manager, uses SAP very widely for monitoring production output. Management accountants just pull information out of SAP, in order to prepare reports in a spreadsheet. Even after four years of the implementation. The information which is pulled from SAP is similar to the information which was produced by the legacy systems, but it is available more quickly and efficiently.

The implementation of SAP accompanied several other changes in the accounting function. Many of the jobs which were done by cost clerks are no longer necessary, either because they are handled by SAP itself or are centralized. Management accountants believed that the implementation of SAP was beneficial for the business, but not necessarily for the management accountants (Scapens & Jazayeri, 2003).

2.1.2 BUSINESS INTELLIGENCE SYSTEMS

ERPs store, or at least record, a vast amount of data. Data which can be financial and non-financial and could allow each user within the organization, granted permission rights, to access that piece of information. Traditionally, ERP systems provide very limited possibilities for analytical capabilities (Shafiei & Sundaram, 2004).

Because of the integrated databases found in ERPs, potentially containing thousands of tables, ERPs offer substantial possibilities for decision making. The type of systems designed to support decision making by examination of large volumes of data are Business Intelligence (BI) systems. The old term, decision making systems, is actually more descriptive.

BI includes a set of methods, processes and concepts to improve business decisions, by using data from one or multiple sources. BI aims to provide the right information to the right persons throughout the organization, with the purpose of improving decisions (Ghazanfari et al., 2011). Examples of BI systems are IBM Cognos, SAP Business Objects and SAS. BI systems are supported with specialized IT infrastructure such as Extract Transform & Load (ETL) tools and data warehouses (Elbashir et al., 2008).





Figure 2: Market share of BI vendors. Oganization X uses IBM Cognos and the Pivot Table of Microsoft Excel (Source: www.informationweek.com)

Despite the limitations of Excel, it is by far the most popular BI tool. Software vendors fought against Excel, but nowadays, they have decided to join in. Typically, these BI software vendors offer an Excel add-in, to connect Excel with the databases of the BI tools. On the other hand, Microsoft has made changes so that Excel can now be used with Microsoft SQL Server (Watson, 2009).

In simple terms, a database is a collection of tables, consisting of columns and rows, just like spreadsheets. However, a big difference is that in a database, each table has a unique set of columns and rows. Different relationships can be made between different tables, called a relational database management system (RDBMS). RDBMS store data in a logical way, providing data integrity, reduce duplication, provides multi-user access and minimizes other irregularities (Pearson, 2013).

Data used by Business Intelligence systems

Data extraction from a source system and loading it into a data mart of warehouse is called ETL and is often performed by hand-written code such as SQL queries. Data is loaded into a warehouse during a so called 'load window'. This is the time for loading new data or refresh the existing data. This load window time is increasingly becoming smaller, provided by technology improvements. For example, Wall mart is able to analyze the details of a sale just after fifteen minutes of the actual purchase in a store (Watson, 2009).

Traditionally, data was stored in data marts, where the data was organized around the application. However, in the late 1980s, organizations began to treat data as an organization wide resource, stored in one or more centralized data warehouses.

Information of data found in data warehouses is called metadata. It is important for IT personnel and users to have metadata. For example, IT personnel who 'get the data in' need to know: the mapping of the data flows from sources to targets, data transformation logic and business rules, data refresh schedules and table and attribute names.

Users, who 'get the data out', need to know: the source systems of the data, detailed business descriptions of the data, measures and dimensions, quality and timeliness of the data.

Ideally, metadata should be created during the development of data warehouses, instead of afterwards. It is best to maintain metadata centralized, accessible by IT personnel and users. The weakest option is to use Excel files, a better alternative is to use the storage capabilities of the ETL or BI tools.

BI tends to expose data quality problems of companies. High data quality is relative to business need and the expectations. Most importantly is that it needs to be consistently defined and used, all of the necessary data should be available, it should be timely, accessible, understandable and usable.

BI systems typically reveal missing data, dummy values, multipurpose field and reused primary keys. The longterm solution to correct the data quality problems is to change things at the source. There is simply not a quick fix for data quality problems. Some practices and human process need to be changed. Often, training and additional education is needed (Watson, 2009).

Relationship between ERP and BI

Grabski et al. (2011), investigated by means of a thorough review of ERP research (A Review of ERP Research: A Future Agenda for Accounting Information Systems), that the relationship between ERPs and BI is an under-researched area that deserves more attention.

The available research is either conceptual (e.g. development of a conceptual integration model) or too technical. Many questions remain in this ERP and BI integration area. For example: what are the ERP and BI

issues faced during implementation and use of these tools? What are the strategic benefits of integrating ERP with BI? How frequently does the use of ERP systems lead to usage of a BI system? There is limited research, either case study or cross-sectional, that shows the benefits resulting from the integration of ERP and BI.

The effects of the implementation of BI systems suggests that the probability of failure is higher than that of success. A recent survey showed that only 24% of BI investments were rated very successful by companies using them (Farrokhi & Pokoradi, 2012).

A way to examine the impact of BI software is to investigate whether there is a reduction of shadow systems after a BI implementation (Grabski et al., 2011). Shadow IT represents all software of hardware or any other solutions used by employees to work around the official IT systems.

2.1.3 UNDERSTANDING SHADOW IT

Despite the growing discussion regarding shadow IT, research is still very limited in understanding the phenomenon (Zimmermann & Rentrop, 2014). Shadow IT usually does not do the core IT processes, like networking or ERP, however, they may replicate in full or in part data and/or functionality of the legitimate systems of the organization (Behrens & Sedera, 2004). For the most part, shadow IT fills the blanks left by IT, such as specialized reporting and modelling, analytics and planning (Raiden, 2005). These are areas that have been neglected by ERP systems software vendors historically. ERP vendors focused more on scalability and good architecture.

Shadow IT adds a large hidden cost to companies, comprised of non-IT workers in departments such as finance, human resources or marketing, who all spend a huge amount of time finding and transforming data. Increased risks of data loss or leaks and inconsistent business logic are other potential risks which companies may face when shadow IT systems are present (Sillic & Back, 2014). In addition, shadow IT can be a barrier to innovation by preventing more efficient work processes, because of the reluctance on the part of shadow IT users (Zimmermann & Rentrop, 2014).

A survey issued to 650 candidates responsible for IT within large organizations in the US and UK, revealed that 67% of the respondents believed that Shadow IT was used in their organization (Smyth & Freeman, 2007). In this study, shadow IT was defined as a vendor application installed without IT department knowledge, by 100% of the respondents. 39% of the respondents considered complex Excel spreadsheets as shadow IT.

The reason for the emergence of shadow IT are departmental constraints according to 71% of the respondents. 38% of the IT managers stated that end-users felt that the current systems did not meet their needs. In other words, the implementation of shadow IT is easier, faster and more flexible as a quick reaction to non-routine issues. The largest potential problems with shadow IT are data security, lack of support and the fact that shadow IT solutions can become mission critical. However, 52% of the respondents stated that shadow IT was sometimes okay because business users should have some local control about their specific needs.

To address the various opportunities and risks of shadow IT for an organization, Zimmermann & Rentrop (2014), explored why business decisions lead to implementations of shadow IT. The majority of shadow IT implementations were based on the argumentation that 'the way to address the IT department was too long' regarding time, costs and the ability to express the requirements. In addition, long delivery times and concerns about support after the implementation were reasons to choose for a shadow IT solution. However, other studies suggest that shadow IT systems itself can be very efficient tools when used in place of the formal systems already present (Behrens & Sedera, 2004).

The largest segment of shadow IT emerges in the field of BI (Raiden, 2005). The vast majority of knowledge workers perform their reporting, number crunching and modeling with personal databases and spreadsheets (Zimmermann & Rentrop, 2014).

2.1.4 SPREADSHEETS USED AS A FORM OF SHADOW IT

Knowledge workers, such as accountants, are interested in tools that work and have the ability to get their work done. What is important to them is saving time in an environment that they can easily navigate in. A spreadsheet program such as Microsoft Excel is often the convenient answer to that need. Most spreadsheets in organizations are developed by business end-users, as research has shown (Powell et al., 2009). It is estimated that 95% of U.S. firms and 80% of European firms use spreadsheets for financial reporting in some form (Panko, 2006). What works for the people on a day-to-day basis is different compared to what is best for the organization in the long term (Raiden, 2005).

Replacing spreadsheets in the near future is utopian (Kulesz & Zitzelsberger, 2012). Today, most BI tools are part of a data warehouse strategy and have therefore inherited data warehousing's read only capabilities (Raiden, 2005). In other words, BI tools are suitable for creating reports of historical data, but weak in robust calculations, modeling, data entry and calculations. The slack of all these areas are picked up by spreadsheets. From an end-user point of view, migrating to a BI environment is often seen as a situation which offers less functionality than the current spreadsheet environment. At the same time, relying on spreadsheets can be a barrier to enhancement in an organization. When spreadsheets are used for critical needs, it is very risky to replace them. For example: producing financial reports, preparing budgets, supporting decision making and business strategy and supporting general accounting entries (KPMG, 2014).

Baskarada (2010), identified several reasons why end-users used the reporting functionalities of spreadsheets instead of the reporting capabilities of BI tools. The main reasons were lack of funding, the complexity of creating the reports in the BI tool, the time frame and conflicting business priorities. One of the respondents stated that it takes forever and it costs a fortune to develop those reports in the BI system. And once they are developed they are not really what you asked for in the first place anyway. Another one said: 'We had a guy from Oracle developing some reports in APEX, but he got moved to another project before he was able to finish them. So, we don't have any other choice but to extract the data we need and to analyze it in a spreadsheet.' And another business expert said: 'I'm sure there is a much better way to do this, but this is the only solution I could come up with.'

2.1.5 END-TO-END FINANCIAL DATA FLOW IN COMPLEX INFORMATION SYSTEMS

The following picture is a typical representation of end-to-end financial data and information flow found in many organizations (Patterson, 2013). The diagram summarizes the role of ERP systems, BI systems and spreadsheets that are used in order to create all kind of financial reports.

Patterson (2013), distinguishes data and information. Information is any data presented in a context that is meaningful to a user. In contrast, raw data is presented without explanation of information about it (i.e. no meta-information).



Figure 3: Typical end-to-end financial data flow in complex information systems. (Source : Patterson, 2013)

The financial data flow starts at the left. Data recording systems such as the ERP store large amounts of data. Moving to the right, BI systems can process this data with Extract, Transform and Load functions. For example, the BI system can 'look' for specific general ledger accounts in the database. It can then group these accounts and present these accounts with their balances. Reports or parts of reports are being created here. In the middle of the picture, financial professionals are using this information to transform these datasets into finalized end reports. End reports in different formats are then consumed by all kinds of stakeholders.

Information integrity in such complex information systems is of great importance (Patterson, 2013). Information integrity is defined as the representational faithfulness of the information to the underlying subject of that information and the fitness of the information for its particular use. In other words, stakeholders need assurances that information generated with the information system is reliable and correct.

2.2 RISKS OF USING SPREADSHEETS FOR FINANCIAL REPORTING

Even though many large organizations rely on spreadsheets for management reporting, data analysis and decision making, limited research regarding their potential impacts on organizations information quality has been published (Baskarada, 2010).

Most spreadsheet research has focused primarily on quantitative errors that occur during the development. These types of research often suggest using a formal software engineering technique during development in order to mitigate these risks. Less attention is given to research on the risks associated with the maintenance and operational use of spreadsheets (Coster et al., 2011).

Coster et al. (2011) define spreadsheet risk as the likelihood of adverse financial or operational consequences from use of a spreadsheet. Most organizations have no formal policies to ensure the integrity of its spreadsheets, according to multiple surveys. For example, a survey among companies in the United States revealed that 21 out of 24 companies (88%), did not have a policy specific to controlling and mitigating spreadsheet risks. These were big companies with asset sizes between \$100 million to more than \$100 billion. This is remarkably, because in the United States, the Sarbanes-Oxley Act of 2002 initiated new policies and disclosures in financial reporting for publicly held companies, emphasizing internal controls and the documentation of those internal controls.

Hermans (2012) found that 85% of the 27 respondents at the Robeco company often transferred spreadsheets to a colleague. Transferring of spreadsheets was classified into three situations. First, a spreadsheet has to be transferred to a colleague, because a new employee starts working at the company, or an employee leaves the company. Second, a spreadsheet has to be checked by an auditor, in order to determine whether spreadsheets are error free, well designed and comply to safety standards. Third, a spreadsheet is being replaced by custom software, because they become so complex that it no longer complies to safety standards, readability and access control. The research also found that 70% of the respondents had difficulties understanding a spreadsheet they received from a colleague.

Spreadsheets are used for a variety of things and have a wide range of usage and complexity. It is important to separate the usage and complexity issues, because the control requirements may be different for a spreadsheet used by only one person with specific expertise than for a shared spreadsheet used by multiple people (PricewaterhouseCoopers, 2004).

2.2.1 THE USES OF INFORMATION IN SPREADSHEETS

According to a report by PricewaterhouseCoopers (2004), the uses of information contained in spreadsheets for financial reporting can be grouped into three categories:

- Operational: Spreadsheets are used to monitor and track the workflow of operational processes, such as listing of unpaid invoices and open claims.
- Analytical or Management Information: Spreadsheets are used for management decision-making and analytical review. For example, to evaluate amounts or ratios over a certain period.
- Financial: Spreadsheets used to create financial statement amounts and balances.

2.2.2 COMPLEXITY LEVELS OF SPREADSHEETS

The complexity of spreadsheets can be divided into three levels (PricewaterhouseCoopers, 2004):

- Low: Spreadsheets serve as an electronic logging and information tracking system.
- Moderate: Spreadsheets use simple calculations such as adding and subtracting.
- High: Spreadsheets support complex modelling tools and calculations. These spreadsheets often incorporate macros and multiple links to cells, workbooks and other spreadsheets or databases. These spreadsheets can be considered software applications in their own right.

2.2.3 HIDDEN COSTS OF REPORTING IN EXCEL

Excel reporting can introduce significant hidden costs to organizations, because they reduce productivity and can cause late or bad decision making. These hidden costs can be caused because of several reasons (Whitepaper Apesoft, 2010):

Dependency Risk (or Information Silos)

Many organizations have 'super-spreadsheets'. These spreadsheets drive decisions and thinking across the company. And with every super-spreadsheet, there is usually a 'super-spreadsheet expert'. The only person that knows how to make that spreadsheet work. What happens when this person is sick or leaves the company? How are new data, new formulas and assumptions added to these super-spreadsheets in such a situation?

Duplication of Effort as a result of poorly defined standards

It is not uncommon for different groups within an organization to create very similar Excel reports. Often, this duplication is the result of poorly defined standards within organizations. Most of the times, this duplication does not happen at the same time. Rather, one person creates a solution for a specific problem in a spreadsheet and months later, someone else in a different group or department needs the same report but has no idea that it has already been created.

The right information is not available at the right time

When input data has to be gathered manually, it can take a lot of time to verify that the data is correct. The longer it takes to verify data, the longer it takes to make informed decisions based on the data in the spreadsheet.

Inability to access corporate resources like ERP systems and data warehouses

For security reasons, most end-users have no direct query level access to data warehouses of their company. Often, end-users find another way to manually extract data from a data warehouse. When someone takes a data snapshot from the previous month's accounting records, but another person in the accounting department updates these records with new billing information, the report does not contain that new data. Without a centralized access point to the data, chances are that the spreadsheet is already out of date before it is finished.

Wasted IT resources

When organizations create a lot of manual spreadsheets, they often put a heavy burden on the IT department. IT department is tasked with manually gathering input data from key corporate systems, such as ERPs and data

warehouses. When efforts to create manual spreadsheets are not coordinated or when there are duplicate efforts, the IT department ends up doing supportive work multiple times.

2.2.3 GENERIC RISKS OF USING SPREADSHEETS FOR FINANCIAL REPORTING

PricewaterhouseCoopers (2004), identified several generic spreadsheet risks, inherent to every spreadsheet, regardless the purpose of a spreadsheet in an organization. Examples are security risks concerned with access of a spreadsheet, version risks and data integrity risks. The full list of these generic risks and their meaning are elaborated in the Method part of this study, chapter 3.

2.2.4 RISKS OF USING SPREADSHEETS FOR FINANCIAL CONSOLIDATION

According to research (Ventana Research, 2014), 53% of companies with between 100 and 1000 employees use spreadsheets to manage the consolidation process. Only 7% use dedicated consolidation software.

Consolidation in spreadsheets often means separation from the source, the general ledger, making it difficult to trace the aggregated balances back to the individual ledger accounts. Therefore, spreadsheets do not provide sufficient audit trails, decreasing the ability of external auditors to spot fraud and making the audit process longer. Furthermore, spreadsheets do no offer automated process controls, ensuring that all necessary steps are always followed.

2.2.5 INFORMATION QUALITY RISKS OF USING SPREADSHEETS FOR FINANCIAL REPORTING

According to Baskarada (2010), there is limited research published on the potential impacts spreadsheets may have on the information quality of an organization. As stated earlier, much spreadsheet research is concerned with quantitative errors. On the other hand, quantitative errors could indirectly lead to information quality risks.

Baskarada (2010), aimed to identify the impact of using spreadsheets on the information quality in an organization by means of a six month case study in a large telecommunications organization. Information quality is defined as 'fitness for use', implying that information quality depends on the user as well as the context in which the information is used. Spreadsheet related factors which may have a negative impact on the information quality have been identified. The most relevant spreadsheet factors (i.e. the factors with a significant rate of occurrence and impact) are listed below.

Separation of data from source systems

When spreadsheets are used to extract data from the source systems, the information quality is negatively impacted, because the data is separated from its original context. Baskarada (2010) investigated that this may result in situations where end-users are unsure about where exactly the information came from. In addition, it is also possible that data in those spreadsheets is updated, but the source is not, resulting in inconsistencies and multiple versions of the truth. It was also found that data sets were most often exported from source systems at a very low granularity level, resulting in a situation that end-users first have to rearrange data.

Redundant storage

When spreadsheets are shared, stored at different locations and consequently, changes are being made to spreadsheets, multiple versions of the truth may emerge. This may negatively impact the information quality.

Spreadsheet silos

It is relatively easy to extract data from a source system in a spreadsheet, it is often not possible the other way around. Any changes in datasets contained in spreadsheets are only accessible when others have access to that spreadsheet. This limits the accessibility of data and therefore negatively impact the information quality.

Manual data transformations

When end-users enter and rekey data or models manually in a spreadsheet, the accuracy and quality of information is impacted negatively.

Quality assurance

Reports and models in spreadsheets are often created on an ad-hoc basis and lack any form of quality control and formal methodologies to ensure that the spreadsheet is working according to management's intention.

Spreadsheet size limitations

When data is extracted and loaded into a spreadsheet, these spreadsheets can become too large to easily share them with others. The researcher found that in such cases, often a selected portion of the total data was extracted, put in another spreadsheet and shared with others. This is again a separation of source data and the data which end-users use, possibly resulting in multiple versions of the truth.

Metadata

End-users may have a hard time understanding what the extracted data in a spreadsheet means, because it is separated from the original context and lacking the context of data, called metadata. One respondent said for example: 'I just have to look at the data and guess what it represents. The column names can sometimes help, but they are often more cryptic than the data itself.'

Integrity Controls

There is a general lack of control to ensure that data entered in spreadsheets is validated for data type, format and business rules. As a respondent said: 'When I enter an incorrect value in system x I get a warning, but I can enter whatever I want into Excel.

2.3 BENEFITS OF USING SPREADSHEETS FOR FINANCIAL REPORTING

There is very limited research on the benefits of using spreadsheets for financial reporting compared to BI tools. However, the current literature agrees that despite the limitations of Excel, it is by far the most popular BI tool. Software vendors fought against Excel, but nowadays, they have decided to join in. On the other hand, Microsoft has made changes so that Excel can now be used with Microsoft SQL Server (Watson, 2009).

Raiden (2005) identified several generic qualities of spreadsheets that make them indispensable compared to BI or other reporting tools. These are: expressive, autonomous, fast, portable, inexpensive and universal.

Expressive

Compared to any other BI tool, spreadsheets offer the broadest range of manipulations and features for calculations and defining models. The possibilities are virtually limitless. However, the expressive qualities result in situations where spreadsheets are applied to problems which require systematic properties, such as version control, security and integrity.

Autonomous

Spreadsheets offer a significant amount of freedom and flexibility for creating reports, models and adding comments and data. However, this large amount of autonomy is a threat to operational security, standards and controls. It is a complicated process to add these controls in spreadsheets. For example, one department may change a set of variables while holding others constant, while another department does the opposite. The model is in both cases correct, but the results will differ. With spreadsheets, all users are owner, developer, programmer, user and tester at the same time. While programmers are often trained in structural analysis and programming methods, the typical spreadsheet end-users are not (Hespenheide, 2009).

Fast

There is no faster way to build a model and perform calculations. However, the speed of creating spreadsheet reports always has to be evaluated against the amount of time it takes to set-up the spreadsheet and build the models. For example, re-keying data and calculations, copying and renaming files all take a large amount of time.

Portable

Because a program like Excel is so widely used, it is easy to transfer the reports. Even outside the network. However, portability is also a threat for duplication of work, handling of files in specific directories and out-ofdate information.

Inexpensive

The start-up cost of a spreadsheet is basically zero. Depending on how you look at it, one could say that the developer's and maintenance time should be considered in the costs. Long-term maintenance and support for a spreadsheet could rise significantly. In other words, the costs of spreadsheets is very low when the complexity of the situation is low, but high when the complexity of the situation modeled in the spreadsheet is high.

Universal

It is relatively easy to start with spreadsheets, because they have a shallow learning curve. However, because the possible functionalities of spreadsheets is so vast, it is difficult to maintain standards. One end-user may apply a technique in a spreadsheet which may be too difficult for another end-user.

2.4 MANAGING SPREADSHEET RISKS

In this part, literature will be discussed about managing or governing spreadsheet risks within organizations. First, the six steps of a spreadsheet audit are elaborated, based on a Deloitte whitepaper (Hespenheide, 2009). Second, the Spreadsheet Change Review (SCR) model of Ferreira & Visser (2009) is discussed.

2.4.1 SIX STEPS SPREADSHEET AUDIT

In a report by Deloitte, six steps are identified as part of spreadsheet audit, in order to help organizations managing their spreadsheet environment (Hespenheide, 2009). These are:

- 1. Identify the population of spreadsheets for review
- 2. Create a spreadsheet inventory
- 3. Rank each spreadsheet's risk level
- 4. Develop a baseline for each spreadsheet
- 5. Evaluate policies and procedures for spreadsheet use
- 6. Review controls that protect spreadsheet baselines

1. Identify the population of spreadsheets for review

Different identification techniques can be used in order to identify the population of spreadsheets to be included in the review. For example, interviews can be used to identify the population of spreadsheets by simply asking the process owners. Another technique is walkthroughs, which is concerned with creating a flowchart or narrative of a business process and note when a spreadsheet is used. It is also possible to scan the network to return a list of all spreadsheets used in the organization.

2. Create a spreadsheet inventory

After the spreadsheets have been identified, they should be documented resulting in an inventory. Information which should be captured includes: name, creator/owner/user, what it does, operational or financial in nature, degree of confidentiality and sensitivity of the data.

3. Rank each spreadsheet's risk level

The risk level of a spreadsheet should be based on its complexity, magnitude and the data being processed. Complexity can be classified as rudimentary, meaning that the spreadsheet does not contain significant calculations to transform data input. Light, where some calculations are used, but users with limited knowledge can easily identify the purpose of these formulas. Intermediate, where a reviewer of a spreadsheet needs additional information in order to understand and interpret the calculations. Advanced, where spreadsheets leverage advanced functionality, such as macros or pivot tables, linkages to other tables, programs or documents.

Magnitude thresholds could be for example: immaterial, material and critical. Immaterial means that the values (in euros for example) calculated in this spreadsheet are too low to be considered material. Material therefore means that a spreadsheet contains values above the immaterial threshold. The critical threshold is established to identify spreadsheets that process a significantly high value.

Once the complexity and magnitude of the spreadsheets have been established, the risk can be determined.

4. Develop a baseline for each spreadsheet

Base lining spreadsheets means to establish a point in time that the spreadsheet is functioning in accordance with management's intentions. This process is divided into two components: validate and verify. Validate is concerned with the task of identifying input data and compare it with the actual source data. Verify is concerned with the task of determining whether formulas are functioning in accordance with management's intentions. Understanding the purpose of each formula is critical for the success of the verifying process.

5. Evaluate policies and procedures for spreadsheet use

A policy is not a control mechanism, but it is a tool to establish an effective and efficient control environment. Therefore, a comprehensive spreadsheet management audit should incorporate the evaluation of these procedures and policies in place, as well as recommendations for their improvement.

6. Review controls that protect spreadsheet baselines

The last step in the spreadsheet audit is to review controls in protecting the integrity of established spreadsheet baselines and recommend their implementation when lacking. For example, versioning should be employed in all spreadsheet changes, meaning that all changes to a spreadsheet should include a form of an unique identifier that is understandable by other parties to understand the different versions. Changes to a spreadsheet are reviewed and approved, by someone other than the party making the change and the validity of the data in spreadsheets should be ascertained.

Detection of spreadsheet errors can be done by two types of studies: laboratory experiments, where subjects are asked to find errors which are placed in spreadsheets by the researchers and in field audits, where researchers try to find errors in operational spreadsheets. Field research also reveals other useful information. For example, what organizational policies and norms exist in organizations with good spreadsheets? (Powell et al., 2008).

2.4.2 SPREADSHEET CHANGE REVIEWS

Ferreira & Visser (2012) developed a pragmatic method for managing the spreadsheet environment of an organization: the model of Spreadsheet Change Reviews (SCR). This model is based on multiple years of research of investigating the quality and risks of spreadsheets used in the corporate environment. In general, this model follows the same logic as the six steps framework by Hespenheide (2009). SCR is based on analysis of the work processes in which the spreadsheets are involved by means of interviews and analysis of the spreadsheets themselves by a peer review and by means of software tools. According to Ferreira & Visser (2012), the SCR model, tries to achieve the best balance between control, flexibility, productivity and user experience. A balance which was lacking by some previous spreadsheet management research, which was only focusing on mitigating the spreadsheet risks.



Figure 4: Workflow of Spreadsheet Change Reviews. (Source: Ferreira & Visser, 2012).

1. Setup-phase

SCR starts with the Setup-phase, the left part of the model. This phase starts with a review of the relevant work processes that the organization has in place. The goal is to understand how spreadsheets are created, used and modified in the context of business processes. It is important to get a clear understanding of the business goals the organization wants to achieve with supporting spreadsheets, in order to balance the control and mitigation of spreadsheet risks against the flexibility and user experience later in the execution phase. Information about best practices and guidelines already used should also be collected, in order to take the organization's context into account when defining controls in the execution phase. For example, when an organization already has a version control system installed, it is pointless to focus on that aspect. The same holds true for access control and other coding standards or documentation already in place.

2. Create a list of critical spreadsheets for review

The next step in the setup-phase is to create a spreadsheet inventory of all spreadsheets that support business processes, the bottom-left corner in the SCR model. Hespenheide (2009) proposes different techniques in order to identify the population of spreadsheets to be included in the review. For example, interviewing the process owners. It is also possible to scan the network to return a list of all spreadsheets used in the organization.

3. Execution phase

The right half of the model is concerned with the Execution phase. It is a continuous cycle of use, change and review of spreadsheets. The spreadsheets identified in the setup-up phase should be subject to an initial indepth analysis. For the analysis of the spreadsheets, the SCR model relies on peer reviews, illustrated by the top-right corner of the model. Peer review ensures that multiple people understand what models or calculations are used within the organization, which is vital in order to understand the overall spreadsheet quality issues in the organization. In addition, the SCR model uses specific software tools to identify spreadsheet risks by looking for example to long formulas or constants used in formulas.

Whenever spreadsheet is added to the inventory or a user of a spreadsheet makes a change, he or she asks a peer to review that change.

The authors of the SCR model acknowledge that the reliance of peer reviewing requires significant time and cost for organizations. Changes in spreadsheets require time consuming process that can block operations from proceeding.

3. METHOD

3.1 RESEARCH DESIGN

Because this research aims to improve the financial reporting process practically, either by changing things in the ERP system, BI system, spreadsheets, with the help of new reporting software or by changing work processes, Action Design Research (ADR) is chosen as the research design method.

ADR is a new Design Research (DR) method overcoming the limitations of pure DR. ADR combines Design Research with Action Research (Sein et al., 2011). Action Research is in essence a change-oriented approach, in which the central assumption is that social processes can best be studied by introducing change and observing their effects. This allows AR to simultaneously inform theory and produce highly relevant results (Hevner & Chatterjee, 2010).

An information system consists of technology, an social setting and the phenomena that emerges from the interaction between these two. Dominant DR thinking pays little attention to the organizational context, because it places the IT artifact at the core of the Information Systems discipline. In other words, this means that DR focus on building and shaping the artifact, but relegate the evaluation to a different phase. DR fails to recognize that the IT artifact emerges from interaction with the organizational context, even when its design is according the researchers' intent. An IT artifact is defined in ADR research as the material and organizational features that are socially recognized as bundles of hardware and/or software.

ADR conceptualizes the interwoven activities of building the IT artifact, intervening in the organization and evaluating it concurrently. Therefore, ADR contributes to the broad consensus that Information Systems research must respond to a dual mission: make theoretical contributions (address a class of problems) and assist in solving the problems of practitioners.

3.1.1 STAGES IN ACTION DESIGN RESEARCH

ADR consists of four stages. Each stage is based on one ore multiple principles (Sein et al., 2011). This ADR research framework was first presented in Management Information Systems Quarterly Vol. 35 No. 1 pp. 37-56.

Stage 1: Problem formulation

The trigger for the first stage is a problem anticipated by researchers, or perceived in practice. The driving force behind the problem formulation can come from end-users, researchers, review of prior research and or existing technologies. This stage includes determining the initial scope and roles of stakeholders and formulating the initial research question.

Two critical elements are encountered during the first stage: securing long-term commitment from the participating organization(s) and defining the problem as an instance of a class of problems.

Two guiding principles are formulated in the first stage: practice-inspired research and theory-ingrained artifact.

Principle 1: Practice-Inspired Research. ADR seeks opportunities at the intersection of organizational and technological domains. The intent of ADR should not be to solve the problem as a software engineer or consultant per se. Instead, ADR should generate knowledge that can be applied to the class of problems.

Principle 2: Theory-Ingrained Artifact. This principle emphasizes that the IT artifacts designed, created and evaluated are informed by theories. Theories play three overlapping roles: structure the problem, identify solution possibilities and guide the design.

Stage 2: Building, Intervention, and Evaluation

This phase is an iterative process in the target environment, interweaving the Building of the IT artifact, Intervention in the organization, and Evaluation (BIE). This stage draws on three principles: reciprocal shaping, mutually influential roles, and authentic and concurrent evaluation.

Principle 3: Reciprocal Shaping. This principle points to the importance of the influence of both the IT artifact and the organizational context. The ADR team may engage in cycles of decisions at finer levels of detail in each domain.

Principle 4: Mutually Influential Roles. This principle emphasizes the importance of mutual learning among the different project participants. The practitioners bring practical knowledge of organizational work practices, while researchers bring their knowledge of theory and technological advances.

Principle 5: Authentic and Concurrent Evaluation. This principle emphasizes a key characteristic of ADR: evaluation is interwoven in the decisions about designing and reshaping the IT artifact and intervening in organizational work practices. In other words, evaluation is not a separate stage.



Figure 5: Generic Schema for Organization-Dominant BIE (Source: Sein et al., 2011)

Stage 3: Reflection and Learning

This stage is concerned with moving from a particular problem to a broader class of problems. This is a continuous process, a conscious reflection on the problem framing, the theories chosen and the emerging IT artifact, to ensure that contributions to knowledge are identified. This stage draws on one principle: guided emergence.

Principle 6: Guided Emergence. This principle emphasizes a vital trait of ADR: the interplay between two seemingly different perspectives: design and emergence. Design implies intentional intervention, whereas emergence implies a sense of organic evolution.

Stage 4: Formalization of Learning

The learning from and ADR project should be further developed in solution concepts for a class of field problems. These outcomes can be formulated as design principles and with further reflection, as refinements to theories that contributed to the initial design.

This stage draws on one principle: generalized outcomes.

Principle 7: Generalized Outcomes. Generalization may be a challenge because of the specific organizational changes and the implementation of an IT artifact. Generalization is divided into three levels: (1) Generalization of the problem instance, (2) Generalization of the solution instance, (3) Derivation of design principles from the design research outcomes.
4. STAGE 1: PROBLEM FORMULATION

Chapter 1 already presented a problem and research questions. Chapter 2 presented a theoretical framework. Therefore, the two principles of stage 1 of ADR are as follows:

Table 1: Stage 1 of ADR

		IT Artifact
Stage 1: Problem		
Principle 1: Practice-Inspired Research	FoodCorp experiences problems with the process of generating the required financial information out of the available data. Problems regarding efficiency in terms of finding the data, transforming data into the required reports and the assurance that the data is complete and correct.	Recognition: A detailed analysis of the current financial reporting architecture: the ERP system, the BI tool Cognos and various shadow IT
Principle 2: Theory-Ingrained Artifact	 Theory used is about: ERP and the impact it had on management accountants Business Intelligence versus ERP and spreadsheets Data warehouses Shadow IT Spreadsheets as a form of shadow IT Hidden costs of Excel reporting Spreadsheet risks and benefits for financial reporting 	spreadsheets for financial reporting.

4.1 STAGE ONE OF ADR

Stage one is in fact what one would normally expect from typical research. A research question is formulated, theory is used to support the research, a methodology is elaborated, the research question is answered and finally conclusion and recommendations are formulated.

Stage one took around four months and consists of:

- Three semi-structured interviews with the Corporate Controller, Commercial Controller and the Supervisor Information & Applications.
- In-depth analysis of the architecture of each shadow IT system using the analysis framework.
- Access to the ERP system, BI system Cognos and all relevant spreadsheets.
- Receiving informal training on specific usage of the ERP system, such as dimensions.
- Lots of informal conversations with the corporate accountants, IT department and other accounting personnel to understand work processes, what data is available (e.g. entered in the ERP system) and how the data is transformed (e.g. prepared) in the BI tool for the creation of reports in Excel.

The researcher received some informal training on dimensions and the internal accounting rules of the ERP system, from a corporate accountant, to understand how transactions are automatically posted to the general ledger from several sub-administrations. For example, when raw materials are transferred to production from the warehouse to the factory, there is an entry posted in the general ledger based on predefined accounting rules in the ERP system. An example of a dimension is a cost center. Whenever an expense account is affected, a cost center can or must be entered. Another example of a dimension is the country code, this dimension can become useful to be able to track the sales to other countries.

The researcher also had access to the BI system IBM Cognos, in order to understand what data is aggregated from the ERP system and prepared for the creation of reports. The Supervisor Information & Applications (Supervisor I&A) gave additional information on the report studio of the BI and the available data in the ERP system, the underlying databases and data warehouses and the transformation of this data.

In addition, the researcher had access to the spreadsheets used by the corporate accountants. During the detailed problem analysis, many days have been spent to understand how the data is organized and flows between Excel databases and Excel reporting sheets.

A schematic overview of the current financial reporting architecture, including ERP, BI software and spreadsheets can be found on the next page. The grey-shaded background represents shadow IT. Five shadow IT systems have been identified. An in-depth analysis of these shadow IT systems, including the use and explanation of Excel formulas is presented in Appendix C. These shadow IT systems (abbreviated: S1, S2, S3, S4, S5) are as follows:

- 1. S1: Spreadsheets used for the annual group consolidation, these spreadsheets replace specific software to perform automated consolidation and elimination, because it lacks reliability. However, the data found in these spreadsheets are exported from that specific software tool.
- S2: Excel database containing thousands of rows and dozens of columns. Basically a trial balance where columns represent meaning such as: divisions, division types, periods, actuals, budget, cost centers, cost center groups, functional P&L line items, budget holders and so on. This database is partially connected with the data warehouse using Microsoft SQL.
- 3. S3: The VLOOKUP database in Excel, containing mapping tables. It is connected with S2 to add more columns (e.g. more meaning) to the database of S2 with VLOOKUP functions. These additional columns represent information for a different mapping of P&L accounts for management reporting.
- 4. S4: The spreadsheets used for recurring reports such as the monthly Balance Sheets, Profit & Loss statements and Cash Flow Statements for banks and management. These spreadsheets are 'connected' with S2.
- 5. S5: Non-recurring or ad-hoc analysis using Excel pivot tables on the database of S2.



Figure 6: The current financial reporting IT architecture at the FoodCorp

4.1.1 ANALYSIS ON THE FIVE SHADOW IT SYSTEMS

While the interviews with the IT department and the Controllers can explain more about the decisions that have been made in the past that lead to the current situation and what the benefits of spreadsheets are over the BI according to the end-users, interviews alone would not be sufficient to fully understand the risks and benefits of the current shadow IT situation. In other words, the researcher needs a practical understanding of what each system does and how the different layers of ERP, BI and spreadsheets relate to each other.

Therefore, on each of the five shadow IT systems, an analysis will be conducted to systematically analyze each shadow IT system and its architecture.

Each shadow IT system will be analyzed in four steps, by means of an analysis framework. Each step in the analysis framework is derived from one or more other spreadsheet studies elaborated in the theoretical part:

Table 2: Analysis framework for systematically analyzing each shadow IT system and its architecture

1. Determine the use of information:	(PricewaterhouseCoopers, 2004)
 Operational Analytical or Management Information Financial 	
2. Determine the complexity of information:	(PricewaterhouseCoopers, 2004)
ModerateHigh	
 3. Determine the spreadsheet risks: Security risks Version control risks Data integrity risks 	(Baskarada, 2010) (Coster et al., 2011) (Hespenheide, 2009) (PricewaterhouseCoopers, 2004)
4. Determine the spreadsheet benefits	(Raiden, 2005)

Defining spreadsheet risks

Based on the literature study on shadow IT and spreadsheet risks (Baskarada, 2010) (Coster et al., 2011) (Hespenheide, 2009) (PricewaterhouseCoopers, 2004), several risks have been identified.

The researcher grouped these risks in three risk categories: Security risks, Version control risks and Data integrity risks. Security is concerned with information leaks. Version Control is concerned with information consistency. Data integrity is the assurance that data is accurate and consistent over its entire life-cycle. Each main category has multiple sub-categories, which are features of spreadsheets.

Besides, it is possible to separate risks for the IT department, the end-users and the organization as a whole. However, for the purpose of this research the risks are concerned for the organization as a whole. A risk for the IT department is for example data governance regarding information standards, however this risk is not necessarily a risk for the end-user.

Table 3: Three categories of spreadsheet risks, divided by multiple features of spreadsheets

Risks	
Security	Limited access to spreadsheets on the network
	Password protected spreadsheets
	E-mailing spreadsheets
Version control	Excel Track Changes in a shared spreadsheet
	Structured directories/folders for business units, periods, and type of spreadsheets
	Naming version when saving spreadsheets
	More than one person responsible for data and maintenance / spreadsheet silo (dependency risk)
	Multiple persons working on the same spreadsheet
Data integrity	Separation of data from source systems
	Lack of input controls that ensure data integrity (e.g. data type, business rules)
	Manually rekeying or copying data between spreadsheets

Security and Version control risks are easily determined by asking the IT department and the end-users. Data integrity risks are less easily determined. For example, separation of data from source system requires a good understanding of what data exactly the source system contains and how it appears in the spreadsheet. The risk: lack of input controls to ensure data integrity, requires a good understanding of the source systems (ERP and BI) as well as the underlying business rules and work processes.

Defining spreadsheet benefits

There is not much literature available on categories or definitions of spreadsheet benefits. It is generally accepted that spreadsheets offer large benefits because they are so flexible; an experienced user can create whatever he or she wants. Furthermore, benefits are subjective and often opinions of individuals. What for a particular end-user is perceived as a benefit, is not a benefit for the other.

Because benefits are opinions, the interviews will give further insights in the specific benefits of the spreadsheets compared to the official IT, according to the end-users. In addition, these benefits will explain why end-users are using spreadsheets. However, to structure the analysis on the five shadow IT systems, the researcher needs definitions of benefits.

Therefore, spreadsheet benefits are based on the study by Raiden (2005). This study identified several generic qualities of spreadsheets that make them indispensable compared to general BI software. By defining benefits compared to BI tools, the researcher is able to identify the benefits these spreadsheets offer in comparison to the BI.

Benefits	
Expressive	Flexibility in offering unlimited possibilities of manipulations
Autonomous	Adding comments and changing variables
Fast	Easy to come up with a quick solution yourself
Portable	Excel sheets are easily transferrable
Inexpensive	Cheap solution
Universal	Easy to start and maintain on other platforms

Table 4: Six categories of spreadsheet benefits compared to BI tools (Source: Raiden, 2005)

4.1.3 SEMI-STRUCTURED INTERVIEWS

In addition to the five case studies, this research will conduct three semi-structured interviews with the main stakeholders. Semi-structured interviews are chosen because they provide a better insight in the current situation, allowing new ideas to be brought up during the interview as a result of what is being said. The interviews can explain 'why' and 'how' the current situation evolved over time and what the risks and benefits of the current situation are according to the IT department and the end-users.

The main stakeholders to interview are:

- Supervisor Applications & Information (IT department)
- Corporate Controller (end-user)
- Commercial Controller (end-user)

The corporate accountants are the end-users of the shadow IT systems. The Supervisor Applications & Information is responsible for the information technology environment and not involved with the support of the shadow IT systems.

Interview with the Supervisor Applications & Information

Theoretical grounding for this interview comes from the literature about shadow IT. Some questions are directly taken from other studies, such as about generally recognized advantages and disadvantages about shadow IT and motivations of using shadow IT, based on Behrens & Sedera (2004), Györy et al. (2012) and Sillic & Back (2014).

However, there are many questions tailored about the specific situation of FoodCorp. For example how the IT environment evolved over time and how the ERP and BI system were selected in the past, and whether or not the IT department is aware of all of the five shadow IT systems. The complete interview conducted with the Supervisor Information & Applications contains 13 pre-defined questions, divided into five categories:

- The rise of the current Information System and shadow IT environment
- Shadow IT Motivations of using it
- Shadow IT Risks
- Shadow IT Benefits
- Interview Closing

The complete interview with the Supervisor I&A can be found in Appendix B.1.

Interview with the Corporate Controller and the Commercial Controller

The Corporate Controller has developed, and is currently working with the shadow IT systems consisting of multiple linked spreadsheets, spreadsheets which replace official software and spreadsheets which are connected to the Data warehouse. However, the current Corporate Controller is only working for just over a year at FoodCorp (third Corporate Controller since the ERP / BI implementation) and consequently, he cannot explain much about the rise of the information system.

Another important remark is, before the spreadsheet environment used by the current Corporate Controller, another reporting tool (end-user variant of the BI software) was used by the former management accountants, according to the Supervisor I&A. But that software was also lacking functionality and flexibility, hence the reason why it is was removed eventually.

Because the current Corporate Controller is not able to explain much about the rise of the current situation, an interview with the Commercial Controller can explain more about that specific area. The Commercial Controller is not working with the five shadow IT systems directly, but he can tell more about the implementation and integration of the ERP and BI tool.

The interview with the Corporate Controller and Commercial Controller follow the same structure as the interview with the Supervisor I&A:

- The rise of the current Information System and shadow IT environment
- Shadow IT Motivations of using it
- Shadow IT Risks
- Shadow IT Benefits
- Interview Closing

The interview with the Corporate Controller can be found in Appendix B.2 and the Commercial Controller can be found in Appendix B.3.

4.2 RESULTS STAGE 1

Results of stage 1 of the ADR method will be elaborated here. This includes the results of the three interviews and the five studies on the shadow IT systems. Consequently, the first research question can be answered.

4.2.1 INTERVIEW WITH THE SUPERVISOR APPLICATIONS & INFORMATION

In this part, the results of the interview with the Supervisor Applications & Information is elaborated.

The interview is coded into five categories:

- Shadow IT The rise of
- Shadow IT Motivations of using it
- Shadow IT Relationship with end users
- Shadow IT Risks
- Shadow IT Benefits

Shadow IT – The rise of

"...we did follow some software selection route back then. We looked to JD Edwards, SAP, PeopleSoft. And from what I remember, we designed a case which every software vendor presented to us. Purely talking about the needs of finance, you could ask that the finance people..."

"...in the case of your example, that arrangement of the chart of accounts in Cognos was implemented by the external consultant and the finance guy back then, during the implementation..."

"...we decided, also in cooperation with the implementation consultant, to do such mappings or arrangements outside the ERP system. Because this is more flexible, you are simply not constrained to any future changes in the ERP. It is possible to create such mappings in the ERP, but that could have adverse effects in the future, when things change in the ERP system."

"...initially, Excel was not involved. Cognos had a tool called Powerplay, in short, it was a tool to create reports from OLAP cubes and extract specific information out of these cubes. But, this tool had costs in the form of licenses, but more importantly, it required specific knowledge. Knowledge about OLAP cube properties..."

"...the whole consolidation software story was something of the former Corporate Controller who is not working here anymore. IT department was not involved in any way with that software. Not with selection and also not with maintenance. The software was only installed at his computer..."

"...before that mapping started its life in Excel, we did have a mapping in Cognos, based on account number and division type, but the addition of cost center, to assign it a place in a report, was new for me. But looking back, this problem should have been eliminated by creating different ledger account numbers for each cost center. And not, assigning multiple cost centers to one ledger account number..."

"...however I only delivered the dataset which is also present in Cognos. The whole aggregation up to a Balance Sheet, P&L etc. is something I was not and am not involved in."

Shadow IT – Motivations of using it

"...but, this tool had costs in the form of licenses, but more importantly, it required specific knowledge. Knowledge about OLAP cube properties..."

"... but another reason I think is, when people leave the organization with that specific knowledge about Powerplay or any other reporting software, and the new employee doesn't receive the proper carry over training, people quickly find their way to Excel, because that is something they know."

"...Again, for us, the shift to Excel mainly had to do because of the knowledge required for Powerplay. So then, people start to work in something which is easier and something they know: Excel. And again, Excel pivot table is more flexible than Powerplay. The drawback of Excel is that it may be too easy to create something new, especially end-user maintained lists, databases or other information. Those things have a tendency to start their own life in an Excel environment."

"...And we sometimes do offer people offer Excel datasets, but in the long-term such things should be maintained in Cognos."

Shadow IT – Relationship with end-users

"...Well, it's not that I want to be involved with every type of software or maintenance, especially when it is really specific one, such as this annual reporting software. It is advisable to be involved in some stage, to know what it does and what its data source is. Especially when it is software concerned with mappings or arrangements of source data. In most cases, end-users do not have a true understanding of what source data is available and what consequences that may have on their software or way of working.""

"...Yes, and maybe that we don't have any policy how we want to report certain things. If I know how we report things, we can figure out what data and or mappings are needed, what data is available in the source and so on. And then we could centralize such data and maintain it..."

Shadow IT – Risks

"...The drawback of Excel. It is so versatile, easy to create something of your own, but in the long run, it is not suitable for maintaining. And that's what we see now, mappings have their own life in Excel, and there is no real check on it, or multiple people each have their own mappings or lists, apart from formerly created lists in Cognos. And yes, then there comes a point in time that things are becoming unworkable, and it's time to sort all these things out and find the differences between these lists."

"... So in the Annual report software example, some information is not available by purely relying on the General Ledger, so solutions are created within the annual report software by the end-user, while it may be possible to extract more data from certain sub-administrations in the ERP system and use that instead. And the result is that if you tackle the problem in the source system, more people may benefit from it, but then I need to know the issue experienced by the controller of course.."

"...potentially that could be. But that has more to do whether or not people are sharing those datasets in Excel. You could ask them about that, I suspect that it is not really the case..."

"...The big problem is when people start to make their own lists or datasets. Then things start to get their own life and in the long run, things become unworkable, because source data appears to be different, based on those user made lists."

Shadow IT – Benefits

"...Sometimes I do deliver Excel datasets to people, because people can use the pivot table function. So, maybe I am promoting it. But, those are datasets which are SQL tables in Cognos. These Excel sheets do not contain new data."

"...Well, it's not that I want to be involved with every type of software or maintenance, especially when it is really specific one, such as this annual reporting software."

4.2.2 INTERVIEW WITH THE CORPORATE CONTROLLER

In this part, the results of the interview with the Corporate Controller are elaborated.

The interview is coded into three categories:

- Shadow IT Motivations of using it
- Shadow IT Relationship with IT department
- Shadow IT Risks
- Shadow IT Benefits

Shadow IT – Motivations of using it

"...the purpose of this operation (analyzing differences between weekly and monthly reports) was to find a solution or a tool to analyze the differences, based on the request by management. The Commercial Controller developed the first concept and now I am maintaining it. In my opinion, considering the purpose of the problem, the BI tool is simply not sufficient..."

"...The thing why the BI too is limited for financial reporting in my opinion is that there are all kind of adjustments needed or wanted, before a report is sent to the receiving party. Whenever a report is completely fixed then I can see the purpose of the BI, but for my finance reports it is not suitable..."

"About a half year ago we added it (mapping table) to Excel. The idea is to use it as a tool to determine the differences between the actual weekly EBT management reports and my period report, which contains four or five weekly reports... when I am already seeing my General Ledger data and everything in Excel, there is no reason for me to not extent it with more useful information."

Shadow IT – Relationship with IT department

"The relationship between finance and IT is simply good. It is only three rooms down the hallway and the IT guy has a very strong knowledge of finance processes because he is a former accounting guy. So that is not really the issue here."

"... I don't think the issues here are a result of the lack of understanding by IT what finance wants..."

Shadow IT – Risks

"...I agree on the data integrity risk, that is the most prevalent risk here. There is no possibility for a complete control where in the process something went wrong. The only thing I can do, is to ascertain an error in the end result compared to the ERP, and from there on, reasoning back to what the cause could be. Either somewhere that an Excel value is empty or that an account from the ERP is not mapped, but that is not easy to determine..."

"... whenever I decide to make an adjustment in a monthly report, which has not been entered in the ERP, I need to maintain a list of adjustment in another spreadsheet, so that they can be entered in the ERP later..."

"...well, those cell references do not give me any practical issues regarding mistakes, for example deleting one. But what I do find a big hassle is each new period, I have to copy worksheet containing the Balance Sheets, P&Ls Cash Flows and manually inspect whether or not the cell references are still in place to assure that I am not missing anything."

"...so whenever I do something weird or something unexpected happens, there is always a possibility to check the ERP system. Indeed, there is a risk and we should be aware of that, but there is also a form of control mechanism to check it with the data in the ERP when things begin to look strange in the spreadsheet reports."

"...true, regarding version control, it's just me who does the reporting for the whole group. It is very much centralized because all data including foreign entities is entered in the ERP here."

Shadow IT – Benefits

"...Well the most important benefits I don't see in your shortlist is the ease of presentation and text formatting. Especially when there is a need to supply the bank with a specific format, I can do that in Excel exactly how the banks want it. Well, maybe it would be possible in the BI layer but still, before the final report is sent to the bank, the report is sent to the CFO and back and undergoes several adjustments..."

"...Yesterday I was doing some Budgeting things in the ERP system, and the problem there is that those changes are not readily available in the BI, because of the delay, (the situation with the databases being uploaded overnight) and this morning, just 45 minutes before I should deliver these budget reports, I receive a message that two of the four upload files have failed.

So yes, the enormous flexibility and the fact that that what you enter is readily available is definitely an advantage over doing things in the BI layer..."

"... And even the (S3 Vlookup), what indeed a horrible mess is regarding manageability, the advantage of doing that in Excel compared to the BI is again, what I type is readily available..."

"... The EBT grouping in the BI tool is not sufficient enough to drill down or filter specific things. Yes I can select things per cost center or EBT Line, generate a small report, but it is simply far less flexible than the Excel Pivot table in my opinion. In Excel it is much easier to use the pivot table and to analyze or drill down specific datasets..."

"...Anything I want to add, for example a part of a budget to analyze differences, a part of a former report is possible in Excel. Yes, theoretically it may be possible in the BI tool, but this takes more effort and time by the supervisor I&A..."

4.2.3 INTERVIEW WITH THE COMMERCIAL CONTROLLER

The Commercial Controller is not directly involved with working on all the shadow IT systems. However, the Commercial Controller can explain more about the past and the rise of the current situation, because he was already working here when the current ERP and BI were implemented. Before the spreadsheet environment, reporting was done with another end-user variant of the BI software. The Commercial Controller can explain more about that tool and why it is not used anymore, because he worked with that particular software in the past. Furthermore, he can explain more about how the former Corporate Controllers worked with that tool.

Shadow IT – The rise of

"...From what I remember, we did not really have a requirements or selection process or gave any particular attention to it. The implementation partner of our ERP had good experiences with the BI, so both the ERP and BI were delivered at the same time in 2005..."

"...So the whole 'BI is too fixed compared to Excel' issue is partially a result of how do we implement the software according to our business'. So it may be more of an issue of ourselves then of the software itself."

Shadow IT – Benefits

"...the drawback of that Powerplay tool was the ability to drill down on my sales statistics. It was simply always hard to see, what am I actually doing here and what selections and filters are active. So I saw a number but the story behind that number is unclear. Yes, that problem can also occur with the Excel pivot table, but in Excel it is easier to see what are my active filters. And it is much more flexible to drill down by dragging a removing a certain column."

"...if we decide that cost centers 100 to 150 are overhead for all divisions. But after some time we realize that at the Holding company we have some other numbers, let's say cost center 15 and 16, which are also overhead, well then we have a problem with those BI tools. In Excel I can easily add or remove that in my pivot table, but not in the BI. Yes, we can change those mappings or groupings if we want to, but then we may have issues in other areas..."

4.2.4 RESULTS OF THE ANALYSIS ON THE FIVE SHADOW IT SYSTEMS

The fully elaborated results of the analysis on the shadow IT systems are presented in Appendix C. Each analysis follows the analysis framework, presented in paragraph 4.1.2. Each shadow IT system is analyzed in detail, including the explanation and purpose of most of the Excel functions.

For clarity purposes, the risks and benefits are aggregated when they apply to multiple shadow IT systems.

Security risks

For all shadow IT systems, security risks are virtually nonexistent:

1. Limited access to spreadsheets on the network: Only the controllers have access to the spreadsheets via structured and protected directories on the corporate network. For example, management reporting sheets reside on a different directory than the annual report sheets. A signed form is required before a new user can get access to a directory or folder. Network accessibility is under responsibility of the IT department.

2. Password protected spreadsheets: Spreadsheets are not protected with a password normally. However, it barely happens that more than one management accountant works on the same spreadsheet.

3. E-mailing spreadsheets: Company has its own mail server. However, parts of spreadsheet reports are e-mailed over the network to a limited amount of people: CFO, other controllers and administrative personnel.

Version control risks

For all shadow IT systems, version control risks arise because of user maintained lists or mappings in the spreadsheet databases. However, version control risks do not emerge because of multiple people working on the same spreadsheet.

1. Excel Track Changes in a shared spreadsheet: At FoodCorp, there are virtually no spreadsheets on which multiple users are working at the same time. Each management accountant has its own directory on the network, where he organizes and saves his spreadsheet work. Therefore, version control risks barely happen because of shared spreadsheets.

2.Structured directories/folders for business units, periods, and type of spreadsheets: FoodCorp uses structured directories and folders with limited user access for each department and function.

3.Naming version when saving spreadsheets: Spreadsheets are barely shared with other controllers, so version control risks arising from multiple people working on the same spreadsheet is not applicable.

4.More than one person responsible for data and maintenance: Each controller has its own spreadsheets and maintains them by himself. Because one person is maintaining and working with these spreadsheets, the risk of dependency emerges. When this 'super-spreadsheet expert' is sick or leaves the organization, nobody is able to maintain or work with these complex spreadsheets containing critical business processes.

5.Multiple persons working on the same spreadsheet: This barely happens, each controller has its own spreadsheets. However, because there exists user maintained lists or groupings in Excel based on source data in the ERP, there is a possibility that these Excel lists will differ from other lists maintained in the BI. A practical example is the Budget holder list. The

mapping of budget holders of the Corporate Controller in Excel is different than the budget holders list in the BI layer.

Data integrity risks

Data integrity risks arise in all of the shadow IT systems, the most prevalent are:

1. Separation of data from source systems:

S1 Annual Report:

- Risk of not knowing which ledger account from the ERP is where positioned (mapped) in a report. Because the Excel consolidation report sheet is not on the individual ledger level, but on a more aggregated level, based on the account mappings from the abandoned consolidation software. This makes it hard to compare the trial balance in the ERP system with the adjusted line item trial balance in the spreadsheet. The mapping from source (Chart of Accounts containing over 700 accounts) in the ERP to the trial balance resides in a separate Excel sheet. A mapping looks like: AA.B.aa which is for example goodwill, part of AA = Fixed Assets.
- Risk of not knowing which adjustment journal entry was made in the Excel trial balance and which adjustment entry was already made in the ERP system. Adjustments made in Excel are maintained in a separate spreadsheet, so they can be adjusted in the general ledger in the ERP later. There is no complete check on these adjustments to know for sure that they are both adjusted in the ERP and in the Excel trial balance.
- Intercompany relationships for revenue and expenses are not directly determined by looking to the General Ledger in the ERP. The elimination adjustment for sub-consolidation is based on information in a separate spreadsheet.

S3 VLOOKUP Database:

- Any new value in the ERP (new account, new cost center) in the ERP, can possibly
 result in outdated groupings in the spreadsheet. All lists based on Division Type, Cost
 Center Type, Budget Holder based on cost center, EBT line items and EBT Category
 based on division type + account, can potentially become outdated because these
 lists are separated from the source in the ERP.
- When a new combination of Cost Center + Account number is entered in the source (ERP system), there is no warning signal 'sent' by the spreadsheet mapping table that a new combination needs to be mapped. The result is that not all revenue and expense accounts are mapped to a EBT line item in the functional P&L. This Excel mapping lists becomes outdated.

S4 Monthly financial statements for banks and management:

- Risks of not knowing which ledger account from the ERP is where positioned (mapped) in a report. This makes it hard to compare the trial balance in the ERP system with the adjusted line item balances in the spreadsheet. The mapping from the chart of accounts to report line items for the banks only exists in the form of adding and subtracting the 'leadsheet' grouping which is maintained in the BI.
- Every period, the Balance Sheet, P&Ls and Cashflow statements are copied to a new worksheet. From Excel database to end-report involves at least four cell references. This manual copying requires therefore manual checking if all the references are still in place.

S5 Management information analysis using pivot tables:

• Parts of these pivot table reports are copied to a new worksheet for further analysis. However, the data in this report is a data-snapshot, not connected to the source trial balance anymore. Data in this snapshot becomes easily outdated.

2. Input controls that ensure data integrity:

- There is no control on data integrity at all. It is possible to accidentally change a value, change a value in a formula, or remove a formula. For example, each of the 150.000 cells in the spreadsheet database contains one or multiple formulas. It is possible that by accident, a formula is deleted, or changed and you may not notice it that it happened, or trace it back. Some input controls exist regarding debit = credit or sum = equal to a couple of rows, but these controls are based on multiple cell references and are not secured.
- Possibility to type whatever you may want, regardless any business logic. For example, it is possible to map a cost center + account to the letter F by accident, while it should be E. When you have to map hundreds of these combinations, a mistake is easily made. In addition, when new cost centers need to be added to these user maintained lists, you can type a four digit cost center, when it needs to be a three digit cost center.

3. Manually rekeying or copying data between spreadsheets:

- For each new period, reports are manually copied to other worksheets for further analysis, resulting in the need to manually check if all of the four cell references are still in place.
- Parts of (pivot) reports are manually copied to other worksheets for further analysis, resulting in snapshots (dead data), not connected to the trial balance containing source data anymore.

Spreadsheet benefits

Spreadsheet benefits are for the most part identified by means of interviews and not by means of the case studies, because benefits are subjective and are opinions of the end-users. However, the researcher also identified some specific benefits during the case studies.

- Expressive: In the Excel database, it is easy to convert foreign currency to Euros, based on a division type with an Excel IF-formula.
- Autonomous: Easy to make last minute adjustment add notes, highlight cells. Text formatting options.
- Fast: Easy to create multiple pivot tables of one dataset and compare them.
- Portable: N/A, spreadsheets are in general not shared with colleagues.
- Inexpensive: N/A.
- Universal: Easy to extract certain parts of the pivot table. Place it in Powerpoint or e-mail it.

4.3 CONCLUSION

In this section, the first research question will be answered:

1. What are the risks and benefits with spreadsheet-based financial reporting as a form of shadow IT at the FoodCorp?

4.3.1 RISKS OF SPREADSHEET-BASED FINANCIAL REPORTING

Based on the interviews with the Supervisor IT, the Corporate Controller and the Commercial Controller and the case studies on each of the five shadow IT systems, several conclusions can be drawn regarding the risks and benefits of the shadow IT systems used for financial reporting.

4.3.1.1 SECURITY RISKS

Despite the fact that there exists a spreadsheet environment without any formal IT support, including user maintained databases, mappings and reporting spreadsheets, there is no reason to believe that FoodCorp is exposed to security risks. The current literature on shadow IT is concerned with potential risks of data loss or leaks at an organization, because end-users maintain their own software or databases without any formal software approval.

FoodCorp uses a secured network with structured folders. Granted permission rights by the IT department, a user can access these spreadsheets. In addition, the company uses an own mail server for the sharing of spreadsheets. However, generally speaking, spreadsheets stay on a fixed place.

4.3.1.2 VERSION CONTROL RISKS

For all shadow IT systems, version control risks do not emerge because of multiple people in different departments are working on the same spreadsheet, a cause which is often mentioned in other spreadsheet studies. However, version control risks do emerge because of user-maintained lists or mappings in spreadsheets. A practical example is the Budget holder list, based on cost center. During the research, it became clear that the mapping of budget holders of the Corporate Controller in Excel is different than the budget holders list in the BI layer. Another management accountant used that budget holder list so differences between reports emerged.

Some groupings or lists of source data exist only in the BI layer but are not used anymore. Some lists do exist both in the BI and in spreadsheets, for example the division type list. There are also mappings which only exist in spreadsheets and are maintained there, for example the mapping of the chart of accounts into a report structure, based on division type and cost center.

All spreadsheets for group reporting are developed and maintained by one person, the Corporate Controller. Because one person is maintaining and working with these spreadsheets, the risk of dependency emerges. When this 'super-spreadsheet expert' is sick or leaves the organization, nobody is able to maintain or work with these complex spreadsheets, containing critical business processes.

The Corporate Controller aware of, the risks emerging from the 'understandability by others' of the spreadsheet environment, during the interview he stated: "...the transferability of such complex models or mappings is a problem. It is very hard to make other people understand what is going on in these spreadsheets."

4.3.1.3 DATA INTEGRITY RISKS

Multiple risks emerge in the field of data integrity. Data integrity is the assurance that data is accurate and consistent over its entire life-cycle. Data integrity risks mainly emerge because of two characteristics of spreadsheets:

- 1. Separation of data from source systems
- 2. Lack of input controls that ensure data integrity

The Corporate Controller stated: "...I agree on the data integrity risk, that is the most prevalent risk here. There is no possibility for a complete control where in the process something went wrong. The only thing I can do, is to ascertain an error in the end result compared to the ERP balance, and from there on, reasoning back to what the cause could be. Either an Excel value could be empty or that an account from the ERP is not mapped or that something is deleted, but that is not easy to determine..."

The most prevalent data integrity risk emerges in shadow IT system 3, the Vlookup Database. Whenever a new combination of division type + account number + cost center is entered in the ERP, the Excel database is not able to automatically update and add this combination in the mapping table. The result is that not all revenues and expenses are reflected in the report structure, in order to analyze the differences between four weekly reports, based on a functional P&L and the management reports based on the traditional P&L format.

Because the report in Excel is 'disconnected' from the ERP system, all adjustments for period closing in Excel makes it hard to determine which individual ledger account numbers need to be adjusted. The Corporate Controller maintains these adjustments (journal entries) in a separate Excel sheet. Some of these corrections do not need to be entered in the ERP later, such as annual IFRS adjustments. However, other adjustments need to be entered in the general ledger in the ERP, such as monthly period adjustments.

The determination of the individual ledger accounts from the aggregated excel report is further complicated because FoodCorp uses three types of report structures, based on the same chart of accounts. This makes the comparison of these reports difficult, although the reports reflect the same trial balance of the ERP.

1: An annual report structure. This report structure was originally mapped with the old annual report software. However, the mapping is based on abbreviations. AA.a.b is for example Machines and Installations, part of AA which is Fixed assets. These abbreviations are added in a separated column in the consolidation worksheet, to be able to have some way of knowing the report structure. This mapping is not maintained in the BI layer, but in the annual consolidation software, in a spreadsheet. Differences arise because of division type. For example, sales divisions place the logistics expenses in the Cost of Goods Sold while this may be different for a Production facility, where it is part of Subcontracted work.

2: An internal management report structure based on a traditional Balance Sheet and P&L format. This internal mapping is maintained in the BI layer, and exists there since the ERP/BI implementation.

3: An internal report structure with a more functional arrangement. (i.e. Direct Labour, Fixed Cost Factory, Overhead etc.). This structure is based on division type + cost center. This mapping only exists in a spreadsheet. This mapping emerged over a year ago, because the management accountants of FoodCorp were in need of a tool to analyze the differences between a four week period result (a traditional P&L) and the internal weekly reports, which is not purely based on the balances of the Chart of Accounts.

Another result of the separation of data from source systems is that whenever a part of a dataset, for example the operational costs of last month, is copied to the report of the current month, the data becomes an

outdated 'snapshot'. Transactions entered in the ERP after the creation of this data snapshot, are not reflected in those numbers.

Furthermore, because there is no form of input control in Excel, it is possible to type whatever one wants. For example, in the mapping table, Excel is not going to prevent a user from typing a four digit cost center, while it should be a three digit cost center (FoodCorp uses both types).

Regarding the central spreadsheet database containing over 100.000 cells, it is possible to change a formula or cell value by accident. Although this is a potential risk, it is not really a practical issue according to the Corporate Controller, still the risk that something in this database is changed without any possibility to trace it back, exists.

From the central Excel database to an end-report, involves at least four cell references over multiple worksheets. Each new period, the reports are copied to a new worksheet. This requires manual checking to see if all of the cell references are still in place, this is not only a risk, but it is also a hassle.

4.3.2 BENEFITS OF SPREADSHEET-BASED FINANCIAL REPORTING

The benefits of the spreadsheet shadow IT environment explain why spreadsheets are so widely used, and why end-users prefer the spreadsheets over the alternative: reporting in, or with the help of the BI software. The benefits of spreadsheets compared to BI are classified in four types:

- 1. Ease of drilling-down on dataset or reports
- 2. Flexibility
- 3. Information is readily available
- 4. Presentation and formatting capabilities

Drilling down on datasets or reports

According to both the IT department and the end-users, a major benefit of spreadsheets compared to BI is the ease of drilling down on datasets with the Excel pivot table. In the BI tool, everything is predefined based on how data is grouped and arranged. In contrast, an end-user can drag on drop and filter on anything he wants, even after the report is made. In the BI it is possible to drill down or filter to some extent, but only before the report is generated.

The Corporate Controller stated: "...the EBT grouping in the BI tool is not sufficient enough to drill down or filter specific things. Yes I can select things per cost center or EBT Line before I generate the report, but it is simply far less flexible than the Excel Pivot table."

The Commercial Controller stated: ".. the drawback of that BI tool was the ability to drill down on my sales statistics. It was simply always hard to see, what am I actually doing here and what selections and filters are active. So I saw a number but the story behind that number is unclear."

The Supervisor I&A stated: "... initially, Excel was not involved...the BI system had an additional tool to create reports from OLAP cubes and extract specific information out of these cubes...it required specific knowledge. Knowledge about OLAP cube properties...anyways, compared to the Excel pivot table function, it is simply less flexible. With Excel, it is more user friendly to turn and slice datasets. So after a while, people began to use the pivot table in Excel, instead of the BI tool."

Flexibility

Whenever a report needs an adjustment, whether it is a bookkeeping adjustment (e.g. journal entry), a new mapping, or expanding a report with, for example a part of a budget, it is possible to quickly add that in spreadsheets. Most of these adjustments, apart from specific finance needs such as adjustment entries, are possible in the BI layer. However, because the report creator of the BI tool requires specific knowledge (including SQL statements and RDBMS knowledge) and time of the supervisor I&A, it is not really an option for the controllers.

The Commercial Controller stated: "...*if we decide that cost centers 100 to 150 are overhead for all divisions.* But after some time we realize that at the Holding company, we have some other numbers, let's say cost center 15 and 16, which are also overhead, well then we have a problem with those BI tools. In Excel I can easily add or remove that in my pivot table, but not in the BI. Yes, we can change those mappings or groupings if we want to, but then we may have issues in other areas..."

Information is readily available

Another major benefit of the spreadsheet situation is that everything adjusted there is readily available.

The load-window of the BI is a couple of hours, executed overnight. At this moment, it is not possible to decrease that load-window, according to the supervisor I&A, due to memory speed. Anything adjusted in the BI layer is only the next day available.

For example, the Corporate Controller stated: "Yesterday I was doing some Budgeting things in the ERP system, and the problem there is that those changes are not readily available in the BI, because of the delay, (the situation with the databases being uploaded overnight) and this morning, just 45 minutes before I should deliver these budget reports, I receive a message that two of the four upload files have failed. So yes, the enormous flexibility and the fact that that what you enter is available is definitely an advantage over doing things in the BI layer."

"And even the (S3 Vlookup), what indeed a horrible mess is regarding manageability, the advantage of doing that in Excel compared to the BI is again, what I type is readily available."

Presentation and formatting capabilities

A specific benefit the researcher was appointed to during the interviews, is the ease of presentation and text formatting options in spreadsheets, according to the Corporate Controller:

"Well an important benefit I don't see in your shortlist, is the ease of presentation and text formatting. Especially when there is a need to supply the bank with a specific format, I can do that in Excel exactly how the banks want it. Well, maybe it would be possible in the BI layer ..."

The Supervisor I&A added to this that it is possible to do all kinds of text formatting in the BI, similar to a spreadsheet, but indeed, once it's made, it is fixed. Any adjustment wanted by the end-user needs to be executed by the IT department in the report studio of the BI software.

4.3.3 SHADOW IT

The ERP system and the BI tool were delivered at the same time, in 2005. The company did a selection process for the ERP system, but the BI was delivered because the implementation partner had good experiences with it.

The Supervisor I&A stated: "...We looked to JD Edwards, SAP, PeopleSoft and our current ERP. And from what I remember, we designed a case which every software vendor presented to us..."

The Commercial Controller, who was also involved with the ERP and BI selection and implementation process, stated: "...for the ERP selection we designed a business case which the vendors had to present. However, the BI was delivered during the ERP implementation by the implementation partner. From what I remember, we did not really have a requirements or selection process or gave any particular attention to the BI selection..."

The ERP system of FoodCorp has some reporting capabilities, including graphs and diagrams, and the possibility to build a report structure based on the chart of accounts, but these are not used. Mainly because it is not user-friendly and it is too limited. For example, the ERP can have only one report structure limited to five different levels and each level is simply a text field which needs to be filled for an account. In addition, there is no possibility to add a control mechanism to ensure that each account is mapped consistently.

During the implementation of this ERP system, the decision has been made, in cooperation with the implementation partner, to do any kind of report creation outside the ERP, in the BI layer.

The 'highest level of a finance report' the ERP is currently used for is a trial balance of all ledger accounts for a division. Simply said, the ERP system stores a massive amount of data. These tables are then accessible with the BI tool to create reports of the historical data.

Before the current spreadsheet environment, there existed an end-user variant of the BI software. This software was also delivered during the implementation of the ERP and the BI software. The current Commercial Controller and the former Corporate Controllers worked with that tool. With that tool it was possible to create traditional Balance Sheets and P&Ls for example. It was also possible to select and drill down on datasets. However, that tool required specific knowledge. Because people with that knowledge leave the organization and new people enter the organization, the tool became slowly redundant.

The current Corporate Controller only works for over a year at FoodCorp. When he started working at FoodCorp, the end-user BI reporting tool did not exist anymore at FoodCorp. However, there did exist a specific reporting tool specifically aimed at creating an (consolidated) annual report. The former Corporate Controller used that reporting tool on his own. It was installed at his computer and the IT department was not involved with the maintenance of that software.

When the current Corporate Controller started working at FoodCorp a year ago, the problems of this specific reporting software regarding version control were a direct cause to start creating reports in Excel. And when parts of reports are created in Excel, it is quickly expanded with more user-maintained lists and other information.

The Corporate Controller stated: "...when I am already seeing my General Ledger data and everything in Excel, there is no reason for me to not extent it with more useful information there or start doing things in the BI..."

The result is that at this moment, all internal and external reports are created in spreadsheets.

Relationship between IT department and end-users

Regarding the existence of the shadow IT environment, it is not a result of poor relationship or departmental constraints between the IT department and the end-users in the finance department. In shadow IT literature, this lack of understanding is the most prevalent reason why shadow IT exists. There is also no reason to believe that it is hard for the finance department to express the requirements to the IT department. The Supervisor I&A formerly worked in the accounting department and therefore he has a good understanding of what it takes to create all kind of finance reports.

The Corporate Controller stated: "The relationship between finance and IT is simply good. It is only three rooms down the hallway and the IT guy has a strong knowledge of finance processes because he is a former accounting guy."

However, in the past, not all issues faced by the finance department have been communicated with the IT department. A clear example is the purchase of the annual report software, but that particular situation is something of the past, of the former Corporate Controller.

Furthermore, the creation of the Vlookup database, containing mappings in Excel, based on data in the ERP was not known by the IT department. According to the supervisor I&A, it is not advisable to have users create their own mappings or list, based on source data.

The Supervisor I&A stated: "... and maybe that we don't have any policy how we want to report certain things. If I know how we report things, we can figure out what data and or mappings are needed, what data is available in the source and so on. And then we could centralize such data and maintain it..."

The Supervisor I&A stated that it is very much advisable to be involved with the purchase of software and creation of new spreadsheet lists and databases:

"It is advisable to be involved in some stage, to know what the software does and what its data source is. Especially when it is software concerned with mappings or arrangements of source data. In most cases, endusers do not have a true understanding of what source data is available and what consequences that may have on their software or way of working."

In addition, the Corporate Controller agrees that whenever it comes about managing or governing data, this should be done by the IT department.

The Corporate Controller stated: "... I think it is a good thing to have IT as a guardian of how we treat our data and that we don't manipulate everything with our Excel formulas."

Overcoming the limitations of the ERP and BI

The reason why there exists a shadow IT environment, is the result that the end-users have a feeling that the current systems (e.g. the ERP + BI) does not meet their needs. Needs regarding the flexibility spreadsheets offers compared to the BI software. (already mentioned in the benefits paragraph in the section above).

The Commercial Controller stated: "... if we decide that cost centers 100 to 150 are overhead for all divisions. But after some time we realize that at the Holding company we have some other numbers, let's say cost center 15 and 16, which are also overhead, well then we have a problem with those BI tools. In Excel I can easily add or remove that in my pivot table, but not in the BI. Yes, we can change those mappings or groupings in the BI, but then we may have issues in other areas." The Corporate Controller stated: "...Anything I want to add, for example a part of a budget to analyze differences, a part of a former report is possible in Excel. Yes, theoretically it may be possible in the BI tool, but this takes more effort and time by the supervisor I&A, so I don't think the BI is sufficient..."

The Commercial Controller stated that the feeling that the BI tool is considered to be 'too fixed' by the endusers may be a result of designing and implementation decisions, and not necessarily a problem of the software itself:

"So the whole 'BI is too fixed compared to Excel' issue is partially a result of how do we implement the software according to our business'. So it may be more of an issue of ourselves then of the software itself..."

The Supervisor I&A confirmed that the usefulness of the BI tool depends on the 'underlying data model'. Whenever that model doesn't change, the BI tool can generate very useful reports for the end-users. Still, in the BI studio are many possibilities to filter and select on datasets.

4.4 DISCUSSION

An important remark is that a software selection process was initiated for new financial reporting software during this research, described in more detail in paragraph 5.2. Eventually, this new reporting tool was purchased by FoodCorp and implemented during this research. In short, this new reporting tool overcomes the risks of Excel, while still offering the required flexibility.

However, what if this new reporting software was not purchased? What would the recommendations for FoodCorp as a result of this research then be?

This paragraph will discuss the recommendations as if there would be no new reporting software.

4.4.1 RISK ISSUES VERSUS PRACTICAL ISSUES

To recall the problem: FoodCorp experiences problems with the process of generating the required financial information out of the available data. Problems regarding efficiency in terms of finding the data, transforming data into the required reports and the assurance that the data is complete and correct.

It is important to distinguish between risk versus practical problems. It is possible to mitigate risks, but if this results in an unworkable situation for the end-users on a day-to-day basis, it is not a solution. Therefore, it is important to consider the context (end-users) when proposing improvements for the IT artifact.

-Risks: concerned with the assurance that the data is complete and correct. Data should be complete and correct for the end-users who deliver the report. Data should also be complete and correct for the organization as a whole, regarding the governance of data by the IT department.

-Practical problems: concerned with the efficiency of finding and transforming data. Finding data is concerned with the immediate availability of the data, while transforming data is concerned with the actual creation of a report when the data is available.

To mitigate the spreadsheet risks, the recommendation is straightforward: use the BI for all the reports. The data and the reports in the BI are governed. For example, there is no risk of deleting or adjusting a cell value. In addition, data-snapshots would not occur, because there is always a link with the source data in the ERP (Reports are based on the data in the Data Warehouse). Furthermore, it is possible to add all kind of integrity controls on what users can and are required to type, regarding the maintenance of mappings. Further, it is possible to build a checking mechanism in the BI layer when a new cost center or account is created in the ERP. Such controls are not available in the current spreadsheet situation.

Specific finance things are possible in the BI. It is possible to create Balance Sheets, P&Ls and Cash Flow statements in the BI tool for each individual entity and the group. These reports would be clickable, meaning that it is possible to drill-down in the report structure onto the ledger account. This would be a practical improvement over the spreadsheet environment, where it is hard to figure out which individual ledger accounts are placed. Besides, the BI enables conditionally reporting, for example, place a debit amount of this account under assets, but place a credit amount under liabilities. Furthermore, consolidation of the entities would be possible, replacing the consolidation spreadsheet, however, elimination adjustments can't be entered in the BI layer. In addition, text and color formatting possibilities in the BI is similar to spreadsheet text formatting.

But then the immediate question is, is it workable on a day-to-day basis? The answer is simple: no, it is not. It is not practical because of two characteristics of BI:

BI is aimed at creating reports of historical data

The BI tool has no option to add (e.g. type) new data. Finance reports require often adjustment entries for period or year-end closing. These adjustment entries need to be entered in the ERP system, because you simply can't type directly in the BI software. But the drawback is the overnight load-window of the Data warehouse (any transaction entered today, is available tomorrow in the report in the BI layer). This would make it practically impossible to add a last minute adjustment, because of a meeting with the CFO for example, before the report is send to an external party.

Data needs to be arranged or grouped, added or subtracted, based on predefined business rules. Whenever an exception arises on these business rules as a result of new insights or organizational changes, the report in the BI can only be adjusted with the help of the IT department. Simple things, such as a ledger account that needs to be mapped differently, can be solved with the help of a centralized mapping portal, so that the IT department is not involved. However, the mapping would not immediately show up, only the next day. Another practical example is when for whatever reason a management accountant decides that some cost centers for a specific entity should not be seen as overhead, but as fixed cost factory for a quick analysis, the BI tool is 'too fixed'.

BI requires specific knowledge

The BI tool requires specific knowledge about SQL, Relational Database Management Systems (RDBMS) and the report studio itself. SQL is for example needed, when an end-user wants to add a budget amount of two years ago of two entities to an ad-hoc report. The budget is somewhere 'hiding' in one of the thousands of tables stored by the ERP.

The researcher discussed with the Supervisor I&A if it would be theoretically possible to give the end-users in the finance department access to the report studio of the BI tool. Currently, only the Supervisor I&A creates reports using the report studio of the BI.

With a little bit of training on RDBMS and SQL, end-users would be able to adjust and create the reports themselves. This would be possible, however such a situation would not be advisable. First it is not practical regarding employees leaving the organization. Whenever an end-user leaves the organization, that very specific BI knowledge needs to be transferred to the new employee. Second, this would not enhance the consistency of the information of FoodCorp. When people have the ability to create all kind of databases on their own, including conditionally groupings and mappings based on source data, multiple versions of the truth will exist after a while. It is very important that an organization maintains control on information standards.

Information standards should be governed and maintained by the IT department, regardless a spreadsheet environment or a new financial reporting tool. For FoodCorp, it means that all relevant mappings or lists based on source data should be identified. In the current situation, mappings are either maintained in the BI layer in conjunction with the intranet, or maintained in spreadsheet lists. There are also lists that exist both in the BI and in the spreadsheets.

Solution: Combining BI and spreadsheets with a new SQL view

The recommendation is to use the BI for any arrangement and maintenance of source data and reporting standards, but leave the actual end-reporting to spreadsheets. Groupings of data (reporting standards) or maintaining lists should not be done in spreadsheets, because there are no integrity controls. In addition, there is a possibility that multiple versions of the truth start to exist after a while. Reporting standards should therefore be maintained centralized, in the BI tool with the help of a portal on the intranet. End-users can adjust and maintain the reporting standards there.

A new 'SQL view' should be created with the help of the BI and maintained in the Data Warehouse. This view needs to be connected to Excel using the built in SQL connector. This view needs to contain every required information, for the maximum possible years back. Information can be seen as an additional column in a table. The Supervisor I&A can add additional columns in this view when required in the future.

Table 5: The new recommended SQL view

Name	Source	Situation before
Division	ERP	ERP
Division name	ERP	ERP
Division type	BI, maintained with the help of the intranet	Maintained in a spreadsheet
Ledger Account Number	ERP, Send a notification e-mail when a new account is created with the BI	ERP, No notification when a new account was created
Ledger Account Number description	ERP	ERP
Cost Center	ERP, Send a notification e-mail when a new account is created.	ERP, No notification when a new account was created
Cost Center Name	ERP	ERP
Cost Center Group	BI, maintained with the help of the intranet	Maintained in a spreadsheet
Budget Holder (based on cost center)	BI, maintained with the help of the intranet	Maintained in a spreadsheet
Account Mapping for Banks/Management (preferably several levels)	BI, maintained with the help of the intranet	Partially maintained in a spreadsheet, partially in the BI
Account Mapping for Annual Report (preferably several levels)	BI, maintained with the help of the intranet	Mapping did not exist in the former view. Mapping was maintained in the old annual report software
Account Mapping for internal analysis based on divison type + cost center (two levels: EBT Category and EBT Line)	BI, maintained with the help of the intranet. Send a notification e-mail when a new combination of account + cost center is created.	Maintained in a spreadsheet
Actuals (for each period, preferably 3- 4 years back)	ERP	ERP, only 1 year
Budget (for each period, preferably 3- 4 years back)	ERP	ERP, only 1 year
Actual Year-to-Date	ERP	ERP
Budget Year-to-Date	ERP	ERP

Maintain every mapping or grouping of source data centralized, with the help of the intranet (BI).

The BI tool can easily check for new accounts or cost centers created in the ERP and it can send an e-mail when new combinations are entered. The advantage of the intranet compared to the spreadsheet is that the maintenance of the mappings can be delegated to someone else in the accounting department. Furthermore, any report requiring that mapping can easily be 'connected' to that mapping. The actual mapping is something which people need still need to do themselves. It is advisable to map for example the last day of the week.

Communicate reporting standards

End-users should communicate with the IT department which mappings of source data (e.g. a division type list, cost center group, budget holder list, annual report mapping and so on) they are using or have created. The

Supervisor I&A can either create a portal on the intranet where these mappings can be managed, and he can assure that there is not already something similar available. Preferably, all mappings and grouping are maintained in the BI with the help of the intranet.

The advantage of this SQL view is, that with the help of the pivot table, end-users have all their data available for quick analysis, and the data is always connected with the source. In addition, as long as end-users communicate reporting standards with the supervisor I&A, there won't exist multiple mappings of the same source data.

The drawback of this situation is that spreadsheet formulas are still used to 'look on the spreadsheet database' with dozens of IF and SUMIF functions for example, to create end-reports. Basically, these IF and SUMIF functions are an end-users variant on SQL statements. Dozens of functions do not solve the risk issues discussed earlier. Besides, data snapshots would still appear.

P&Ls to analyze the differences between a weekly report and the four weekly management reports

End-reporting should be done in Excel. One exception on end-reporting exist however. The Corporate Controller wants to analyze the weekly management report, not purely based on the chart of accounts, with a traditional four week P&L format. The solution for this problem is to create a new report in the BI tool, including the three report structures.

This is practically possible, according to the supervisor I&A. However, this could become a very long report. (A traditional P&L consisting of 20 line items would be expanded to several hundred for a single division, and even more for the whole group). A more practical alternative solution is to immediately present this report in Excel and filter there on P&L line items.

Annual Report	Banks/Management	ERP Account Number	Cost Center	Cost Center Group	Weekly Report	Actual (\$)
Pay and Salaries	Salaries	401100	100	Direct Production	A (Direct Labour)	1.000
			130	Central Services	C (Salaries)	500
			180	Central Services	F (Overhead)	800
Pay and Salaries	Salaries	401101	130	Central Services	C (Salaries)	453
Pay and Salaries	Salaries	401102	130	Central Services	C (Salaries)	1.230
			180	Central Services	E (Fixed Cost Factory)	6.000
Other Costs	Insurance	402103	110	Fixed Cost Factory	F (Overhead)	5.600

Table 6: A design of a new report structure to analyze the weekly vs the monthly report, including the three types of structures in the BI tool.

5. STAGE 2: BUILDING, INTERVENTION, AND EVALUATION (BIE)

This chapter will elaborate on stage two of ADR. This phase is an iterative process in the target environment, interweaving the Building of the IT artifact, Intervention in the organization, and Evaluation (BIE). The IT artifact is a four phase framework that aids in analyzing a financial reporting architecture and arrive at a reporting architecture without shadow IT. This framework will be further developed to include design principles which can be applied to other organizations, where ERP, BI, spreadsheets and/or end-user financial reporting software is present to transform data into reports.

Stage two draws on three principles: reciprocal shaping, mutually influential roles, and authentic and concurrent evaluation.

Principle 3: Reciprocal Shaping. This principle points to the importance of the influence of both the IT artifact and the organizational context. The ADR team may engage in cycles of decisions at finer levels of detail in each domain.

Principle 4: Mutually Influential Roles. This principle emphasizes the importance of mutual learning among the different project participants. The practitioners bring practical knowledge of organizational work practices, while researchers bring their knowledge of theory and technological advances.

Principle 5: Authentic and Concurrent Evaluation. This principle emphasizes a key characteristic of ADR: evaluation is interwoven in the decisions about designing and reshaping the IT artifact and intervening in organizational work practices. In other words, evaluation is not a separate stage.

5.1 BUILDING THE IT ARTIFACT

The IT artifact is a financial reporting architecture that removes shadow IT. Regarding shadow IT, it is important to emphasize that spreadsheets are not by definition shadow IT. Shadow IT is simply all IT within an organization that does not receive official IT support and maintenance.

It is possible that the IT department maintains spreadsheet databases for the end-users, for example by 'connecting' these spreadsheets to the Data Warehouse using the built in Microsoft SQL connecter of Excel. The IT department knows exactly what data is contained in those spreadsheets, what reporting standards are used and where the information is coming from. Such a view on shadow IT would mean that shadow IT is theoretically removed from an IT architecture by means of communication between the end-users and the IT department. However, communication alone would not solve the risks and practical problems arising from an existing shadow IT environment.

These risks and practical problems can only be solved by an in-depth analysis of the current architecture, by assessing the capabilities and limitations of the official IT that is currently available, by evaluating the needs of the end-users and consequently, making changes to the financial reporting architecture.

5.2 FIVE STEPS IN THE FINANCIAL REPORTING PROCESS

In order to create a design for the new financial reporting architecture, the financial reporting process is divided into five steps. Each step in the financial reporting process can be performed at one or more IT building blocks (e.g. ERP, BI, Spreadsheets or financial reporting tool). However, there is no one-size-fits-all solution (e.g. which step should be performed at which IT building block). Also note that these steps are iterative.

- **Recording data**: This step is concerned with entering new data in the form of numbers and comments.
 - These can be journal entries and adjustment entries in the General Ledger and the Trial Balance (including additional data entries in dimensions and sub-administrations). In addition, recording data can mean informal notes to describe (internal) reports and more formally the notes found in an annual report.
- Storing data: Physically saving or storing financial data.
 - Saving or storing financial data can be done in the corporate Data Warehouse or more locally in spreadsheet tables or the database of the reporting tool. It is also possible to make combinations, for example: an export to a spreadsheet database using Microsoft SQL Server.
- **Transforming data**: Transforming data is concerned with grouping or mapping of source data.
 - Examples are: cost center in a cost center group, mapping division numbers in a division type, grouping ledger accounts to a type of an expense, mapping the chart of accounts to different report structures, assigning a range of cost centers to a budget holder, create a cost category based on account number + cost center.
- **Creating recurring reports:** Recurring reports such as Balance Sheets, Profit & Loss Statements and Cashflow statements including making adjustment entries on these reports.
- **Creating ad-hoc reports**: Ad-hoc reports and analysis, such as the tracking of expenses related to subcontracted work for all foreign production divisions.

The next step is to evaluate in which IT block, each step of the financial reporting process can take place and should take place. This is an iterative process where the IT department, the end-users and the researcher are involved and assist each other with their knowledge about the available systems, the capabilities and limitations of the available IT to arrive at the best solution for the end-user's needs.

Enterprise Resource Planning

- <u>✓Recording data</u> <u>✓Storing data</u>
- <u>± Transforming data</u>
- <u>± Creating recurring reports</u>

<u>± Creating ad hoc reports</u>

Business Intelligence / Data Warehouse solution

*****Recording data

√Storing data

<u>± Transforming data</u>

<u>± Creating recurring reports</u>

<u>± Creating ad hoc reports (using RDBMS/OLAP)</u>

Spreadsheets

<u>± Recording data</u>

<u>±Storing data</u>

<u>±Transforming data</u>

<u>± Creating recurring reports</u>

<u>± Creating ad hoc reports (using Pivot table)</u>

For FoodCorp, it means that the reporting capabilities of the ERP are very limited. It is possible to create one report structure on the chart of accounts. However, this report can only be five levels deep. After evaluation, it would not be beneficial to create the structure here because it is not user-friendly. The decision was made to use the ERP only for data recording. This would also appear to be more flexible when report structures might change in the future.

The Business Intelligence software cannot record data. However, it can transform and store data and it can create reports. The data and reports in the BI layer are secured, data snapshots would not occur and reports would be clickable to more detailed levels. However, after evaluating it would not seem beneficial for the end-users to create reports here. Simply because changes in these reports require specific attention and time of the IT department. A solution proposed by the supervisor I&A is to maintain report structures by means of user maintained .asp pages, instead of maintaining report structures in spreadsheets. This would give the end-user the flexibility in changing these structures, and would secure the data integrity of the reporting standards of the company. In addition, a new 'SQL view' was created by the supervisor I&A containing all required data and report structures, this view can then be send to a spreadsheet, similar to the current spreadsheet database.

The initial design for the architecture at the FoodCorp would still rely on spreadsheets for mapping (e.g. creating the report structure) of the chart of accounts. Furthermore, the risk of data snapshots would still exist. More importantly, financial consolidation and elimination would still be performed by means of manual labor in spreadsheets.

Therefore, the decision was made to look for a new reporting tool that can replace spreadsheet reporting.

For the purpose of this thesis, the selection process for the new reporting software is only described briefly. In short, a shortlist of twelve possible software candidates available in the Netherlands were evaluated, based on three base criteria: Budget, No cloud solution and besides financial consolidation, the possibility for any type of management reporting.

This first selection round resulted into three remaining candidates. Big players such as Oracle Financial Close Suite were too expensive. Some reporting tools were only cloud solutions. Other reporting tools were only used for the annual report and useful for audit firms, but not for companies who want to analyze and create management information, for example based on cost centers or any other arrangement.

Each of the three software vendors gave a demonstration at the company. These demonstrations were followed by multiple controllers, the IT department and the researcher. A list of requirements for reporting software can be found in paragraph 7.2 where the four phase IT artifact is presented.

5.4 INITIAL DESIGN OF THE REPORTING ARCHITECTURE AT THE FOODCORP

The initial design of the financial reporting architecture at the FoodCorp consists of an ERP system for data recording, a BI system for managing the report structures and the creation of a new 'SQL view' containing all the data and spreadsheets connected to this 'SQL view' for end-reporting.



Figure 8: The initial design of the IT artefact, still relying on spreadsheets, but no shadow IT.

The first change in the target environment was concerned with improving the problems with the mappings based on Division type + Account Number + Cost Center for weekly management reports. These mappings were stored previously in shadow IT system S3. To recall the problem of shadow IT S3: when a new combination of division + account + cost center is entered in the ERP, there is no check in Excel that there is a new combination. The result is that revenues and expenses are not reflected properly in the management reporting analysis.

5.4.1 PRINCIPLE 3: RECIPROCAL SHAPING

The Supervisor I&A started with transferring the mappings to the central Data warehouse, part of the BI tool. It is now possible to access the finance portal on the intranet, granted permission rights, and update or change the mappings. After additional insights of the researcher and the Supervisor I&A, a checking mechanism was built in the BI software Cognos to easily determine when a new combination of Division type + Account + Cost Center is not mapped. However, after around two months, it became clear that it is more user friendly to maintain these mappings directly in the new reporting tool. The new reporting tool is also able to notify new combinations of account number and cost center. In other words, the BI layer and the reporting tool do the same, but the latter is more user-friendly.

Figure 9: The centralized mapping on the intranet of division type + account number + cost center

Search				
Accounting Identity [
Cost Center [
Division Type [SelectValue 🗸	·]		
EBT Category	SelectValue 🗸	·]		
EBT Line	SelectValue	~		
		Search		
list of FBT W	/eekly cat	tegories		
List of EBT W	/eekly cat	tegories	EBT Category	EBTLI
List of EBT W Accounting Identity 401110	/eekly cat Cost Center 100	tegories Division Type	EBT Category	EBT Line
List of EBT W Accounting Identity 401110	Veekly cat Cost Center 100	tegories Division Type	EBT Category	EBT Line Direct Labou Direct Labou
List of EBT W Accounting Identity 401110 401110	Veekly cat Cost Center 100 100	tegories Division Type 0 P S	EBT Category A A A	EBT Line Direct Labour Direct Labour Direct Labour
List of EBT W Accounting Identity 401110 401110 401110	Veekly cat <u>Cost Center</u> 100 100 100 110	tegories Division Type 0 P S 0	EBT Category A A A A	EBT Line Direct Labour Direct Labour Direct Labour Direct Labour
List of EBT W Accounting Identity 401110 401110 401110 401110	Veekly cat Cost Center 100 100 100 110 110	tegories Division Type 0 P S 0 P	EBT Category A A A A A A A	EBT Line Direct Labour Direct Labour Direct Labour Direct Labour Direct Labour



Figure 10: The checking mechanism in the BI tool to determine for a selected division, which combinations have not been mapped.

Table 7: Checking mechanism to determine which combinations have no mapping.

Division	Division name	Туре	Rekening	Rekening omschrijving	сс	CC Dim 2.	EBT Category	EBT Line	Year
xxxx	ххххх	Р	401110	Gross wages	105	xxx	**** ERROR ****	**** ERROR ****	2.014

5.4.2 PRINCIPLE 4: MUTUALLY INFLUENTIAL ROLES

The researcher went to the IT department to explain the current situation and problems. With the spreadsheets containing the mappings and some notes from the Corporate Controller, it was possible to clarify the problem for the supervisor I&A. The Supervisor I&A then began to transfer the mappings to the centralized database.

In addition, the researcher determined in cooperation with the Corporate Controller inconsequent mappings. The Corporate Controller explained that there were five categories of cost centers: Direct Production, Fixed Costs Factory, Central Services, Selling Costs and Intercompany Charges. It should be possible, according to the Corporate Controller, to determine the EBT Line based on cost center category alone. For example: Direct Production cost centers can only be classified as Efficiency and Nett Content. This principle is important, because it is then possible to determine in advance where each new combination of account + cost center will be positioned. The result would be that there would be no mapping process or portal needed.

However, the Corporate Controller and Commercial Controller decided that too many exceptions existed, so the principal of determining an EBT line on cost center alone was removed. For example, cost center: administrative services, is in most cases, for each type of division classified under EBT Line: Overhead. However, some exceptions did exist. For example, expenses for administrative services were classified under: Fixed Cost Factory. Many of these exceptions could be mistakes, but at the same time, these exceptions would be perfectly logical.

5.4.3 PRINCIPLE 5: AUTHENTIC AND CONCURRENT EVALUATION

The purpose of this mapping is to analyze the traditional P&L with the weekly report. At this moment, the mapping in this centralized database is still a concept and during the research it already became clear that it may not be the most practical solution.

However, after evaluation, the supervisor I&A, the Corporate Controller and the researcher agree that this concept has a couple of benefits over the old situation in spreadsheets. Not only because it is simply more user friendly, the earlier determined risks concerned with data integrity arising from maintaining a mapping in a spreadsheet are minimalized:

1. The mapping is now easily accessible on the intranet, granted permission rights, instead of one information silo in a spreadsheet. This makes it possible to maintain the mappings with other people within the administrative department. In other words, the mapping process is better manageable. Even if the mapping will be maintained in the new reporting tool, it can be exported back to the centralized data warehouse.

2. When a new combination is entered in the ERP, it is now possible to automatically send a notification e-mail and consequently, map the new combinations in the centralized database. With Excel it was not possible to notify any new combinations. In addition, the new reporting tool will automatically notify new combinations when loading data.

3. Duplications of mappings and inconsistencies existed in the Excel solution. One of the advantages of the database solution is that duplications are not possible anymore, because the database works with unique keys.

4. The checking mechanism allows a user to easily determine which combinations of accounts + cost centers are not mapped, for each division.

5.5 FINAL DESIGN OF THE REPORTING ARCHITECTURE AT THE FOODCORP

The final design of the IT artefact included the new reporting tool. This tool replaces spreadsheet reporting for the most part. A more detailed presentation of the new architecture can be found in Appendix A.



Figure 11: The final design of the financial reporting architecture, including the new reporting tool.
5.5.1 PRINCIPLE 3: RECIPROCAL SHAPING

This new reporting tool is 'connected' to an SQL database. Unlike Excel, the reporting software cannot work without a database. This is a fundamental change compared to spreadsheet reporting.

The supervisor I&A, Corporate Controller and researcher held several meetings to determine what data should be contained in this new table, where the data should be coming from and what data needed to be sorted out. The goal for this new database was to gather all information streams from the ERP, BI and Excel maintained lists into one centralized database. The determination of the data for the new database was based on the assumptions of the Corporate Controller, the Supervisor I&A and the researcher, before the new reporting tool was actually delivered.

One of the main challenges was to transfer the mapping from the chart of accounts to the database. This mapping only existed in a spreadsheet, made by an external accountant. However, this mapping did not contain the actual aggregation level required in an annual report. In addition, many accounts had more than one mapping and this needed to be sorted out by the researcher and the Corporate Controller. The already mentioned EBT mapping based on Division type + Account Group + Cost Center, now maintained in a separate database, was also added. However, when the new reporting tool arrived, it became clear that it is more convenient to create the report structure there and manually map the chart of the accounts.

Furthermore, discussions took place on what basis ICO transactions could be easily eliminated. Therefore, the SQL table was expanded with the 'to/from country dimension' of the ERP system. At least, was the assumption, this should help in determining the ICO revenue streams, and consequently know what should be eliminated in the (sub) consolidated financial statements (all divisions use one ICO revenue account).

After the second day of implementation training of the new reporting tool, the Supervisor I&A came up with the idea to use a certain dimension in the ERP system to determine the relationship between divisions regarding ICO relationships. Currently, ICO relationships are not easily determined for most P&L accounts. By using a dimension in the ERP, it will be easier to determine the sending and receiving entity for one account number. The new reporting tool is able to 'read' that relationship. This will be a big improvement considering the effort it now takes to eliminate these ICO relationships in sub-consolidations, with a separate spreadsheet.

The following table represents the database to which the new reporting software is 'connected'. Yellow columns is data from the ERP system, Green is data from the BI. In the new situation, there are no Excel maintained lists, mappings or other databases. All data is governed by IT department and resides in the company's Data Warehouse.

Table 8: The current database or 'SQL view' (columns are placed under each other due to space)

Division	Division Name Long	Division Type	Accounting dimension 1	Account_Description_Translation_NL
ххх	ххх	0	501189	ICO realized contribution S&M (P)

CostCenter	Cost Center Level 6 Name	Cost Center Group 2	Account Group	Leadsheetname
260	ICO Charges	Fixed cost factory	U2-R.7.* Sales Costs	Cost of raw materials
		Total		

EBT_Category	EBT_Line	Base country	From/to country	toDivision (Will be filled with dimension 4 in the ERP system)
F	Contribution S&M (P)	NL	BE	(empty)
			DE	(empty)
			GB	(empty)
			NL	
				(empty)

Year	FAM Period	Actuals	Sum of Budget Amount
2013	1	0	0
2013	1	-351.206,00	0
2013	1	-152.859,00	0
2013	1	0,00	-1034529
2013	1	-331.534,00	0
		-975.945,00	-1034529



5.5.2 PRINCIPLE 4: MUTUALLY INFLUENTIAL ROLES

During the process of determining the required data for the new database, the Corporate Controller contributed with explaining on what base certain types of elimination adjustments were made in the current situation. The Balance Sheet eliminations didn't need any adjustments in the ERP of BI tool, because these eliminations are known on the basis of the trial balance/chart of accounts.

However, the eliminations for the (sub) consolidated P&Ls, required additional information besides the trial balance. For example, ICO Charges and Contributions are currently eliminated on the base of a separate spreadsheet where the ICO relationships are determined.

The insight of the Corporate Controller in combination with the supervisor I&A, resulted in a change in the ERP system. In short, it means that for each ICO charge transaction, the from and receiving entities are explicitly recorded in a dimension in the ERP system. The new reporting tool is then able to automatically 'read' how a contribution, for example credited at the Holding company, relates to multiple debited amounts of multiple subsidiaries. The reporting tool can then automatically eliminate these amounts, based on the consolidation structure.

The researcher contributed by sorting out inconsistencies in the different mappings and by assisting the Supervisor I&A to make sure that all the required 'columns' (the lists and databases formerly maintained in Excel) were presented. In addition, the creation of

5.5.3 PRINCIPLE 5: AUTHENTIC AND CONCURRENT EVALUATION

Given the duration of the research, there simply is not enough time to transfer all reports, which are currently made in Excel, to the new reporting tool, including budgets, management reports and reports for the banks. However, the concept of a dedicated reporting tool in combination with a centralized database is already showing major benefits over the old Excel situation.

Besides the fact that the new reporting software is actually consolidating and offers the possibility to automatically eliminate once a user determined what needs to be eliminated, several benefits over the spreadsheet environment are clearly visible.

User-maintained lists in Excel do not exist anymore. All relevant data either comes from the ERP system or the BI tool. All mappings (or lists) of the chart of accounts, division types, cost center groups, EBT mappings for management information and bank report mappings are now centralized, minimalizing version control risks arising from inconsistencies of these Excel maintained lists.

In the future, new lists or groupings of the chart of accounts may emerge because end-users have a need to do so, these can easily be added to this centralized database, according to the supervisor I&A. Of course, these need to be communicated to the IT department and people should not start to create a new list in a spreadsheet on their own.

The main improvement a dedicated reporting tool in combination with a database governed by IT is that this overcomes the two fundamental limitations of spreadsheets:

- 1. separating the end-report with the source
- 2. lack of input controls that ensure data integrity
- Because the new reporting tool is always connected to a database, all historical data is available. In the past it was hard to get data from several years back, but in this new reporting tool it is always

available. In addition, data snapshots will not occur anymore. When an end-user wants to compare a couple of months of earlier years, it is a matter of clicking or expanding periods. This flexibility applies also to budgets and actuals.

- With the new reporting tool it is easy to determine where each individual account from the general ledger in the ERP system is positioned in the report. It is also possible to simply drag-and-drop an account within the actual report, to a different place. In Excel it was impossible to find where each individual account was positioned in the report. It is also possible in the new reporting tool to create a derived report format. Basically, a different grouping of the account numbers. This flexibility is also a major improvement over Excel reporting.
- Version and logging problems do not exist anymore. The reporting tool automatically creates an accounting document (e.g. journal entry) for each adjustment. All adjustments are maintained in the General Journal in the reporting tool. Furthermore, all changes in mappings, data imports, and even renaming a report is logged.
- The reporting tool can distinguish accounting entries made in the source, which is the ERP system and accounting entries made manually in the reporting tool, for example adjustments made by the Corporate Controller for year-end closing like IFRS, or any adjustment made for a bank report. These adjustment are separated from the source. With Excel reporting it was hard to determine, in combination with the lack of knowing where each account was placed in the report, to know which adjustment entries were made in the Excel trial balance and which adjustments still needed to be made in the ERP. The new reporting tool simply places the source (ERP) balances in a column and additional entries in different columns.
- Any report aggregation or mapping based on the chart of accounts can be exported from the reporting software and easily added to the centralized database for maintenance. The report structure for the annual report can be easily compared to the report structure of the internal management reports.

However, there are two specific areas in which the new reporting software is not going to replace Microsoft Excel.

- Drill-down analysis using pivot table. The reporting tool lacks the flexibility which the Excel pivot table function does offer for drill-down analysis. On the other hand, drilling down for ad-hoc analysis is more BI instead of financial reporting. For example, analyzing specific cost centers for certain divisions is somewhat limited in the report tool. Therefore, the new reporting tool is not likely to replace the spreadsheets completely. The advantage of the reporting tool is that everything can be exported to an SQL-database with the help of a script, including but not limited to report structures and adjustment entries. Excel, can import that same data, using a SQL query macro, developed by the Supervisor I&A This means that all data in the reporting tool can be drilled down and filtered with the help of the pivot table. In addition, because the reporting tool and the pivot table use the same SQL-query, the data is up-to-date and that the numbers in the reporting tool are the same as the numbers in Excel.
- The new reporting tool has no built in text-editor. Therefore, by using a built-in Excel export function in the reporting software, the reports are exported to Excel. In Excel, the reports are formatted to the right fonts and colors.

6. STAGE 3: REFLECTION & LEARNING

Insights from the implementation of the new reporting software to replace spreadsheets at the FoodCorp during the ADR project were often a direct cause to change or revise things in the IT artifact. This stage builds on the principle of guided emergence, meaning that theories and practical insights constantly adjust and improve the design of the artefact.

6.1 GUIDED EMERGENCE

When the new reporting software was delivered, training and implementation on the software resulted in the change of a dimension in the ERP system for ICO relationships. In addition, when it became clear that the data in the reporting tool could be exported back into the RDBMS, the advantages of keeping Excel for drill down analysis emerged. With these new insights, it is possible to schedule an export of the reporting tool to the RDBMS and from there, export a SQL view to Excel.

Phase three in the IT artefact: Separating the financial reporting process in five steps, was added after practical insights and experience during the implementation of new reporting software. Because it became clear that decisions needed to be made where new journal entries should be entered and report structures should be maintained, because multiple options were possible. There was no right solution to decide where (e.g. ERP, BI, Reporting tool) such events should take place. Therefore, the model was adjusted by dividing the financial reporting process in five steps and consequently evaluate where each step of the process should be performed.

The tradeoff between end-user flexibility and the risk that a shadow IT environment may emerge (Phase four of the FRASIT-framework) is something which was added after new insights that spreadsheets are not per definition shadow IT. To decouple the term shadow IT from the IT type, a trade-off between end-user flexibility and the risk that shadow IT may emerge was added to phase four of the IT artefact. This trade-off is based on the premise that software where end-users have more possibilities to add new data, store data and transform data, the risk of shadow IT increases.

Typically, spreadsheets and financial reporting software are more end-user oriented and should be more prone to transform into shadow IT in the longer term. ERP and BI systems are more IT department oriented and when most of the financial reporting process is done in these type of systems, shadow IT is less likely to emerge, according to the FRASIT-framework.

7. STAGE 4: FORMALIZATION OF LEARNING

The learning from and ADR project should be further developed in solution concepts for a class of field problems. These outcomes can be formulated as design principles and with further reflection, as refinements to theories that contributed to the initial design.

In this ADR research the solution concept is the FRASIT-framework: an approach to analyze and arrive at a financial reporting architecture that removes shadow IT. The class of field problems in this ADR project is a financial reporting architecture consisting of spreadsheets and 'single use license' software used as shadow IT by the end-users, besides the ERP and BI system.

7.1 GENERALIZATION OF THE PROBLEM INSTANCE

ERPs store a vast amounts of data. Traditionally, ERPs have very limited reporting capabilities. ERP vendors focused more on architecture and scalability.

With the help of a BI software and additional Data warehouse technologies, the ERP data can be turned into meaningful reports. BI can group, add and perform calculations on that data. Furthermore, all kind of text formatting, graphs and table options are available.

The drawback of reporting in the BI layer is that BI is focused at creating reports of historical data of the ERP. BI has usually no possibility to actually type new data. In addition, reporting in the BI reporting requires specific knowledge, such as SQL and knowledge on RDBMS. Therefore, the creation of the financial reports for the end-user is often performed by a business analyst of the IT department of an organization, in cooperation with the end-user.

Because of these two characteristics of BI systems (based on historical data and it requires specific knowledge), BI reporting is often not sufficient for the end-user. BI requires very precise definitions of business rules and concepts. For example, when a situation requires that data from a couple of years back is also included in the report, it requires an adjustment of the IT department. Besides, when cost centers fall in a cost center category, but a situation requires that the end-user wants to map those cost centers temporarily to another category for ad-hoc analysis, it is not easily adjustable in the BI by the end-user alone. Even though the BI offers many possibilities to create a flexible report where the end-user can filter and select on specific datasets and create mapping structures via secured intranet portals, in the end, the reality is that the end-user often requires something different than initially was anticipated and programmed in the BI software.

Because end-users in the finance department want solutions to their needs, they start to work around the limitations of the BI software. Excel is often the convenient answer to that need, simply because it is very flexible. End-users can extract data to a spreadsheet database and create the reports there by themselves using multiple formulas and cell references. In addition, spreadsheets offer very good analytical capabilities of datasets with the help of the pivot table.

When end-users start to work around the official IT, a shadow IT environment emerges. Shadow IT are all IT solutions which do not receive any formal approval and maintenance of the IT department. Shadow IT can emerge because end-users have a feeling that there is a gap between what they need and what the official IT can deliver.

From an IT perspective, the drawback of Excel reporting for the end-users is that it is not a completely secured BI/reporting tool. Excel reporting is often surrounded with a lot of inefficient and unstructured processes. People spend too much time wrangling data and fine-tuning reports instead of making actual informed decisions based on these reports. Therefore, the use of Excel, although very flexible and fulfilling the needs of

the end-user initially, can result in hidden costs for organizations because of wasted time and effort. For example, even when spreadsheets are initially connected to the Data Warehouse, it is not uncommon that datasets are copied to other spreadsheets. The result is that this data quickly becomes outdated. Other practical problems arise in the field of accidentally changing or removing values without a possibility to trace it back.

Furthermore, Excel reporting as a form of shadow IT may result in several risks regarding information security, version control risks and data integrity risks. For example, end-users maintain their own lists in a spreadsheet, based on parameters in the ERP. Someone else in the organization may not be aware of such a list, resulting in multiple versions of the truth of the same data.



Figure 12: Generalization of the problem instance: A shadow IT environment for financial reporting

7.2 GENERALIZATION OF THE SOLUTION INSTANCE: FRASIT-FRAMEWORK

The solution instance is a financial reporting architecture that removes shadow IT. In order to arrive at this new financial reporting architecture, a four phase framework is created: called the FRASIT-framework. The framework consist of four phases:

- 1. PHASE ONE: Analysis of the shadow IT architecture
- 2. PHASE TWO: Analysis of the IT capabilities and limitations
- 3. PHASE THREE: Evaluating the financial reporting process
- 4. PHASE FOUR: Building of the new financial reporting architecture

PHASE ONE: Analysis of the shadow IT architecture

Investigate the risks and benefits of each shadow IT system

PHASE TWO: Analysis of the IT capabilities and limitations

Combine knowledge of the IT department about the capabilities and limitations of the IT with the knowledge and
 needs of the end-users

- Determine who is responsible for reporting standards
- Initiate a software selection process for a new reporting tool to replace spreadsheets

PHASE THREE: Evaluating the financial reporting process

Recording data Storing data Transforming data Creating recurring reports Creating ad hoc reports

Figure 13: The first three phases of the FRASIT -framework



Figure 14: Phase four of the FRASIT-framework

7.2.1 PHASE ONE: ANALYSIS OF THE SHADOW IT ARCHITECTURE

The first phase is concerned with investigating the risks and benefits of the current shadow IT architecture and consists of four sub-phases.

Table 9: Phase one of the FRASIT-framework

1. Determine the relationship between the IT department and the end-users

- Lack of understanding between IT department and end-users?
- Departmental constraints?
- Costs?
- Opinions of end-users on capabilities and limitations of corporate IT?

2. Determine the use of information in the shadow IT system

- **Operational**: Shadow IT systems used to monitor and track the workflow of operational processes, such as listing of unpaid invoices and open claims.
- Analytical or Management Information: Shadow IT systems used for management decision-making and analytical review. For example, to evaluate amounts or ratios over a certain period.
- Financial: Shadow IT used to create financial statements.

3. Determine the shadow IT risks

- Security
 - Limited access to spreadsheets on the network
 - o Password protected spreadsheets
 - o E-mailing spreadsheets
 - o Data leaks

• Version control

- Excel Track Changes in a shared spreadsheet
- o Structured directories/folders for business units, periods, and type of spreadsheets
- Naming version when saving spreadsheets
- More than one person responsible for data and maintenance / spreadsheet silo (dependency risk)
- o Multiple persons working on the same spreadsheet

• Data integrity

- Separation of data from source systems
- o Lack of input controls that ensure data integrity (e.g. data type, business rules)
- Manually rekeying or copying data between spreadsheets
- 4. Determine the shadow IT benefits for financial reporting compared to corporate IT
 - Ease of drilling down on dataset or reports
 - Flexibility (e.g. exceptions on business rules)
 - Information is readily available (e.g. Load-window time)
 - Presentation and formatting capabilities

7.2.2 PHASE TWO: ANALYSIS OF THE IT CAPABILITIES AND LIMITATIONS

Once the risks and benefits of each shadow IT system are investigated, the limitations and capabilities of the current IT systems needs to be analyzed. Typically, this means a thorough investigation of the ERP system, the BI tool and the available spreadsheets, combining the knowledge of the IT department with the insights of the end-user. In addition, decisions need to be made who is responsible for reporting standards within an organization. Is it the end-user or is it the IT department? How often do reporting standards change? There are a lot of factors which determine what the most optimal solution for the architecture will be.

Optionally, a software selection process should be initiated to evaluate whether or not a new reporting software application can improve the spreadsheet situation.

LIST OF REQUIREMENTS FOR FINANCIAL REPORTING SOFTWARE TO REPLACE SPREADSHEETS

The following list of requirements can be used to evaluate financial reporting software:

1. Import of the ERP system and the BI

- Does the company have experience with our ERP and BI system?
- Can the reporting software load dimensions?
- Is there a limit on the number of dimensions?
- Drill-down capabilities to transaction level in the ERP system?
- How does the software handle periods, fixed or user defined?
- Is there a limit on historical years and periods?
- Possibility of 'sending' the mappings made (report structure) or any other adjustments in the reporting software back to the BI/RDBMS tool?

2. Mapping of Chart of Accounts

- What is the process of mapping the chart of accounts to reports?
- How flexible is this mapping process, easy to change or is it fixed?
- Multiple versions of mappings possible, based on division type?
- How clear is the mapping overview when approximately 750 accounts need to be mapped?
- When a new account is created in the ERP, how does the reporting software tool notice that?

3. Version Control

- What version control capabilities does the software offer?
- When a journal entry is posted in the reporting tool, but not in the ERP system, how does the software separates those?

4. Consolidation structure of business units

• When the consolidation structure changes, how easy is it to change that in the reporting tool. For example from a minority interest to 100% ownership. Or when new companies are added.

5. Actuals vs Budgeting

- Report based on Actual vs Budget
- 6. Periods
 - Fixed or flexible, weeks, quarters
 - Fiscal year
 - How to analyze a year with last year, a period with multiple periods of earlier years?

7. Elimination entries

• How does the software eliminate?

- Eliminations based on the General Ledger and eliminations not directly traced to individual ledger accounts.
- 8. Multi-currency
 - How does the software handle foreign currency effects?

9. Excel import/export

- Possibility to export reports to Excel or other programs?
- Possibility to import reports or datasets from Excel?

10. Adding notes and comments to reports

• Possibility to add comments or other additional information to a report.

11. Create an annual report with notes to the accounts

• Possibility of creating an annual report including comments and notes.

12. XBRL support

• Export to XBRL?

13. Technical requirements

- Server type, Windows or Linux for example
- Hardware requirements

14. Implementation plan

- How many days?
- Support after implementation?
- 15. Price
 - Fixed and annual license costs?

7.2.3 PHASE THREE: EVALUATING THE FINANCIAL REPORTING PROCESS

The end-to-end financial reporting process should be divided into five broad categories. The purpose of this categorization is to evaluate which IT solution should be used for each particular part. It is possible and sometimes even needed to do several steps at more than one IT block. For example, recording data is done at the ERP level in the form of journal entries by accounting employees, whereas an adjustment entry wanted for the monthly report for the bank is entered in a spreadsheet in the end report. Directly entering an adjustment entry in the ERP may not be possible, because there is often a load-window between the ERP and End-reports via the Data Warehouse (e.g. no real-time connection).

There is no one-size-fits-all solution. A careful analysis, combining the knowledge of the IT department of the capabilities and limitations of the IT systems and the needs of the end-users is needed to be able to make the most optimal decisions.

- Recording data: This step is concerned with entering new data in the form of numbers and comments.
 - These can be journal entries and adjustment entries in the General Ledger and the Trial Balance (including additional data entries in dimensions and sub-administrations). In addition, recording data can mean informal notes to describe (internal) reports and more formally the notes found in an annual report.
- Storing data: Physically saving or storing financial data.
 - Saving or storing financial data can be done in the corporate Data Warehouse or more locally in spreadsheet tables or the database of the reporting tool. It is also possible to make combinations, for example: an export to a spreadsheet database using Microsoft SQL Server.
- Transforming data: Transforming data is concerned with grouping or mapping of source data.
 - Examples are: cost center in a cost center group, mapping division numbers in a division type, grouping ledger accounts to a type of an expense, mapping the chart of accounts to different

report structures, assigning a range of cost centers to a budget holder, create a cost category based on account number + cost center.

- **Creating recurring reports:** Recurring reports such as Balance Sheets, Profit & Loss Statements and Cashflow statements including making adjustment entries on these reports.
- **Creating ad-hoc reports**: Ad-hoc reports and analysis, such as the tracking of expenses related to subcontracted work for all foreign production divisions.

7.2.3 PHASE FOUR: BUILDING OF THE NEW ARCHITECTURE

Once the capabilities and limitations of each IT component is investigated and decisions have been made where each part of the financial reporting process will be performed and the responsibilities of the IT department and the Finance department are determined, a new architecture can be build.

As long as the IT department and the Finance department are involved with the building of, and changing the architecture, shadow IT will not exist. However, depending on which IT blocks the emphasis is on regarding the five steps of the financial reporting process, there is more or less risk that shadow IT may emerge.

The new financial reporting architecture can be either IT oriented, meaning that there is more emphasis on the ERP and BI tools or either end-user oriented, meaning that more of the reporting process is done in spreadsheets and optionally the reporting software.



Figure 15: Trade-off between flexibility and potential shadow IT risk

Potentially, the IT dominant approach is less likely to turn into shadow IT in the long term, because the IT department creates and maintains the reports and reporting standards there. However, in general terms there is a trade-off in end-user flexibility, because the end-user can't change reports themselves.

7.3 DERIVATION OF DESIGN PRINCIPLES FROM THE DESIGN RESEARCH OUTCOMES

In this paragraph, four design principles are formulated from the FRASIT-framework. Consequently, the second research question is answered here:

What are design principles leading to a financial reporting architecture without shadow IT?

1. Communicate reporting standards with the IT department

Communication between end-users and IT department about (new) reporting standards is vital. When endusers are creating a new list based on source data, the IT department can ascertain if this may be conflicting with other reporting standards. Furthermore, the IT department often knows what data is available in the ERP and how that data can help the end-users in creating the required report.

2. Maintain mappings of source data centralized and not in a spreadsheet

Mappings of source data or reporting standards based on source data, should be maintained centralized. This ensures data governance on these reporting standards.

Preferably, reporting standards are maintained on the intranet where multiple end-users can access or maintain the mapping. However, new mappings cannot be created there, only maintenance.

In addition, BI offers data integrity controls on the reporting standards compared to a spreadsheet environment. In a spreadsheet, a user can type whatever he/she wants, regarding any business logic. These BI integrity controls secure the information quality within an organization.

3. Use spreadsheets for analysis and end-reporting, but not for maintaining or adding new data

New datasets should not be created in a spreadsheet database, because these datasets can start their own life. Instead, create an SQL view of the required data in the Data Warehouse with the help of the BI system and the IT department. This dataset is governed by the IT department. Export that view using a secured SQL connection to Excel. End-users can drag and drop and filter on any dataset they want with the help of the pivot table.

4. Introduce a reporting tool in combination with a dedicated database to replace spreadsheetreporting

Compared to a spreadsheet environment for end-reporting, a secured reporting tool in combination with a database always ensures that data is up to date. What is entered in the ERP is available in the reporting tool. Unlike a spreadsheet, a reporting tool cannot work without a database connection. Because there is no separation of the source, data snapshots are not possible anymore.

A reporting tool which can export back to a RDBMS is advisable. Any new data or grouping, added by the enduser, in the reporting tool can be controlled for inconsistencies.

7.4 DISCUSSION, LIMITATIONS AND FUTURE RESEARCH

Gregor & Hevner (2013) presented a framework (in: Positioning and presenting design science research for maximum impact. *MIS quarterly, 37*(2), 337-356) to assess the contributions of design research.

Identifying a knowledge contribution in design research is difficult. A fundamental issue is that nothing is really new. Everything builds on some previous idea. The degree of knowledge contribution can vary: there might be incremental artifact construction or only partial theory building, but it may be significant because it is 'new to the world'. In addition, the knowledge contribution could be offset by the practical impact the IT artifact has in a knowledge area.

According to Gregor & Hevner (2013), a design research project can be classified in either one of four types, depending on its starting point in terms of problem maturity and solution maturity.



Figure 16: DSR Knowledge Contribution Framework based on Gregor & Hevner (2013). The IT artifact (FRASIT-framework) in this design research is positioned as 'Improvement'.

A design research in the improvement quadrant is aimed at creating better solutions in the form of more efficient and effective products, services, technologies, processes, or ideas. Researchers must be able to clearly demonstrate that the artifact either does not exist or is suboptimal in the application context. Researchers will draw from a deep understanding of the problem environment to build the innovative artifact as a solution to important problems.

The application context for the IT artifact (FRASIT-framework) in this design research is a financial reporting architecture (at larger organizations) where the IT department maintains the corporate IT (ERPs, BI reporting/Data Warehouse solutions and other corporate software) and the end-users want practical solutions that work for them to create the required reports and do the required analysis.

Because end-users want solutions that work for them, they may start to work with own software in the form of buying 'single use license' software or by creating complicated spreadsheets. The available literature on shadow IT is very limited. The available research mainly focusses on the outcomes of shadow IT: risks and problems regarding corporate information security and data integrity risks. Literature on why end-users have a need to work around corporate IT is very limited and in most studies it is said to be a result of the lack of understanding between the IT department and the end-users. Interestingly, in this research, shadow IT was not a result because of a lack of understanding between the IT and the end-users. At FoodCorp, shadow IT emerged because former end-users purchased and installed specific reporting software on their own. When new people enter the organization, knowledge about that software is lost. In addition, new end-users have to find a quick solution to be able to create reports. In addition, shadow IT emerged at the FoodCorp because end-users have a feeling that corporate IT is not sufficient for their needs.

Research that actually investigates the end-users' needs in the finance department and their perceived benefits of the shadow IT environment consisting of multiple complex spreadsheets does not exist. In addition, research on how to arrive at a financial reporting architecture without a shadow IT environment, based on concrete steps or advice does not exist.

The FRASIT-framework is able to analyze a shadow IT architecture at an organization and arrive at a new financial reporting architecture without shadow IT by means of a four phase framework. The first phase is concerned with a risk versus benefits analysis of the current shadow IT architecture. This risk versus benefit analysis is based on multiple literature sources explaining shadow IT risks, spreadsheet reporting risks and literature about the benefit of using spreadsheets instead of a typical BI layer. In addition, phase one is concerned with investigating the relationship between the IT department and the end-users.

The second phase is concerned with a thorough investigation of the capabilities and limitations of the corporate IT, regarding the needs of the end-users. The third phase is concerned with systematically analyzing the financial reporting process in five steps. In phase four, the actual building of the new financial reporting architecture can take place. Basically, the capabilities and limitations of each software system is evaluated against each of the five steps of the financial reporting process. By combining the knowledge of the IT department and the end-users, decisions can be made in which corporate software 'block' each of the five steps in the financial reporting process should take place.

7.4.1 LIMITATIONS

This research has some limitations regarding the generalization of the problem and the solution instance, because this research took place at one organization and is only a small case study. There was only one person (Supervisor I&A) who could comment on the ERP and BI capabilities and limitations for financial reporting. In addition, risks and benefits of using spreadsheets to work-around the BI software were only commented on by the Corporate Controller, Commercial Controller and the Supervisor I&A. Although this research addressed the benefits from both the end-users' perspective and the technical perspective (e.g. IT department), the benefits are subjective and are based on the organizational context: specific software systems and the specific needs of the end-users at FoodCorp.

Investigating the benefits of using spreadsheets instead of the official IT, consisting of other ERP and BI systems may result in other findings. For example, a benefit at the FoodCorp was the ease of drilling down on datasets with the help of the Excel pivot table, however this may be a specific drawback of the BI solution at the FoodCorp.

However, the ERP is from a big international software vendor, and is used at many production facilities worldwide. The BI tool Cognos is a big player in the BI world and has approximately 33% of worldwide market share. Still, the conclusions of this research would not necessarily be applicable to all ERP and BI systems.

The latest news about Cognos BI is that they offer, as of December 2014, a tool called Cognos Watson Analytics. This tool is aimed more to the end-user and enables simple drag and drop of datasets (www.ibm.com). Maybe that this BI tool can solve the issue faced at FoodCorp that 'BI is too fixed' and that it requires specific knowledge on SQL and RDBMS. In addition, it must be noted that Cognos sells a specific financial reporting tool called Cognos Controller, aimed at the end-user in the finance department. However, this is a reporting tool and not a traditional BI tool.

The IT artifact also has some limitations regarding the external validity. The tradeoff between end-user flexibility and the risk that a shadow IT environment may emerge is something which is based on the situation at FoodCorp and by the insights of the researcher. Further, the relationship between end-user oriented IT and IT department oriented IT is a term created by the researcher to be able to distinguish the risk of shadow IT emerging versus the type of software. (e.g. spreadsheets are not by definition shadow IT)

In addition, the four phases in the framework incorporate a fairly level of abstraction. A researcher who is not familiar with financial reporting in general and some basic knowledge about relational database systems will probably have a hard time understanding it.

7.4.2 FUTURE RESEARCH

The best test for the validity of the FRASIT-framework is to use the framework at different organizations and assess its usefulness. The FRASIT-framework can either be used in scientific research or as a practical guide for software consultants.

Future research should further investigate the usefulness of this model in larger organizations where the corporate IT is not physically nearby and what consequences that may have on the financial reporting architecture. In addition, some organizations may have more strict reporting standards than FoodCorp, or multiple finance departments need to work with the same reporting standards instead of a handful of centralized corporate accountants. In such situations, choices on who is responsible for data governance and reporting standards may be much more important. Based on the FRASIT-framework, more of the reporting process should be done in IT department oriented IT in such organizations. In other words, less flexible for the end-user, but less risk on shadow IT risks such as version and data integrity problems.

Further, the relationship between IT department oriented IT and less risk on emerging shadow IT, versus enduser oriented IT and more risk on emerging shadow IT should be further investigated. At this moment, this relationship is nothing more than a premise based on insights of the situation at FoodCorp. One possible way to investigate this relationship is to research at multiple companies what types of software are more likely to turn into shadow IT.

In addition, the FRASIT-model should be tested in other departments (e.g. sales, logistics, planning, purchasing, marketing). End-users in these departments may or may not experience similar issues. Issues regarding the needs by the end-user and the possibilities the official the ERP and BI offers in answering that need.

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APPENDIX A- SCHEMATIC OVERVIEW OF THE NEW FINANCIAL REPORTING ARCHITECTURE AT FOODCORP



APPENDIX B- INTERVIEWS

B.1 INTERVIEW SHADOW IT WITH SUPERVISOR APPLICATIONS & INFORMATION

Introductory question

1. Q: What is your function or position within the company, can you describe your main activities and responsibilities?

A:"My function is simply said, making information out of data. That means that the raw data, entered in the ERP such as journal entries for the finance department, will become information, with the help of reporting tools such as Cognos. And that people can work with that information."

The rise of the current Information System

2. Q: When were the ERP and the Business Intelligence system implemented?

A: "In 2005, the current ERP system was implemented. We did have another ERP system at that time. Since 1992 we had an ERP system from Baan. In 2003/2004 we concluded that ERP system was not sufficient anymore. Mainly because the database of this ERP was not easily accessible. In short, this means that data first needed to be aggregated in some sort of report, before it could be extracted."

3. Q: And at the same time, the Business Intelligence Cognos was implemented?

A: "Yes, the vendor who did the implementation also delivered some peripheral software, including Cognos and the Business Performance Warehouse."

4. Q: I do understand that purely and ERP system is not sufficient for reporting and analysis, so the decision for Cognos, was it was the advice from the implementation partner?

A: "Yes exactly, creating OLAP cubes and other analysis is something you do with Business Intelligence and not with ERP. And indeed, Cognos and the ERP were delivered to complement each other."

5. Q: And for example, a leadsheet mapping in Cognos, did you create that, are you always involved with such mappings? And who decided it will be a good thing to aggregate, in this case the Chart of Accounts, to a certain level?

A: "Yes I do make those mappings or lists from the ERP data, but in the case of your example, that arrangement of the chart of accounts was implemented by the external consultant and the finance guy back then, during the implementation. But, during the implementation in 2005, I had a different role, more concerned with the technical aspect and less with the soft side, for example creating specific information for the finance department.

When we had to think about the arrangement or in this case, aggregation of data in the form of the chart of accounts, we decided, also in cooperation with the implementation consultant, to do such mappings or arrangements outside the ERP system. Because this is more flexible, you are simply not constrained to any future changes in the ERP. It is possible to create such mappings in the ERP, but that could have adverse effects when in the future, when things change in the ERP system."

6. Q: And who decided to use Excel in combination with such a leadsheet mapping? Because a leadsheet is not an end report, more something 'inbetween'. From raw data in the ERP to end reports in Excel.

A: "Yes, but initially, Excel was not involved. Cognos had a tool called Powerplay, in short, it was a tool to create reports from OLAP cubes and extract specific information out of these cubes. But, this tool had costs in the form of licenses, but more importantly, it required specific knowledge. Knowledge about OLAP cube properties, such as predefined things. I think I can best illustrate this with an example of an article, which is part of an article group and so on. Anyways, compared to the Excel pivot table function, it is simply less flexible. With Excel, it is more user friendly to turn and slice datasets. So after a while, people began to use the pivot table in Excel, instead of Powerplay.

But another reason I think is, when people leave the organization with that specific knowledge about Powerplay, and the new employee doesn't receive the proper carry over training, people quickly find their way to Excel, because that is something they know."

7. Q: Okay, and talking about another mapping which currently resides only in Excel, the so called ABCDE mapping (a functional P&L mapping based on division type, account number, cost center). First of all, to make this clear, you did not know its existence, did you?

A: "Indeed, that mapping based on division type, ledger account number and cost center, was something I did not know."

8. Q: But then it would be interesting to know, would the current problems be solved when it (arranging the mapping in Cognos instead of Excel) was directly in Cognos', or in cooperation with the IT department?

A:"Well, before that mapping started its life in Excel, we did have a mapping in Cognos, based on account number and divison type, but the addition of cost center, to assign it a place in a report, was new for me. But looking back, this problem should have been eliminated by creating different ledger account numbers for each cost center. And not, assigning multiple cost centers to one ledger account number."

9. Q: But the controller who designed this mapping in Excel did not communicate it to the IT department?

A:"No...The drawback of Excel. It is so versatile, easy to create something of your own, but in the long run, it is not suitable for maintaining. And that's what we see new, mappings have their own life in Excel, and there is no real check on it, or multiple people each have their own mappings or lists, apart from formerly created lists in Cognos. And yes, then there comes a point in time that things are becoming unworkable, and it's time to sort all these things out and find the differences between these lists"

10. Q: In what way where the requirements or needs of the finance department evaluated during the software selection process for the ERP and BI software back then?

A:"We did follow some software selection route back then. We looked to JD Edwards, SAP, PeopleSoft. And from what I remember, we designed a case which every software vendor presented to us. Purely talking about the needs of finance, you could ask that the finance people."

11. Q: So, instead of internal reporting matters, now a question about the software for external reporting. Was the IT department involved by the selection and implementation of CaseWare?

A:"In short, the whole Caseware story was something of the controller who is not working here anymore. IT department was not involved in any way with that software. Not with selection and also not with maintenance. The software was only installed at his computer."

12. Q: Okay, so it is hard to analyze more about that today.

A:"Well, it's not that I want to be involved with every type of software or maintenance, especially when it is really specific one, such as this annual reporting software. But it is advisable to be involved in some stage, to

know what it does and what its data source is. Especially when it is software concerned with mappings or arrangements of source data. In most cases, end-users do not have a true understanding of what source data is available and what consequences that may have on their software.

So in the Caseware example, some information is not available by purely relying on the Chart of Accounts, so solutions are created within Caseware by the end-user, while it may be possible to extract more data from certain sub-administrations in the ERP system and use that instead. And the result is that if you tackle the problem in the source system, more people may benefit from it."

13. Q: Was IT department involved with the creation and development of the periodic reporting spreadsheet used by the Corporate Controller?

A:"No, However I only delivered the dataset which is also present in Cognos (Base datasheet). The whole aggregration up to a Balance Sheet, P&L etc. is something I was not and am not involved in.

So, to conclude this section of the interview. The origination of the current situation started around 2005, with the new ERP and BI implementation. The decision to use Cognos as an 'inbetween' layer started to arise because the reporting tool Powerplay was simply less flexible than Excel, people leave the organization and don't carry over the required knowledge for Powerplay, resulting in the fact that people tend to start to work in a program that is familiar: Excel. That in itself is not a bad thing, but in the long run, and especially when people are maintaining their own lists and databases, based on source data, things are becoming rather complicated and unworkable in the long run.

Then for external reporting purposes, the issues with the annual reporting software are again, separate maintenance of lists of mappings of source data, instead of a centralized system and that IT department was not involved at all with that software.

A: "Yes, and maybe that we don't have any policy how we want to report certain things. If I know how we report things, we can figure out what data and or mappings are needed, what data is available in the source and so on. And then we could centralize such data and maintain it."

Shadow IT – Motivations of using it

14. Q: What do you think is the motivation for using Shadow IT (Excel models and databases) among the people of the finance department? (Using Excel pivot instead of the Business Intelligence layer for EBT reports, doing consolidation tasks in Excel instead of CaseWare?)

(Refer to Powerplay)

15. Q: Do you think that controllers have a feeling that "the way to address the needs and problems to the IT department" seems to long? (The ability to express the requirements, support after implementation) As a reason of using Excel to meet their needs?

A: "Again, for us, the shift to Excel mainly had to do because of the knowledge required for Powerplay. So then, people start to work in something which is easier and something they know: Excel. And again, Excel pivot table is more flexible than Powerplay. The drawback of Excel is that it may be too easy to create something new, especially end-user maintained lists, databases or other information. Those things have a tendency to start their own life in an Excel environment

And we sometimes do offer people offer Excel datasets, but in the long-term such things should be maintained in Cognos"

16. Q: Do you feel there are any data security risks associated with information security or leakage, with regard to using complicated spreadsheets?

A: "Well, potentially that could be. But that has more to do whether or not people are sharing those datasets in Excel. You could ask them about that, I suspect that it not really the case, since people use their own databases or lists by themselves. Our network directories and folders are secured"

17. Q: Do you feel there are any risks associated with inconsistent business logic with Shadow IT?

(Refer to maintenance of these lists)

Shadow IT - Benefits

18. Q: Do you see these complex Excel sheets as a form of Shadow IT as a good thing? Are you promoting it, because it is a quick and cheap solution in the short term, which does not require IT support in order to meet the needs of the end-users. In other words, it is some sort of data maintenance, so your workload is less?

A:"Sometimes I do deliver Excel datasets to people, (not the finance department) because people can use the pivot table function. So, maybe I am promoting it. But, those are datasets which are SQL tables in Cognos. These Excel sheet do not contain new data.

The big problem is when people start to make their own lists or datasets. Then things start to get their own life and in the long run, things become unworkable, because source data appears to be different, based on the user made lists."

Interview Closing

19: Q: Would you like to add anything else?

"Not really, you can always ask more things later on."

Shadow IT - Motivations of using it (e.g. benefits over the BI tool)

1. Q: So, last year you began working at this company, can you explain what your considerations where to choose for Excel to create the group reports, considering the benefits it may have over the BI environment?

A:"Well an important benefit I don't see in your shortlist of benefits is the ease of presentation and text formatting. Especially when there is a need to supply the bank with a specific format, I can do that in Excel exactly how the banks want it. Well, maybe it would be possible in the BI layer but still, before the final report is sent to the bank, the report is sent to the CFO and back and undergoes several adjustments. For example to include a cost in this period or postpone it. In addition, the ease of which I can add columns of other periods or whatever and do certain text formatting, is something the BI tool cannot do in my opinion. The BI is simply too fixed for finance end-reports."

2. Q: But was there a consideration to build certain fixed/recurring reports, for example a more aggregated level or even a complete Balance Sheet for each single entity, and extract those reports to a spreadsheet and make the final adjustments?

A: "Well, such mappings/aggregations aren't the real issue here. The thing why the BI too is limited for financial reporting is that there are all kind of adjustments needed or wanted, before a report is sent to the receiving party. Anything I want to add, for example a part of a budget to analyze differences, a part of a former report is possible in Excel. Yes, theoretically it may be possible in the BI tool, but this takes more effort and time by the supervisor I&A."

3. Q: And talking about other benefits of this whole spreadsheet environment, compared to the BI environment, can you name specific advantages why Excel is still the best alternative?

A: "Yesterday I was doing some Budgeting things in the ERP system, and the problem there is that those changes are not readily available in the BI, because of the delay, (the situation with the databases being uploaded overnight) and this morning, just 45 minutes before I should deliver these budget reports, I receive a message that two of the four upload files have failed.

So yes, the enormous flexibility and the fact that that what you enter is available is definitely an advantage over doing things in the BI layer.

And even the (S3 Vlookup), what indeed a horrible mess is regarding manageability, the advantage of doing that in Excel compared to the BI is again, what I type is readily available."

4. Q: Regarding the decision to create the S3 Vlookup database in Excel, when or why was it made?

A: "About a half year ago we added it to Excel. The idea is to use it as a tool to determine the differences between the actual weekly EBT management reports and my period report, which contains four or five weekly reports. They are both P&Ls based on the same source, but in a different format. It is simply not acceptable for management to live with the fact that the four weekly reports added up together, show a different result than a period report also spanning four weeks, without a clear explanation.

The EBT grouping in the BI tool is not sufficient enough to drill down or filter specific things. Yes I can select things per cost center or EBT Line, but it is simply far less flexible than the Excel Pivot table. Because in Excel it is much easier to use the pivot table and to analyze or drill down specific datasets. The whole idea of this Vlookup mapping is for me to determine where the differences exist between the actual weekly EBT management reports and my period report, which contains four or five weekly reports. So Excel offers me the flexibility to analyze these datasets better than the BI EBT report.

From what I remember, the guy who worked here before me tried to build some model to actually pool those two types of formats of P&Ls. But that didn't work."

5. Q: And the creation of this EBT mapping in Excel using VLOOKUP, has it even been considered to create it within the BI tool with the supervisor I&A, because there already exists another EBT report for individual entities in the BI tool?

A: "No, the purpose of this operation was to find a solution or a tool to analyze the differences, based on the request by management. The Commercial Controller developed the first concept and now I am maintaining it. In my opinion, considering the purpose of the problem, the BI tool is simply not sufficient."

6. Q: And because you already created the monthly reports in Excel based on the S2 Database, it was easier to just paste or add this EBT mapping / Vlookup in there, instead of using a separate tool in the BI?

A: "Yes, when I am already seeing my General Ledger data and everything in Excel, there is no reason for me to not extent it with more useful information. And besides, I can control missing combinations with the pivot table somewhat with the pivot table by filtering on the #Value!."

7. Q: Apart from the fact that it works in Excel, a benefits of maintaining such a list based on combinations in the ERP, in the BI is that more people can access it because it is centralized. Do you think that the fact that the mapping only exists in one spreadsheet may be a risk?

A: "I Agree, that is part of the problem here or a risk. The transferability of such complex models or mappings is a problem. It is very hard to make other people understand what is going on in these spreadsheets."

8. Q: Besides the fact that it was not communicated with the IT department, how would you describe the relationship with the IT department in general, to express exactly what you need?

A: "The relationship between finance and IT is simply good. It is only three rooms down the hallway and the IT guy has a very strong knowledge of finance processes because he is a former accounting guy. So that is not really the issue here."

9. Q: Yes, I already noticed that, IT definitely understands what the issues are, with a little to no additional explanation.

A: "Yes. Still I think it is a good thing to have IT as a guardian of how we treat our data and that we don't manipulate everything with our Excel formulas. But again, I don't think the issues here are a result of the lack of understanding by IT what finance wants."

Shadow IT - Risks

Data Integrity risks

10. Q: At this moment, following my own analysis in the case studies, data integrity risk is the most prevalent one, because there is a separation in Excel from the source systems. For example, the annual report situation has no connection to the individual ledger accounts and the Vlookup database depends on the Cost Center + Account number in the ERP system, but there is no real check on that. What is your opinion regarding the data integrity risks?

A: "I agree on the data integrity risk, that is the most prevalent risk here. There is no possibility for a complete control where in the process something went wrong. The only thing I can do, is to ascertain an error in the end result compared to the ERP, and from there on, reasoning back to what the cause could be. Either somewhere that an Excel value is empty or that an account from the ERP is not mapped, but that is not easy to determine.

In addition, after a year of working like this, another important drawback of this spreadsheet environment is whenever I decide to make an adjustment in a monthly report, which has not been entered in the ERP, I need to maintain a list of adjustment in another spreadsheet, so that they can be entered in the ERP later. For example, when I decide to already include a plus 1 million in period 8, I have to maintain and determine what portion of that amount is adjusted in the ERP. So that is error prone."

11. Q: And talking about the numerous cell references, for example, from the S2 database to a Balance Sheet for a single entity there are four cell references needed. Do you experience practical issues with that? For example mistyping or accidentally changing formulas?

A: "Well, those cell references do not give me any practical issues regarding mistakes, for example deleting one. But what I do find a big hassle is each new period, I have to copy worksheet containing the Balance Sheets, P&Ls Cash Flows and manually inspect whether or not the cell references are still in place to assure that I am not missing anything.

In addition, the flexibility of Excel is also a problem that I create things, and copy new worksheets, add more columns, budget or a part of last month, things start to explode and the file sizes of Excel limits the ease of transferring it."

12. Q: So to conclude, there is a potential risk regarding accidentally changing values in the database containing more than 100.000 cells, but practically you do not experience issues with it?

A: "Well, the advantage of this set-up of ERP-BI-Excel is that I can always check a result with the General Ledger in the ERP system."

13. Q: So there is always a control mechanism in place to ensure that the reports in Excel reflect the results in the spreadsheet made reports.

A: "Yes exactly. So whenever I do something weird, there is always a possibility to check the ERP system. Indeed, there is a risk and we should be aware of that, but there is also a form of control mechanism to check it with the data in the ERP when things begin to look strange in the spreadsheet reports."

Security and version control risks:

14. Q: Talking about the security risks, and I already talked about that with the IT department, there is a good organization of secured folders and directories with limited access. In addition, you are not working with multiple people located in different departments or other locations on the same report. So based on my analysis, I would conclude that there are little to no security risks involved with the spreadsheet environment. Do you have any comments on that?

A: "True, regarding version control, it's just me who does the reporting for the whole group. It is very much centralized because all data including foreign entities is entered in the ERP here."

Q: I am asking this because it is not uncommon for spreadsheet studies to focus on the whole organizational problems regarding duplications of the same reports in different departments and transferring of complex spreadsheet models to colleagues for example, but that is simply not the case here.

A: "Well, we do have such a spreadsheet for the weekly reports, but that is outside the scope of your research. For the weekly reports we do work with one spreadsheet where multiple people from different departments, the Sales, and the Plant Controller and the accountant for those specific entities fill in their values in their portion of the report. But indeed, regarding group reporting it is very much centralized and it is only me who works on the spreadsheets."

B.3 INTERVIEW SHADOW IT WITH THE COMMERCIAL CONTROLLER

Q: I talked with the Corporate Controller and the Supervisor I&A. The interesting fact is that in the past, there was a tool called Powerplay, the end-user tool of the BI software, and Excel was barely or not involved. Powerplay was introduced during the the ERP and BI implementation. Since you are currently the only controller left at this organization who worked with that tool, I would like to ask you some questions about that particular tool and some questions about the ERP and BI selection/implementation process back in 2004/2005."

Shadow IT - The rise of the current Information System

1. Q: In what way where the requirements or needs of the finance department evaluated during the software selection process for the ERP and BI software back then?

A: "Well for the ERP selection we designed a business case which the vendors had to present, so for the ERP selection we had a good understanding of what we wanted. However, the BI was delivered during the ERP implementation by the implementation partner. From what I remember, we did not really have a requirements or selection process or gave any particular attention to it. The implementation partner of our ERP had good experiences with the BI, so both the ERP and BI were delivered at the same time in 2005."

Shadow IT - Motivations of using it (e.g. benefits over the BI tool)

2. Q: Can you tell me what can you remember from Powerplay (end-user BI tool)? A broad question, but for example, compared to the current BI tool? In the BI it is possible to create all kind of reports, but mainly fixed reports of historical data of the ERP. And yes, it is possible to select and filter for example on a period or cost center, but it is all very much fixed, selections can only be made in the selection window. After the report is generated and presented on your screen, you are unable to add or remove or filter anything in the report. So how did Powerplay compare to the current BI tool?

A: "With Powerplay it was definitely possible and easier to select and add periods or a budget, so after the implementation of the ERP and BI, it was used for some time, by the former Corporate Controller who was working here then. And from what I remember, that was not bad, it worked. But why it eventually was not used anymore or removed is something I don't really know"

3. Q: "Well, I talked about it with the supervisor I&A, at the most important reason he mentioned was that it definitely required good understanding of that program, so when people leave the organization that knowledge is lost. In addition, that tool also had license costs, but that was not a reason to remove it in the first place. Besides specific knowledge, were there any other drawbacks?

A: "Yes, well for me, the drawback of that Powerplay tool was the ability to drill down on my sales statistics. It was simply always hard to see, what am I actually doing here and what selections and filters are active. So I saw a number but the story behind that number is unclear. So yes, that problem can also occur with the Excel pivot table, but in Excel it is easier to see what are my active filters. And it is much more flexible to drill down by dragging a removing a certain column."

4. Q: "And besides drilling-down, what can you remember of creating a traditional Balance Sheet and P&L for example? Was that possible? Because it is possible to create a Balance Sheet and P&L in the BI layer if you really want to, but that really takes some effort to create it in cooperation with the Supervisor I&A".

A: "Yes, that was possible and the two former Corporate Controllers worked with that. The issue with the 'fixed' reports was less of a problem there from what I remember. For example, it was possible to select only a part of a P&L or even individual ledger accounts. But the problems which occurs because reports were too fixed is also a result of implementation.

For example, if we decide that cost centers 100 to 150 are overhead for all divisions. But after some time we realize that at the Holding company we have some other numbers, let's say cost center 15 and 16, which are also overhead, well then we have a problem with those BI tools. In Excel I can easily add or remove that in my pivot table, but not in the BI. Yes, we can change those mappings or groupings if we want to, but then we may have issues in other areas.

So the whole 'BI is too fixed compared to Excel' issue is partially a result of how do we implement the software according to our business'. So it may be more of an issue of ourselves then of the software itself."

APPENDIX C- RESULTS OF SHADOW IT ANALYSIS

C.1 S1: ANNUAL REPORT

- 1. Determine the use of information:
 - Financial: This group of spreadsheets contains all of the single entities' Balance Sheet and P&L, including (sub-) consolidations, eliminations and other adjustments such as Tax and IFRS.
- 2. Determine the complexity of information

Low. The sheets do not contain complicated formulas or references to other spreadsheets.

3. Determine the spreadsheet risks

- Security risks
 - For all shadow IT systems, security risks are virtually nonexistent:
 - **1. Limited access to spreadsheets on the network:** Only the controllers have access to this spreadsheet via structured and protected directories.
 - **2. Password protected spreadsheets:** Not protected with a password, but spreadsheets stay within structured and protected folders.
 - **3.** E-mailing spreadsheets: Company has its own mail server. Virtually no risk. These spreadsheets are not e-mailed or transferred to people outside the organization.
- Version control risks
 - This spreadsheet stays on a fixed place and only the Corporate Controller makes adjustments to it. Therefore version control risks are virtually non-existent, regarding multiple versions of the truth.
- Data integrity risks

1. Separation of data from source systems:

Source of the trial balance in contained in this spreadsheet is the annual reporting software, which is extracting its data from the ERP system. The annual reporting software maps each account number to a line item in the report. However, this mapping is lost when the trial balance is exported to Excel. There is virtually no way to see where each individual account number is positioned in the report. As a result of that, it is hard to know.

Adjustment entries, which also need to be entered in the ERP at account number level, are adjusted at the aggregated trial balance in the spreadsheet.

2. Input controls that ensure data integrity: No data integrity, you can change any kind of value.

4. Determine the spreadsheet benefits

The benefits of spreadsheets over the specific software are concerned with the drawbacks of that specific software: No version control at all and no possibility to undo changes. Apart from that, doing annual consolidation in Excel has no benefits.

- Expressive: N/A
- Autonomous: N/A, changing variables in a database is not desirable.
- Fast: N/A, to setup a database like this takes a lot of time.

- Portable: N/A, this database is not shared with others.
- Inexpensive: N/A
- Universal: N/A, this database is not meant to be used on other platforms.

C.2 S2: DATABASE AT TRIAL BALANCE LEVEL

1. Determine the use of information:

- Analytical or Management Information and Financial.
 - 1. Database contains the general ledger for all divisions in the group, including Cost Centers, Period Actuals, Period Budgets, Year to date Actuals, Year to date Budget.
 - 2. All other reports take their data from this central Excel database. Either directly with Excel formulas, pivot table, or indirectly with manual copy and pasting.
- 2. Determine the complexity of information:
 - High.
 - This database contains more than 4695 (rows) and 33 columns and is effectively an OLAP cube. This database consists of two parts, combined using Excel functions: =ALS(AU17="";"";AU17)

-Part 1: This part of the database is connected with SQL to the data warehouse. -Part 2: This part of the database adds more columns to Part 1 with VLOOKUP functions referencing to the VLOOKUP database.

Part 1 of the database S1. Note that the first row, the yellow marked boxes are explanations the researcher added. The bottom row indicated where the information or column finds it source.

Account group code	Account group	Divion or entity	Account number	Account name	Cost Center	Cost Center name	Period actuals	Period budget	Year to date Actuals	Year to date Budget
Group	Account group O	Division	Account	Account Translation	(nl) Cost Center Level 6	(nl) Cost Center Level 6 Name	Per.x actuals	Per.x Budget	2014 Actuals	2014 Budget
U2	U2-P.4.* Pay and Salaries	200	401100	Gross Wages	110	Production	0	0	0	0
BI	BI	ERP	ERP	ERP	ERP	ERP	ERP	ERP	ERP	ERP

Part 2 of the database S1. Note that the first row, the yellow marked boxes are explanations the researcher added. The bottom row indicates where the information or column finds it source.

Defines the type of account: B = Balance Sheet P&L = Profit & Loss	Defines the responsible budgetholder. Is barely used.	Defines the responsible executive. Is barely used.	Groups the Cost Centers, based on type. DirProd = Direct Production, VKF = Fixed Cost Factory, CD = Central Services, VKK = Sales Costs, ICO = ICO charges.	Defines the type of division. Prod = production, sales = sales, other = other.	Defines an EBT Category = Line item in a functional P&L for management	Defines an EBT Category = Sub - Line item in a functional P&L for management
B or P&L	Budgetholder	Executive	DirProd/VKF/CD/VKK/ICO	Prod/ Sales / Other	EBT Category	EBT Line
В	x	x	#WAARDE!	Р	#N/B	#N/B
P&L	x	x	CD	0	F	Overhead
VLOOKUP	VLOOKUP	VLOOKUP	VLOOKUP	VLOOKUP	VLOOKUP	VLOOKUP

2. On each cell in the database an Excel formula to combine Part 1 and Part 2.

	Purpose
Excel function:	
- 41 5/ 474 4 - 111, 111, 474 4)	Reference to database Part 1 and copies the
=ALS(ATTT=;;ATTT)	value. Database Part 1 is copied to another part
	of the worksheet and combined with Part 2.

3. On each cell of the Actual and Budget columns, an Excel formula to change GPB to Euro.

Excel function:	Purpose
=ALS(\$D21="200";BJ21/R\$3;BJ21)	If division is 200, the British division, numbers will be converted from GPB to Euro.
R\$3 = The annual average exchange rate.	

4. On each cell under the Part 2 Columns, VLOOKUP functions referencing to the VLOOKUP database S3.

Excel function:	Purpose
=ALS(\$AK2585="B";""; <mark>ALS(\$AO2585="P";</mark>	If account number is of type B(alance), do nothing.
VERT.ZOEKEN(\$E2585&\$G2585;lookup!\$M:\$U;5;ONWAAR); VERT.ZOEKEN(\$E2585&\$G2585;lookup!\$M:\$U;8;ONWAAR)))	If account number is of type P&L and

division type is Production= look for the account number (Column E) & Cost center (Column G), in the VLOOKUP mapping table in the domain M:U, column five.
If account number is of type P&L and Division type is Sale or Other = look for the account number (Column E) & Cost center (Column G), in the VLOOKUP mapping table in the domain M:U, column eight.

3. Determine the spreadsheet risks

• Security risks

For all shadow IT systems, security risks are virtually nonexistent:

1. Limited access to spreadsheets on the network: Only the controllers have access to this spreadsheet via structured and protected directories.

2. Password protected spreadsheets: Not protected with a password, but spreadsheets stay within structured and protected folders.

3. E-mailing spreadsheets: Company has its own mail server. Virtually no risk. These spreadsheets are not e-mailed or transferred to people outside the organization.

• Version control risks

This spreadsheet is a database and is not used to add or remove calculations or data (manually). It stays on a fixed place. Therefore version control risks are virtually non-existent, regarding multiple versions of the truth.

• Data integrity risks

Separation of data from source systems: This database in a spreadsheet is partially connected with the source system and partially separated. The balances from the ERP system are updated every 24 hour using SQL. The values from the VLOOKUP database are not connected to a source system, these values are connected with another Excel database.
 Input controls that ensure data integrity: It is possible to accidentally change a value, either numeric of text values. However, values will be updated again to the right balances after 24 hours have passed. It is also possible to accidentally break a formula in this database or remove a formula on one of the thousands and thousands of cells. However, Excel will show a small triangle, indicating inconsistent formula.

4. Determine the spreadsheet benefits

- Expressive: Flexibility in converting exchange rates from GBP to EURO, based on a division number.
- Autonomous: N/A, changing variables in a database is not desirable.
- Fast: N/A, to setup a database like this takes a lot of time.
- Portable: N/A, this database is not shared with others.
- Inexpensive: N/A
- Universal: N/A, this database is not meant to be used on other platforms.
C.3 S3: VLOOKUP DATABASE

- 1. Determine the use of information
 - Analytical or Management Information

1. This database contains mappings. Mappings from source system values, such as division number and cost centers. For example: a cost center number is mapped to a broader cost center category. The purpose of these mappings in S3 is to 'add' more information (seven columns) to the Part 1 database of S2, in order to create management reports.

				Prod/		
B or				Sales /	EBT	EBT
P&L	Budgetholder	Executive	DirProd/VKF/CD/VKK	Other	Category	Line

2. EBT mappings contain mappings for a different P&L format. An account number is normally mapped to a line item in either a Balance Sheet or P&L, a 1:1 relation. The EBT mapping is based on a combination of three variables:

Division type + Account number + Cost Center = EBT Line

- 2. Determine the complexity of information
 - Low

The complexity of information is low, because it is a large database containing mappings. Cell values do not contain formulas.

3. Determine the spreadsheet risks

• Version control risks

This spreadsheet is a database and is not used to add or remove calculations or data (manually). It stays on a fixed place. Therefore version control risks are virtually non-existent, regarding multiple versions of the truth.

• Data integrity risks

1. Separation of data from source systems: The mappings in this database are not connected to any source system. This is problematic, because the EBT mappings are based on a combination of three variables from the ERP system:

Division type + Account number + Cost center

When a new combination of Account number + Cost center is entered in the ERP, there is no notification in this mapping table, resulting in a situation where revenues and expenses are not presented on the correct line in the EBT report.

2. Input controls that ensure data integrity: It is possible to accidentally change a value, either numeric of text values. It is also possible to map wrongly. In other words, a person can type what he wants in this mapping table.

3. Manually rekeying or copying data between spreadsheets: Because this is a database containing mappings, there is no manually rekeying of data between spreadsheets.

- 4. Determine the spreadsheet benefits
 - Expressive: Flexibility in creating any mapping the controller wants, however this is not desirable.
 - Autonomous: N/A, changing variables in a database is not desirable.
 - Fast: N/A, to setup a database like this takes a lot of time.
 - Portable: N/A, this database is not shared with others.
 - Inexpensive: N/A
 - Universal: N/A, this database is not meant to be used on other platforms.

C.4 S4. MONTHLY FINANCIAL STATEMENTS FOR BANKS AND MANAGEMENT

1. Determine the use of information:

• Analytical or Management Information and Financial.

 Monthly Balance Sheets, P&Ls and Cashflow statements are created for the banks and management. For management, Actual and Budget and Actual vs. Budget is included.
 Financial Ratios are included.

3. It is possible to change the division number and period in the worksheet and with the help of Excel formulas, the report is changed to that period and division.

4. The mapping of the ledger account numbers to the line item reports for the banks only exist in the form of adding and subtracting account groups.

2. Determine the complexity of information:

• High.

In S4 Balance Sheets, P&L's and Cashflow statements are created using Excel formulas referencing to database S2. Within this worksheet, multiple cell references (+-6) are used from data to end-report.

 ALS(3C3120<=AV32;SOM:ALS(data13A36.3A35000; "="&AP148data1\$K\$6:\$K\$5000);0) Logical test: \$C\$120 stays always empty, AV\$2 = the period (reference to cell H2) → SUMIF = values in database S2 equals to AP148 (= text description of the account group), add the values under column K (the corresponding period) in S2. Return 0, when the logical test is not true. 	Step 1 = Filter all account groups from the database S2, place them in a worksheet with their corresponding Actual balances for all periods, depends on the period and division.
=SOM.ALS(data!\$A\$6:\$A\$5000; <mark>"="&'rapport per</mark> <mark>company'!\$Y52;data!\$L\$6:\$L\$5000)</mark>	Step 2 = Filter all account groups from the database S2, place them in a worksheet with their corresponding Budgeted balances for all

Domain is database S2 Criteria = Y52 (text description of the account group) Add the values in database S2 in column L	periods, depends on the period and division.
= <mark>-</mark> AU139/1000-AU140/1000-AU142/1000 Credit balances are made positive.	Step 3 = An Budgeted P&L for a division and period is formed + and Actual Budgeted P&L and Balance Sheet and Cashflow statement is formed by aggregating the account groups.
=SOM.ALS(\$AA\$1:\$AL\$1; "<="&\$H\$2;AA11:AL11) In domain (row in the report of step 3 containing periods) Period is smaller or equal to the period in \$H\$2 Add the values in row 11.	Step 4 = Actual vs budgeted reports are being generated by adding and subtracting the values from the separate Actual and Budget reports.
=ALS(F\$10=0;"-";-F11/F\$10) If the value is zero then no ratio. Otherwise divide two values	Step 5 = several ratios are added at the bottom of the report.

3. Determine the spreadsheet risks

• Version control risks

One controller uses this spreadsheet and this spreadsheet resides in the same directory. No version control risk.

• Data integrity risks

1. Separation of data from source systems: Indirectly, the values in this spreadsheet are connected with the warehouse using four times formulas. cell references.

2. Input controls that ensure data integrity: It is possible to accidentally change a value or a formula. No data integrity at all. This may become problematic, because there are four cell references needed from database to end-report.

3. Manually rekeying or copying data between spreadsheets: Parts of these reports are manually copied to other worksheets for further analysis.

- 4. Determine the spreadsheet benefits
 - Expressive: Flexibility in creating any report aggregation based on account groups, add certain ratios.
 - Autonomous: Easy to make last minute adjustment to reports or add notes, highlight cells.
 - Fast: N/A, to setup this reporting in Excel takes a lot of time.
 - Portable: N/A, this database is not shared with others.
 - Inexpensive: N/A
 - Universal: Easy to extract certain parts of the reports, place it in Powerpoint or e-mail it.

C.5 S5: ANALYSIS OF WEEKLY REPORTS FOR MANAGEMENT

- 1. Determine the use of information:
 - Analytical or Management Information

1. On the database of S2, multiple pivot tables are created to analyze and slice and dice the data in S2.

- 2. Determine the complexity of information:
 - Low
- 1. No Excel functions are used, only the built-in pivot table functionality of Excel.

3. Determine the spreadsheet risks

• Version control risks

Multiple pivot tables or parts of pivot tables are copied to other Excel worksheets, resulting in multiple versions of the truth.

• Data integrity risks

1. Separation of data from source systems: Sometimes, parts of these pivot table reports are copied to a new worksheets for further analysis. However, the data in this report is not connected to the source anymore.

- 4. Determine the spreadsheet benefits
 - Expressive: Very easy to drill-down datasets.
 - Autonomous: Easy to make last minute adjustment to reports or add notes, highlight cells.
 - Fast: Easy to create a pivot table of a dataset.
 - Portable: N/A, this database is not shared with others.
 - Inexpensive: N/A
 - Universal: Easy to extract certain parts of the pivot table, place it in Powerpoint or e-mail it.