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Digitalisation of the Core

Developing Dynamic Visual Reporting for the Case Company

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This thesis focuses on the replacement of the case company's current reporting solution by a modernized Business Intelligence solution. The objective of this thesis is to propose a conceptual, automated, and dynamic visual reporting solution for the users to support business needs and leadership needs. The case company launched a new strategic plan, and one initiative is to develop its personnel's digital skills. To support this initiative, the company tools must be updated to match the needs in the reporting.

The current state analysis concentrates on the current reporting practices and what kind of data the key stakeholders would like to have in their use. It identified that recently the company has implemented a new CRM solution, but the current reporting solutions do not fully support this data source, and there are other recognized limitations that affect the data leadership. The key stakeholders were interviewed about the needs related to data reporting to drive the business, and their insights were used in identifying the development areas. The results from the analysis and the stakeholder inputs informed the directions for the search for best practice and relevant tools from existing literature in the theoretical framework.

As an outcome of this thesis, the new company-wide reporting solution and distribution channel was proposed and implemented. The employees now have a modern BI-based reporting solution in place. Also, the preliminary blueprint for the new common data model was created to support further steps. The new solution is a starting point for the journey toward analytics and efficient data leadership at the case company. It has established the basis for further development by bringing the internal reporting to the modern era.

Keywords	Business Intelligence, leading with data, data modelling

Contents

Glossary

KPI	Key performance indicator. Measure how to present business, process etc efficiency and performance.
ERP	Enterprise Resource Planning. Data system which combines data from the different business processes.
CRM	Customer Relationship Management. Customer data management system which collects basic information and the customer insights.

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1 Introduction

The digital transformation of the business environment is a hot topic of the 21st century. Companies are trying to get value added for their current business, develop their processes, and develop their financial position and productivity with digitalisation in the markets. Big data, analytics, cloud services and business intelligence are just some of the keywords which the companies are looking forward to by transforming their way of doing business and implementing strategies.

The tools and the digital environment have evolved at a fast pace and this has been witnessed in the Finnish companies, too. Microsoft and PwC (2018) studied 22 Finnish organizations were surveyed to understand their approach to digitalization. 86% of the companies gave digital transformation high importance in their strategy. (PwC & Microsoft, 2018, p.9-12). As Pekka Horo, General Manager of Microsoft Oy, said (PwC & Microsoft, 2018, p.3) the CEO's expectation is that technology will have effect on their business more than other global megatrends and the digital leaders will show the way and outperform their competitors.

Digital transformation is not just technology. Rather, it is also a way of optimizing and developing the processes and culture. The transformation should be going beyond the company strategy instead of being part of it. (Tabrizi et al. 2019.)

This thesis will take a look at the digital transformation in terms of transforming old reporting approaches to the more agile and sophisticated analytics approaches, which will provide deeper knowledge, new KPI's and a more visual tool for the end user to support faster pace of making decisions and leading the teams, engagements and finally the person itself to support the company's strategy.

1.1 Business Context

The case company of this Thesis is one of the so-called Big4 companies (the Big4 is a nickname of the global audit professional accounting network companies). There are over 1000 professionals working in the company and annual net revenue is about 140

m€. Although the company is part of a global network, it is fully owned and managed independently and shares a global brand that contains common name, visuals outlook, and comment quality standards with other network entities.

Today, the main business areas are Assurance, Advisory and Tax and Legal and services. The company provides, for example, annual audit services, tax advisory service, mergers and acquisition service and management consulting services.

The company has launched a new four-year strategy campaign in 2020 and one of its key initiatives is to develop different kinds of digitalisation skills of the personnel. This also requires a new approach in a term of reporting and analysis solutions to support management and leadership needs to reach strategic initiatives. The software and reporting solutions are expected to be updated to match the new skills and capabilities of the company personnel and to provide maximize added value for the company and for the personnel. The reporting development for the top management has already taken place, but the common reporting for the team leaders, portfolio leaders, individuals and special projects is still provided in an old environment that does not provide the needed information and analytics.

1.2 Business Challenge, Objective and Outcome

The current common reporting infrastructure was established 2015 and it is based on old technology (mainly Excel reporting), which is very limited compared to modern BI-tools. The current data model gets data from the ERP and only limited data from the CRM. However, there is some crucial limitations in the CRM data and the potential that CRM data can provide cannot be unleashed with the current data model. Also, the HR data is not supported by the current data model. CRM is named as a key element in the new strategy period and to support transformation of current sales and business development and therefore CRM data is critical to support business leads. The new data model will be based on the ERP, CRM and HR systems and this will enable new KPI’s and BI analysis models for the team leaders, portfolio leaders and individuals.

The current reporting infrastructure is not capable of providing more advanced analytics for the end users. Also, the current data model does not support all the new platforms

that have been implemented in the past years (CRM & HR). With the new visualization and functionality, the KPI's will be updated to match current criteria. New analytic tools can provide much more measurable data and information to support decision making and measuring of the personnel. The new platforms should be adapted to the new data model.

Accordingly, the Objective of this thesis is *to propose a conceptual, automated and dynamic visual reporting solution for the users to support business needs and leadership needs.* The Outcome is *a conceptual, automated and dynamic visual reporting solution for the users to support business needs and leadership needs.*

This solution should combine the current data sources (ERP, CRM, HR, FI) into the one data model to provide **Power BI-**based advanced and visual analysis tool for the end user, which is fully automated (meaning the data set is updated on a daily basis). Also, this work should result in a company-wide concept and common rules on how to **create** and **publish** the reports for the end users. The reporting solution will, in the first place, contain 2-4 actual reports. The creation of the blueprint, data model and the reporting solution itself is included in the study and the needed documentation. However, the process related to how to create reports and how to maintain the infrastructure is not included in this study. This approach supports the outcome which is *a conceptual, automated and dynamic visual reporting solution for the us*ers to support business needs and leadership needs, instead of the more process orientated digital transformation approach.

1.3 Thesis Outline

The main source for data collection and analysis are interviews within the case organization. The interviews will provide the input to identify the current challenges and define the targets. As the goal of this study is to provide analytics tools for the end users, the study uses Action research methodology.

The Thesis contains 7 sections. Section 1 is the introduction presenting the case company and describing the business challenge, objective, and outcome. Section 2

describes the research approach and the data collection methods. Section 3 reports on the results of the current state analysis, which will contain currents status of the reporting, KPI's and data model and the challenges the company is facing with these at the moment. There will also be analyses of what the business is expecting from the new solution. Section 4 contains the conceptual framework, which is built from selected elements of existing knowledge and best practice. Section 5 focuses on the creation of initial proposals for the analytics platform, KPI's and data model based on the feedback of the data collection plan. Section 6 presents the results of validation and the final proposal with the modifications based on the last data collection results. This section contains a potential development plan and next steps. Section 7 contains the conclusion of the study and thesis evaluation.

2 Method and Material

This section describes the research approach and research design used in this study, as well as data collection and the research quality criteria selected for this thesis.

2.1 Research Approach

Choosing the right research approach depends on the nature of the business challenge and the selected tools and methods to collect the data. As different approaches have their own characteristics, there is certain logic which defines the choice of approach for a study. The research can be fundamental or applied research. The fundamental research expands knowledge and understanding, and it is highly appreciated in the academic field. The applied research leads to improving or creating products and services, new technologies or processes. (Hirsjärvi et al. 2015 p.132-133.)

Next, research is typically divided into qualitative and quantitative studies, according to the methods used. The quantitative approach is based on measurements, while qualitative approach looks more into how topics are perceived and experienced. (Adams et al. 2013, p.6.) The quantitative research uses the data in the form of number and statistics. The statistics and numbers are used to verify theories. The qualitative approach, on the contrary, utilizes various types of “soft” data, typically documented in the form of texts.

To find a suitable research approach, the research methods and research deliverables need to be taken into account (Kananen 2013, p.33-35). The common applied research strategies are Case studies and Action research. There are significant differences between these strategies. The Case study is based on the analysis of one or more cases. The Case study aims to understand some phenomena based on the detailed examination of cases. (Kananen 2013, p.37-38.)

Action research, as Tripp (2005, p.2,4) describes it, is a process which aims at bringing about change in the organization and contains certain characteristics such as setting pragmatic, innovative, strategically driven goals and should be well documented. Action research concerns action in practice and relies on co-operation in terms of expectations

and collecting experiences (Tripp 2005, 10). It results in the changes to practice after the implementation. The Action research cycle consists of several consecutive steps, as shown in Figure 1 below (Tripp 2005, p.4-5).

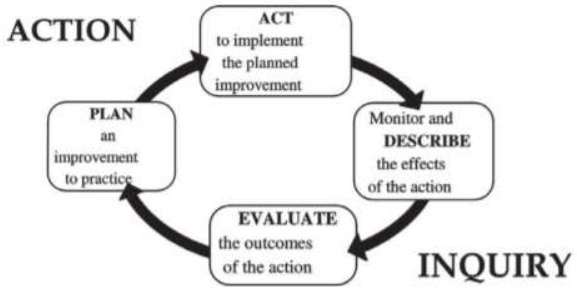


Figure 1. Action research (Tripp 2005, p.2,4).

As seen in Figure 1, the cycle is iterative, and the end of research is the starting point to next cycle. The cycle starts from the identification of the problem. The context, the practices and participants are identified in the beginning to understand the overall picture. The change of practice is identified in the Planning phase. The Act phase is like implementation. In this phase, the planning results are put into the practice. The Monitor phase is to evaluate the effects of the Act phase. The final phase evaluates the outcome and defines the success of the Action research. (Tripp 2005, p.9,10.)

This study uses qualitative research methods as the most suitable research approach. The qualitative research methods are selected for this study since they relate more to human encounters (interviews, experiences) than the hard data and figures. Due to the nature of this study, to create something for the end user based on their expectations, interviews and user experience will provide the needed data for the data collection and creating the proposal. In addition, this study will also utilize some elements of qualitative research, such as analysis of numerical data from the case company, but the methods used in this study (interviews, user experience) mostly rely on the qualitative research approach.

The research strategy of this study is Action research. The study is innovative instead of routine and aims to develop a new approach to benefit the case organization. It is

strategically driven as it is identified as one of the company's development initiative. It is also participatory as there is a nominated team to provide various insights and try out the change. Finally, this study is not explaining the phenomena but providing a problem solution. Such characteristics (in the logic of Tripp 2005, p.2,4) point to Action research as a research startegy. As the outcome, the study produces an innovative hands-on solution which supports the strategic initiative instead of a theory-based proposal.

2.2 Research Design

Figure 2 below shows the research design of this study.

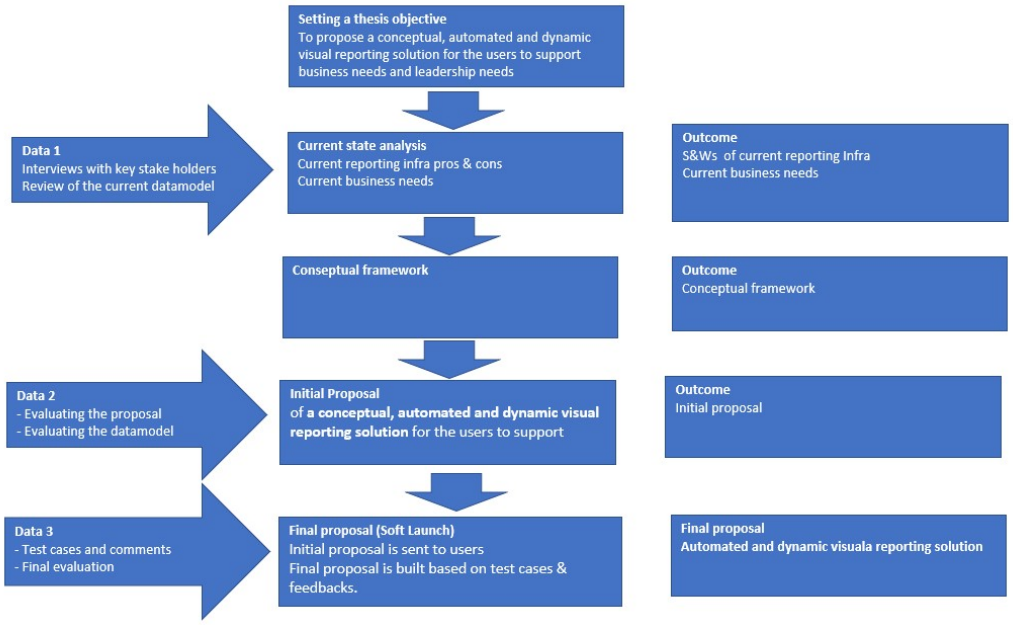


Figure 2. Research design of this study.

As seen in Figure 2, the first phase of the study is setting the objective to resolve the business problem. The second phase is the current state analysis. The current state analysis is conducted based on analysing the data collected from the case organization and its selected key stakeholders. As outcome of this stage, the business needs for the reporting platform and the current data model are defined.

The third phase is focused on exploring existing knowledge, literature, and best practice from the similar projects reviewed to find suggestions in order to build a suitable solution. The outcome of this phase is the conceptual framework.

The fourth phase is building the initial proposal. The initial proposal is built based on co-creation with the case organization and the data collection where the data model and proposal are co-created and evaluated. The initial proposal will be launched with the test user group.

The fifth phase is the validation and building of the final proposal. The final proposal is defined based on the review of the test users' comments and experiences. The final proposal is modified to match the need and requirements that has come up in the comments. The final proposal will be published to the company use.

2.3 Data Collection and Analysis

This study gathers data from a variety of sources, and the date was collected in three data collection rounds. Table 1 shows details of Data collections 1-3 used in this study.

Table 1. Details of Data collections 1-3 in this study.

Participant/Role	Data Type	Description	Date & duratior	Document type
Data 1, Current state analysis				
Head of Business Controlling	Face to Face Interview	*Evaluation of the current Internal reporting status*	16.11.2020	Written document
		Evaluation of the current business needs	16.12.2020	Written document
		Evaluation of the business KPI's	16.12.2020	Written document
Director	Face to Face Interview	*Evaluation of the current business needs*	16.12.2020	Written document
Manager - HR	Face to Face Interview	*HR KPI's*	15.12.2020	Written document
Senior manager	Face to Face Interview	*New KPI's*	14.12.2020	Written document
Data & Platforms Specialist	Face to Face Interview	*Evaluation of the current datamodel*	15.12.2020	Written document
		Evaluation of the current business needs	15.12.2020	Written document
Data 2, Proposal building				
Head of Business Controlling	Face to Face Interview	*Evaluation of the proposal*	17.3.2021	Written document
		Evaluation of the improvements	17.3.2021	Written document
Manager - Brand & Communcatior	Workshop	*Creating the Intranet "frontpage"*	11.2.2021	Written document
	Workshop	*Evaluation of the Intranet "frontpage"*	25.3.2021	Written document
Manager - HR	Workshop	*HR KPI's*	20.4.2021	Written document
Data & Platforms Manager	Face to Face Interview	*Evaluation of the new datamodel*	15.5.2021	Written document
Partner	Face to Face Interview	*Evaluation of the proposal*	19.4.2021	Written document
Partner	Face to Face Interview	*Evaluation of the proposal*	15.4.2021	Written document
Data 3, Final proposal				
User Stories	Email	*Evaluation of the final proposal*	30.4.2021	Written document
Manager	Email	*KPI Validation of the final proposal*	21.4.2021	Written document
Manager	Workshop	*Collecting the needs*	9.6.2021	Written document
Manager - Brand & Communcatior	Workshop	*Final Evaluation of the Intranet "frontpage"*	25.3.2021	Written document
Manager - HR	Workshop	*Final Evaluation of the HR KPI's*	23.4.2021	Written document
	Workshop	*Final Evaluation of the HR KPI's*	26.4.2021	Written document
Specialist - CRM	Workshop	*Final Evaluation of the CRM KPI's*	26.4.2021	Written document

As seen in Table 1, the data collection in divided into three rounds. In the first phase, the current status of reporting is defined as well the current data model and KPI's currently used in the reporting. After this, the preliminary blueprint of the data model and KPI's are defined in the interviews with the key stakeholders. The interviews are also used to define the vision about what the requirements and the outcome in a term of data and KPI's.

In the second phase, the proposal building, the current data model capabilities are reviewed, and the needed action are defined to create the first version of the reporting infrastructure (what reports is created in the 1st wave).

In the third phase, after the test period users provide comments, user experience is reviewed with key stakeholders to define the final version of the reporting infrastructure based on the user experience. To gain more data from the end users, there will be a short e-mail survey conducted for the final proposal. This data is reviewed with the key stakeholders to verify that the findings are relevant in a term of the outcome of this study and will serve the masses instead of some minor user group.

Thus, round 1 of the interviews are documented accordingly, and the interview strategy relies on open-end questions based on certain themes instead of the structured conversations with direct questions. In Round 2 and 3, interviews contain a more structured approach because the subject is more focused on defining the proposals.

As seen in Table 1, this study is mainly based on the interviews with the key stakeholders who were identified in the company as those most relevant and knowledgeable, and the research methods used are qualitative. The interviews provide the input which is needed in the current state analysis and in the review phases of the initial proposals. While creating the initial proposal, the stakeholder co-creation is used to help visualisation and defining the KPI's. All the textual data is analyzed using Thematic/ content analysis.

3 Current State Analysis of Existing Reporting Infrastructure

In the current state section, the study focuses the current state of the company's reporting infrastructure. The data model and sources are both included in analysis, as is reporting solution that is in current use. Analysis contains a description of the Reporting Infrastructure which is divided into the reporting solution itself and the data models that are applied for the reporting purpose.

3.1 Overview of the Current State Analysis Stage

The current state analysis is divided into the four separate steps. The first step focuses on the analysis of reporting practices, and the second step is focused on the data model. Both are large topics needed to achieve the objective of this study, and both of these topics support each other in the end. Reporting cannot be developed without developing the data model, and the data model cannot be developed without clear and present target setting related to the final product. The third step focuses on identifying the business needs, while the fourth step points out the strengths and weaknesses of the current reporting practice and the tool, as well as summaries the identified business needs.

The current state analysis is based on the interviews with the selected key stakeholders. The key stakeholders come from different functions of the company and they were chosen by their involvement in the earlier reporting development initiatives or responsibility for the key activities (for example, providing the needed data for the reporting purpose). The interviews were arranged with different focus areas; for example, the stakeholders who were involved with the client assignments and team leading had a different approach. In total, eight interviews were held to gain information about the current status. The interviews took from 30 minutes to 90 minutes. The data was collected into a note in the excel sheets to secure the documentation. The interviews were done with face-to-face and the method was open-end questions with two themes:

1. The current reporting, in order to find out about user experience and how each person is using and finding the solution feasible for daily use.

2. Positive and negative experiences of the current reporting tool, to target what kind of benefits and disadvantages current model offer from the user point of view.

The results of the current state analysis led to identifying the strengths and weaknesses of the current reporting practice and the tool, as well as identifying the business needs at the end of Section 3.

3.2 Description of the Current Reporting Infrastructure

Current reporting infrastructure is from 2015 and although it has gone through updates and upgrades it is way outdated today to support business initiatives. The reporting is based on the ERP tabular data model, that contains only data ingested to ERP.

Description of the current reporting infrastructure focuses on two areas, the current reporting, and the data model.

3.2.1 Reporting

The current reporting is based on the system that is a company wide solution. The current reporting infrastructure is based on ERP's bulk reporting with heavy tailoring to get more benefits to support business. Most of the reports were applied between 2015 and 2016. Since then, the reports have been updated and new reports developed if needed. The reporting contains personal metrics (revenue, margin, hours, utilization rate), portfolio details (managed revenue, margins, client portfolio details) and top management reporting (profit and loss statement). The main tool for the reporting is Excel and reporting are published in the traditional excel tabular format or user can use web browser version instead. Figure 3 shows samples of current reporting.

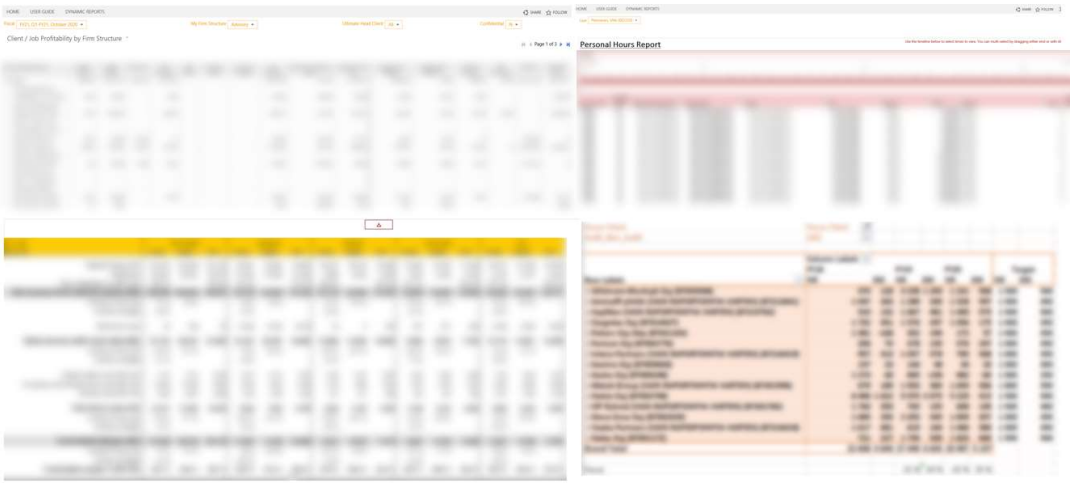


Figure 3. Sample of current reports.

Presently, the bulk reporting does not support business needs as it should support and there is a need for the separate reporting which is done mainly in Excel or Power BI reports that has been applied to fill the specific needs.

The current reporting also does not support the advanced KPI's because the needed data sources are not included. Some of the KPI's are not feasible to include with the current functionality, as this informant confirms:

> *"We need a companywide reporting approach where the KPI's, visualizations and even basic issues, like fonts, colors and naming conventions are standardized to provide professional overview of company reporting." (Head of Business Controlling, 2020.)*

Based on the results of the interviews, the major drawback is defined as the lack of visualization. As pointed out by the informants, the visualization would provide much more insight than the current tabular format. As new BI tools provide better user experience with dynamic functionalities (Data filter/Slicers are part of the visuals), the tabular and static report provide detailed level information, but the user experience is not that efficient as users must create own views from the raw data with Pivoting tools.

The most used reports in the current solution are company operational statement, personal metrics, team metrics and portfolio reports. These are for different user profiles.

Personal metrics is for individual follow up, team metrics is for team leader purposes, portfolio reports are for portfolio leaders, client leaders or engagement leaders (project managers) and operational statement are for the company financial reporting. There are other reports also available, but these are the most used reports for leadership work.

3.2.2 Data model

The current data model used in the reporting is mostly based on dimensional multi cube architecture and additional data sources (Financial system, HR system and Client feedback system). Data cube is the most common source in the reporting, which contains operational data from the ERP system and limited input from the CRM. The cube itself is quite sophisticated, but still the data available is limited. As data and platforms specialist described it,

> *"The data cube is created for the Excel reporting and it's providing all the needed KPI's and attributes for the reporting, however this approach is defined by some central team or product provider and cube itself doesn't support todays reporting solutions as it should. The data is quite limited in the cube and external data sources are not supported in the reporting as they should be and this needs lots of local effort and external services to be applied."* (Data & Platforms Specialist, 2020.)

The current cube does not support directly all the KPI's that are needed in the reporting because the mode does not contain data by default from HR system, while Financial system and CRM data is also limited and not accurate. The need to update data model is crucial for the reporting. Figure 4 shows the structure of current data model.

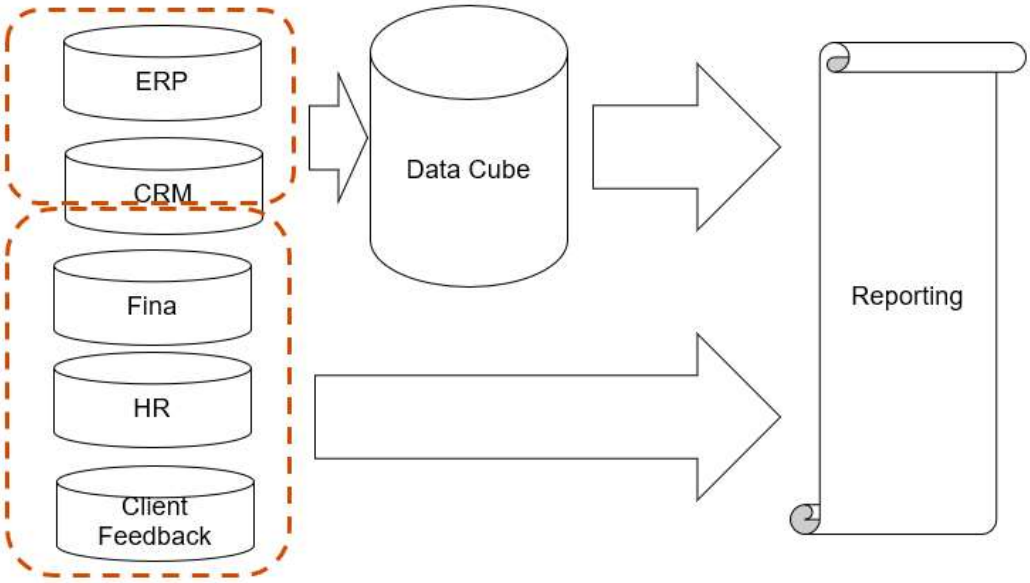


Figure 4. Current data model.

As seen in Figure 4, the current data model is simple. The multi cube (data cube) structure provides combined and multidimensional collection of separate data tables, which contains raw data. The cube contains processed data. The other sources are raw data which must be processed with separate queries or in the report itself before they can provide decent amount of information.

Based on the results of the interviews and stakeholder observations, the current model has one a major problem. The data cube cannot be automated with the Power BI Corporate Gateway technology due the authentication credentials, which are user related instead of a superuser or similar. This creates challenges for the full automation process. If the data cube can be excluded from the data model and replaced for example with tabular tables, the gateway technology will work without problems. As this informant expresses it:

> *"The cube cannot be used in as data source in the common reporting if we want have the most reliable solution, because of the personal authentication process. We would need to have common access instead of personal access and currently that is not an option if we want to use Corporate Gateway technology."* (Data & Platforms Specialist, 2020.)

The data model is set to be the core of the solution. The model needs to be re-evaluated in a way that it provides all the needed elements for current and future reporting initiatives.

3.3 Analysis of the Current Reporting Infrastructure: Strengths and Weaknesses

Although, as stressed by the interviewed stakeholders, the current reporting infrastructure is outdated, it still serves its purpose to some point. The following strengths were identified during the current state analysis, based on the results from the stakeholder interviews:

First, the core data is available. The current solution provides the needed data for the user to manage daily work. The ERP data is the most used data currently and contains most crucial operative metrics and data. The CRM is not fully used in the business unit yet and some stakeholders have no experience of it yet.

Second, the data is updated automatically on daily basis. The data in data model is up-to-date and it is refreshed every day. Automatic update is core piece of functionality of the reporting. Some top management reports are manually updated and that has been recognized negative feature. Fully automated update functionality is expected in the new solution.

Third, access control is enabled. The distribution of the data is limited to certain users because of the nature of the projects and assignments (M&A and strategy projects contain insider information that needs to be restricted).

Fourth, reports are easy to use. The users find that the current solution is simple enough to use. Reports are collected in the one place and they are easy to access for the users.

5) The common KPI's are available. About data availability, the most crucial KPI’s (Revenue, Margin, Utilization) are provided to the end user.

6) Reports easily modified in Excel. Data is compatible with Excel and directly downloaded in Excel format for modifications, pivoting or creating visualizations.

Importantly, the following weaknesses were also identified in the current state analysis, based on the results from the stakeholder interviews:

First, not all the data is available in the current data cube. As the new data sources have been implemented these sources are not connected to the current solution. For example, user needs to see different reports or systems if he wants to see team statistics (Hours from HR system, client activities from CRM and operational data from CRM).

Second, Microsoft SharePoint technology does not support modern tools; mainly Excel reporting is used. The current model does not fit in to the modern BI tools and data is coming from multiple sources and is still dependent on the manual mapping of tables or Excel extract files that need to be manually updated.

Third, not all the new data sources are supported by the current data model. The current data model ingests data from the ERP and not from the HR system at all. Also, CRM and Fina data is just partly ingested, and it is not useful in its current form. Regarding data availability, the new sources that provide useful information are not supported and the user experience is not the best with current solution, because the user needs to have multiple sources to get the data and all the user doesn't either have access to the sources or skills to get the data. One-Stop-Shop model in reporting is needed.

Fourth, not all the needed KPI's are supported by the current data model. This is seen as a major shortcoming. CRM provides lots of new KPI's to support management of the daily work. Also new KPI's from the ERP has been implemented and these are mainly done in Excel reporting instead of getting them automatically from the system. As Senior Manager described:

> *"We have nice collection of data and metrics about what are we doing in our customers. But we don't have any metrics and data of that what our clients are doing without us. This is crucial if we want to find out new ways of making business". (Senior Manager, 2020).*

5) No common approach (outlook) currently exists. As the current reporting is more based on the Excels, there is no common guidance and governance in place. Fixing this

with common reporting solution would provide a more professional view of the company reporting.

6) Tabular form is not visual enough. The current solution provides reporting that is in tabular format. Although, these are Excel compatible (seen as a strength), they are not visual enough for the end user to grasp the information by just looking at them.

7) Business insight for the basic user is quite limited. As related to the KPI's, the current solution does not provide deeper insights of their portfolio or performance, just the main topics.

8) Flexibility (SharePoint reports) is limited. The current platform is based on SharePoint and tailoring reports of the report view is not possible and needs IT interaction. More flexible approach in terms of modifications is appreciated.

9) Too much tailoring needed to get business insights. If user wants to have something that is not part of the "bulk" reporting the data must be uploaded and somebody has to do the tailoring. This will affect the user's client time and in some case is not the most efficient approach.

10) No view for the future, just the past. The current solution is answering the question "what happened". More foresight is needed to support forecasting and actions.

11) Data fragmented in to the several places, one place should be needed. As related to the data availability and tailoring. The current model does not support all the sources and therefore user needs to find data from different platforms and combine them to support their own approach.

The identified strengths and weaknesses are summarized in Table 2 below.

Table 2. Summary of the strengths and weaknesses of the current reporting infrastructure.

Strenghts	
	Core data available
	Updated automatically on daily basis
	Access control enabled
	Easy to use
	The common KPI's are available, minumum is delivered
	Reports easily modified in excel
	"It's OK, this is what we have"
Weakness	
	All the data not available
	Technology does not support modern tools - Mainly Excel reporting
	All the new datasources not supported
	All the needed KPI's not supported
	No common approach (outlook)
	Tabular form is not visual enough
	Business insight for the basic user quite limited
	Flexibilty (Sharepoint reports)
	Too much tailoring needed to get business insights
	No view for the future, just past
	Data fragmented in to the several places, one place shoud be needed
	Reporting instead of analytics

3.4 Analysis of Business Needs for New Reporting Solution

Based on the interviews with the stakeholders, the stakeholders divided the business needs into three different categories based on the nature of the demand and into two different areas related to each category, New KPI's and Reports, to separate the nature of output that is needed. The three categories are leading business, leading teams and leading self, and they are discussed below.

The *Leading business* category is for the persons who drive business and who have customer responsibilities, for example project team leader or customer owner who wants to follow customer development. Three different roles that needs to have their own metrics were identified. These are: (1) engagement owner (lead partner), (2) engagement manager (engagement lead) and (3) client lead (client owner). The same metrics can apply for each role, but there is a difference in how the metrics will be reported.

The *Leading team* category is applied for the supervisor and team leader purposes. In this category, the crucial issue is following the data that is related to direct subordinates.

The third category is *Leading self*, and this is for following personal metrics, such as how much have you created revenue, what kind of client feedback you have collected, etc. All the KPI's cannot be applied for every professional grade.

Table 3 shows the business needs that came up in the interviews.

In Table 3*, the New KPI's segment* defines the KPI's that the interviewees noted were missing from the current reporting system, and which would be needed. *The Reports segment* defines the issues related directly to the end product (report) or process (data update, visualization).

Table 3. Business needs collected from the interviews of the business representatives

Business Needs - Summary	Leading		
	Business	Teams	Self
New KPI's			
Market Share	X		
Client investments (activities)	X	X	X
Client contact relationships			
Sales credits*			X
Detailed Profitablity**	X		
Personal Rating history			X
Client feedback	X	X	X
Opportunities (Won/Lost/Open)	X	X	X
Reports			
Personal Dashboard			X
Client Portfolio Dashboard	X	X	
Engagement Dashboard	X	X	X
Investment Dashboard***	X	X	X
More visualized report	X	X	X
Data daily updated	X	X	X
Multi device support (smartphone, Laptop, Tablet)	X	X	X
Reporting "hub" for the all reporting related issues & items	X	X	X

* How much persons effort has generated Revenue
** What has affected in the profitablity (writeoffs, team structure)
*** For the PMs to follow external and internal spend related to the investment

As seen in Table 3, *the New KPI's section* shows that current KPI setting is largely sufficient. The most critical KPI's missing are related to CRM data. The reporting need was as expected. The initiative is to develop new reporting solution to replace old one. The expectations are easier to fulfill with reporting when the stakeholders have a common approach for the product.

> *"We have talented people who lead their daily work with Excel sheets, which needs more often tailoring. That's not talented approach, if you ask me. For example, I'm not aware of my clients NPS (Net Promoter Score), if I don't ask for the data from someone who will make the data available for me after this and that. I want to see NPS at least in monthly basis just with a few clicks." (Senior Manager, 2020.)*

First, *the current KPI setting* is already providing good picture of the business, but there came up some specific CRM related KPI's which would improve the transparency of the customer actions, for example, client activities and established client relationships. As the senior manager from Advisory line of service said,

> *"The new tools (CRM) do not have the needed power, if we can't have the data mashed up for the readable format for the end user, who could then make more decent assumptions of for example how much company is having contacts with customers or do we even know all the key decision makers!"* (Senior Manager, 2020).

These new tools would provide the insight to clarify how often customers are met, how deep relationships with the customers were developed, and if there are key customer contacts who the company should have deeper relationships with.

Second, business recognized 8 different kinds of KPI's that would help to drive the leading with data and provide more detailed information. The KPI's were Market share, Client investments, Client contact relationships, Sales credits, Detailed profitability, Personal rating history, Client feedback and Opportunities. These KPI's have different meaning, but they can separate to two different categories, client and personal KPI's. In Table 4 the KPI's has been sorted and descripted.

Table 4. Definitions of the New KPI's.

New KPI's	Description	Type
Market Share	Companys marketshare compared to other Big4 companies	Client
Client investments (activities)	How much activites has been booked for the client	Client
Client contact relationships	How many contacts has been established for the client	Client
Sales credits*	Personal share of total opportunity value	Personal
Detailed Profitablity**	Breakup of the profitablity	Client
Personal Rating history	For follow up the personal development	Personal
Client feedback	NPS, the client feedback value	Client/Personal
Opportunities	How many opportunities has been booked for the client and what are their status.	Client

* How much persons effort has generated Revenue
** What has affected in the profitablity (writeoffs, team structure)

The most of the KPI's are client related and that is because of the new CRM data, that provide multiple options for the reporting. Also, the more detailed client relations data is expected to provide deeper insights of company's client base. The personal KPI's are more related to the individual performance to support career planning.

Next, the business representatives also evaluated the business needs in *the Reports.* The business side have raised the need to look at them from a totally new angle.

First, *the reporting* must be driven to a new direction that provides users the opportunity to have a transparent view of the current metrics from one platform that contains up-to-date data, reliable metrics, and a common approach (the metrics methods is applied through the organization). For example, the employer's yearly process is currently done manually in most of the cases. Supervisors need to collect to metrics as do the subordinates. As this is taking effort from the core activities of 1000 employees, the impact on the whole organization is enormous.

Second, business recognized 8 different kinds of reporting topics that would help to drive the leading with data and provide more detailed information. In Table 5 the topics has been sorted and descripted.

Table 5. Definitions of the recognized reporting topics.

Reports	Description	Type
Personal Dashboard	For personal metrics follow up (contains personal metrics)	Personal report
Client Portfolio Dashboard	For client and client portfolio follow up (contains client related metrics)	Portfolio leader report
Engagement Dashboard	For engament follow up (contains engagement related metrics)	Engagment leader report
Investment Dashboard***	For internal project spend and budget follow up	Project manager report
More visualized report	More user friendly adoption for reporting	Overall user expericence
Data daily updated	More reliable data availability	Overall user expericence
Multi device support (smartphone, Laptop, Tablet)	More user friendly adoption for reporting	Overall user expericence
Reporting "hub" for the all reporting related issues & items	One place that contains all the reporting related topics (reports, documentation, news, etc..) for keeping the reporting infrastructure simple for the users	Overall user expericence

*** For the PMs to follow external and internal spend related to the investment

The reporting topics are separated to the direct report needs and to the topics which provide better user experience. The direct report needs are visualized versions which are updated with the new and relevant data sources of the old reports. The user experience related topics are to help users to find the needed updated data (visualizing, data updating and reporting hub). As Power BI easily can be used in the other devices than laptops it was also mentioned that multi device support would be nice to have.

The new visualized concept for reporting must be rolled for the whole company. As the key stakeholder expressed it:

> *"There are few units and layers who have access to the visualized reporting now. For the future we need to have same opportunity to each person who works for the company"* (Director, 2020).

The reporting needs are quite straight forwarded. The business needs are easily fulfilled in the first place. The reporting is in the core of the development and this will provide value add for the company and for the users.

3.5 Summary of Key Findings and Selected Focus Areas for Development

The key findings contain, first, the strengths and the weaknesses of the current reporting infrastructure and, second, the summary of key business needs. The key business needs contain the most crucial needs that the business side can see.

Regarding *the strengths and weaknesses*, as the current solution can still fulfill some of core information needs, there is major limitations which are working against this. As seen in Table 2, the strengths are more user experience related. The substance has become the crucial part of the reporting as new sources has been implemented. Most topics that came up in the interviews were that business insights are too limited and more visualized reports are needed.

The strengths and weaknesses analysis indicates that users have also seen that the current solution is in its sunset. A common comment what came up in the interviews was the question that would happen if the company would rely on the current solution that would in the end somehow provide the needed analytics, but without heavy tailoring it to the end user. This is also one of the lines that must be drawn. Is it acceptable that expensive resources must be used in the basic copy-paste kind of work instead of using these resources for the activities which would provide the most value for the company?

The interviews confirmed the business challenge statement stating that the current reporting infrastructure is outdated and based on old technology, with limited KPI's and insights and data sources are limited. The current solution has its strengths, but the interviews confirmed that the weaknesses consider more crucial topics.

Regarding *the business needs*, as a summary from the business side, the business needs were quite clear. Also, the business representatives who were interviewed were very keen on setting their insights for the blueprint of *the new reporting solution*. Some of those needs were too advanced and the capabilities to provide solution to these needs are not available. In the interviews, it was also communicated that if *the current tabular format* could be changed to a more visualized solution, that would already be excellent development.

Also, from the business perspective, *new data sources* should provide capabilities for deeper customer and engagement analytics. For example, it should demonstrate if the project team mix is healthy compared to the corresponding engagements and the total client feedback of the client owner.

Thus, the business needs are not exact KPI's or certain visualizations, the main need points to creating a complete collection of topics which in the short term can be described as *One-Stop-Shop*. The needed insights should be easily available from this one certain place.

Table 6. Selected focus areas for development of dynamic visual reporting infrastructure.

	Selected areas for development of dynamic visual reporting infrastructure
1	New Reporting solution
2	Reporting infrastructure launch page (Distribution channel)
3	Common Data Model

These selected areas for development of the dynamic visual reporting infrastructure will be dealt with in the following sections. In the following Section 4, best practice of reporting development is used as a guide in search for solution models and tools utilized later in Section 5.

4 Available Knowledge and Best Practice for Developing Dynamic Visual Reporting Infrastructure

This section discusses how development of the dynamic visual reporting will provide value for a company with the data and digital technology. Leading with data is in centre of the reporting development. The leading with data is supported by three different elements, *data, culture,* and *technology.* Data driven leadership is based on the decisions where data informs and drives the executives instead of the intuition or experiences. These topics are discussed below.

4.1 Selected Knowledge Areas for This Thesis

In this thesis, the following areas was selected for exploring the available knowledge and best practice, as shown in Figure 5 below. These areas were chosen following the diamond model created by Kerimoglu, Basoglum and Daim (2008) who investigated how information systems are implemented in companies.

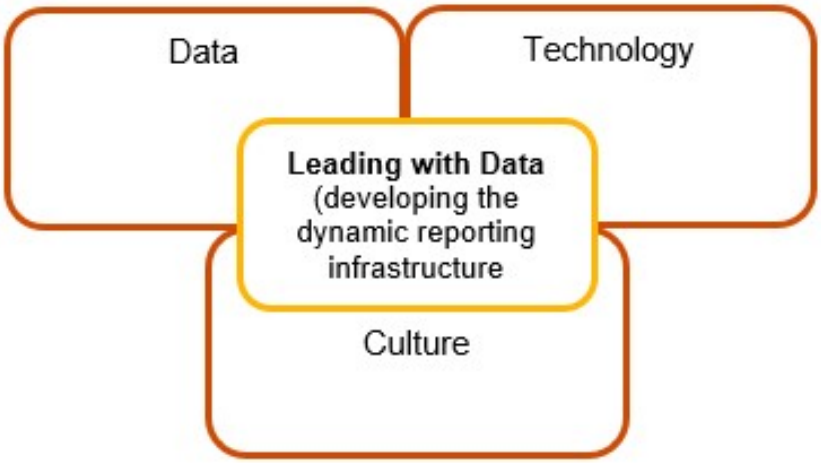


Figure 5. Selected knowledge areas for exploring in this study.

The three selected knowledge areas (Data, Technology and Culture) are chosen to support the core theme of this thesis (Leading with data - Developing the Dynamic visual reporting infrastructure). The First element is *Data,* and it is the main building block of the core theme. Data is the element that enables the leading position of the organization.

Second element is *Technology,* which is linked to the data as it enables the story telling best reach to the users and customers in the organization. The Third element is *Culture*. The culture bands data and technology into a one entity and plays an importance role in the overall picture of the organizational existence and performance. Business practice has proven that, even if a company can provide data and technology, but its culture is resistant to these elements, the whole arrangement will not work. Also, the company can provide technology, but not the needed data and vice versa, data but there is no technology to use it.

These areas make parts of the Conceptual framework of this study, and exploring them will provide relevant tools, methods, concepts and ideas for development of *the Dynamic visual reporting infrastructure* in this study.

4.2 Element 1 of the Conceptual Framework - Leading with Data

According to PwC and Microsoft (2018), the shift to a more collaborative business environment seems inevitable. However, currently organizations are not getting most benefits of their own data (customer, personal, etc.) and this has a direct effect on the success of the company. Also, companies might have serious problems in utilizing the data in their use and the problem might be deeper than expected. (2018, p. 44.)

The data driven leadership or data driven decision making is a process where different kind of data has been processed to a form which supports decision making that drives actions. Today there is lots of different kinds of data from different sources available that can be processed to certain information. Although data has been there for years, modern tools have provided opportunities to unleash the full potential of massive amounts of data that companies have stored in previous periods of time. (Storbierski, 2019.)

The data can be leveraged in different ways and ultimately how you utilize the data and in which context is the key element. The data driven decision making provides certain benefits for the companies, as discussed by Storbierski (2019).

First, the company can make more confident decisions. The date that is current, logical and concrete which instinct and intuition are not. The data provides insights and patterns

that tell a certain story. However, this does not mean that all the decisions can be correct. For example, false process in data handling could jeopardize the outcome of the decision.

Second, the company can become more proactive. The data provides insights of topics that needs to react. For example, data might show that cost structure is not good, and company must act.

Third, the company can realize cost savings. The data enables operative efficiency. Decision making is based on the up-to-date hard facts, which enables faster reaction. (Storbierski, 2019.)

Business Technology Research (n.d.) points to the benefits of the data driven culture that follow the same themes, adding *data as market research tool* and *consistency*. First, *Data as market research tool* can be leveraged to provide key insights for example of customer behavior, market data and company performance tool. This is possible since companies have stored huge amount of data in transactional level. Second, *Consistency* means minimizing the possibility that different persons/teams/service lines are using different data and increasing the actions following the company policies/strategy. (Business Technology Research n.d.)

In the daily operations, the benefits of leading with data can be seen in efficiency in the decision making. Once the persons in leadership position have access to the needed information, which has been created and visualized with the technology, the decision making will be more consistent and well justified. (Business Technology Research n.d.).

However, data is not always the truth. While using data to justify management decisions, the organization must be aware of the disadvantages there might become when relaying totally for the data. These can be related to the organizational culture and inhuman behaviors. The data allows more decent research which instead of the intuition and experience. (Khan, 2019). The recognized disadvantages, according to Khan (2019), include:

First, Data overload. As amount of the data is exponentially increasing it is crucial no to waste resources to collect wrong data.

Second, Low-Quality Data. As related to data overload, the data quality is the key to provide decent information. Human errors in data entry might have huge effect to the information.

Third, Trust. Data is cannot be always correct and does not provide the right answers. As data leader, the company should understand the context, know the possible insights and have the needed business acumen. (Khan, 2019.)

According to Khan (2019), the companies that enable the data in their leadership work will gain competitive advantages. To achieve this the leaders should take steps to develop into data-driven leaders who can combine data-based information and culture.

In the McKinsey & Company study, “How six companies are using technology and data to transform themselves” (2020) there was companies like Petrosea, Freeport-McMoran, and Levi’s. These companies have utilized their data to help the decision making. The use of data differs heavily between the companies and it shows that there is no one clear path how to drive the business with data. Companies use for example AI to help to run and develop promotions or how to use real time data to have cost benefits instead of making decision based on experience. The case companies saw data as crucial part of how to develop company’s ways of doing business to gain value add. The study shows that companies need to act faster in the different business areas, decisions must be based on the data and to actions should be done customer centrically. The companies need to have digital capabilities to support the leading with the data.

The data orientated decision making and leadership is the central piece of the development of the dynamic visual reporting infrastructure. The reporting is not needed if the management is not ready to see the benefits it’s providing for the users. Also, the dynamic visual reporting infrastructure needs to answer to the correct questions to give proper insights which support leadership. The most crucial part of dynamic visual reporting infrastructure is the data itself. This topic is discussed next.

4.3 Element 2 of the Conceptual Framework - Data

Today data is considered as a key enabler for the decision making. It might be big or small, but it will tell the stories of different kinds of tasks and actions that has created it in the first place. According to Sherman (2014, p. 3-4), data gives a narrative for the story.

Data however is not ready to be used directly. It is in most of the cases not useful right away, because the data is stored in a transactional level without any modifications, and it does not provide any information for the users. As the companies collect huge amount of data from different sources, this raw data needs to be modified and processed with different kinds of methods to make it understandable for the end users. (Sherman, 2014, p. 3-4).

Before data can be used for knowledge, it needs to be correct and useful. False data possess many risks. Sherman (2014, p. 12-13) presents the 5 C's of data management, as shown in Table below.

Table 7. The 5 C's of data management (Sherman 2014, p. 12-13).

1. The data should be clean, which means that missing items, possible errors and other false items should be corrected or cleaned accordingly.
2. Data should be consisted, which means that data follows logical rules.
3. Conformed, which means that users can make the same assumptions from different angles of business based on the data they have utilized.
4. Current, which means that data needs to be up to date for the end users.
5. Comprehensive, which means that users have access to all the data they need to drive their business.

As Delen (2014) describes, data needs go through a process where data is modified to the knowledge. This process is called data mining. Data mining is a process to create measures, calculations and statistics based on facts of the source system datasets. (Delen, 2014). For example, creating efficient metrics based on fact data is part of data mining process, as shown in in Figure 6 below.

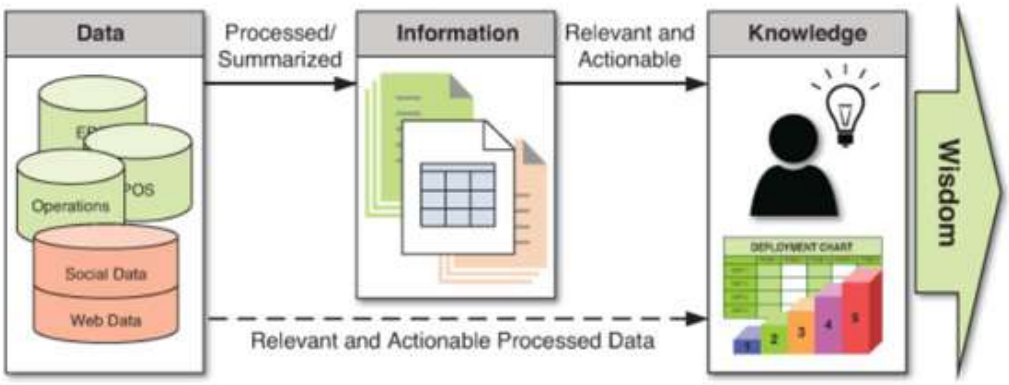


Figure 6. The Continuum of data to Information to Knowledge (Delen, 2014).

Data mining is used to discover knowledge from the masses of data. The process uses different kinds of techniques (for example statistical, mathematical an artificial intelligence) to look out information that is useful in the current business context. This information is based on certain patterns that rely on the business rules, correlations, trends or predictions. Data mining is an approach where different kinds of models and techniques are used to find key information. (Delen 2014.)

For the data mining, there are different data mining processes available. The Datascience-PM.com (2020) ranks the most popular data mining processes, as shown in in Figure 7 below.

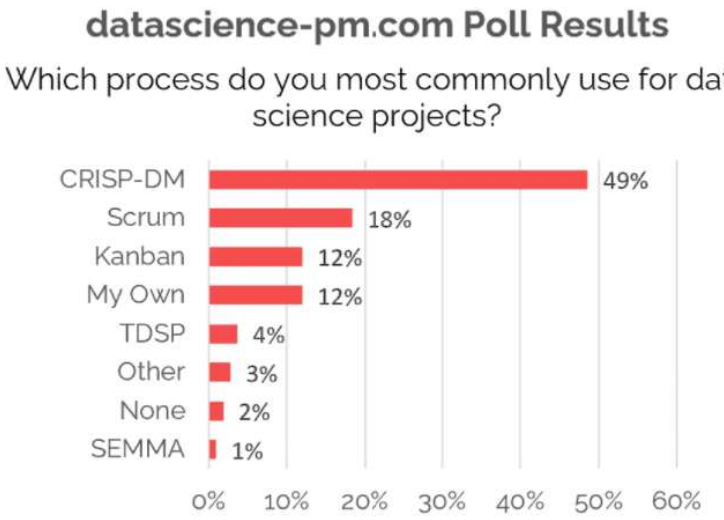


Figure 7. Ranking the Data Mining processes (Saltz, 2020).

This thesis will be looking closer to the Crisp-DM technique, that was found the most useful recognized technique in the survey above (Saltz, 2020), this technique is discussed in more detail in the next sections.

The cross-Industry standard process for data mining (Crisp-DM) is the process that is in common use. The process contains six steps which are illustrated in Figure 8 below. The process starts from the deep understanding of the data and the business. This step is crucial to understand the business context and why the data mining takes a place and what is the goal of the process. (Delen 2014).

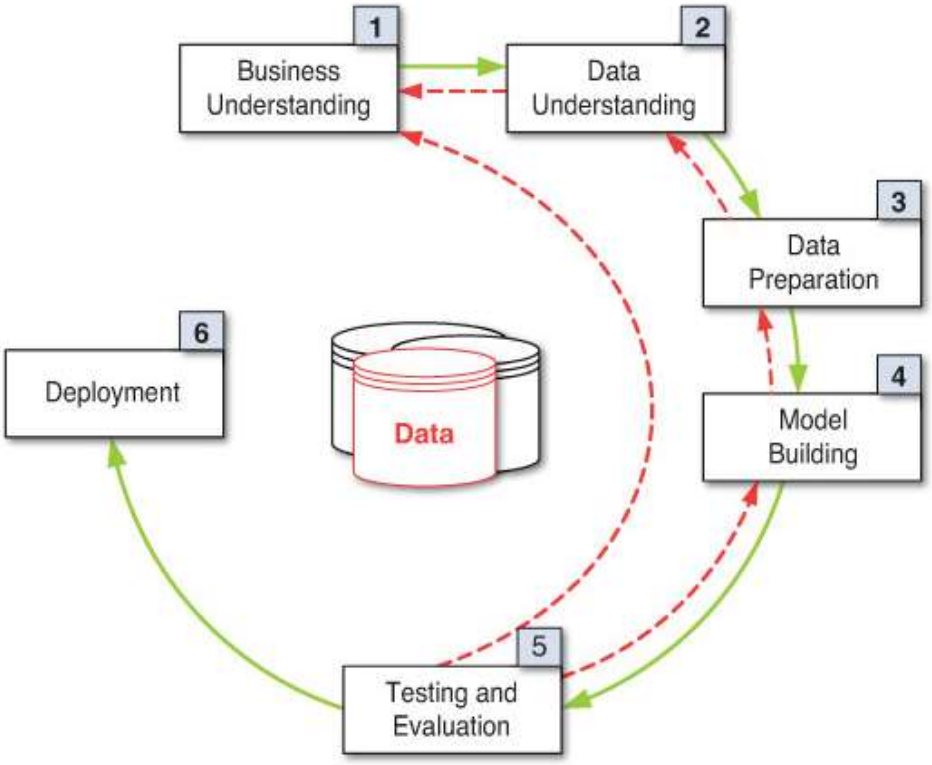


Figure 8. The Crisp-dm data mining process framework (Delen 2014).

As seen in Figure 8, the second step is data understanding. It is important to recognize the valid data sources, valid variables, and what kind of variable the data contains. Also, the data might be qualitative or quantitative which must be taken into a consideration and mirror these to the business context. For example, if goal is to make customer analysis, the qualitative data might not be useful in this case. (Delen 2014.)

The third step is data preparation. This step is the most time-consuming step in the process. In most of the case data needs to be heavily modified. Some attributes might be incomplete, the formats of the datasets might differ to each other and data might contain outliers that are illogical because of the human or system error and these needs to be cleared or corrected. (Delen 2014.)

The fourth phase is building a model. The modelling is applied to prepared dataset. For the modelling there is no universal best practice, instead to business need drives the

modelling and different kinds of models can be applied in this stage. The modelling is to search useful patterns of your data. Standard approach is that the data is divided to training and testing. In training set models can be developed and in testing these models can be verified to provide the best effort. (Delen 2014.)

The fifth phase of the process is testing and evaluation. In this phase developed models are taken into action. Selected models are set into the business context to provide information if some adjustments are still needed to be made. As the outcome of the models is to serve real life scenario testing and evaluation is crucial step in the process. Data mining provides no value for the business objective if any business knowledge cannot be identified. It is important that testing and evaluation is done by entities who have the needed knowledge of the business objective. (Delen, 2014.)

The sixth and final phase is deployment. The deployment step does not automatically mean the end of the process. The deployment phase contains maintenance of the deployed models as business object is not in most of the cases stable status. And as time goes by the models will have its end date and they might become irrelevant for the business needs. (Delen, 2014.)

However, it must be also noted that Crisp-DM model is over 20 years old, and the maintenance of the model is not active and for example how the model can work with new technologies like big data is unknown. Due to know limitations the Crisp-DM remains as one of the most used models. It is up to user to determine if the model supports the business need. (Stirrup, 2017.)

Although there are questions related to the Crisp-DM model there are also benefits. The benefits that Crisp-DM model has is that the model can easily be modified if the model does not fit in the beginning of process.

However, according to Aniruhd (2019), the key is to define the business need. For example, in some cases the data might be in place and modelling is not necessary. Instead of the modelling the patterns can be found with the visualization and data exploration.

As the data will be stored in several repositories and databases it is crucial that data mining process will be take into the action and followed. The Crisp-DM methodology provides tools for creating logical concept that provides modified data for the reporting needs.

4.4 Element 3 of the Conceptual Framework - Technology

Technology in dynamic visual reporting development is the most concrete topic after data. At the moment of writing this thesis, the technology related to leading with data today is modern BI tools. The technology is an enabler that supports the story that information is telling the audience. In the reporting development context, there are two recognized technology areas, *visualization,* and *data modelling* at the reporting end.

4.4.1 Visualization technology and its best practice

There are multiple visualization solutions available in the market. The business intelligence tools are the modern era solutions which can provide business insights and analyses based on the visualization of the collected data. Business today collects data from multiple sources and in different formats. The business intelligence tools combine these sources and formats together to provide meaningful insight in visual format to the end users. These visualizations can be shared and communicated with modern BI-tools (DeMuro, Turner, 2021.)

In the data visualization, there is two main categories of *visual reporting* and *visual analysis*. Visual reporting is a more common trend for performance reporting. Visual analysis enables users to explore the dataset with visual context. Visual analysis helps provide deeper insights for the users.

Visual reporting and visual analysis serve different users. Visual reporting is for the decision makers and leaders while visual analysis is for the analyst who seeks for trends, relations or anomalies for the other users to support the decision making. In short term, visual reporting relates to different kinds of dashboards, and visual analysis finds the patterns of the data. There are several ways to design visual elements of the

dashboards. In most of the cases, the dashboards contain several related charts, pictograms, bar, or pie charts. According to Eckerson and Hammond (2011), anything that helps to tell the story of data can be employed. Dashboards can also contain functionality that provides dynamics and interactive functionality into the charts (slicers, dropdown menus, etc.).

Visualization needs to be logical and provide the needed information. The developers need to be precise with the visualizations they are working with. Sherman (2014) lists some best practice of visualization layouts, as summarized in Table 6 below.

Table 8. Best practice in visualization layouts (Sherman 2014, p. 360-361).

1. Titles, legends, navigations tools should have standard positions. Text and icon styles should follow the common rules or branding guidance. These are the ways to make dashboards and reports familiar to user.
2. The dashboard should be simple. Too much information and too many visuals make the dashboard too reckless for the user and it might make finding the correct information too hard for the user. Four visuals are optimal count for on dashboard.
3. Place your visuals logically. The most important data should be in top, where it's easiest to find. If visuals are related to each other (for example year to date and monthly visuals) they should follow either top to bottom or left to right logic. But same pattern must be applied in the dashboard.
4. Use colours wisely. Colours can add more understanding to the visuals (for example green means ok). The colours can't yet have dominant role in the visuals, and they must be used logically, and they should have the same meaning in the dashboard.
5. The Dashboards layout should be designed to work accordingly in different kind of platforms such as PC, tablet or smartphone. Some software doesn't have functionality

that allows designer to create for example smartphone optimised layouts. (Sherman, 2014.)

Figures 9 and 10 shows examples of standardized dashboard layouts which visualize the best practice in visualization layouts.

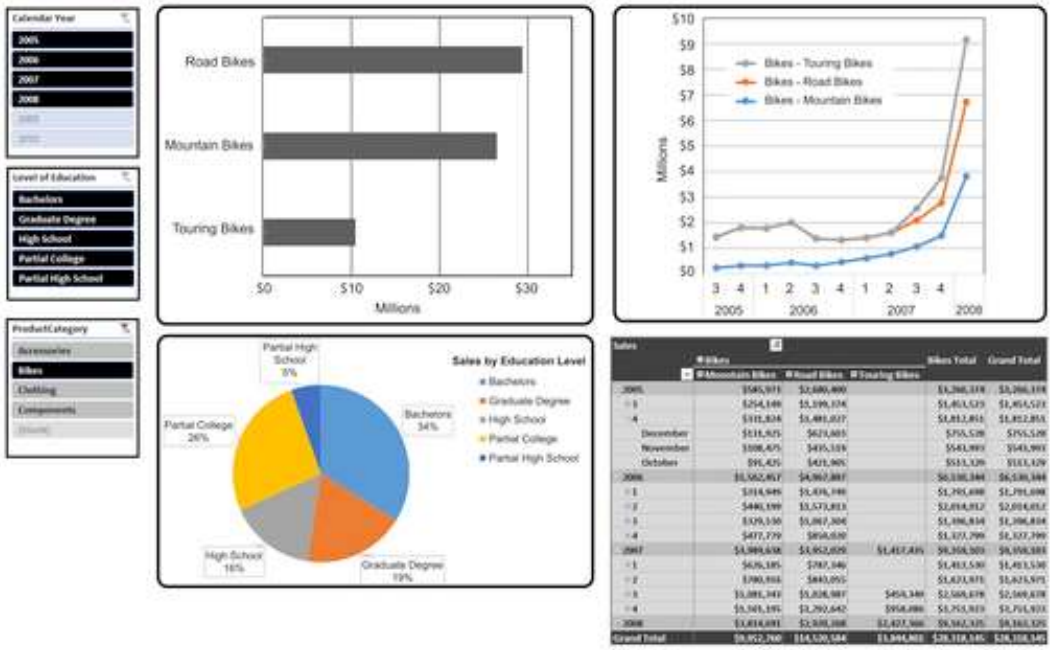


Figure 9. Dashboard example of standardized dashboard layouts (Sherman, 2014, p. 368).

Figure 9 above contains filters that are placed in their own section on the upper left corner and the whole report is expected to follow this rule. The left section contains overview comparisons and time trending analysis is in top right corner. Detailed tabular form table is in the lower right side.

Figure 10 example has a similar approach. In Figure 10, the dashboard contains four visuals which provide different kind of insights. Both examples follow the practise that visuals should be limited to four to keep the outlook clear enough for the user. (Sherman, 2014).

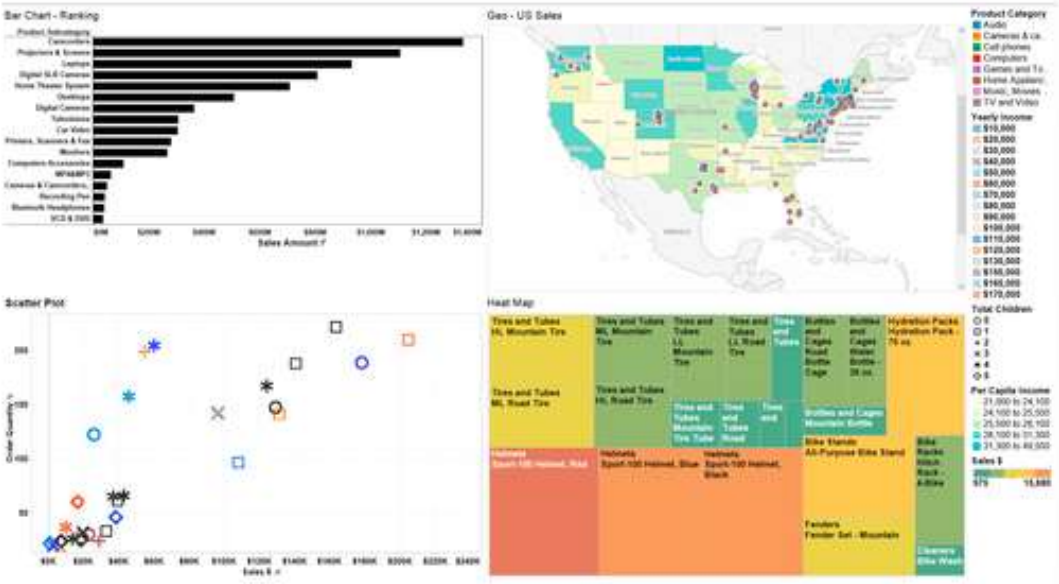


Figure 10. Dashboard example of standardized dashboard layouts (Sherman, 2014, p. 347).

The data visualization plays an important role in the context of leading with data. By using simple logic in the visualization like increasing the text size or using visual tools like “cards” for the visuals that contain important data, the section can be easier to find interesting. In other terms, the visuals are there to arouse interest. The visualization enables the story telling and it provides users a way to adopt the complex masses of data into a simple collection of different kinds of diagrams.

4.4.2 Data modelling and its best practice

In the reporting which is based on the BI tools, the visualizations and dashboards are built on top of the data model. Data model is a collection of dimensional tables (for example calendar, organisation, staff, customer, etc) that contains unique data of these elements (staff ID, customer ID, date etc) and fact tables (transaction data, sales data, etc) that contains data from sales events, accounting transactions etc. If the data model is expected to work in a way where these tables communicate with each other, there needs to be relations established between them. According to Sharma (2020), to establish the relationship the tables need to have a common nominator (for example

date, unique ID, etc.). Sharma (2020) lists the following best practice in data modelling, as summarized in Table 9 below.

Table 9. Best practice in data modelling (Sharma, 2020).

1. Filter Unused Rows. This will reduce the amount of the data and make model smaller and faster. Large data models might have problems with speed.
2. Always have a data table in your data model. For visualizing time data, the calendar table contains in most of the cases much more date attributes than data tables from source systems.
3. Always review the relationship which Power BI has created automatically. Power BI automatically creates some relationships, and it is good to check those out and delete the redundant relationships.
4. Store all your measures in a separate table. Once the measures are in one table, they are easy to find for the users.
5. Name your measure in a meaningful way. Keep certain naming logic applied in the dataset. For example, net revenue is always “Net Revenue”, “NR” or similar that gives clear description of the measure.

Along with these best practice, one important phase in the data model development is how the tables are organized in the data model. Star and waterfall schema approaches are the most widely used methods to organize a data model (Philps, 2021). Figure 11 below shows the star model.

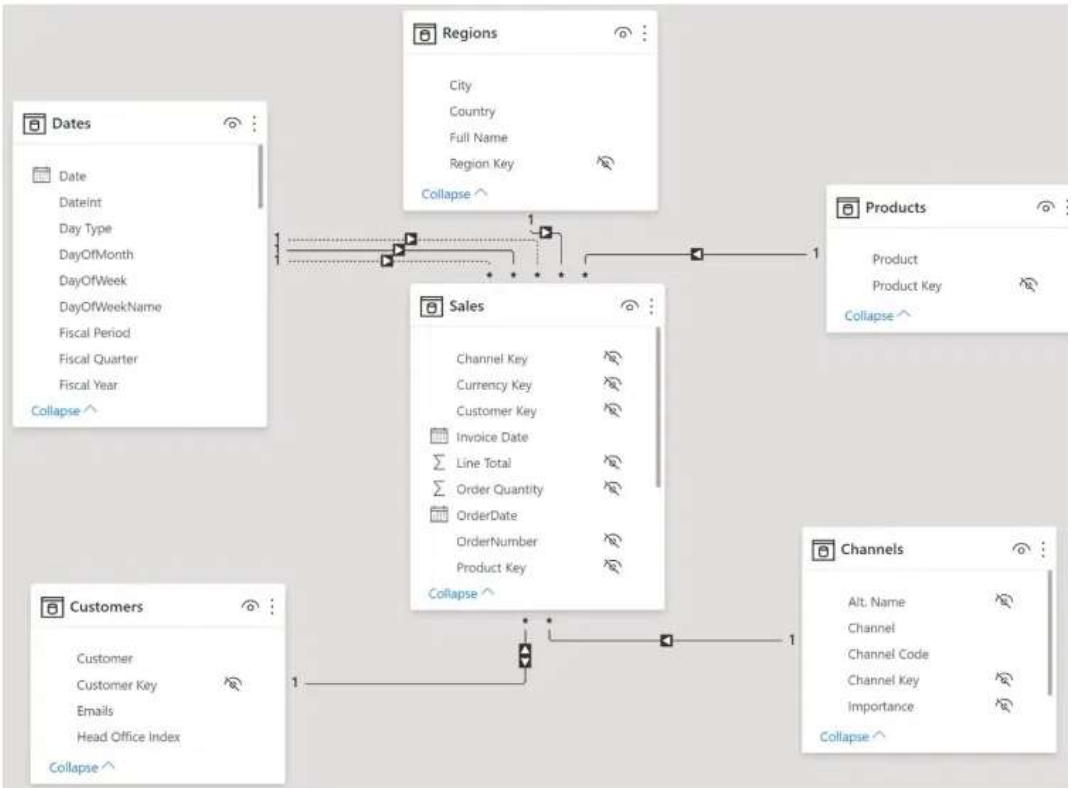


Figure 11. Star Schema (Philps, 2021).

As seen in Figure 11 above, the star model is very clear and understandable. The star schema is organized as its names describes it. The fact table is in the middle and dimension tables are kind of end points of the star. The user has clear view of the table and relations.

Figure 12 below shows the waterfall model.

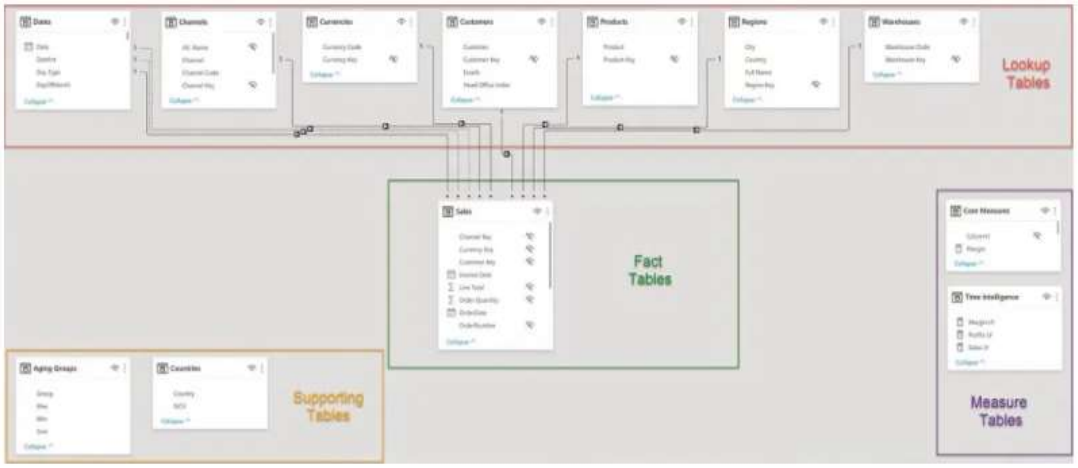


Figure 12. Waterfall Schema (Philps, 2021).

As seen in Figure 12 above, in the waterfall schema the fact tables are placed beneath the dimension tables. As in the star schema, the waterfall schema also provides a clear picture to the user of how the data model has been built.

With these best practices, the modelling the data follows certain logic. This is also a more user-friendly approach when a data model is used by someone else than its designer.

The visualization is in the core of the development process. Clear and logical visual format was something that users wanted to have in the upcoming solution. The modelling itself does not directly reflect to users. Instead of the benefits of the solid data model are for the persons who will be working with the reporting development. If the data modelling is done the best practices it is investment for the future as models are easy to understand and read.

4.5 Element 4 of the Conceptual Framework - Culture

The digitally upskilled organizations who have established culture that uses varies of data in the decision making create value for both the companies and their customers, compared to opposite organizations (Davenport, Mittal, 2020).

In the data driven culture, it is crucial to understand that it just not the data that makes the culture. The data driven decision making is at the core and it is the most important part. Second part is the technology and final part is data itself. The data driven culture is about leading the company and leading the daily operations by making data-informed decisions. Such decision making should become part of a company's culture. The issue is how to drive it toward data orientated process instead of relying on hunches, feeling, experience and intuition. (Thusoo, Sen Sarma, 2017.)

As business practice shows, becoming a data driven organisation is not an easy and smooth process. The data driven business is a growing trend and companies are working to find out the ways of more effective use of data, analytics and other technology-based solutions to drive their daily operations. However, some of the companies face the fact that their culture is not ready to use the advantages that data and technology can provide. Today, business cultures which rely on the data have decision making culture that uses data and analytics to justify decisions with facts. However, there are still companies where decision making, and actions are based on intuition and experience. (Davenport, Nittal, 2020.)

According to Davenport and Nittal (2020), companies have their ways to develop its culture to be more data orientated. This development must be coherent and able to show the added value because some behaviours are hidden. The top management has an important role in creating the culture that relies on data. Top management task is to show example to the company and as they adopt the data as an element of decision making, the organisation is set to follow this act. This does not mean the CEOs for example should take more part of the decision making in every level and use reports and analyses etc. The CEO can invest in the personnel who can coach the company's digital readiness or certain type of analytics to provide the information that is needed to support top management vision. (Davenport, Nittal, 2020.)

The companies can also launch different kinds of development programs to change their approach towards data. These can be educational programs, where a company, for example, implements new kinds of tools and processes for the personnel. The company might set up a campaign that encourages employers to change their daily ways of working (for example providing some amount from office hours for learning digital skills).

Some of the personnel who act as influencers could show an example to fellow colleagues. The ways to support the transformation are limitless. The company needs to have faith in their actions and stay on the road they have chosen. (Davenport, Nittal, 2020.)

From the technical perspective, organizing the data to be accessible for everyone and investing into the new technology helps in the transformation. If the data is accessible for everyone who needs it in decision making, the organisation encourages users to look a bit deeper and this will create the need to develop reporting and analytics to answer to questions that are being asked. Investing into the new solutions also has the same kind of function for the user. As old systems and solutions are replaced with new technology this will have impact. However, when implementing new solutions, it is important to train users accordingly. (Thusoo, Sen Sarma, 2017.) The push toward a data driven culture can be big or small. The key issue is to keep the transformation in motion.

Summing up, leading with data is not complex in the end. It needs certain pieces to the puzzle to make it work in an efficient way that provides value for the decision making.

The cultural transition is not quick process. With right actions and tools than transition pace can be more effective. In the data driven culture the most beneficial catalyst is the visualizing of the data. As data is available for the decision making for all the employee levels easier is to enable data driven culture.

4.6 Conceptual Framework of This Thesis

The conceptual framework follows the diamond model created by Kerimoglu, Basoglum and Daim (2008) who investigated how information systems are implemented in companies. These four areas were discussed, and the following relevant ideas selected that could help guiding the proposal building in Section 5:

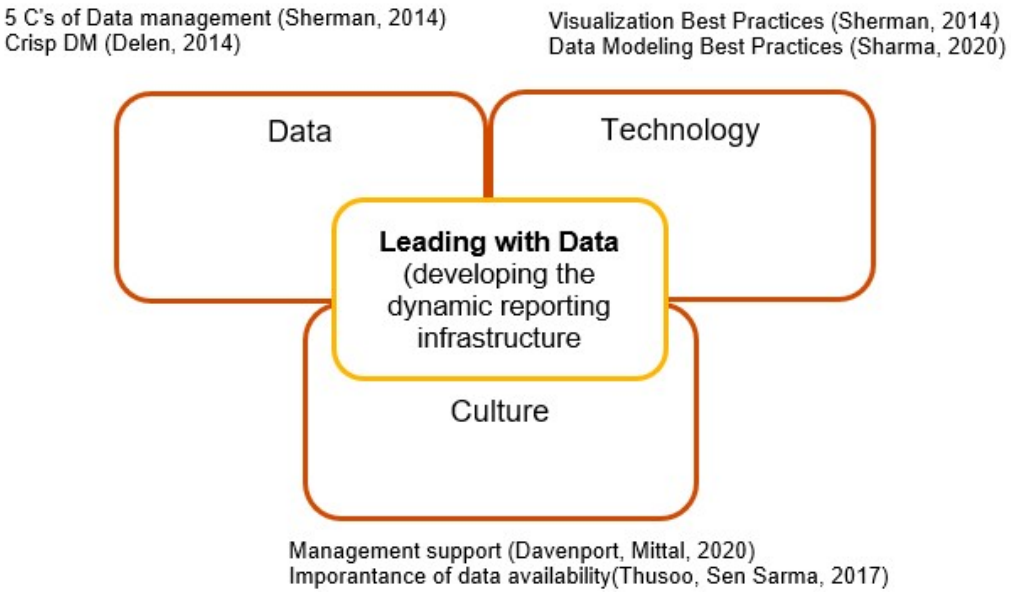


Figure 13. Conceptual framework for developing the Dynamic visual reporting.

The conceptual framework contains 3 basic elements that all support the core theme of this thesis (Leading with data). The First element is *Data* and its main sub-elements selected for this study include: Data sanitation, which is to ensure that data is valid and correct (Sherman, 2014, p. 12-13). Data processing, which modifies the data to the knowledge (Delen, 2014). Data mining, to discover some knowledge from the masses of data (Delen, 2014).

The second element is *Technology.* its main sub-elements selected for this study include: Visualizing, which is way to efficiently provide the data in easy and readable format for the users (Sherman, 2014, p.343). Data Modeling, which is a way to build dashboards and reports with common logic and terms to ensure that other developers can easily adopt maintenance role (Sharma, 2020).

The Third element is Culture. its main sub-elements selected for this study include: Top management example, which is for to show the way to organization and for leading the transformation (Davenport, Nittal, 2020). Data availability, as data is easy to reach out and in readable format (Thusoo, Sen Sarma, 2017). In the next section, the proposal is built based on the selected suggestions from available knowledge and best practice that were synthesized into the conceptual framework in this Section 4.

5 Building Proposal for the Dynamic Visual Reporting Infrastructure for the Case Company

This section merges the results of the current state analysis and the conceptual framework towards building of the Proposal using Data 2.

5.1 Overview of the Proposal Building Stage

The goal of this development initiative is to propose a conceptual, automated, and dynamic visual reporting solution for the users to support both their business needs and leadership needs.

The business challenge is that the current reporting infrastructure does not contain all the data needed for leading the business. The goal is to provide a Power BI-based advanced and visualized analysis tool for the user that is fully automated (= Dataset is updated in daily basis) and thus combine the current data sources (ERP, CRM, HR, FI) into one data model. In addition to this, the goal is to create a distribution channel for the reports and reporting related topics.

For the proposal building, the literature review provided insights about the reporting and building of a clear and understandable visualization concept. The proposal will be based on these best practice and literature review, as well as will address the identified business needs from the CSA.

The proposal building was executed in four steps. In the first step, the current reporting infrastructure was reviewed with human resources and business controlling lead to ensure that all the key elements would be included in the proposed solution. In addition, the output of the key stakeholders from the first data collecting round was reviewed with the human resources to ensure that all the required new elements were included in the proposed solution. As result of the first step, the proposal draft was created.

In the second step, the data models were created to support the proposed reporting solution. The separate data models were created for reporting purposes with the help of local IT-services. Local IT-services provided the valid data tables and connections for data modelling from the mainframe (ERP, CRM, FINA, HR), and after that, the data was

processed for the reporting purposes which included cleaning the data, creating the calculated measures (KPIS), and other relevant attributes, and, finally a data model was created from these elements.

The multiple data models were built instead of one data model (later in the study, the one data model, common AAS-model, will be presented as the next step development phase). Multiple models were needed as due to the size of the models and because the local data warehousing concept was not ready to be fully used. The models used in the reporting were minimized to ensure smooth usability, so that the models contained the data just from those sources that were used in the reports (the common model that is presented in Section 5.2.3. contains all the sources combined in the one common data model and that can be used in different kind of reporting) to keep them as simple as possible. The data models were based on a snowflake or Waterfall model and the datamining process followed the CRISP-DM approach. The Valid data sources, variables and attributes were identified, and the data was prepared by modifying the data to be simple to use for building the reports (a reasonable time periods was used, outliers were excluded etc.).

As the live Common Data Model was not possible to develop due to technical reasons, the blueprint of the Common Data Model was created instead. This solution was seen useful as the Common Data Model will be developed soon in the future.

The third step was to create the reporting launch page and the reports itself. The reports followed the best practices of how to use layouts that were presented in Section 4.4.1. For example, the visualizations were limited to four per page to provide calm visual layout, so the user can easily see the clear picture of the data that has been visualized for the report. The functional buttons, menus and filters were placed on top of the dashboard to provide logical user experience. In the development of reporting launch page, the local internal communication manager was involved to ensure that the reporting hub would follow the company terms of outlook of the internal communications. The reporting launch page was designed to be an intranet site which contains all the reporting related topics, and the main function was to provide simple user interface to the users from which they could easily find the relevant reports and documents.

In the fourth phase, the reports were sent to businesspersons who was involved in the data collecting for testing.

5.2 Proposal Draft

In this chapter the proposals for the new reporting solutions (technology & culture), reporting infrastructure launch page (technology) and blueprint of the new data model (data) are presented. The proposal draft is based on the business needs, the current state analysis and the best practices found in literature. In the data, 2 phase new stakeholders were involved in the process.

Table 10. Data collection plan of the proposal building stage.

Data 2, Proposal building				
Head of Business Controlling	Face to Face Interview	*Evaluation of the proposal*	17.3.2021	Written document
		Evaluation of the improvements	17.3.2021	Written document
Manager - Brand & Communcatior	Workshop	*Creating the Intranet "frontpage"*	11.2.2021	Written document
	Workshop	*Evaluation of the Intranet "frontpage"*	25.3.2021	Written document
Manager - HR	Workshop	*HR KPI's*	20.4.2021	Written document
Data & Platforms Manager	Face to Face Interview	*Evaluation of the new datamodel*	15.5.2021	Written document
Partner	Face to Face Interview	*Evaluation of the proposal*	19.4.2021	Written document
Partner	Face to Face Interview	*Evaluation of the proposal*	15.4.2021	Written document

As seen in Table 10, the data collection was done with the same structure as in data collection 1 phase. Two partners from the business teams and a manager from brand and communications took part in the data collecting phase 2.

5.2.1 New Reporting solution

New reporting solution was based on the findings from data and technology best practice and literature review, CSA, and Business needs. The stakeholders noted in the interviews that the current reporting solution was needed to replace with a more modern solution. In Addition, the business needs indicated that new KPI's was needed to implement to provide deeper knowledge and more insights to the users.

The Initial proposal for a new reporting solution was divided into three different categories based on the needs and legacy solution. These categories were needed to create to provide solutions that contains specific characteristics.

1. Leading team. This category represents the supervisor needs. The supervisor needs to have detailed data of team members activity, to which the client and the project have the employee booked hours, holiday and net hour balances and employee utilisation that indicates how much billable work an employee has booked on monthly and year to date basis.

2. Leading business. This category represents the engagement and client lead needs. The engagement and client leader need to have detailed data of the client or engagement portfolio they are responsible for. This data contains information of net revenue, profitability, receivables and booked hours by project team on monthly and year to date basis. In addition, the client feedback is needed to support client management.

3. Leading self. This category represents the personal needs of the employee. The employee needs to have detailed view of their key metrics that align with the yearly CRT (Career Round Table = individual development evaluation) process. Human resources team collected the needed metrics (Appendix 1) from the supervisors, and this document was used while building the initial proposal. The KPI's were categorized by type of the KPI, Source system, business unit and measurement level (Business unit, individual or portfolio team). In the appendix "Business unit KPI needs for the reporting" indicates how many KPI's are used in the CRM process. As supervisors had different naming conventions for the KPI's, the KPI's were grouped in the categories that match the KPI definition. The Type of KPI's needed in the reporting indicates the reporting category of what KPI's should be collected to different reports.

This document was used as a blueprint to choose the most common KPI's and utilize them for the reporting purposes.

Table 11 summarizes the inputs from the stakeholders to the proposal building on the New reporting solution according to each category, Leasing team, Leading business and Leading self.

Table 11. Findings of Data 2 for the proposal building in relation to the findings from CSA (Data 1) and the conceptual framework.

Key focus area from CSA (from Data 1)	*Input from literature (CF)*	*Suggestions from stakeholders for the Proposal, summary*	*Description of their suggestion (in detail)*
New Reporting solution	Data Visualation Best Practises (Sherman, 2014) Data Modeling Best Practices (Sharma, 2020)	1) Team Leader Dashboard (Leading Team) - The key team member metrics should be available - Booked hours by month and year to date - Utilization by month and year to date and comparison to previous year - Detailed information of bookings (Project, customer etc.) - Holiday balances and absences - The access must be restricted to supervisors only	The Stakeholder input was that visual version of the current report is needed to support supervisor job. Supervisors need to have clear and consistent view of his/her team status, what's the utilization, how much hours have been booked to a project, holiday balances and summary. The report is to provide one place where all the key metrics can be found.
	Data Visualation Best Practises (Sherman, 2014) Data Modeling Best Practices (Sharma, 2020)	2) Client Portfolio Dashboard (Leading business) - The key Client metrics should be available - Revenue, margin, billing and receivables by month and year to data and comparisons to previous period - Detailed information of bookings (Project, customer, grade etc.) - Fully visualized and dynamic functionality needs to be applied	The Stakeholder input was that visual version of the current report is needed to support portfolio leaders' job. Portfolio leaders need to have clear and consistent view of his/her client portfolio status, how much revenue clients have generated, what's the profitability, what's the utilization, how much hours have been booked to a project, what's the client/project team structure. The report is to provide one place where all the key metrics can be found.
	Data Visualation Best Practises (Sherman, 2014) Data Modeling Best Practices (Sharma, 2020)	3) Personal Dashboard (Leading Self) - The key personal metrics should be available (CRM metrics) - Booked hours by month and year to date - Utilization by month and year to date and comparison to previous year - CRM data utilized to provide needed data of client relations and activity - Client feedback data utilized to provide needed client reviews of projects - Detailed information of bookings (Project, customer etc.) - Holiday balances and absences - The access must be restricted to personal level	The Stakeholder input was that visual version of the current report is to provide needed data to the personnel across the company. HR collected the needed metrics which is needed in the CRM (Career Round Table = Yearly evaluating) process. Those metrics were used in the dashboard.
	Data Visualation Best Practises (Sherman, 2014) Data Modeling Best Practices (Sharma, 2020)	4) Client feedback Dashboard (Leading Team, Leading Self, Leading Business) - The client feedback metrics should be available and comparisons to previous period - Wider distribution solution needed (heavily restricted data for engagement leader only)	The stakeholder input was that wider distribution is needed for the data. The data itself is heavily restricted due to sensitivity issues. 3 different modifications of the dashboard will be created to provide needed insights. The key measures will be NPS (promoted score), answer rate, sent feedback requests and overall satisfaction in detailed level (client and

Table 11 shows the stakeholder suggestions for the proposal. The suggestions have been divided into the three categories which were presented earlier.

The initial proposal contains four different report models that are,

1. Leading Self report. The report is available for every person in the company. The person can see their own personal metrics. Visibility is restricted to an individual's personal information. Table 12 presents the content of the report and describes the purpose of each reporting page.

Table 12. Leading Self: Report description.

Report Pages	Metrics	Purpose
Hours	- Utilization-% - Booked Hours (Client and project level) - Billable hours - Client activity-%	User can follow his/her own performance on client and project level. The Page contains year to date visuals and possibility to filter by a client. Utilization-%, Billable Hours and Activity metrics contains comparison to previous year. User can also see detailed data and upload it to the Excel.
Revenue	- Persona revenue (=personal selling rate * billable hours) - Average hour rate - Managed revenue (applicable for the project managers who may see how much revenue has been booked his/her projects) - Managed receivables - Profit and Loss metrics (for the seniors, who may have these metrics included in their target setting)	User can follow his/her own performance on client and project level. The Page contains year to date visuals and possibility to filter by a client. User can also see detailed data and upload it to the Excel.
Client Feedback	- Net Promoter Score (NPS) - Overall Satisfaction (OSAT) - Promoter, Passive and Detractor rate (-%) - Count of sent and received feedback - Answer rate (-%)	User can follow his/her metrics on client and project level. Page contains additional comments that client has provided
CRM Metrics	- Open and Won opportunities (Value & Count) - Winrate-% - Count of activities and count of activities vs previous year - Count of owned contacts and relationships - Count and value of opportunities where user has been in a referrer role - Count and value of sales credits	User can follow his/her key client relation and sales metrics. User can also see detailed data and upload it to the Excel.
Holidays, Net Hours	- Holidays (Holidays left & Accrued for next year) - Time Off in Lieu	User can follow his/her holiday and net hours development

Figure 14. Sample pages of a Leading Self-Report.

2. Leading Business report. The report is available for individuals who act as the client engagement partners, managers, or client lead partners. Visibility is restricted to engagements where a person is in a manager role or is nominated as the client owner.

Table 13 presents the content of the report and describes the purpose of each reporting page.

Table 13. Leading Business: Report description.

Report Pages	Metrics	Purpose
Project Partner/ Project Manager - overview	- Revenue - Engagement Margin (Eur & %) - Recovery-%	User can performance of his/her project portfolio. The page contains visuals that provide year to date development, visual breakdown of portfolio by clients and comparison to previous periods. User can choose chosen month or year to date view and filter with product or
Project Partner/ Project Manager - Details	- Revenue - Engagement Margin (Eur & %) - Recovery-% - Average Hour Rate - Receivables - Billing - Billable hours	User can performance of his/her project portfolio. The page contains visuals that provide year to date development, visual breakdown of portfolio by clients and project. User can choose chosen month or year to date view and filter with client dimensions. The page contains visual breakdown of billable hours to provide information how much each grade of person has booked billable hours for the project
Client Lead Partner overview	- Revenue - Engagement Margin (Eur & %) - Recovery-%	User can performance of his/her client portfolio. The page contains visuals that provide year to date development, visual breakdown of portfolio by clients and comparison to previous periods. User can choose chosen month or year to date view and filter with product or

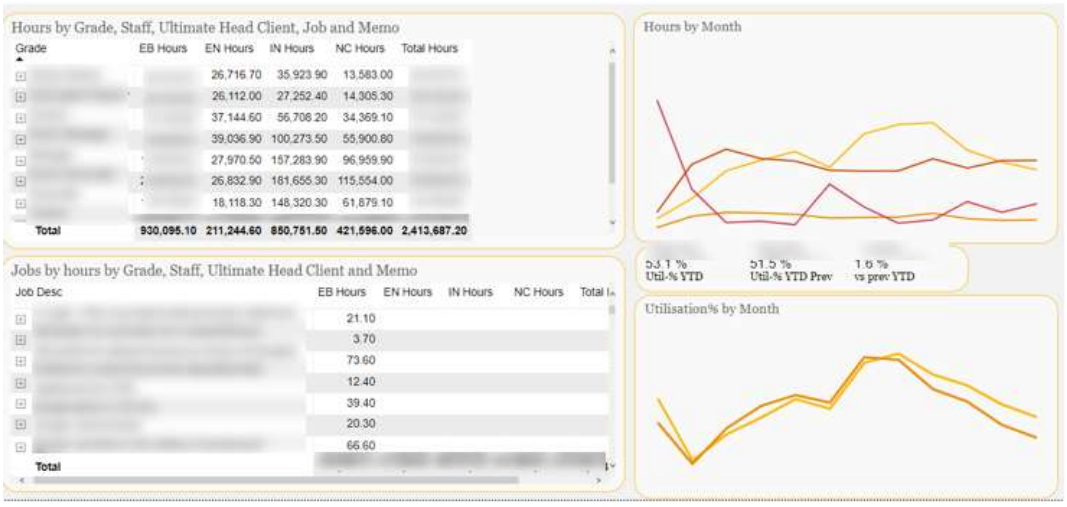
Figure 15. Sample pages of a Leading Business report.

3. Leading Team report. This report is available for individuals who act as supervisors. Visibility is restricted to those persons who are in the role of a supervisor user. Table 14 presents the content of the report and describes the purpose of each reporting page.

Table 14. Leading Team: Report description.

Report Page	Metrics	Purpose
Hours	- Utilization-% - Booked Hours (Client and project level)	User can follow his/her team performance per staff grade on client and project level. The Page contains year to date visuals and possibility to filter by a client. Utilization-% metric contains comparison to previous year.
Annual Leave Hours	- Holiday hours (Annual leavy & Holiday bonus Leave)	User can follow his/her team holiday bookings per staff grade. The Page contains year to date visuals.
Absences	- Holiday balances - Time off in Lieu - Current absences - Hours exceeding standard hours - Net hours	User can follow his/her team absences in detailed level.

Figure 16. Sample page of Leading Team report.



4. Client Feedback report. Three versions of the Client Feedback report are available. One for the whole company (Leading Business), one for the leaders of the business unit (Leading Teams & Business) and one for individuals (Leading Self) who act as engagement managers. Due to GDPR regulations, visibility must be highly restricted as some of the feedback may contain personal related information that is not supposed to

be shared to wider audiences. Therefore, three different report was created, and they were not part of Leading Team, Leading Self, or Leading Business reports. The reports contain the same KPI's and dimensions. Detailed information and comments were for authorised persons only. Table 15 presents the content of the report and describes the purpose of each reporting page.

Table 15. Client Feedback: Report description.

Report Page	Metrics	Purpose
Client Feedback overview	- Net Promoter Score (NPS) - Overall Satisfaction (OSAT) - Promoter, Passive and Detractor rate (-%) - Count of sent and received feedback - Answer rate (-%)	User can follow his/her metrics on client and project level. Page contains visuals of participation (sent & received), NPS and OSAT year to date development.
Business unit overview (only for business unit leaders and management team)	- Net Promoter Score (NPS) - Overall Satisfaction (OSAT) - Promoter, Passive and Detractor rate (-%) - Count of sent and received feedback - Answer rate (-%)	User can follow his/her business unit metrics. Page contains visuals of participation (sent & received), NPS and OSAT year to date development.
Individueal Feedbacks (only for engagement leaders, business unit leaders and management team)	- Net Promoter Score (NPS) - Overall Satisfaction (OSAT) - Promoter, Passive and Detractor rate (-%) - Count of sent and received feedback - Answer rate (-%)	User can follow his/her metrics on client and project level. Page contains additional comments that client has provided.
Count of feedback (only for engagement leaders, business unit leaders and management team)	- Net Promoter Score (NPS) - Overall Satisfaction (OSAT) - Promoter, Passive and Detractor rate (-%) - Count of sent and received feedback - Answer rate (-%)	User can view detailed metrics on client level to see client answer activity and results.

Figure 17. Sample page of a Client Feedback report.

As seen in Figures 14, 15, 16 and 17, the report layout follows the best practices that Sherman presents (2014). The design principle is to use four visuals per page and the filters placed on the top of the page. The common outlook was applied in the reports to provide good user experience. Some differences may appear because of the nature of the data. In these cases, it is more logical to provide plain KPI's cards that presents one figure instead of using bar or line charts. The reports are designed to be as clear as possible in order to avoid different kinds of interpretations.

The New KPI's were created and published for the reporting. The KPI's were created as defined in Table 6. The current month, previous year month, current year to date, last year to date, rolling 6 months, and rolling 12-month time period dimension for each KPI was created to provide time related metrics.

5.2.2 Reporting infrastructure launch page

As one of their suggestions, the stakeholders noted in Data 2 collection phase that the reporting solution needs a proper distribution channel. The distribution channel must work as showcase for the whole reporting which provides professional outlook and functionality that create reliability among the users. Furthermore, the as the reporting is developed to the more visualized and modern direction, the distribution method should follow to provide high quality user experience.

> *"I get lots of different links to reports. Some of them works and some of them not. Some of them come without any decent description. If I add these links to my bookmarks they might stop working in some period of time. I would love to see one place where all these links are working properly without any extra hassling around." (Partner 2021).*

The current reporting solution has a launch page available where users can find the current reports. The current solutions provide only links to the reports and instructions, and for example, wider knowledge or latest news and information are missing.

Table 16 summarizes the inputs from the stakeholders to the proposal building on the Reporting infrastructure launch page.

Table 16. Findings of Data 2 for the proposal building in relation to the findings from CSA (Data 1) and the conceptual framework.

Key focus area from CSA (from Data 1)	*Input from literature (CF)*	*Suggestions from stakeholders for the Proposal, summary*	*Description of their suggestion (in detail)*
Reporting infrastructure launch page (Distribution channel)	Data Distribution (Thusoo, Sen Sarma, 2017)	Currently common landing page is available and same kind of solution is needed for the new reports and dashboards to help users to find the reports and dashboards. Outlook must follow the company communications guidance. In the future all the reporting related material will be distributed via landing page.	Professional distribution channel is needed that align with the "new way of providing information easily and to wide audience". New intranet page will be created. Marketing will provide assist for the outlook questions. Site will contain links to the dashboard, support material for the user and developers and news

As seen in Table 16, the stakeholder input was to keep the same kind of approach that is currently used, but with more reporting related content. Accordingly, the new version of the launch page was created to support the reporting of the whole company. The site should contain all the dashboards and reports that have been published earlier and the ones which was developed. The site will act as a primary distribution channel for the reporting initiative and the main communication channel, which means that all the latest news and information related to the reporting can be distributed via the launch page. In addition to this, the site should contain user instructions, developer support material and links to the source systems. Table 18 shows how the Reporting infrastructure launch page could look like if implemented with the help of Power BI's own "Front page".

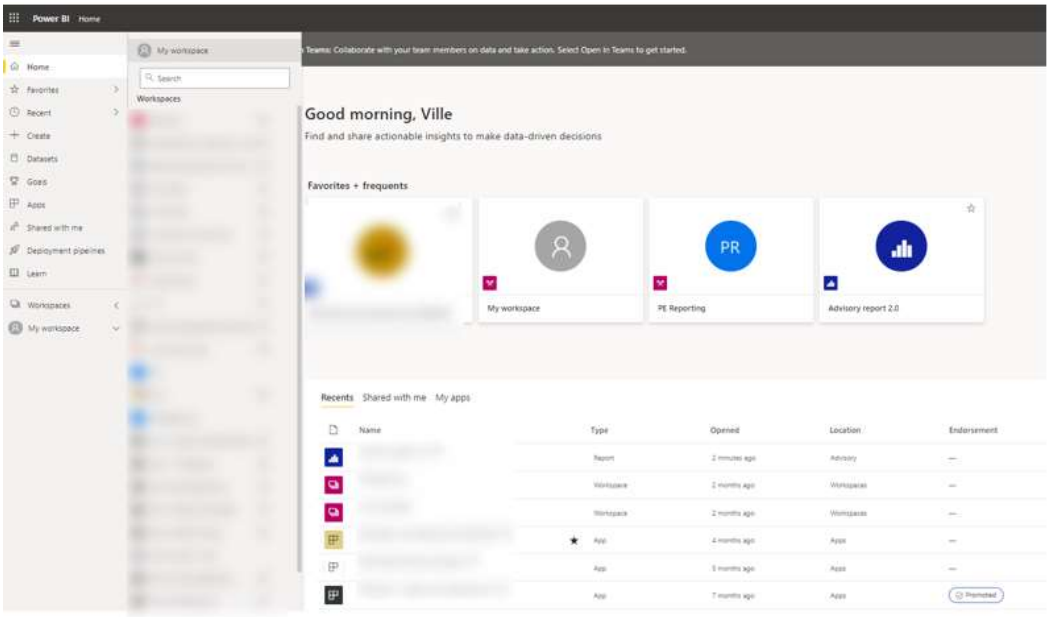


Figure 18. Powerbi.com reporting front page (2021).

The options for the reporting distribution channel were either the Power BI's own "Front page" or a completely new intranet web page. As seen in Figure 18, the front page of

PowerBI.com reporting only contains the reporting elements (reports, workspaces) and no other reporting related topics. As the stakeholders noted in Data 2, one place that collects all the reporting related topics is needed. Table 19 shows how the Reporting infrastructure launch page looks like when implemented with the help of a new launch page.

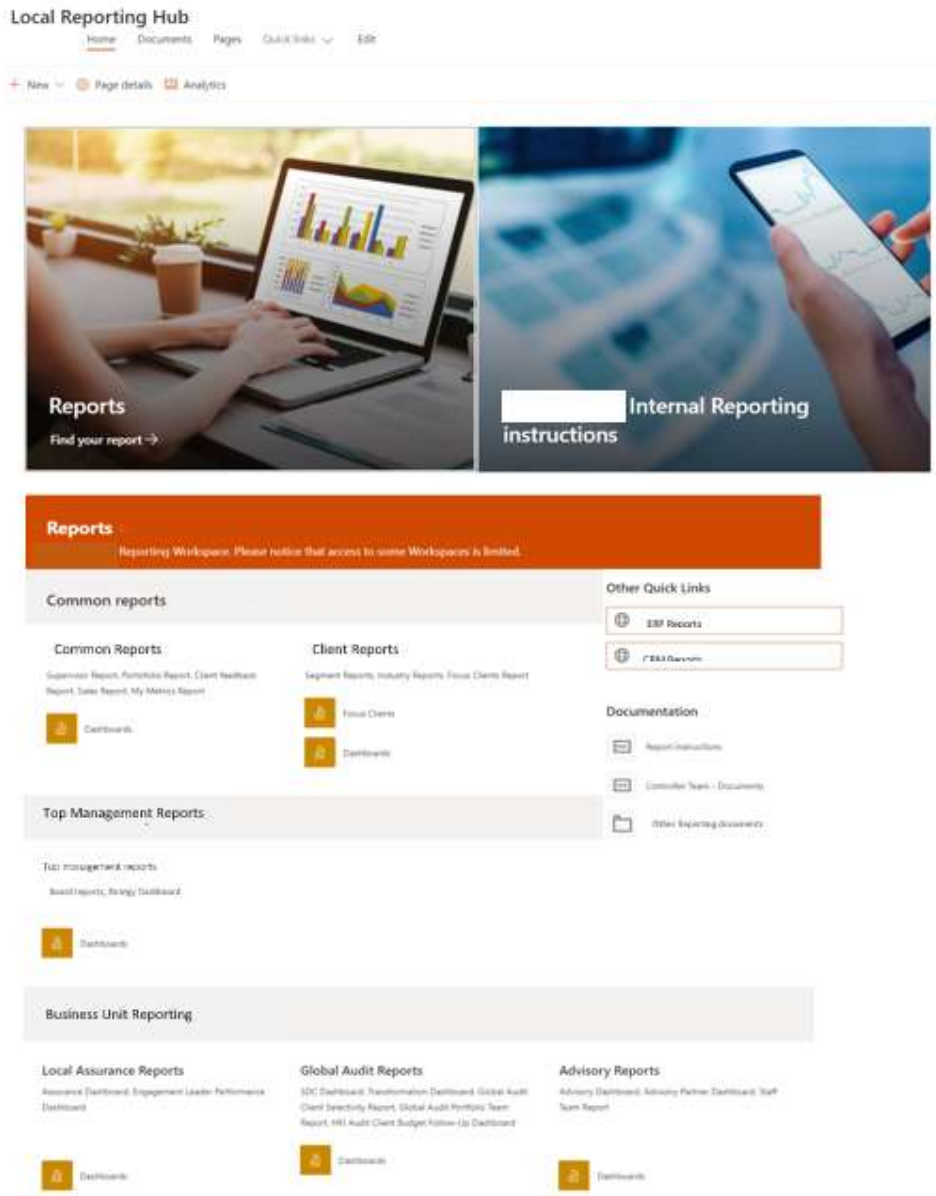


Figure 19. Reporting hub, a local intranet web page (2021).

This new launch page (Figure 19) was developed for the initial proposal with support from the company's internal communications department. Internal communications department provided a platform (Microsoft SharePoint), the guidance of how to use common rules and regulations of visual looks of the launch page, and the user guidance (design help, how to publish news and documents etc). The design of the launch page follows the Thusoo and Sen Sarma (2017) best practices of how to be sure that data driven culture is enabled in practice. In this variant, the data is made available for common use in the way that it was easy to reach out. The page contains direct links to the Powerbi.com cloud service workspaces, where reports and dashboards are published. This page provides the users with a simplified way to find correct reports in a minute instead of searching reports directly from Powerbi.com. In addition, the page contains the communication channel for the news posts that are related to the reporting topics, links to the external source systems (ERP, CRM, FINA) and tools and links to Power BI communities on the Internet for developers.

5.2.3 Blueprint of the new data model

The stakeholders noted that due to the tight schedule, the proposal of the ready-to-use model cannot be completed. Instead of the new data model, stakeholders decided that a blueprint of the data model based on the reporting needs would provide more value at this point. The blueprint was designed to support the upcoming new reporting infrastructure and address the future needs of reporting. The blueprint was designed to be a preliminary sketch and will be further iterated if needed.

Table 17 summarizes the inputs from the stakeholders to the proposal building related to the Common data model.

Table 17. Findings of Data 2 for the proposal building in relation to the findings from CSA (Data 1) and the conceptual framework.

Key focus area from CSA (from Data 1)	*Input from literature (CF)*	*Suggestions from stakeholders for the Proposal, summary*	*Description of their suggestion (in detail)*
Common Data Model	5 C's of Data Managment (Sherman, 2014) CRISP-DM Methodoloy for data mining (Delen, 2014)	Blueprint of new AAS (Azure Analysis Service) will be created.	Blueprint of AAS model will be created. The model will replace current multi cube model. ERP, CRM, Fina, HR and other external solutions will be combines sources in data lake or similar solution.

As seen in Table 17, the actual data model will replace the current multi-cube model (Figure 4) that was presented in the current state analysis. The new data model will be based on Microsoft Azure Analysis Service (AAS). Azure Analysis Service is a platform which is used in the cloud service for data models and data modelling. This data model will allows developers to combine data from multiple data sources and create the needed metrics and variables that support their reporting vision (according to best practices described in Microsoft, 2021). Figure 20 shows how AAS will look like in practice.

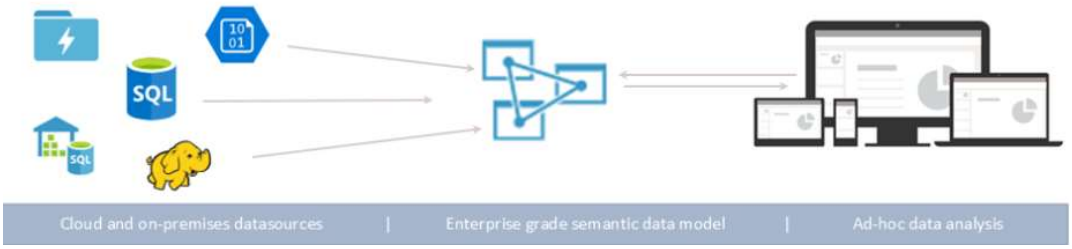


Figure 20. Azure Analysis Service (Microsoft, 2021).

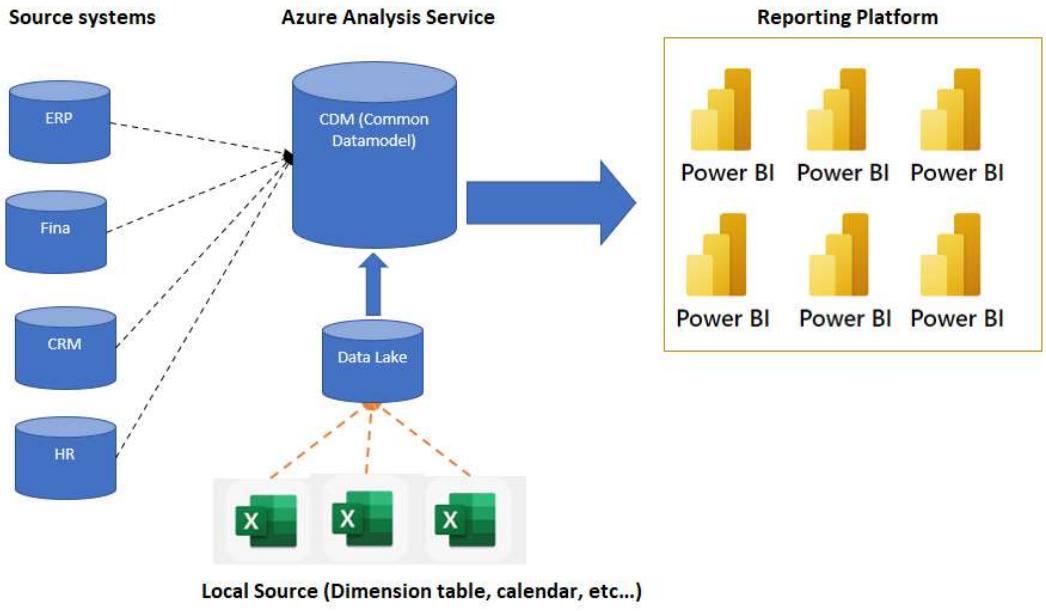


Figure 21. Initial blueprint of the data model.

In Figure 21, the initial blueprint of the data model is presented. Appendix 2 presents the detailed view of the architecture of the data sources. The initial blueprint of the data model shows the local source systems (ERP, HR, CRM, Fina and Local dimension tables) that are ingesting data to the local data storage. There are different options to ingest data to the local data storage, but the common approach is to set up a direct connection to the source system database from where the data is ingested to the local data storage with direct queries (=direct connection to the source system).

After the architecture of the new data model is developed according to this blueprint, the work in the data storage will begin. The ingested data will be prepared based on the Sherman 5 C's of data management methodology. The data will be cleaned accordingly, and errors and false inputs will be corrected. Consistency of the data and conformed data will be ensured. Finally, the data will be current in terms of what will be needed (for example, from the past year until today), and the data will be comprehensive for modelling purposes.

In the data model itself and combining the data into a common data model (CDM), the Crisp-DM methodology will be applied in combination with Sherman's 5 C's methodology. Crisp-DM methodology is a development process, as 5 C's present the rules about how data can be cleared to be as consistent and useful as possible. The Crisp-DM methodology is more a process like approach where data modelling is divided into the pieces, and it is used to support 5 C's methodology that helps understand to the business context and find the patterns of the data and creating the needed variables and measures instead of modifying the data.

These methods will be used in the transforming phase. Sherman's 5 C methodology will be applied in the transforming of the data from the source systems to the common data model; and Crisp-DM methodology will be used when creating the data model itself.

Table 18 shows the data sources that will be relevant in the new data model.

Sources	Source Type	Data	Data Type
ERP	Database	- Revenue - Hours - Operational Data (Clients, products, projects etc.)	Dimensional and fact data. Base data of the customers and projects.
HR	Database	- Staff data - Staff Evaluationg - Comptences - Absences - Holidays - Job detais (Salary etc)	Dimensional and fact data. Base data of the personnel, cost centers, location, personal details.
CRM	Database	- Opportunity Data - Activities Data - Customer Contact Data - Customer relationship Data	Dimensional and fact data. Base data of the sales efforts, relationships, contacts, and pipeline.
FINA	Database	- General Ledger - Vendor data	Dimensional and fact data. Chart of accounts, cost centers, row level GL transactions, vendor details
Customer mapping tables	Excel	- Local customer groupings (Key Customer mapping etc.)	Dimensional data, customer details
Budget Data	Excel	- Budget data from external budgeting tool	Fact data
Client Feedback	Excel	- Client feedback data from external tool	Fact data
Forecast Data	Excel	- Forecast data from external budgeting tool	Fact data

Table 18. Data source definitions.

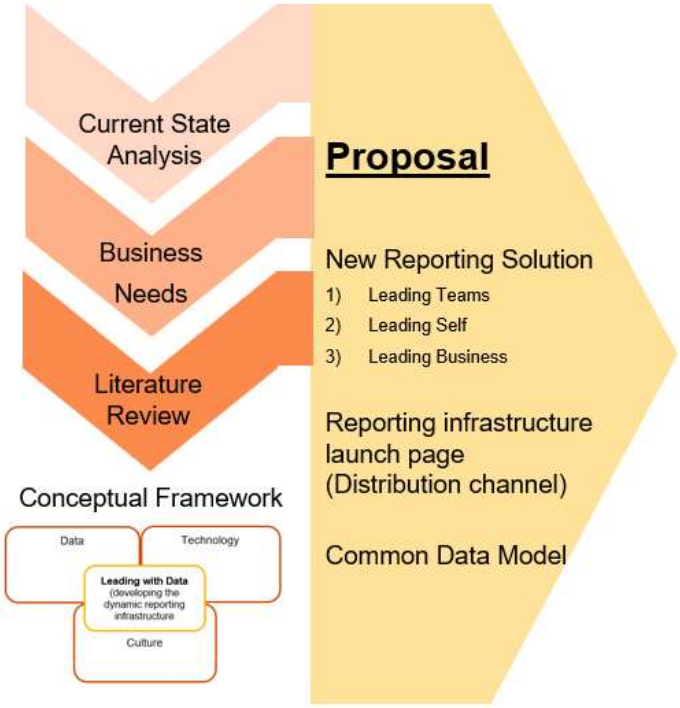
In Table 18, the sources that are relevant in the new data model are defined. As seen from Table 18, there are 4 main data base sources (ERP, HR, CRM and Fina) that contain most of the needed data for the reporting purposes. The Excel datasheets represent the more locally maintained sources that contain dimensional data which is not stored in the data bases (Local mappings etc.).

The new data model will simplify the data collection, processing and distributing. It will create one clear channel and process and provide efficiency for developers, as there it creates only one model available for the reporting purposes.

5.2.4 Summary of the proposal

Figure 22 shows the logic and structure of the proposal building. As seen from Figure 22, the proposal for the Dynamic Visual Reporting Infrastructure that was built based on two data collections (Data 1 and 2), the results from the current state analysis, the identified business needs, and the selected relevant elements from the literature review and best practices.

Figure 22. The logic and structure of the proposal building.



As seen from Figure 22, the current state analysis helped to identify the business needs, and three focus areas for development: the New Reporting Solution, Reporting infrastructure launch page (Distribution channel) and Common Data Model. Thus, Leading with Data was identified as the key focus for search for available knowledge and best practice so that to find solutions how to provide more data to personnel to lead their daily operations. From the literature review, it was founded that Leading with Data can be enabled with three specific topics: Data, Technology and Culture. As the result, four elements of the proposal were built by finding the most suitable solutions to fulfil the business needs that enable Leading with Data.

Table 19. Summary of outcomes from the current state analysis: 3 directions for development.

	Selected areas for development of dynamic visual reporting infrastructure	Proposed solution
1	New Reporting solution	Power BI based reporting solution
2	Reporting infrastructure launch page (Distribution channel)	Intranet web page for all the reporting related topics
3	Common Data Model	Common data model blueprint

Table 19 shows the three identified directions from the current state analysis that were developed into solutions in the proposal building. First, the new Reporting solution and Reporting infrastructure launch page were developed. The included the Power BI based reporting solution (Leading Teams, Leading Self, and Leading Business) and the intranet web pages for all the reporting related topics designed to match the identified business needs and guided by best practices from the literature review. Second, the Common data model was drafted but was not finalized due to the technical challenges with the setup. Instead of a live model, the blueprint of the common data model was developed that will be further detailed in the future.

Table 20 shows the identified business needs and the outcomes that were proposed to address them.

Business Needs - Summary	Leading Business	Teams	Self	Proposed Outcome
New KPI's				
Market Share	X			Market data not applicable for reporting purposes. Will be tested in the Phase II.
Client investments (activities)	X	X	X	KPI's developed for the reporting purposes and are published for the reporting
Client contact relationships	X		X	
Sales credits*			X	
Detailed Profitablity**	X			
Personal Rating history			X	
Client feedback	X	X	X	
Opportunities (Won/Lost/Open)	X	X	X	
Reports				
Personal Dashboard			X	Reporting developed and published
Client Portfolio Dashboard	X	X		Reporting developed and published
Engagement Dashboard	X	X	X	Reporting developed and published
Investment Dashboard***	X	X	X	Definition of investment in hold
More visualized report	X	X	X	Power BI reporting replaced old Sharepoint reports
Data daily updated	X	X	X	Daily update process implemented
Multi device support (smartphone, Laptop, Tablet)	X	X	X	Reporting developed and published
Reporting "hub" for the all reporting related issues & items	X	X	X	Local intranet page developed and published

* How much persons effort has generated Revenue
** What has affected in the profitablity (writeoffs, team structure)
*** For the PMs to follow external and internal spend related to the investment

Table 20. Summary of outcomes of the business needs.

In Table 20, the identified business needs and outcomes are presented. The business needs were addressed in the proposal building in most of the cases. For example, the proposed solutions for Leading Teams, Leading Self and Leading business fulfilled the KPIs and reporting needs. At the same time, Market share KPI and Investment

Dashboard were not completed. It happened since there was no reliable data for the Market Share calculation that would have provided enough business insight and thus, this KPI was not seen as critical at this point. The Investment Dashboard was postponed for implementation because the definition of the investment in this context was not clear enough and this development was postponed until the next phase.

Summing up, the sections above described the proposal draft of the Dynamic Visual Reporting Infrastructure that was built based on two data collections (Data 1 and 2), the result from the current state analysis, and suggestions selected from the literature review and best practices. This proposal draft was launched for use by the personnel as phase one stage of the reporting development initiative. Next section reports on the results of the proposal validation.

6 Validation of the Proposal of the Dynamic Visual Reporting Infrastructure

This section presents the results of the validation stage and points to further developments to the initial Proposal of the Dynamic Visual Reporting Infrastructure. At the end of this section, the Final proposal and next step development plans are presented.

6.1 Overview of the Validation Stage

The data validation of the Proposal of the Dynamic Visual Reporting Infrastructure was done by key stakeholders. The validation process was to ensure reliability of the proposal. First, the validation of New Reporting solution contained the testing of the data itself, testing of the functionality of the reports, and testing of the visibility of the reports. Second, the validation of Reporting infrastructure launch page validation included the layout and functionality testing. Finally, the Data model blueprint validation contained logical checks of the data flow process and sources.

The validation process included both, technical testing and comments from experts. Technical testing was executed to ensure the data quality and functionality of the New Reporting solution. Testing of the Reporting infrastructure launch page was to ensure that needed information is in place. For the Common Data Model, the discussion with the experts was organized. Experts provided their insights of the proposal and validated its logic and architecture.

6.1.1 Validation of the New Reporting solution

This validation was executed by testing the key elements. The testing of the New Reporting solution was done in production environment and the goal of the testing was to ensure the functionalities and data are working as expected. This approach was selected because of the urgency to get reporting and data be in use for the employee year end evaluation, and it was found out that reports included in the initial proposal contained all the required metrics that supported supervisors and employees. The testing stage was set as more as an iterative and reactive phase than a traditional piloting phase.

This approach enabled a very agile testing process and a quick launch of the New Reporting solution into the production.

Due to the urgency in launching this solution, the data itself needed to be tested before the launch. The data was the most critical part in the New Reporting solution, and it needed to have high quality, as the data was used to evaluate employee performance. Thus, it was crucial to ensure that data itself was valid and ensure visibility restrictions, where users see only own data. The validation confirmed that they were valid and working properly. Furthermore, key functionalities were tested to ensure that they would not jeopardize the user experience.

The data testing was done by the key advisors of the development phase. Owners of the data took samples and went through the material to check that data was coherent and logical. There were no critical issues found while testing. After the data testing, the New Reporting solution was implemented to the users.

The outlook of the reports was checked with the company's internal communications specialist to ensure that correct colour schemes and fonts were used. No major findings appeared in this stage due to the excellent support in development stage.

After the official launch into the production, the users had a chance to provide their comments, development ideas and adverse events related to reporting (errors in the visibility restrictions etc). As the spread of the user profiles were wide, different kinds of development or change proposals were found from which some of them went into production immediately, and some of them were left to wait for the final evaluation and will be implemented if the changes are valid for the company wide reporting.

6.1.2 Validation of the Reporting infrastructure launch page (Distribution channel)

This validation was executed by testing the functionality and outlook of the proposal. The proposal of the Reporting infrastructure launch page (Distribution channel) testing was done with the internal communications specialist. The company has globally defined the visualization rules and regulations of its internal communications.

The colour schemes, fonts, visual elements were tested, and no major findings appeared in the layout. Testing of the functionalities was done in production environment, as the launch page was needed to provide a distribution channel for the reports. Some links to other sources was needed to check and correct, but as overall the launch page functionality worked as planned.

One major topic came up after the testing period, which however is not directly related to the Reporting infrastructure launch page itself. Instead, the finding was related to the overall communication process of the Internal Reporting. The finding was that there was no communications plan or guidelines in place, and it was noted that there was a need to have a common approach on how to publish reports, news and make the internal reporting familiar to the users in terms of how to use the report and from where the users can find the needed metrics and information.

This finding was taken into the development plan, and planning of communications will be one of the next steps that are going to be executed.

6.1.3 Validation of the Common Data Model

Validation of the Common Data Model was executed by evaluating the blueprint with the specialist as the expert discussion organized with the nominated person. Thus, this validation was a more theoretical validation because the technical solution was not available. The discussion provided expert insights for the data model blueprint as it was a more holistic approach of what kind of a solution could be possible to developed due to the nature of the data and reporting needs. The data model structure, sources and logic were examined by and discussed with the experts.

It was acknowledged that the data model blueprint contained all the needed elements (ERP, CRM, Client Feedback, Local mapping tables) and it can be used as phase 1 model of the upcoming AAS data model.

The development topics that appeared in the data validation phase are presented in more detail in the next sections.

6.2 Developments to the Proposal (based on Data Collection 3)

In the validation phase, the following improvements and development topics were found (Data 3). Data Collection 3 concentrated on identifying improvements / developments proposed by the specialists/ the key stakeholders to the Initial proposal. Data Collection 3 is strictly focused on the Proposal contents and seeks to finalize it based on the feedback.

One major development need came up in the initial proposal, but most of the other findings were related to the visualizations and data availability. In addition, most of the development topics included preliminary ideas which can be executed later. The one topic that came up, however, was identified crucial part of the upcoming year end evaluation process and it helped the team leaders to collect the needed metrics for the evaluation process from one tool instead of having heavy tailoring of data from multiple different data sources.

The development inputs are presented separately for every solution in the next sections.

6.2.1 Developments to New Reporting Solution Proposal

As the testing was done in a production environment and in the period where employee evaluation started, the reporting got more attention than other areas.

Table 21. Stakeholders' suggestions (findings of Data 3) for the initial proposal in reporting.

Element 1 of the Initial proposal	Parts commented in Validation	Description of the comment/ feedback by experts (in detail)	Development to the Initial proposal
New Reporting solution	Leading Self	Report contains data and metrics that could be useful for the supervisors. Could it be possible to make changes for the setup that would provide supervisors team level information?	Supervisor reporting template was developed to HR, that did the needed adjustments to the data to provide supervisor setup that was based on the personal report setup.
	Leading Self/Leading Business	More Metrics (detailed receivables follow up, partner metrics) is needed in specific topics.	The needed metrics will be added to the report in the next development phase (Q3/2021). The partner reporting will be established in the next development phase (Q3/2021).
	Leading Self	Clear explanations and calculation formulas of the metrics needed to add to the report to provide better user experience.	Information boxes and links added to report promptly.
	Leading Self	Minor fixes of the visualizations.	Ensure that color schema follow the company rules and is applicable in every visual.
	Leading Team	Supervisor reports needs to have more metrics. Hours, absences, and utilization is good starting point, but to support team leader work there is a need to get more detailed information and statistics of team members performance.	The Team Leader Report will be replaced with the promptly developed yearend report. Some adjustments will be made to the date to ensure restricted visibility (payroll data will be excluded).

Table 21 summarizes the development proposals based on the testing. No major findings appeared while testing and, due to the iterative and reactive development approach, most of the user experience related proposals were completed accordingly. One topic came up in the testing phase and as result of this correction, the Leading Self template was modified for the Human Resources (HR) purposes who enriched the report with HR data to provide more relevant information to the team leaders. The main reason for this transformation was that it was noted that the report provided more detailed data from the ERP and CRM for the team leaders than Leading Team-Report that contained just some ERP and HR data. Previously, the team leaders got the data directly from the business controlling, and this data needed to be combined and tailored from different sources, thus, no common approach existed in the past. With the Leading Self report, there was on option created to straightforward the process, simplify the data collecting and provide a common solution to every team leader. As a result of this, the team leaders got a new dynamic and visualized report from HR that supported their actions in the year end evaluation process. In addition, it was decided that the Leading Team report that was developed earlier was set to be replaced with the version that was launched to the team leaders for end of the year evaluation process.

6.2.2 Developments to Reporting infrastructure launch page (Distribution channel) Proposal

The testing of Reporting infrastructure launch page (Distribution channel) was done in a production environment. Table 22 summarizes the development suggestions.

Table 22. Stakeholders' suggestions (findings of Data 3) for the initial proposal in reporting.

Element 2 of the Initial proposal	Parts commented in Validation	Description of the comment/ feedback by experts (in detail)	Development to the Initial proposal
Reporting infrastructure launch page (Distribution channel)	Reporting Launch Page	Direct links does not work accordingly.	Links corrected and tested.
	Reporting Launch Page	Specific page for partner, where partner evaluating metrics can be easily found would be helpful.	Web content will be added.
	Communications Plan	Wider communications related to the reporting topics should be applied.	Communications plan and guidance needs to be created. How the information is distributed etc.

Table 22 shows the development proposals based on the testing. No major findings appeared in the testing. The main development finding was related to the functionality of the content of the launch page and the need of additional content. Findings of the current

content consisted mainly of the links that were not working due to change of the file source destination, and those were more a maintenance issues instead of the development findings.

The additional content that was needed was related to the upcoming target setting process. Due to a new fiscal period and the target setting process, the company needed a specific place for the top management evaluation metrics. Previously, this was based on the static word document that contained instructions and the links to the reports that contained the needed data. The challenge with the document was that it was sent by email to the top management right in the beginning of the financial year and if changes appeared in the report links, the links in the document would not work anymore and a new document needed to be sent to the management, and there was risk identified that a single email could be lost in email boxes. The solution was that the New reporting launch page could contain the direct links to the reports and databases, because the sources could be easily updated in the intranet once changes appear, and it would not affect the users. This topic was taken into the development plan to be executed as soon as possible.

6.2.3 Developments to Common Data Model Proposal

Table 23. Stakeholders' suggestions (findings of Data 3) for the initial proposal of reporting.

Element 2 of the Initial proposal	Parts commented in Validation	Description of the comment/ feedback by experts (in detail)	Development to the Initial proposal
Common Data Model	Data Collecting	Global team has developed data model that contains ERP data. Building the local setup might be too heavy and other solutions needs to be taken into consideration. Global model is still a compromise solution and additional data might need to be ingested from ERP. Global model provides shortcut and complete ERP model might not be needed to be created locally.	Global Reporting and Analytics model will investigated. In best case scenario the Global model will provide majority of the needed data and local adjustments would be minimal.

Table 23 presents the proposals based on the expert discussion. The main question that appeared was that could it be possible to use the data model that the global team has developed instead of bringing data directly from the own ERP. Using the Global Model has one major benefit. As the data source is ready to use, it would spare time and resources as new metrics, new attributes and data cleaning is not needed to be executed. The level of granularity is the major disadvantage, and this needs to be

investigated more if there is any kind of change needed to create a hybrid model that would contain the data from both sources. This would help in the development phase.

Thus, the Global data model contains data from ERP, but the granularity of the data is insufficient. The current reporting needs are more detailed than what the global model can provide. According to the stakeholders, the pre-study of global model and comparison to the current models is needed to have a decent view of the capabilities and shortages in the data if there are any. If the level of granularity is good enough, the parts of the Global data model could be taken into the consideration while building the Common data model.

6.3 Final Proposal

For the Final proposal of the Dynamic reporting infrastructure, no major changes or adjustments needed to be implemented. Most of the development findings that came up were transferred to the development backlog to wait for the next development phase. The soft launch of the Dynamic reporting infrastructure was successful. The users found the reports immediately, and it was found very useful set of new tools for Leading Team, Leading Self, and Leading Business.

6.4 Next Steps

The proposal validation phase raised some topics that need to be taken into consideration. The Dynamic reporting infrastructure is up and running and with some enhancements it can provide even more useful data to the users. However, it must be noted that now the company has a modern reporting platform in use, but in the terms of analytics there is still a lot of work to do. The thesis researcher recommends that the following five development suggestions will be taken into the action to ensure the quality of service and the solution for the business and for the users.

1. Development of the common data model according to the plan. This will be the next major development stage to enable development and production of the analytics tools for business use. The common Azure Analysis Service model based on the preliminary blueprint will be created to support reporting and analytics initiatives.

2. Development of the analytics. As major part of this project, the first version of common reporting infrastructure is in place and running. The company wide analytics platform will be the next major step. The platform provides more prescriptive and predictive analytics instead of reporting.

3. Ongoing and iterative development process for V2 reporting models. Development and update of the current reporting solution will continue, and the internal customer's needs (Visual, KPI's) will be fulfilled.

4. Developing the internal reporting and analytics development practice. Internal reporting will be centralized to one team which is responsible of end-to-end development and production process. Communications, training, and other administrative tasks are also included in the responsibilities.

5. Developing communications plan to increase adoption rates and to provide more information for the users. As reporting is developing, the adoption rates need to increase. As one major action, the SharePoint reporting environment will be updated within H1 of 2022 and more visualized and dynamic launch page will be developed. In addition, communications plan will be created which provides guidelines on how to communicate efficiently to the end users' changes, updates, and other reporting related topics.

It would be important that these development initiatives are taken into action in the upcoming months to ensure that the development of the reporting infrastructure serves its users in the best possible way.

7 Conclusion

This section contains the executive summary that pulls together the challenge and proposal development. In addition, thesis evaluation is included based on evaluation criteria defined earlier in the study.

7.1 Executive Summary

The objective of this thesis was to propose a conceptual, automated, and dynamic visual reporting solution for the users to support the business needs and leadership needs. The case company launched a new strategic plan, and one initiative is to develop its personnel's digital skills. To support this initiative, the company tools must be updated to match the needs in the reporting. The reporting is expected to develop from the old environment to the new modern BI integrated environment that connects the new source systems together with the old ones.

The study started with the current state analysis that was done by interviewing the identified key stakeholders. The stakeholders' vision was very clear in the beginning due to fact that most of them have had connection with modern BI-tools, and it was noted that the current available solution did not present the modern tool in any terms and the lack of recently implemented source system data was seen as a critical shortcoming. Stakeholders provided the needed insights and vision of the strength and weaknesses of the current solution, the expectations for the new solution and new KPI's that were needed for the conceptual, automated, and dynamic visual reporting solution. Three development areas were identified at this point, New Reporting solution, Reporting infrastructure launch page and Common Data Model.

These development needs informed the directions for literature review and search for best practices. Leading with Data was the key theme and the Data, Technology, and Culture were identified as the supporting elements. It was found out that Leading with Data needs an efficient and structured data modifying process, a visual reporting solution and a distribution channel that will share information to the users. These methods were used in the proposal building.

The proposal for the Dynamic Visual Reporting Infrastructure was built based on two data collection rounds, the results from the current state analysis, the identified business needs, and selected suggestions from literature. The proposal consisted of the New Reporting solution, Reporting infrastructure launch page, and Common Data Model. The New Reporting solution contained three different reporting categories, Leading Team, Leading Self, and Leading Business. As a result, four different report models, Leading Self, Leading Team, Leading Business and Client Feedback reports were developed to provide the needed information for the users. These reports were built by using the latest BI-tools to provide the maximum user experience with a dynamic and visual layout. The reports contained new KPI's which were identified with the stakeholders earlier. The Reporting infrastructure launch page was designed to be a central hub for the reporting topics. The launch page was created to be part the company intranet environment. The launch page key feature has a visual layout where direct links to the reporting workspaces are easy to find by users. In addition, the site contains news posts related to reporting and support material for the users. The site is set to be the primary communication channel for the reporting topics. The Common Data Model was not created as it was supposed in the beginning of this project. Due to technical issues with the IT-infrastructure, there was no chance to start building a live data model. Instead, the blueprint of the model was created as the Common Data Model. It will be needed in the future if the company wants to enable a reliable data and analytics platform and reporting. The blueprint was designed to work in Azure Analytics Services, and it collects data from every source system that are in the company use and utilizes one data model from these data sets. The blueprint will be used as a guideline when development of the Common Data Model starts.

Thus, the Proposals that form the outcome of this thesis include the New Reporting solution and Reporting infrastructure launch page (Distribution channel) to support business needs and leadership needs. In addition, the outcome of this thesis is the preliminary blueprint for the Common data model.

The validation phase was done in production environment. The validation phase contained testing of the data, functionalities, and outlook. The expert discussion was organized to evaluate the Common Data Model. The reports and launch pages were implemented immediately due to the need of the data in the employee year end

evaluation process. Some development topics were found and those will be implemented in the upcoming development phases if they provide value for the users and business. The New Reporting Solution and Reporting infrastructure launch page were found very useful. The users found these solutions immediately and used these in their year-end process as a supporting tool.

The reports and the launch page represent a modern corporate reporting solution and starting point of the company wide business intelligence and analytics journey which will lead to a more deeper data leadership in the company. The data model blueprint is the key element of developing the analytics and the preliminary version based on the needs and will provide structure for the upcoming setup.

After the implementation of automated and dynamic visual reporting solution, the company has leveraged its ability to the lead with the data.

7.2 Managerial Implications

This study is a first step towards a more data driven organization culture. The study provides tools and action points for the upcoming challenges and is a starting point of the digitalization and analytics journey of the company. In Section 6.4, the next steps were presented that the company is recommended to follow. The core topic of the next steps is to set up an internal reporting and development practice which is responsible for the companywide internal reporting and analytics. The practice is to create common guidance, rules and visual outlook that should be followed by the users. Reporting development and production is concentrated into this practice. Furthermore, the practice is working in close relationship with local IT-resources to ensure smooth and reliable data development process. The practice will act as central hub for the company internal reporting and analytics.

If the decisions are made and next steps get completed in the future, the company's capabilities of reporting and especially analytics will reach a new level. In the future vision of the company's reporting and analytics platform, descriptive, prescriptive, and predictive analytics are implemented, a modern tool adopted, and the company is fully led with the data.

7.3 Thesis Evaluation

This thesis outcome changed compared to the objective (from conceptual to the implemented solution). The thesis researcher needed to adjust the new outcome so that the outcome supported the needs of the company and as result the production models were created. The research design supported this approach because no changes needed to be applied in the research structure. CSA and the research of the existing knowledge and best practices supported the changed outcome without need to make any adjustments.

The research design helped to conduct a structured research process and accurate data collection. The thesis researcher ensured that correct stakeholders were involved. The review of existing knowledge and best practices helped to identify selected themes and relevant sources for building the proposals. However, the data collection could have been more efficient. The data collection was documented in written documents and other data collection methods should have been applied to provide more variance in the methods and to provide more data. In addition, the thesis could have been more concentrated on the possible next steps and future vision of company reporting and analytics initiative.

While working on an academic study, research quality must be evaluated to ensure that the results of the research are correct and the research has creditability (Kananen 2013, p.176). In the qualitative research, the evaluation in not as simple as it is in the quantitative research, as the research approach is considered more human orientated. This quality plan will consider Credibility, Transferability and Dependability (Kananen 2013, p. 188-189).

7.3.1 Credibility

Credibility of research can be increased by a careful focus on the analysis and proper documentation of data. The analysis and documentation should be prompt and it should consider all the stages of the research and all the activities which are involved in the research. The more well-analyzed and well-documented data is available, the more credibility there is. (Kananen 2013, p. 188-189.) Saunders et al. (2016, p.206) also

describe the techniques such as checking the data with research participant and using reflections with different persons, which can be used to strengthen credibility of the research.

In this study, credibility was ensured by taking the following steps. The analysis and documentation of the data were prompt and related to all the stages, from data collection to proposal stages. The data collection and the proposals were reviewed and evaluated with the named participants after each stage. The participants of the study were chosen because their expertise and interest in the internal development or they had the needed skillset to support this research.

7.3.2 Transferability

Transferability of the research can be seen as how the results, methods and approach can be applied in similar contexts (Kananen 2013, p. 190-191). The transferability of the research provides the accurate starting point for other researchers. However, the qualitative research is flexible, so transferability of its results is limited. (Kananen 2013, p. 192).

In this study, transferability was ensured by providing a detailed description of the research process in terms of interviews questions, design models of the data models and datasets and documenting the findings with needed accuracy. In addition, the research was not strictly detail oriented from technical point of view. The level of details was informative enough and didn't go too deep into the technical glossary. Too detail orientated research could had jeopardized the transferability. The key concepts of the research were described accordingly, and certain holistic approach was enabled to ensure the study concept can be used in similar development studies

7.3.3 Dependability

Dependability of the research was ensured. As dependability is synonym for reliability, reliability can be used as a quality criterion (Saunders et al., 2016 p. 206). Reliability of the research stands for the consistency of the outcome and the result of the research can be replicated with the same results (Kananen, 2013 p. 189).

In this study, reliability was based on the consistency and transparency of the data collection process. There were some challenges with the interview method, which was a more open conversation, that was planned to follow a certain structure to gain data for the key questions. Afterwards the open conversation was sufficient, but the more structured interview process might have provided even more results, especially for future needs and challenges related to reporting and analytics.

The data collection of the topics that were related to the data model, data sources and technology itself, had a more structured approach, because of the nature of the subjects. Therefore, the data collection was narrowed to certain subjects to avoid multiple entries with different approach and sharpen the findings. For example, the company's top management was not included in the data collection, instead of that the stakeholders who were involved lead teams and business engagements. They had the needed insights and development needs and provided more relevant data for this research.

Based on these evaluation criteria's the research quality was ensured for the study results to have better creditability.

7.4 Closing Words

The implemented solution will provide to every employee of the company access to the new and visual data and metrics with modern BI-tools. Hopefully, this modern approach will increase employees interest of digital upskilling and it will increase the interest to start working with own BI-solutions to find new ways of providing their services and knowledge to customers. In the end this will ultimately increase the company's digital capabilities.

The study has provided more understanding and experience of the modern digital tools and their capabilities. In addition, it has provided significant information of how data can drive companies and what are the key factors of leading with data. The study provided an excellent starting point for the company in their journey toward data leadership and analytics.

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KPI Collection defined by business units

Business unit KPI needs for the reporting

Count of Category	Column Labels				
Row Labels	Business unit 1	Business unit 2	Business unit 3	Business unit 4	Grand Total
ClientFeedback	12	9	8	11	40
No of Client Feedback	5	4	4	5	18
NPS	7	5	4	6	22
CRM	7	11	6	11	35
Activities	4	3	3	3	13
No of leads				2	2
No of sales meetings		2			2
Opporttunities	3	3	3	3	12
Contacts		3			3
Referrers				3	3
ERP	19	17	5	11	52
Additional invoicing	1			1	2
Ebita	1	1	1	1	4
Hours (Billable)	1		2	2	5
Hours (Not Billable)	1	2			3
NR	4	5	1	2	12
NR (Key Client)		1			1
Profitability	2			1	3
Realisation	1	2			3
Receivables	2		1	2	5
Utilization	4	3		2	9
NR (Project manager Revenue)	2	3			5
HR	9		3	5	17
Feedback	6		2	4	12
Training	3		1	1	5
Grand Total	47	37	22	38	144

Type of KPI's needed in the reporting

Count of Category	Column Labels				
Row Labels	Business unit 1	Business unit 2	Business unit 3	Business unit 4	Grand Total
Business Unit	7	7	7	8	29
ClientFeedback	2	2	2	2	8
CRM	3	3	2	3	11
ERP	2	2	3	3	10
Individual	31	22	11	23	87
ClientFeedback	8	5	4	7	24
CRM	2	5	2	5	14
ERP	12	12	2	6	32
HR	9		3	5	17
Portfolio Team	9	8	4	7	28
ClientFeedback	2	2	2	2	8
CRM	2	3	2	3	10
ERP	5	3		2	10
Grand Total	47	37	22	38	144

Data model detailed architecture (preliminary blueprint)