A Technology Roadmap for Providing Predictive Analytics Services

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EXECUTIVE SUMMARY

Nowadays companies endure several challenges in order to succeed. They operate in dynamic environments in which customers are more demanding and active. The products and services they offer are similar in comparison with their competitors and one of the few key differentiators is improving business processes such as marketing, customer relationship, product and services quality, and financial performance. In order to improve these processes is imperative to recollect data from different sources (customers, sales, feedbacks, finances, etc.), but then a new challenge emerge: what to do with the bulk of historical data that companies have and don't know what to use for? One of the answers to this question is provided by Predictive Analytics (PA), a general term that includes statistical models, empirical methods and tools that are used to gather and analyze information and to predict outcomes of the problems solutions

Predictive analytics is gaining attention and is forecasted as one of the next technologies to be broadly adopted by companies in the near future, therefore, IT consultancy companies can find new opportunities for their businesses, offering services to their customers related to that technology. Such services are named Predictive Analytics Services (PAS). Nowadays, companies such as SAP, IBM, CGI or Teradata currently provide predictive analytics services to their customers, however, other companies such as Avanade Netherlands BV have not incurred in providing them.

Decide to provide predictive analytics services is the first step an IT consultancy company should do, however, there are another important decisions that the company must take in order to reach the final goal. These decisions are related to which technology approach to adapt, which type of predictive analytics technologies (existing on the market) to focus, the type of services that should be provided, which type of industries will be services targeted and on which lines of business within those industries to focus. One of the managerial tools that can help IT consultancy companies such as Avanade Netherlands BV in taking the right decisions for providing predictive analytics services is a technology roadmap.

The main objective of this master thesis was to develop a roadmap for providing predictive analytics services. First, information was gathered about Predictive Analytics and Predictive analytics services in the market. Then with such information a model roadmap for providing predictive analytics services was designed. This model, contained three main layers named market, technology, and company and one extra layer used as a guide for the application process named choices. Then, information about Avanade Netherlands BV was collected and use as the main input for applying the model.

When implementing the roadmap in the company some relevant aspects were identified. One of them was the importance of finding the right people that have access to the information to make the right choices. Another important aspect to take into account when implementing the roadmap is the communication – of the main objectives of the roadmap, the decisions/choices made so far during the process and the level of technical detail that is needed during the process.

Regarding the usability of the roadmap in Avanade, it was possible to conclude that roadmapping process helps to connect external with internal aspects in a high level, being more useful when connecting external factors such as Industries and market analysis with internal factors such as readiness/ skills of staff and technical readiness of products available. Also, according to the evaluation performed in Avanade, it was possible to conclude that roadmapping integrates different aspects such as product/service, business and

market perspectives in a high level. However, on the other side, roadmapping helped in the decision making process in a medium level.

This roadmap could be generalized and applied in other type of IT consultancy companies different that Avanade because it contains certain steps that might help them according to their characteristics. Also, the roadmap model provides extra information gathered from the market study that other companies might use applying different criteria to analyze each decision.

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1. INTRODUCTION

1.1. Research context

1.1.1. Research problem

Nowadays companies endure several challenges in order to succeed. They operate in dynamic environments in which customers are more demanding and active. The products and services they offer are similar in comparison with their competitors and one of the few key differentiators is improving business processes such as marketing, customer relationship, product and services quality, and financial performance [1]. In order to improve these processes is imperative to recollect data from different sources (customers, sales, feedbacks, finances, etc.), but then a new challenge emerge: what to do with the bulk of historical data that companies have and don't know what to use for? One of the answers to this question is provided by Predictive Analytics (PA). By analyzing historical data, predictive analytics allows companies to forecast the behavior of their customers, detect and prevent threats, measure social media impact or identify future business scenarios [2, 3].

Predictive analytics is a technology that is gaining attention and is forecasted as one of the next technologies to be broadly adopted by companies in the near future. SAP and Loudhouse Consultancy did a survey to 309 companies in early 2013. The results showed that "about 69 per cent of U.K. businesses and 78 per cent in the U.S. said they believed they'd be investing in predictive analytics in the next five years. About 61 per cent of all respondents said they were actually investing in it already, and that it was a priority within their organizations" [4]. Also, firm consultancy Gartner pictured Predictive Analytics as one of the technologies that will be adopted by the mainstream in less than two years, when its applicability and importance will pay off [5].

These previous studies demonstrate the importance that Predictive Analytics is gaining, therefore, IT consultancy companies can find new opportunities for their businesses, offering services to their customers related to that technology. Such services are named Predictive Analytics Services (PAS). Nowadays, companies such as SAP, IBM, CGI or Teradata currently provide predictive analytics services to their customers [6, 7, 8, 9], however, other companies such as Avanade Netherlands BV have not incurred in providing them.

Decide to provide predictive analytics services is the first step an IT consultancy company should do, however, there are another important decisions that the company must take in order to reach the final goal. First of all, it has to assess if it counts with all the elements to provide predictive analytics services. Second, the company has to decide which is going to be the technology approach to adapt, this is, on which type of predictive analytics technologies (existing on the market) is it going to focus. Third, the company have to choose the type of services they should provide according to its strategy and capabilities. Finally, it's important to decide to which type of industries will be services targeted and on which lines of business within those industries to focus.

1.1.2. Research objective

One of the managerial tools that can help companies such as Avanade Netherlands BV in taking the right decisions for providing predictive analytics services is a technology roadmap.

Technology roadmap help to address three main questions: (1) what goal does the company needs to achieve, which in this case is defining what are the type of predictive analytics services the company

needs and is able to provide; (2) what is the current state of the company regarding such goal. As mentioned before, here is important to analyze Avanade Netherland BV's current provision of analytics services, capabilities and their customer's needs; and (3) which are the necessary steps to be done in order to reach that final goal, in other words, what are the changes that the company must do in its processes, people or assets if they want to provide such services to the market.

One of the major challenges making this roadmap is that in the designing process is not just important to consider the aforementioned three main questions but also it is necessary to study some external factors. Some of them are: which are the type of services that are currently offered, to what target market segments are they focused on and what are the vendors or providers on the market. If this external factors are not considered as part of the roadmapping process then the final roadmap won't be completely adjusted to the market.

Although there is a big challenge in designing this roadmap there is also a trade-off which is important to mention. Avanade Netherlands BV is going to provide admission to Accenture's knowledge database. This will provide access to business cases, documentation and papers which will be of a lot of help in answering the research questions.

Now, why a roadmap is needed, why not other managerial tool? There are certain benefits that a roadmap has in comparison with other tools. According to Phaal et al [10] a roadmap is a time-based chart that comprises several layers of the company such as market, product/service and technology. Also, a roadmap enables the exploration in the evolution of those three components. Additionally, as Phaal et al describes "many of the benefits of roadmapping are derived from the roadmapping process, rather than the roadmap itself. The process brings together people from different parts of the business, providing an opportunity for sharing information and perspectives and providing a vehicle for holistic consideration of problems, opportunities and new ideas" [10]. This means that with this specific tool there are benefits not just with the outcome but also with the process. Finally, the graphical form of the roadmap is considered as a strong communication instrument.

Taking into account the aforementioned problem and the possible solution the next objective is set for this research:

Developing a roadmap for providing predictive analytics services

1.1.3. Research questions

Derived from the main objective of this master thesis the following main research question is proposed:

- ***RQ0: How is the process of roadmapping that an IT consultancy company such as Avanade should make in terms of the firm, market, and technology in order to provide predictive analytics services?***

    This answer will be resolved when the roadmap application process is complete. To do so, information about predictive analytics services will be gathered in order to create a model roadmap. This roadmap will be applied to Avanade Netherlands BV taking into account the

capabilities and business drivers of the company. Finally, an analysis of the gaps and similarities between the model and the application to Avanade case will be performed.

This main research question can be broke down in five relevant sub questions:

- *RQ1: What is the current state of the art of predictive analytics and predictive analytics services, and how technology roadmapping can help in the implementation of such services?*

  In order to answer this question, it is important to provide information about the predictive analytics such as where it is located within the spectrum of BI technologies, how the process of predictive modeling is, and what are the current applications found on the market. Next, PAS will be analyzed providing the following information: which are the type of services offered on the market, to which industries are they targeted, how are those services grouped, and what are the different technology approaches that companies follow. Also, information about the current needs of customers/clients towards PAS should be provided. Finally, an overview of technology roadmapping will be provided explaining how this technique can help in the implementation of PAS.

- *RQ2: What are Avanade's drivers and capabilities, and how they currently deliver services to their customers?*

  In order to offer PAS it is important to analyze how the company currently delivers services to their customers, taking into account the services and technologies. In addition to this, it's essential to assess the company's business drivers and capabilities identifying their strengths and weaknesses, and the opportunities and threads they see on the market regarding predictive analytics services.

- *RQ3: How should be a technology roadmap model for providing predictive analytics services based on the information gathered in RQ1 and how should this model be applied to Avanade Netherlands BV, considering the information collected in RQ2?*

  Once all the information of RQ1 is collected, a technology roadmap model for providing predictive analytics will be designed. This roadmap will consider three main layers named company, technology and market but also an additional that will guide the uses of the model in the application process. The second step to answer this question, is to use the aforementioned model and applied to Avanade Netherlands BV case, taking as main input the information gathered in RQ2.

- *RQ4: Which aspects should need special attention during the process of implementation of the roadmap and what is the level of usability of the roadmap in an organization such as Avanade as well as in other type of companies in the industry?*

  To answer this question it is necessary to analyze the aspects that were more relevant during the implementation process of the roadmap (RQ2). Also, it is necessary to evaluate the level

of usability of the roadmap within Avanade but also to other type of companies in the industry.

1.2.   Research approach, required data and collection methods

The research process will be divided in four different phases: state of the art, case study of Avanade, technology roadmapping for predictive analytics services and evaluation of the roadmap (Figure 1). Below there is a description for each of the phases as well as of the required data and collection methods used in each of them.

1.2.1.   State of the art

In this phase, question RQ1 will be answered in three sections.

The first section is a literature review of the state of the art of predictive analytics and predictive analytics services. The information will be gathered from secondary data such as papers, books and online articles.

The second section consists of a market study of the current offering of PAS, and an analysis of the customer needs based on alternative resources. The market study consider aspects such as the type of services offered in the market, the industries to which those services are targeted, how are those services grouped and which are the focus technology approaches that the companies follow. The main source of information will be secondary data gathered from the companies' webpages and documentation. On the other hand, the analysis based on alternative resources depicts information about the customer needs in regards to business lines, industries, type of services and an emergent market named cloud hosted predictive analytics. The main sources for this analysis is secondary data taken from research reports, an article published in Forbes and a non-scientific paper published by an expert in predictive analytics.

The third and final section of this phase is a brief literature review of technology roadmapping. Here, technology roadmaps will be described in terms of their purpose and format, explaining which of them will be used in this thesis. Also, this section explains how technology roadmapping can help in the implementation of predictive analytic services. The information for this section will be gathered from secondary data such as papers and online articles.

State of the art

- Predictive analytics (PA)
- Predictive analytics services (PAS)
- Technology roadmapping

RQ1

Case study of Avanade

- About the company
- Business drivers
- Capabilities
- Delivering of services

RQ2

Technology Roadmapping for providing Predictive Analytics Services

- Technology roadmapping model for providing predictive analytics services
- Applying the model roadmap to Avanade Netherlands BV case

RQ3

Analysis

RQ4

- Analysis of the implementation
- Analysis of the usability of the roadmap in Avanade
- Applications to other type of companies

Figure 1. Research approach
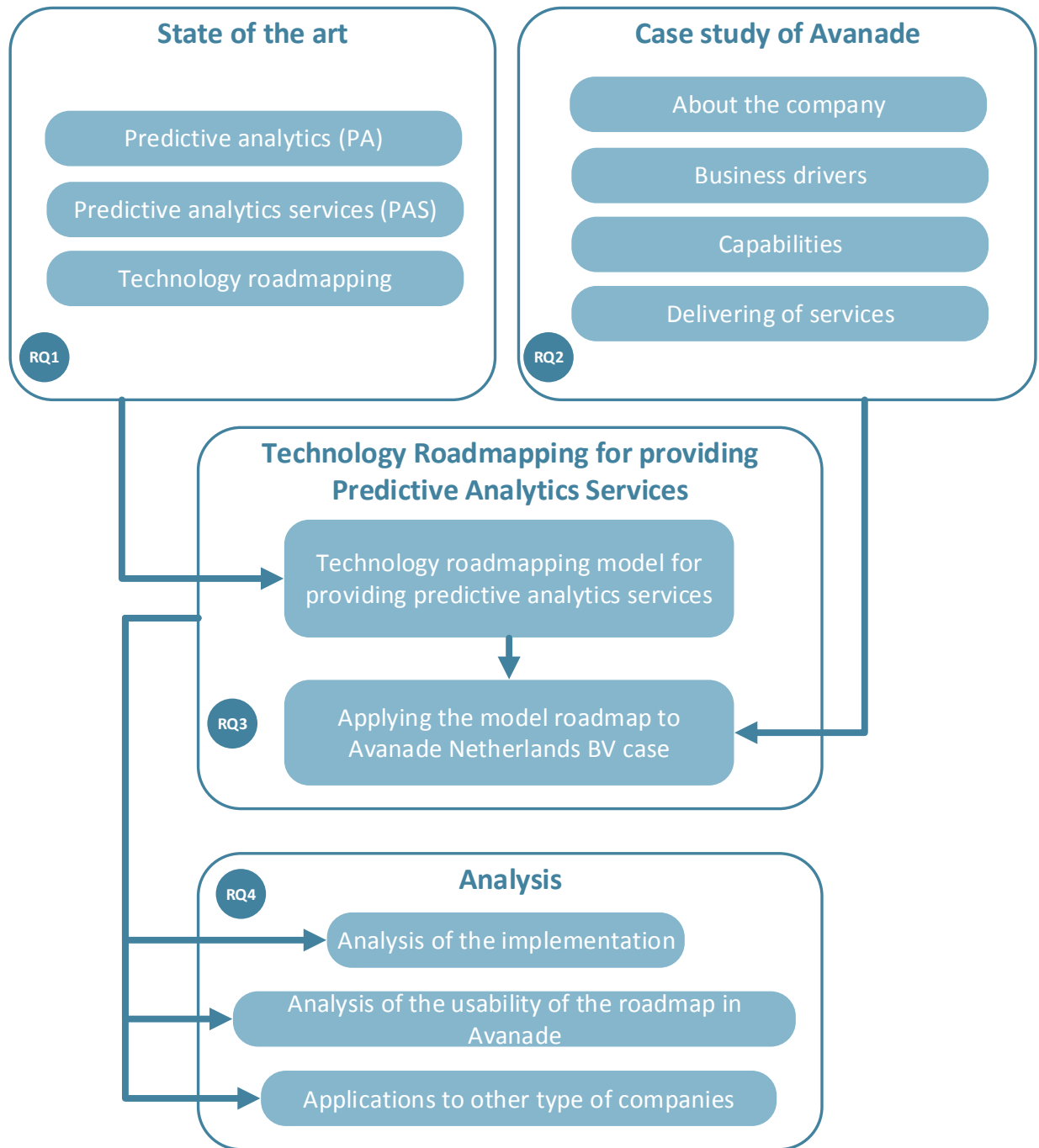
1.2.2. Case study of Avanade Netherlands BV

The main objective of this phase is to tackle RQ2 by gathering diverse information about the company in four different sections.

The first section describes information about Avanade Netherlands: when it was founded, their main focus, how it is composed by different service lines and why the need of providing predictive analytics

services. The information will be gathered from the company' documentation and knowledge database and using a semi-structured questionnaire.

The second section describes the business drivers within Avanade Netherlands. This information will be collected by means of a workshop that will be conducted with one of the managers of the Data & Analytics (D&A) Service Line.

The third section explains Avanade's capabilities by means of a SWOT analysis. This information will be collected by means of a workshop with one of the managers of the D&A Service Line.

The final section explains how Avanade Netherlands BV currently delivers services to their customers, the services they provide and the technologies they use. This information will be collected using semi-structured interviews with one of the managers of the D&A Service Line

1.2.3. Technology roadmapping for providing predictive analytics services
This phase is intended to answer RQ3 and will be divided in two main sections.

The first section will take the information collected in phase 1 – State of the art – and use it as the input to design a roadmap model for providing predictive analytics services. This model, will contain three main layers named market, technology, and company and one extra layer used as a guide for the application process named choices.

The second section consists of the implementation of the aforementioned roadmap to Avanade Netherlands BV case. The idea is to take the information gathered in phase 2 – Case study of Avanade Netherlands BV – and combine it with extra information gathered in a workshop called 'the game of choices'. In this workshop, 7 participants will make choices in terms of the services, industries and business lines as part of the application process of the roadmap model.

1.2.4. Analysis
The final phase of the thesis is to do an analysis on the implementation of the roadmap and its usability for Avanade and other type of companies.

The idea is to analyze those aspects that were more relevant during the process of implementation and that must need more attention for future implementations in other companies. Also, a questionnaire will be done in order to analyze the usability within the company. Finally, some aspects are analyzed to justify the usability of the roadmap in other companies different from Avanade.

1.3. Relevance of the research

1.3.1. Academic relevance
Considering the academic perspective this master thesis will contribute to the roadmapping literature in different ways.

First of all there is no papers related to roadmapping of predictive analytics services, in fact, not even related to roadmapping of analytics services. Two master theses were found related the topic, however, they don't use roadmapping in analytics: one of them is an adoption model of analytics (in a user perspective and not provider perspective) [11] and the other is a technology roadmap for software platform products [12]. So, considering these facts, this master thesis will complement the

roadmapping literature by providing a roadmap for providing predictive analytics services. After finishing the research new insights will be learnt about roadmapping. For example, what aspects should be and should not be considered in order to implement predictive analytics services in a consultancy firm, also, which type of services should the company focus on.

Secondly, as mentioned previously predictive analytics projects have a high rate of failure, moreover there are evidence that shows that customers are not well educated about their benefits and functionalities. These factors increase the complexity of the designing services because there are external factors that should be analyzed in tandem with the company's capabilities, expertise and customers' need. This complexity also brings a challenge to one of the steps of the roadmapping process: the market workshop [10]. In this first step external analysis should be done (SWOT, market/business drivers, etc.), however, additional external factors such as services offered by other companies should be studied too in order to design the proper roadmap. This additional effort will bring some insides on which other aspects should be considered when designing a roadmap specifically for providing predictive analytics services.

Thirdly, the roadmap will be a point to start further research in other IT consultancy companies, that is, it could be validated and even implemented in those types of companies that would like to offer predictive analytics services to their customers. An example of further research that could be conducted is to analyze the results of validating or implementing the roadmap in other types of companies (small or medium).

Finally, and most important, roadmapping approaches have been developed for other type of software products, however, applying it to predictive analytics is different. When developing roadmaps for software products there are usually two approaches. The first approach is focusing on a need of a company and implementing a software product to tackle that need. In this case the roadmap is focused mainly in the internal aspects of the company. An example of this approach is a roadmap for developing a specialized database for a medical department [13]. The second approach is using roadmapping to implement a software product as an enabler to achieve a goal within a company, for example, a roadmap to achieve green supply chain in an organization through Enterprise Resource Planning (ERP) implementation [14]. In this case, however, those two approaches differ. First, since the idea is to provide a new type of service to the market then it is more important to focus in the external factors of the company rather than the internal (first approach). Second, in this case, the technology - predictive analytics - is not an enabler but a tool that is part of the service provision process (second approach).

1.3.2. Practical relevance

There are important companies in the market already offering predictive analytics services but there are also others that have the intention of providing them in the near future. For example, the website www.kdnuggets.com provides a lists of 95 consulting companies in data mining and analytics, however, only 32 of those companies currently offer predictive analytics services [15]. In this case, Avanade Netherlands BV is the company which has such goal and therefore providing a technology roadmap for the development of these new services is relevant for Avanade Netherlands BV.

Moreover, the increasing demand in predictive analytics makes this market attractive for other consultancy companies different from Avanade Netherlands BV, therefore, the need for providing

predictive analytics services. Hence, having a case of roadmapping around the provision of predictive analytics is interesting not just for Avanade Netherlands BV but also for other IT consultancy companies.

Finally, there is also an important management contribution regarding the decision making process. One of the features of the roadmap proposed here is to provide a guideline to select the type of technology, the type of services, the industries to approach and the business lines to tackle. Since decision making is one of the activities that requires more effort and attention within companies, providing them with such guideline will help them in the decision making process.

1.4.   Structure of the document

The document is structured as follows.

Chapter 2 explains in detail what predictive analytics are about, and describes predictive analytics services as well as their characteristics. Also, this chapter depicts an overview of technology roadmapping arguing how this technique can help in the implementation of predictive analytics services. The main objective of this chapter is to answer research question ***RQ1: What is the current state of the art of predictive analytics and predictive analytics services, and how technology roadmapping can help in the implementation of such services?***

Chapter 3 explains detailed information about the company itself, business drivers within Avanade Netherlands BV, the company's capabilities by means of a SWOT analysis, and how Avanade Netherlands BV currently delivers services to their customers, in terms of type of customers, the services they provide and the technologies they use. The main objective of this chapter is to answer research question ***RQ2: What are Avanade's drivers and capabilities, and how they currently deliver services to their customers?***

Chapter 4 will describe in detail the propose roadmap model, which contains three main layer named market, technology, and company, and an extra layer named choices which main objective is to lead the users of the model thru the application process by means of 6 steps. Also, this chapter will show how the model was implemented in Avanade Netherlands BV. The main objective of this chapter is to answer research question ***RQ3: How should be a technology roadmap model for providing predictive analytics services based on the information gathered in RQ1 and how should this model be applied to Avanade Netherlands BV, considering the information collected in RQ2?***

Chapter 5 takes the model and the implementation done in Chapter 4 and provide an analysis of the implementation, the usability of the roadmap in Avanade and the application in other type of companies. The main objective of this chapter is to answer research question ***RQ4: Which aspects should need special attention during the process of implementation of the roadmap and what is the level of usability of the roadmap in an organization such as Avanade as well as in other type of companies in the industry?***

2. PREDICTIVE ANALYTICS, PREDICTIVE ANALYTICS SERVICES AND TECHNOLOGY ROADMAPPING

2.1. Introduction

In order to answer the first research question - ***RQ1: What is the current state of the art of predictive analytics and predictive analytics services, and how technology roadmapping can help in the implementation of such services? -*** it is important to perform three steps described below.

First of all and before understanding predictive analytics services, it is imperative to explain what predictive analytics are about. This includes aspects such as where is predictive analytics located in the spectrum of business intelligence technologies, how is the process of doing predictive analytics (named process of predicting modeling), and what are the different applications in the market.

Once predictive analytics is clear, the next step is to explain what predictive analytics services are, this implies to explain information such as: which type of services are offered in the market, to what industries are they targeted, how are these services grouped, and on which predictive analytic technologies are they focused. Lastly, to have a better understanding of predictive analytics services it's important to research about the current customer needs for those type of services.

Finally, when predictive analytics services are clear enough, the last step is to give an overview of technology roadmapping, describing the types and formats, and how this technique can help in the implementation of predictive analytics services.

The following sub-chapters include the aforementioned steps. Chapter 2.2 explains in detail what predictive analytics are about, chapter 2.3 describe predictive analytics services and their characteristics, and finally, chapter 2.4 depicts an overview of technology roadmapping while chapter 2.5 describes how this technique can help in the implementation of predictive analytics services. Figure 2 provides a graphic representation of the three steps.

2.2. Predictive analytics

Predictive analytics (PA) is a general term that includes statistical models, empirical methods and tools that are used to gather and analyze information and to predict outcomes of the problems solutions [3, 2]. Other definitions describe PA as a set of Business Intelligence (BI) technologies that analyze big amounts of data to identify relationships which can be used to predict future behaviors [16].

Next sections explains in which part of the spectrum of BI technologies is PA situated (section 2.2.1), how is the process of delivering PA in a business environment (section 2.2.2), which are some of the applications of PA (section 2.2.3) and other characteristics of PA (section 2.2.4).
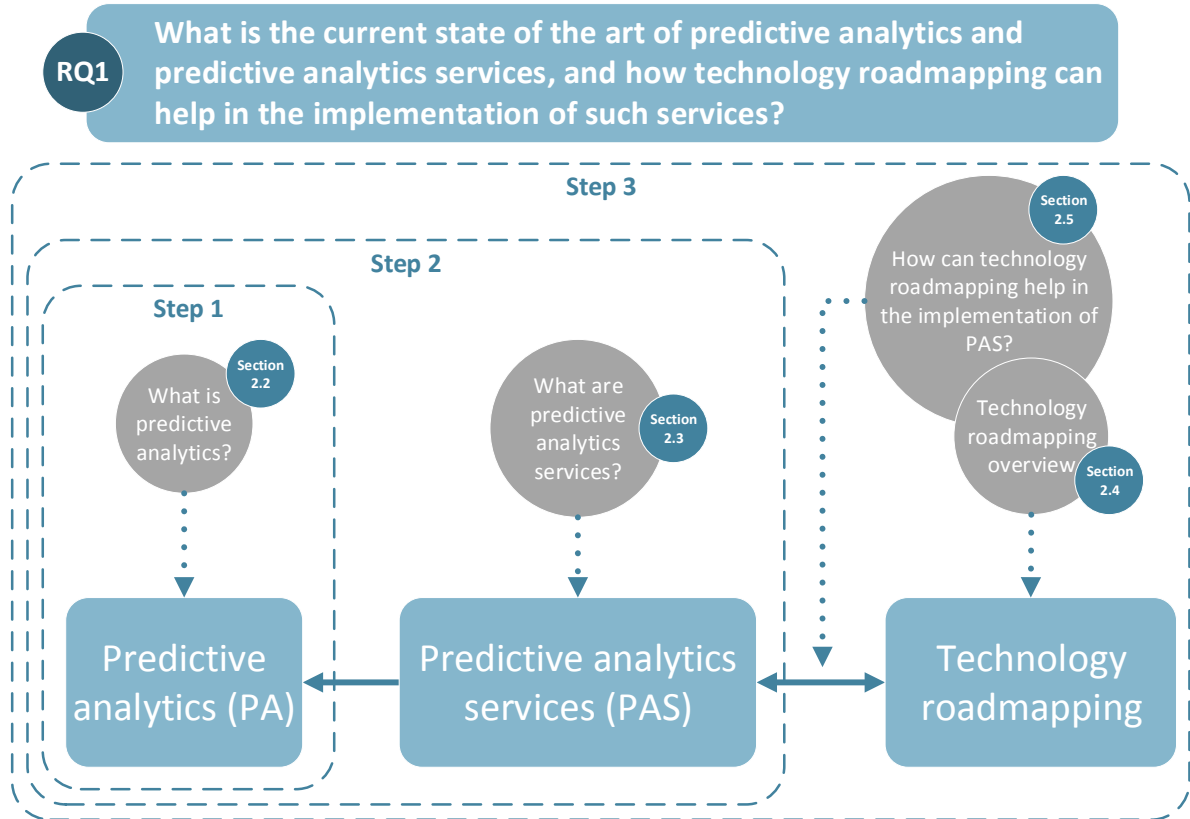
Figure 2. Chapter 2 approach - Predictive Analytics, Predictive Analytics Services and Technology Roadmapping

2.2.1. Location of PA within the spectrum of BI technologies

The spectrum of Business Intelligence encircle four different disciplines each of them tackling different issues and with the support of diverse technology tools. These disciplines are [16]:

- (1) Reporting: addresses the question "what happened?" and its main function is to provide consolidated information on the events that already occurred. The main technologies that support this discipline are query, reporting and search tools.
- (2) Analysis: this level aims to solve the question "why did it happen?" Here, information is not only consolidated and presented but also an analysis on the events is performed in order to detect patterns. Online Analytical Processing (OLAP) and visualization tools are the main technologies that support this discipline.
- (3) Monitoring: the main intention of this discipline is to answer the question "what is happing now?" In this stage, information is consolidated and visualized (in order to facilitate analysis) but also it is presented with a set of hypotheses in the form of KPIs or other type of metrics that managers review often. The main tools that support this discipline are dashboards and scorecards.
- (4) Prediction: finally, the last discipline tackles the question "what might happen?" Information has to be queried, analyzed, monitored but also other additional type of analyses are applied in order to forecast future behaviors. It's in this discipline where Predictive Analytics plays its role as the main supporting tool.

Each of these disciplines builds up on the previous one, they are additive and the higher the level, the more complex the technologies but also the value they deliver to the business. As it was previously mentioned, predictive analytics is the main supporter for prediction which is the last level in the spectrum of BI technologies (Figure 3).

2.2.2. The process of predicting modeling

Section 2.2.1 already explained where PA is located in the spectrum of BI technologies and how it helps companies as a supporting tool, however, a new question raises: how is it possible to deliver PA in a business environment?

The Spectrum of BI Technologies
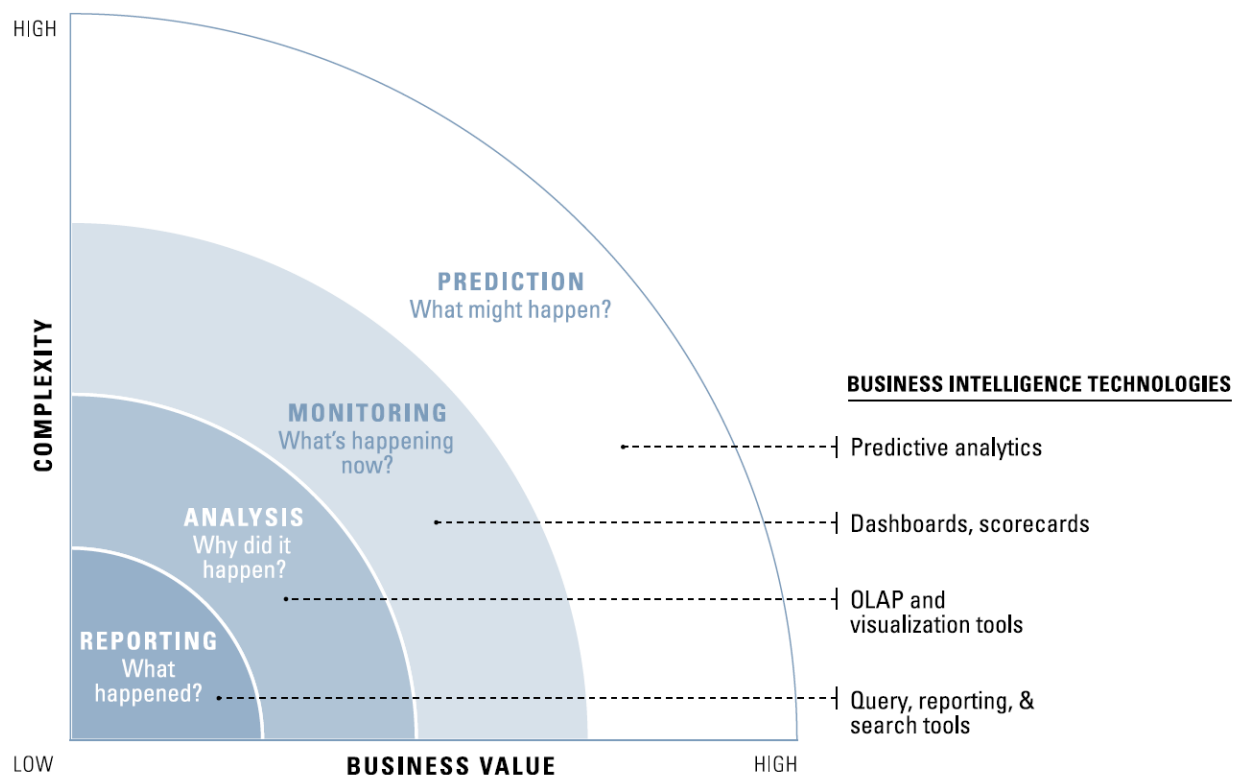
Figure 3. Spectrum of BI Technologies [16]

There are six steps regarding the process of predicting modeling or delivering Predictive Analytics: defining the project, exploring the data, preparing the data, building predictive models, deploying analytical models, managing models [16].

Step 1: Defining the project
One of the main errors customers commit is that they often approach IT consultancy companies with the idea of implementing PA projects without having a clear goal in mind [17]. Despite the fact that practitioners do not expend enough time in the phase, most agree that defining the project is the most critical for the success of any PA project.

Companies should analyze the main objectives of the PA project and translate them into predictive analytics objectives and tasks. Actually, a possible outcome of the process is that the solution the company is looking for is not exactly a PA solution.

A key element to be considered in this phase is having a close collaboration with the business. Communication between the analytic modeler and business is the base to define any objective for the project. For example, if the final goal is to develop a new marketing strategy then the campaign managers should be involved since the very beginning of the process.

Step 2: Exploring the data

The main goal of this phase is to find good and clean source of data. "Good sources of data have a sufficient number of records, history, and fields (i.e., variables) so there is a good chance there are patterns and relationships in the data that have significant business value." [16]

Modelers can extract data from different data sources such as: transaction data, demographic, data, summarized data, external/purchased data, behavioral data, campaign history, predictive scores, contact history, survey data, text data, psychographic data, web log data, and weather data, among others. The ideal model must pulls data from 8.6 data sources in average.

There are tools in the market that offer different alternatives to explore data. Some of them provide the basic functionalities such as descriptive statistics (i.e. standard deviation or max and min values) while others offer advance options to explore data or analyze models visually.

Step 3: Preparing the data

Preparing data means cleaning data of any errors and then transforming them to a form which can be read by an analytical tool.

To clean the data from errors it's necessary to discard records that contains incomplete data, or data that could generate processing errors in the future (for example, an alphabetic value where a numeric value is expected).

Usually, data is transform from one or several tables into one single table with hundreds of columns. Transformations vary depending on the type of data. For example, gender (male or female) is usually transformed into a numeric value where 0 represents male and 1 represents female, or vice versa. Another used technique is called binning, which consists in taking a field that is naturally continuous and grouping it into "bins" [18], for example the age is a field that could be grouped into subcategories (i.e. 0-18, 18-30, 30-50 and >50).

Step 4: Building predictive models

The first step in building predictive models is to define the predictors, that is, the variables that have to be predicted [19]. Using predictive analytics tools one or more algorithms are ran against the data with the predictors as dependent variables. Then, the data must be split in two and use one half to create the model and the other one to train the model. Finally, the result model must be tested with live data.

The aforementioned process is iterative and time consuming, this is why it is considered an "art", Eckerson remarks: [16]

Most analysts identify and test many combinations of variables to see which have the most impact. Most start the process by using statistical and OLAP tools to identify significant trends in the data as well as previous analytical work done internally or by expert consultants. They also may interview business users close to the subject and rely on their own knowledge of the business to home in on the most important variables to include in the model.

As a result, most analysts cull the list of variables from a couple hundred in an initial version to a couple dozen in the final model. Along the way, they test a variety of algorithms to see which works best on the training data set. They may find it necessary to add new data types or recombine existing fields in different ways to improve model accuracy.

At this point it is important to mention another component in PA modeling: the methods for evaluating the predictive power (also known in the literature as predictive accuracy) of a model. Predictive power "refers to a model's ability to generate accurate predictions of new observations, where new can be interpreted temporally (i.e., observations in a future time period) or cross-sectionally (i.e., observations that were not included in the original sample used to build the model)" [3]. Hence, part of the process of building a PA model is applying the methods for assessing the accuracy of such model.

Step 5: Deploying analytical models

A predictive model can be accurate but not effective. In order for a predictive model to be effective the business must to interpret the results and take actions. There are several ways of deploying a model:

- *Share the results*: business analysts can share the results and insights with their peers by means of reports, presentations or talks.
- *Score the model*: the model is transformed into "programming code and then apply the statement or code to every single record in the company's database pertaining to the subject area of the model." [16] The result is a "score" that is a number between 0 and 1 and is store in the database to be used later. For example, a marketer can take decisions based on a recensy score higher than 0.7, in which is based on the number of weeks since the last purchase and has higher values for more recent customers [19].
- *Embed the model in a BI tool*: the problem with predictive models is that they are complex and therefore not all the people in the organization are able to understand them clearly. To tackle this issue, a good deployment strategy is to embed the predictive model into a BI tool in order to generate reports for common users with predictions from the model.
- *Embed the model in an Application*: another way to deploy a model is to embed it into an operational application. The idea is that parts of the code become automatic taking into consideration the model's score. The ultimate goal of predictive analytics is that all the predictive models could be embed in applications to take automatic decisions, however, in most of the cases, there is a component of the process that must be performed by humans.

Step 6: Managing models

This part of the process refers to improve performance of the models, promote reuse, manage control access and minimized overhead. Although it's also considered a key step in the process, few companies are concerned about the management of predictive models. In fact, some of them admit

that they don't have a good management process despise the fact that their tools support model management [16].

2.2.3. Applications of PA

Predictive Analytics are currently used in a variety of business areas, from marketing to fraud detection. Here, there is a description of each of these applications:

Marketing

The area that currently has more implementations of predictive analytics solutions is marketing. Marketers use PA to identify response from their customers towards advertisement messages, pricing strategies, and distribution alternatives. "This includes not only whether customers are likely to show an interest in a product or service, but the rate at which inquiries, web site visits or store visits are converted into actual sales" [20].

Churn and response modeling for sales and marketing operations is another areas where PA are broadly used [21]. Churn is directly related to customer retention and it's about whether a customer will leave or stay with the company. For example, by analyzing different consumer behaviors such as service usage or performance, it is possible to determine the likelihood of a customer to finish the subscription to a service [22]. On the other side, response refers to the customer will to buy a product or acquire a service. This strategy is well known because it has being implementing by retail companies such as Amazon, performing product recommendations based on previous consumer's purchases [23].

Medical support

Predictive analytics are being used to analyze healthcare databases in order to identify and profile patients likely to develop diseases or medical conditions such as cancer, heart failures, among others. Also, part of such analysis is to predict the effectiveness of surgical procedures or medical tests [20].

Likewise, companies such as IBM offer medical applications (named care analytics or health analytics) to analyze narrative content (physician notes, lab results or leading electronic medical record (EMR) systems) applying natural language processing tools to identify insights that might help doctors to predict individual risk or prioritize population health initiatives [24].

Fraud detection and credit/loan scoring

Different type of companies use profile analysis as part of their sales processes. Insurance companies, for example, have to perform declarations of insurability to their customers before selling a health or life insurance policy. Likewise, banks have to analyze credit or loan applications from their customers before approving them. Predictive analytics are being used in both fields; the idea is to score the prospect customer in order to determine the risk he/she might bring in the future and use such information for decision making before selling the policy or approving the credit/loan [25].

Law enforcement

Police are creating predictive models using information such as arrests, crimes and call records, but also weather and location data to determine potential threats for the community. "For example, the police have been able to predict the likelihood of robberies in specific nightclub parking locations near closing time – robbers consider inebriated club-goers to be easy marks" [20].

Financial markets

Companies are using predictive analytics techniques and tools to identify trends in stock, bond, capital, and real estate markets. Also, they predict companies and stocks performance by analyzing multiple sources of data. One example of this case is the creation of predictive models which main objective is generating trading signals for buying and selling decisions. Those models are built from the examination of public data such as Twitter tweets, traditional news articles, Yahoo! Finance forum messages, and Standard & Poor's 500 Index (S&P500) [26].

Social web mining

Predictive analytics are being used in conjunction with social media such as Facebook or Twitter in order to determine trends or determine the sentiment of the users. For example, Pang and Lee conducted a research in which by analyzing movie reviews from IMDB they could determine the sentiment of the people (positive or negative) towards those movies. This type of approach is called sentiment analysis [27]. Also, companies may use sentiment analysis for tracing customer complaints, opinions and comments of their products and services and predict their response towards future campaigns or promotions.

Another field in which predictive analytics is actively used is in infodemiology[1]. One example of this is Google Flu Trends. By analyzing search engine queries, this application predicts the emergence of flu activity within certain areas. Kamel Boulos et at highlights the impact of this application [28]:

> *Google Flu Trends (http://www.google.org/flutrends/) uses aggregated Google search data to estimate flu activity up to two weeks quicker than traditional systems. Such an early detection of disease activity (in close to real time), when followed by an appropriate rapid response, has the potential of reducing the impact of both seasonal and pandemic influenza.*

2.2.4. Other characteristics of PA

Other important characteristics about predictive analytics are:

Predictive analytics are not only statistics

It is true the fact that predictive analytics models use descriptive statistics as a base in order to understand the phenomena they try to analyze. However, due to the progress in terms of processing power and databases, new predictive techniques are now being used to perform complex calculations on the data. Some examples of these technologies are neural networks, genetic algorithms, support vector machines, and decision trees, among others [16, 22].

Predictive models differ from descriptive models

The main objective of predictive models is to forecast specific events of the future (behavior of a customer, likelihood of getting a disease, city zone that will have more crimes). In other words, their main goal is to predict future observations based on previous ones. On the other side, descriptive models aim to determine and describe relationships in data in order to classify it into different subgroups (for example, by analyzing customer data it is possible to classify customers, prospects or events into different types of groups used for different types of strategies [20].

---

[1] "The science of distribution and determinants of information in an electronic medium, specifically the Internet, or in a population, with the ultimate aim to inform public health and public policy" [45]

Predictive analytics differs from exploratory statistical modeling

*P*redictive analytics differs in many ways with explanatory statistical modeling. For example, in the later, the main goal is to test for causal hypotheses while the mail goal of PA is to predict new observations and asses predictability levels. Shmueli & Koppius [3] distinguish the main differences in terms of analysis goal, variables of interest, model building optimized function, model building constrains, and model evaluation (Figure 4).

Step	Explanatory	Predictive
Analysis Goal	Explanatory statistical models are used for testing causal hypotheses.	Predictive models are used for predicting new observations and assessing predictability levels.
Variables of Interest	Operationalized variables are used only as instruments to study the underlying conceptual constructs and the relationships between them.	The observed, measurable variables are the focus.
Model Building Optimized Function	In explanatory modeling the focus is on minimizing model bias. Main risks are type I and II errors.	In predictive modeling the focus is on minimizing the combined bias and variance. The main risk is over-fitting.
Model Building Constraints	Empirical model must be interpretable, must support statistical testing of the hypotheses of interest, must adhere to theoretical model (e.g., in terms of form, variables, specification).	Must use variables that are available at time of model deployment.
Model Evaluation	Explanatory power is measured by strength-of-fit measures and tests (e.g., R^2 and statistical significance of coefficients).	Predictive power is measured by accuracy of out-of-sample predictions.

Figure 4. Differences between explanatory statistical modeling and Predictive Analytics [3]

2.3.   Predictive analytics services

Predictive analytics services are enabling services delivered/tailored specifically for predictive analytics. They vary from general services applicable to any type of industry (i.e., offering support or capacitation on a new predictive analytics software tool) to industry-specific services (i.e., supporting retailing companies to identify future business scenarios and optimize decision making process, or helping to take advantage of analytics to forecast risk profiles in the banking industry). The deliverables differ depending on the type of services, for example, one deliverable could be a software model or a market study report, while another one could be knowledge in form of capacitation or accompaniment in the implementation phase of a new predictive analytics software tool [6, 7, 9].

When looking in the literature for predictive analytics services, no successful results were found. Several papers related to predictive analytics came out, highlighting mostly technical characteristics and the aspects that were explained in chapter 2.2, however, in any of those papers there were mentions to the type of services, target industries, focus technologies, nor customer needs towards predictive analytics. This finding represented and obstacle for the research, since predictive analytics services is the main topic of interest.

In order to tackle this issue, two alternative approaches were conducted to gather information about predictive analytics services. Firstly, a market study based on the information provided by IT consultancy companies on the market, and secondly, an analysis based on alternative resources such as research reports, an article published in Forbes and a non-scientific paper published by an expert in predictive analytics. Figure 5 shows in detail which information was extracted from each of both approaches.
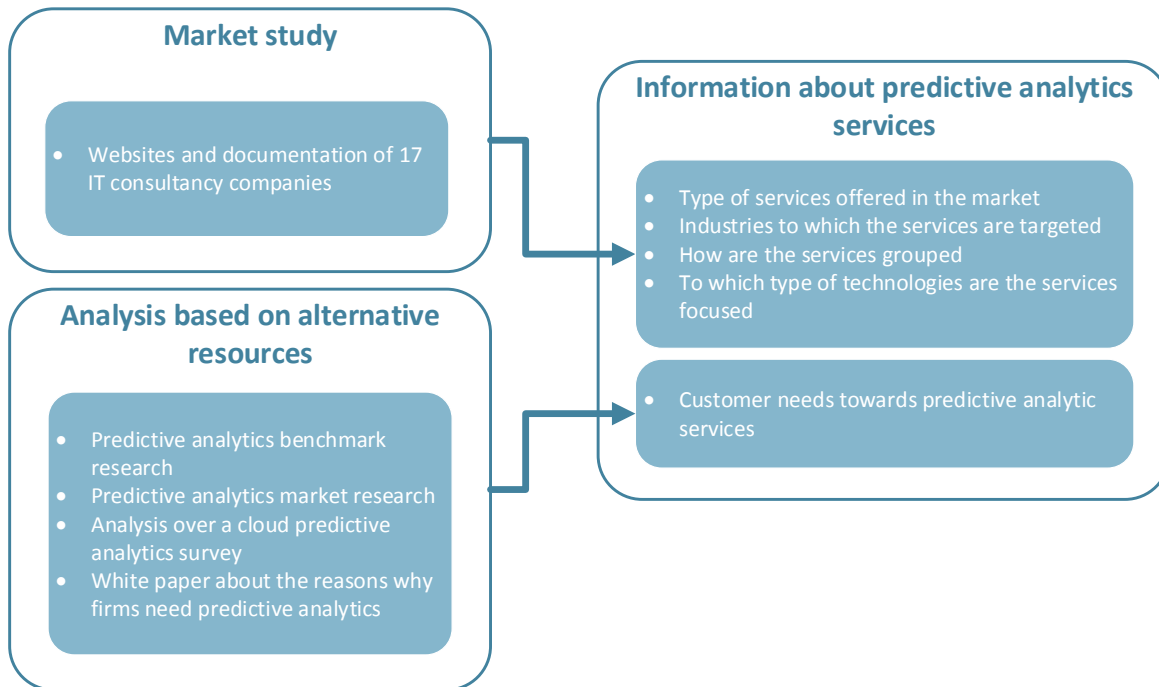
Figure 5. Approaches to collect information about predictive analytics services

The Market study

The market study was conducted extracting information from the websites and documentation of IT consultancy companies. The criteria for selecting the companies was the following: biggest IT consultancy companies in the world (with more than 65000 employees) and also software providers (SAP, Oracle and Terada) which are leaders in the data analytics or big data markets. The information of the companies was extracted from Forbes [29] with the exception of some employees' data. A total of 17 companies where finally selected.

Table 1 contains the main information of such companies.

Once the list was completed, each of the main company's website was accessed - for example, for Infosys, the main webpage is www.infosys.com. When located on the website of the company, the following tasks were performed:

a) Look for services and solutions menus which contained key words related to predictive analytics such as 'big data', 'analytics', 'predictive analytics', or 'advance analytics'
b) Look for services and solutions menus which contained key words related to predictive analytics technologies and vendors such as 'SAP', 'SAP HANA', 'ORACLE', 'ORACLE R', among others.
c) Look for industries menus, browsing each industry and searching for services or solutions that involved predictive analytics or predictive analytics technologies, using the same keywords as in a) and b)
d) Use the search option that every webpage has and look for white papers, reports, brochures and business cases that involved the implementation or use of predictive analytics. Again, the key words used for this search were the same used in a) and b)

When the services were identified, they were classified in one of six different types of services (section 2.3.1 explains them in detail). Also information about target industries (section 2.3.2), grouping of the services (section 2.3.3), and to which type of technologies are they focused on (section 2.3.4) was analyzed.

It's important to remark that the information contained in each of the webpages is provided directly by the IT consultancy companies, is based on real facts (services/solutions they provide, business cases with their customers, etc.) and additionally is regularly updated. Due to such reasons, the companies' webpages and documentation could be considered as valid resources for collecting information about predictive analytics services.

Continent	Company	Country	Employees
Asia	HCL	India	85505
	Infosys	India	149994
	Tata Consultancy Services	India	277586
	Tech Mahindra	India	87300[2]
	Wipro	India	135920
Europe	Capgemini	France	125110
	KPMG	Netherlands	155000[3]
	SAP	Germany	64422
North America	CGI	US	68000[4]
	Cognizant	US	156700
	Computer Sciences Corporation	US	98000
	Deloitte	US	+200000[5]
	Ernst & Young	US	175000
	HP Enterprise Services	US	331800
	IBM	US	466995
	Oracle	US	117229
	Terada	US	10200

Table 1. Companies offering predictive analytics services

Analysis based on alternative resources

In order to gather information about the customer needs four alternative resources where analyzed:

a) A predictive analytics benchmark research done by Vendana Research [30]
b) A predictive analytics market research done by Transparency Market Research [31]
c) An analysis over a cloud predictive analytics survey, done by a Forbes collaborator [32]

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[2] Tech Mahindra. http://www.techmahindra.com/en-us/wwa/company/Pages/default.aspx

[3] KPMG. Structure. http://www.kpmg.com/global/en/about/governance/structure/pages/default.aspx

[4] CGI. Company overview. http://www.cgi.com/en/overview

[5] Deloitte. About Deloitte. http://www2.deloitte.com/global/en/pages/about-deloitte/articles/about-deloitte.html

d) A white paper written by Eric Siegel on regards to the reasons why firms need predictive analytics [33]

Taking into account these resources, information about customers need were gathered specifically in terms of the business lines, industries, type of services and a new emergent market (cloud hosted predictive analytics). The results of the analysis are explain in detail in section 2.3.5.

Like the market study, the resources used in this case are considered not as valid as scientific papers, however, they still could be considered valid resources for the following reasons: both of the research reports were done by firms specialized in such type of research, the analysis performed by collaborator Louis Columbus was published in a recognized publication such as Forbes, and finally, the white paper was written by Eric Siegel who is considered as one of the experts in the predictive analytics field[6].

2.3.1. Type of services offered in the market

Before describing the type of services found in this market study it's important to explain two findings. First of all, some companies address the term predictive analytics in different ways. Some of them use predictive or advance analytics. Other companies use more focused names according to the target market. For example, if the service is a vertical-oriented solution then the name is usually related to the specific industry (i.e. predictive analytics for retail); in other cases, if the services is horizontal-oriented then the name is related to the line of business which is focused on (i.e. customer analytics)

Secondly, predictive analytics services are, in most of the cases, packed into bigger solutions, usually named analytics, big analytics or advance analytics. Also, most of the consultancy companies have articles and mention the importance of analytics in their webpages and brochures, however, not all of them promote predictive analytics services nor analytics services as part of their pool of services or capabilities. Examples of these cases are CSS's Information Strategy and Governance, KPMG's IT Advisory Services and TCS's IT Strategy Consulting.

After analyzing the services offered for each company, they were grouped in six main categories according to their focus: (1) assessment of the strategic role of predictive analytics, (2) operational/developer support, (3) training, mentoring and/or certification for tools or platforms, (4) integration of tools into operational environment, (5) definition, design, architecture and implementation, and (6) manage services for predictive analytics tools/platforms.

Definition, design, architecture and implementation services could be considered as a standard services within the market of predictive analytics since 14 out of the 17 companies provide them. On the other side, services such as Integration of tools into operational environment and Manage services for predictive analytics tools/platforms are services that are not common (only 5 and 4 companies provide them, respectively). Table 2 indicates the type of services offered by each company. The next sections explain in detail each of the aforementioned categories.

Appendix A.1 includes further information about the services each company provide.

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[6] Eric Siegel, Ph. D. http://www.cs.columbia.edu/~evs

Assessment of the strategic role of predictive analytics

These type of services are focused on advising companies to identify the strategic impact that predictive analytics can have on their businesses. The idea is to help them to recognize areas of opportunity, evaluate current capabilities and choose which are the most suitable analytics tools/platforms to use according to their needs.

Some of the services such as IBM's BAO Jumpstart for Strategic Alignment or Deloitte Analytics are focused specifically in the analytics (and predictive analytics) strategic role in the company, while other services such as TCS's IT Strategy Consulting focus on the strategic role of IT, being predictive analytics one of the tools that they take into account in their assessment.

Operational/developer support

These services are oriented to deliver operational/developer support to customers who already have a predictive analytics solutions or product. Operational support focuses on the operation of the company addressing specially incidents that occurs in the day-to-day business. Developer support focuses on how to solve specific problems from a design and architectural perspective.

Some of the predictive analytics solutions found in the market are: SAP HANA, Oracle R enterprise and Oracle Datamining, Oracle Business Intelligence Applications, Microsoft SQL Server 2012, IBM SPSS and Apache Hadoop.

Training, mentoring and/or certification for tools or platforms

These services provide clients with detailed information around technologies or tools. Clients learn how to how to size, configure, instantiate and use their predictive analytics tools. Usually, companies such as SAP or Oracle offer online course and training. Interested people register, practice and present tests in order to get the certification. Also, some other IT consultancy companies provide expert people who go to their customer's offices. These people is charge according to the number of hours they serve.

Integration of tools into operational environment

Nowadays companies have complex and diverse operational environments where different applications and technologies interact between each other. Integrating a new tool or platform into such systems is a task that requires advice. These type of services are intended to support the process of integration of predictive analytics solutions into the operational environment. It's important to clarify that integration does not only refer to technology but also to management and decision processes.

Definition, Design, Architecture and Implementation

Services designed to help clients in the process of definition, design and implementation of predictive analytics solutions. In occasions, part of the service includes the delivery of architecture or implementation. In these cases, other services such as operational/developer support, training for tools and platforms, and integration of those tools into the operational environment are (usually) included as part of the main package.

Some IT consultancy companies such as SAP offer these services without focusing in a specific area of their clients, however, there are services (i.e. Cognizant's Customer, Risk and Operation Analytics service) which are focused in certain line of business. These line of business are:

- Customer, sales and marketing
- Operations
- Risk management
- Fraud management
- Financial processes
- Product/service improvement and pricing
- Network performance/security
- Supply chain

11 companies provide at least one service focused in one of the line businesses. Some of them, such as product/pricing or network are served just by one company, meaning that they could offer good opportunities for entrant IT consultancy companies. On the other hand, other line of businesses such as customer, sales and marketing are served by multiple companies.

Regarding this last point there could be two ways of analyzing it: 1) since almost all of the IT consultancy companies offer services specifically tailored for Customer, sales and marketing then it would be more difficult to enter the market because there is more competition, however, 2) customers are demanding more services targeted to this type of line of business, and in order to get access to more customers it is necessary to provide services that fulfill such demand, moreover, "marketing and sales applications of predictive analytics are its flagship value propositions" [33].

Table 3 specifies the companies that offer services in each of the aforementioned line businesses.

Manage services for predictive analytics tools/platforms
The aim of this type of services is to provide operational support for predictive analytics environments in an outsourced scheme. Some of these services are focused exclusively in analytics/predictive analytics tools. An example of such services is Teradata's Managed services for Hadoop. On the other hand, there are services that supply a fully outsourcing of IT, including also analytics and predictive analytics tools and platforms. CGI's Full IT Outsourcing is one example of these.

2.3.2. Target industries

There are two type of approaches that IT consultancy companies follow when it comes to provide predictive analytics services. One of them is to offer the service in a general way, without specifying any type of industry, the other one is to provide solutions for specific type of industries where the company has experience. The advance in the second approach is that customers can find easily what they're looking for.

In this market study 19 industries where identified in which at least one of the companies offer services specially targeted to that industry. There are industries that are more attended that other ones, for example, Retail and Utilities industries. On the other hand, Airspace & Defense, Airlines, Automotive, Education, Pharmaceutical and Biotech, and Oil and Gas are some industries that are not focused by companies when it comes to predictive analytics services.

Table 4 provides information about the companies that offer services targeted to specific industries.

2.3.3. Grouping of PAS

As mentioned before, predictive analytics services are, in most of the cases, packed into bigger solutions, usually named in a different way (i.e. analytics, big analytics or advance analytics). Within such bigger solutions there are special features or solutions that implicitly involves predictive analytics services. For example, Capgemini service is called Analytics Solutions and within this category there are sub-solutions such as Fraud Management and Risk Analysis which involve the use of predictive analytics.

The other case is that IT consultancy companies group their predictive analytics services in different ways. Some companies, such as Terada offer and specify their services according to the specific customer needs, this is, they offer Operational/developer support, Manage services for predictive analytics tools/platforms, Training/Mentoring for tools or platforms, Assess the strategic role of predictive analytics, Definition, Design, Architecture and Implementation, and Integration of tools into operational environment services, each of them separately. In contrast, other companies offer Definition, Design, Architecture and Implementation services including also integration of tools into the operational environment. The difference in these cases is that the IT consultancy companies do not provide Integration of tools into operational environment as a stand-alone service. Usually, companies such as SAP, IBM or Oracle apply this strategy.

Company	Assessment of the strategic role of predictive analytics	Operational/developer support	Training, mentoring and/or certification for tools or platforms	Integration of tools into operational environment	Definition, Design, Architecture and Implementation	Manage services for predictive analytics tools/platforms
IBM	✓	✓	✓		✓	
Terada	✓	✓	✓	✓	✓	✓
Ernst & Young	✓					
Deloitte	✓					
KPMG	✓					
SAP		✓	✓		✓	
Cognizant	✓				✓	
CGI					✓	✓
Tech Mahindra	✓	✓		✓	✓	✓
HCL					✓	
Infosys	✓	✓	✓	✓	✓	
Tata Consultancy Services	✓	✓	✓	✓	✓	
Wipro	✓				✓	
Capgemini	✓	✓	✓		✓	✓
HP Enterprise Services	✓			✓	✓	
Oracle		✓	✓		✓	
Computer Sciences Corporation	✓				✓	

Table 2. Type of services offered by each company

Company \ Line of business	Customer, Sales & Marketing	Operations	Financial processes	Manage risk	Manage fraud	Product/ pricing	Network	Supply chain
IBM	✓		✓	✓	✓			
Terada								
Ernst & Young	✓							✓
Deloitte								
KPMG								
SAP								
Cognizant	✓	✓		✓	✓			
CGI								
Tech Mahindra	✓		✓		✓		✓	
HCL	✓					✓		✓
Infosys	✓							
Tata Consultancy Services								
Wipro	✓		✓					✓
Capgemini		✓	✓	✓	✓			
HP Enterprise Services		✓						✓
Oracle	✓		✓					✓
Computer Sciences Corporation					✓			

Table 3. Companies that offer services targeted to specific line of businesses

Company	Aerospace and Defense	Airlines	Automotive	Banking	Education	Energy	Financial Services	Health care	Hospitality and Leisure	Insurance	Manufacturing	Logistics	Media and Entertainment	Pharmaceutical and Biotech	Oil and gas	Public Sector	Retail	Telecom	Utilities
IBM		✓	✓	✓	✓	✓	✓		✓						✓	✓	✓	✓	
Terada							✓		✓			✓			✓			✓	✓
Ernst & Young																			
Deloitte																			
KPMG																			
SAP			✓								✓						✓		✓
Cognizant			✓		✓		✓		✓	✓	✓						✓		✓
CGI			✓			✓	✓		✓	✓	✓			✓	✓	✓	✓	✓	✓
Tech Mahindra												✓		✓			✓	✓	
HCL												✓					✓		
Infosys	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓			✓
Tata Consultancy Services			✓		✓	✓	✓	✓	✓	✓		✓				✓	✓	✓	✓
Wipro					✓	✓		✓		✓	✓	✓					✓	✓	✓
Capgemini										✓								✓	✓
HP Enterprise Services					✓	✓		✓		✓			✓			✓	✓		
Oracle						✓	✓			✓						✓	✓		
Computer Sciences Corporation										✓									

Table 4. Companies that offer services targeted to specific industries

2.3.4. Focus technologies of PAS

There are four different approaches that IT consultancy companies follow regarding predictive analytics technologies: focusing on their own analytics technology, focusing exclusively on third-party technologies, focusing on both their own analytics technology and third-party technologies, and do not focusing in a specific predictive analytics technology.

In the first approach, there are a total of 7 companies which provide support to their own analytics technologies: IBM, SAP, Cognizant, CGI, HCL, Oracle and Computer Sciences Corporation.

In the second approach, there are 4 predictive analytics technologies that receive support from 5 different IT consultancy companies. These are: Oracle, SAP HANA, Apache Hadoop and IBM SPSS. Infosys and Tata Consultancy Services provide support to Oracle. Likewise, both of them provide support to SAP HANA, but also Capgemini, Wipro and HP Enterprise Services. Hadoop is supported by HP Enterprise Services. Finally, Wipro is the only company that provide support to IBM SPSS.

In the third approach, there are only two companies which focuses in both, their own solutions and third-party products: Terada and Tech Mahindra, and both of them support Apache Hadoop. The reason behind this could be that Hadoop is an open source technology of Apache, hence, despite the fact that those IT consultancy companies are not the owners, they could develop their own solutions under such technologies.

Finally, there are 3 companies that follow the fourth approach, that is, they don't focus on a specific predictive analytics technologies or solutions. These companies are Ernst & Young, Deloitte and KPMG. There are two factors that could be related to this decision in terms of the focus of the services. Firstly, all of them are companies that do not provide exclusively IT consulting services but also other type of consulting services such as audit or tax services. Secondly, all 3 companies only offer assessment of the strategic role of predictive analytics service. According to this, one could conclude that they only provide assessment and advice in a general way and do not focus on one specific technology because they lack the technical expertise IT consultancy companies have when they are exclusively specialized in the IT sector.

2.3.5. Customer needs regarding PAS

Customer needs regarding predictive analytics services vary according to the business lines, industries or type of services. In the following sections there will be a description of each of those features plus a brief explanation of an emergent market: cloud hosted predictive analytics.

Lines of business

There are four lines of business that stand out both in the present and in the future of predictive analytics applications: customer, sales and marketing, financial processes, risk management and fraud management.

On one hand and as it said before, marketing and sales applications are the flagship of predictive analytics, therefore, there is a greater customer demand for these type of applications (65% for marketing and 57% for sales) [33, 30]. But the preference of companies towards such applications is not just for the present but also for the future, in fact, a recent study demonstrated that customers reported strong interest in applications related to customer analytics and marketing [32].

On the other hand, financial processes, risk and fraud management are business lines that will get market share in the future. First of all, there will be an increase demand on real time scoring (for online ad selection or fraud detection) and fraud security intelligence applications [33, 30]. Secondly, finance and risk management applications are forecasted to keep the largest market share in applications from 2013 until 2019 [31]

Industries

By 2012 there were six industries that had 78% of the market share: banking, financial services, insurance, pharmaceutical, public sector and telecom. Out of these industries, there are three that will have the largest market share between 2013 and 2019: banking, financial services and insurance, however, retail industry will have the faster growth within the same timeslot [31].

Type of services

There are three type of services that are highly demanded by predictive analytics users: training, support and integration of tools into operational environment.

According to a recent study, customers reported that they face frequent problems related to training and support processes. Actually, only 24% of them provide adequate support (i.e. help desk support) [30]. These facts indicate that there are several opportunities for IT consultancy firms when providing training and operational/developer support.

On the other hand, customers think their biggest challenge is the integration of predictive analytics tools into their operational environment. For example, continuing with the same study, customers said that the biggest challenges is to integrate predictive analytics tools with the information architecture, other Business Intelligence tools or other applications [30].

Emergent market: cloud hosted predictive analytics

Besides the traditional predictive analytics solutions, there is also an emergent market of cloud hosted predictive analytics applications [33, 32]. These type of applications offer the same features as traditional predictive analytics solutions with the additional characteristics of cloud computing (on demand capabilities, measured services, broad accessibility and rapid elasticity). The increasing interest of customers towards cloud-based solutions imply that IT consultancy companies have to increment their offer on services focused on that field.

2.4. Technology roadmapping overview

As seen in the previous section, in order to provide predictive analytics it's important to take into account different aspects both internal and external in regards to the company. If a company has to take decisions about such factors it has to consider the connections between all of them and the evolution in the decision making process. A technology roadmap is a tool that is useful in such task providing a view from different layers (company, technology, market).

Technology roadmapping is a technique "for supporting technology management and planning, especially for exploring and communicating the dynamic linkages between technological resources, organizational objectives and the changing environment" [10]. One of the key aspects of technology roadmapping is that it provides a time-based structured plan that integrates different aspects such as product/service, business and market perspectives. This plan is known as technology roadmap and "is the document that is generated by the technology roadmapping process" [34].

There are different types of technology roadmaps, in terms of the intended purpose and format. Section 2.4.1 explains which is the type of roadmap will be used based on the intended purpose. On the other side, section 2.4.2 explains which type of format will be considered.

2.4.1. Technology roadmaps in terms of the intended purpose

According to Phaal et al. there are different types of technology roadmapping in terms of the intended purpose: product planning, service/capability planning, strategic planning, long range planning, knowledge asset planning, programme planning, process planning and integration planning [35].

For the case of providing new services the proposed choice in terms of purpose is a mixture between strategic planning and service/capability planning roadmaps. Phaal et al. define each of them as follows [10]:

> *Service/capability planning: This type is more suited to service-based enterprises, focusing on how technology supports organizational capabilities... This roadmap focuses on organizational capabilities as the bridge between technology and the business, rather than products.*
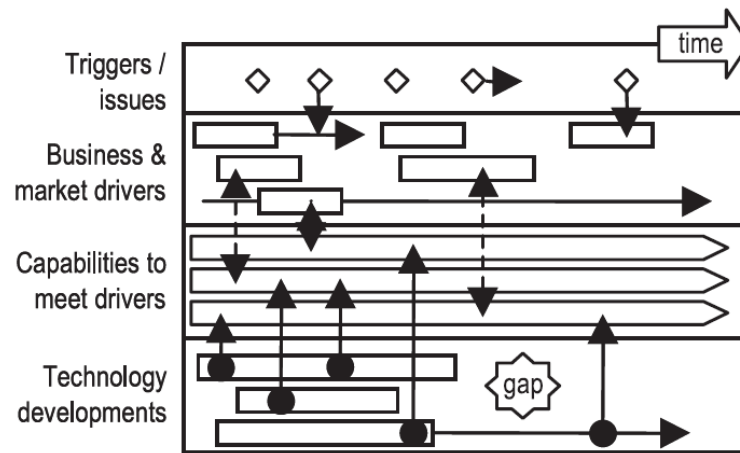
Figure 6. Service/capability planning [10]

> *Strategic planning: This type is suitable for general strategic appraisal, in terms of supporting the evaluation of different opportunities or threats, typically at the business level... The roadmap focuses on the development of a vision of the future business, in terms of markets, business, products, technologies, skills, culture, etc. Gaps are identified, by comparing the future vision with the current position, and strategic options explored to bridge the gaps.*
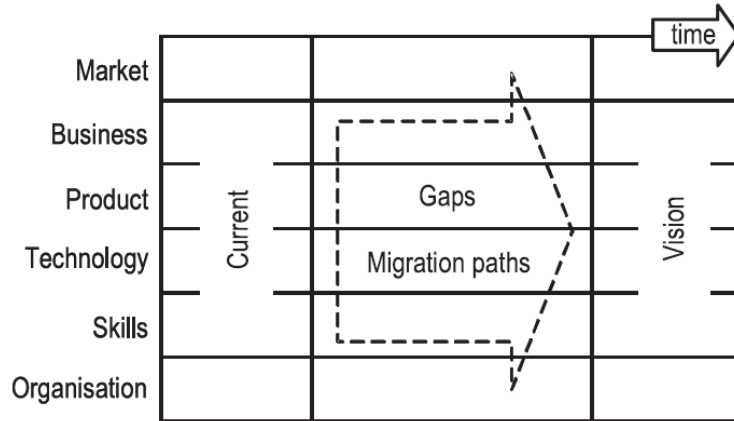
Figure 7. Strategic planning [10]

There are two reasons for the choice of such mixture. First of all, an IT consultancy company is a service company that works not only using technology but also providing services related to information technologies, and the provision of services around predictive analytics is not the exception. Secondly, the company which wants to provide the new services has to track the progress of the evolution of the technology itself, and elaborate a strategic plan according to the trends and needs of the market and the evolution of the capabilities of predictive analytics in the near future.

2.4.2. Technology roadmaps in terms of the format

Phaal et al. also distinguish eight different type of roadmaps in terms of the formats: multilayers, bars, table, text, single layer, graph, pictorial and flow [35]. The one that will be used for this thesis is the multiple layers format. Phaat et al. define this type as follows [10]:

Multiple layers: This is the most common format of technology roadmap comprising a number of layers (and sublayers), such as technology, product and market. The roadmap allows the evolution within each layer to be explored, together with the interlayer dependencies, facilitating the integration of technology into products, services and business systems.
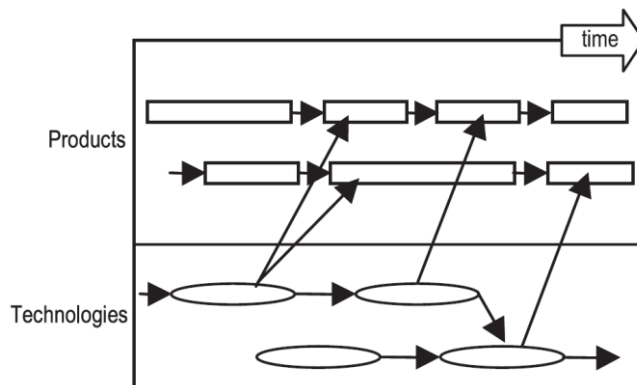
Figure 8. Multiple layers format [10]

The multiple layers format offers two main advantages for this specific case. First of all, it helps to visualize the relationships and dependencies between each layer, this is especially useful because

there is a lot of interdependencies between the technology development (predictive analytics), the company's capabilities evolution, and market needs and trends. Secondly, the company would be able to develop strategies according to each layer. For instance, they could designate different teams to be in charge of each layer: a HR team could be in charge of the evolution of the capabilities evolution while a technical team could be in charge of the technology development.

2.5. How can technology roadmapping help in the implementation of PAS?

When looking for literature related to predictive analytics and roadmapping a similar situation to the one described for predictive analytics services occurred: no scientific papers were found. This meant that there is not research on applying technology roadmapping for predictive analytics nor for predictive analytics services, and therefore it is difficult to justify how technology roadmapping can help in the implementation of predictive analytics services. However, despite this fact, there are three reasons to argue the contrary.

First, as explained in section 2.2.1, predictive analytics services are part of the spectrum of business intelligence technologies, which at the same time are part of the software field. Now, several research has been done in using technology roadmapping in software projects. For example, a roadmap for adopting a new specification of industrial automation devices and systems [36], or a roadmap for implementing an international software project [37]. Since predictive analytics services are part of the software field then it is possible to say that technology roadmap can help in the implementation of such services.

Second, as described in section 2.3, there are different aspects that should be considered in regards to predictive analytics services. Some of those are the industries, the type of services and the technologies. On the other hand, as described in section 2.4.2, one of the types of technology roadmaps is the multiple layer format, which can be applied to different features. In this order of ideas, a technology roadmap can provide a clearer view of each of the characteristics that must be analyzed for predictive analytics services, since those characteristics can be mapped into each layer in the roadmap. One layer could be the market, which includes the type of industries that those services must target. Another one could be the company, which should include the services themselves. Finally, one last layer could be the technology, where both enabling and focus technologies are included.

Third, as mentioned in section 1.3.1 one of the aspects to consider when providing predictive analytics services is to analyze external factors in relation with the internal in the company in order to take decisions. In such aspect a technology roadmap provides another advantage because the user is able to analyze internal and external layers and the connections between them. Then it is possible for example to see the relation between the industries in the market layer and the capabilities the organization has in the company layer.

2.6. Summary

The first step in this chapter was to start with the explanation of predictive analytics (PA), a general term that includes statistical models, empirical methods and tools that are used to gather and analyze information and to predict outcomes of the problems solutions. Also, predictive analytics are considered technologies which support one of the four disciplines of the spectrum of business intelligence (BI) technologies, named prediction. The prediction discipline is the one that has more

complexity but also the one that delivers more value to the business. Finally, predictive analytics applications are present in different areas: marketing, medical support, fraud detection, credit/loan scoring, law enforcement, financial markets, and social web mining.

The next step was to explain in detail enabling services delivered/tailored specifically for predictive analytics, named predictive analytics services (PAS). To do so, two approaches were conducted: a market study based on the information provided by IT consultancy companies on the market, and an analysis based on alternative resources such as research reports, an article published in Forbes and a non-scientific paper published by an expert in predictive analytics. The market study revealed information about the six different types of services offered in the market, the industries to which those services are targeted, how those services are grouped, and on which technologies they are focused. On the other side, the analysis based on alternative resources exposed information about customer needs in regards to predictive analytic services, in terms of the business lines, industries, types of services and a new emergent market known as cloud hosted predictive analytics.

The following step was to explain technology roadmapping, a technique that provides a time-based structured plan which integrates different aspects such as product/service, business and market perspectives. There are different types of technology roadmaps in terms of the intended purpose and format. For the case of providing predictive analytics, the better format in terms of intended purpose is a mixture between service/capability planning and strategic planning roadmaps, and in terms of format is the multiple layers format.

Once the state of the art of predictive analytics and predictive analytics services was depicted, and an overview of technology roadmapping was provided, the final step was to justify how this technique can help in the implementation of the former services. Three main reasons where given. First, some research was found on how technology roadmapping has helped in the implementation of software projects, and since predictive analytics services are part of the business intelligence spectrum which at the same time is also part of the software field, then it is possible to say that technology roadmap can help in the implementation of predictive analytics services. Second, a technology roadmap can provide a clearer view of the characteristics of predictive analytics services (named industries, type of services, and technologies) by mapping each of them into a layer in the roadmap. Third, a technology roadmap can help their users to connect external with internal factors by the use of its multiple layers. It is possible for example to see the relation between the industries in the market layer and the capabilities the organization has in the company layer.

3. CASE STUDY OF AVANADE NETHERLANDS BV

3.1. Introduction

This chapter aims to provide further information about Avanade Netherlands BV and answering the research question ***RQ2: What are Avanade's drivers and capabilities, and how they currently deliver services to their customers?*** To do so, it is divided in four different sub-chapters.

Chapter 3.2 explains detailed information about the company itself; when it was founded, their main focus and how it is composed by different service lines. This information was gathered from the company's documentation found on its knowledge database. Finally, a questionnaire was perform in order to collect information on why Avanade Netherlands BV has the need of providing predictive analytics services.

Chapter 3.5 describes the business drivers within Avanade Netherlands. This information was collected by means of a workshop that was conducted with one of the managers of the Data & Analytics (D&A) Service Line. This service line is specifically focused in providing services and solutions for big data, analytics, and extracting value from customers' information. In fact, Predictive analytics services will be located in the future as one of the services offered by the D&A Service Line.
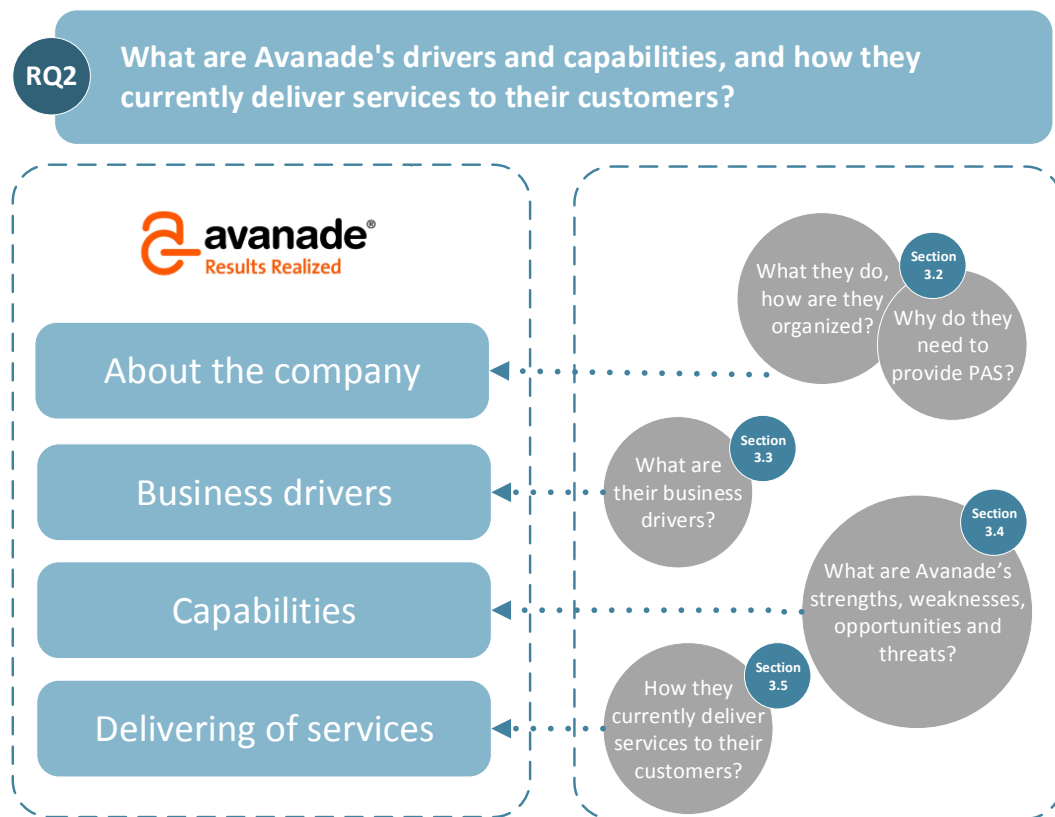
Figure 9. Chapter 3 approach. Avanade's drivers, capabilities and delivering of services

Chapter 3.3 describes Avanade's capabilities by means of a SWOT analysis. The idea is to provide insights about the strengths, weaknesses, opportunities and threads within the company focused

especially on the Data & Analytics Service Line and on the possibility of providing predictive analytics services in the future. This information was collected by means of a workshop with one of the managers of the D&A Service Line.

Finally, Chapter 3.5 explains how Avanade Netherlands BV currently delivers services to their customers. Information about the customers they approach, the services they provide and the technologies they used is presented. This information was collected using semi-structured interviews with one of the managers of the D&A Service Line.

Figure 9 presents a graphic description of the approach on this Chapter.

3.2. About Avanade Netherlands BV

Avanade is a joint venture between Microsoft and Accenture that was founded in 2000 which provides enterprise business technology solutions and managed services. They help customers with IT solutions that deliver business outcomes in areas such as CRM, .NET application development, business intelligence, collaboration, ERP, infrastructure and offer flexible deployment models on-premise, outsourced, cloud or a hybrid. They are specialized exclusively in Microsoft products [38]. Avanade Netherlands BV started their business in the Dutch country in the middle of 2004.

Currently, Avanade Netherlands BV is divided in seven different service lines: Application Development, Collaboration, Outsourcing, CRM, ERP, Technical Infrastructure and Data & Analytics. Each of them has different objectives and focuses in specific technologies and solutions. Table 5 explains this information in detail.

Avanade, through its partner Accenture currently provide analytics services such as functional analytics to transform a specific function or business process, Industry analytics to adapt specific capabilities in different industries or Information management services, also, the company currently provides a predictive analytics solution that is deployed only in USA. However, predictive analytics are not part of the pool of services offered by Avanade Netherlands BV. The company sees that in the near future there will be an increasing demand in this area, hence, they feel the necessity to provide predictive analytics services.

3.2.1. Need for providing predictive analytics

In order to know why Avanade has the need of providing predictive analytics services, a questionnaire was sent to a manager of D&A Service Line who is in charge of the analytics solutions. The questionnaire is included in appendix A.2.1 and the information gathered is described below.

The idea of providing predictive analytics services came from the middle management of Avanade, specifically from the director of the D&A Service Line and one of his managers. The increasing demand from their customers for predictive analytics, and the information provided by analysts such as Gartner triggered the decision. Joris Valkonet, manager of the D&A Service Line, quotes:

> *In maturity models, predictive analytics is a logical next step in regards to getting information out of data. By providing predictive analytics as a service, we – as Avanade – get a position in a market segment where we are currently not in, meaning the predictive analytics market. Moreover, as predicted by many analysts, the predictive analytics market is growing in the next years and we need to be in there to retain and strengthen our position and bring more value to our customers.*

Service Line	Role/Objectives	Focus
Application Development	- Design and implementation of rich, connected, state-of-the-art applications. - Help companies to stay current on Microsoft technologies and leverage upcoming technologies to help companies keep a competitive advantage in their markets.	- Mobile development - Web technologies - Integration - Web Technologies - Architecture
Collaboration	- Enables companies keep in touch whenever & wherever they need to do so. - It accelerates their entrance into the markets they want to dominate. - It stretches across the globe. It improves how employees do their work.	- SharePoint 2013 - Social Collaboration - Document Management
Outsourcing	- Delivers managed services for application and infrastructure management, with a dedicated focus on Microsoft technology - This is backed up by clear Service Level Agreements.	- Managed Collaboration Services - Private Cloud Managed Services - Microsoft Application Management
CRM	We can help you build that great relationship. Using Microsoft CRM technology we'll make it quick and easy to manage the customer – each and every time, across any touch point, so you can meet the demands of your customers, before your competitors do	- Finance Sector - Products Sector - Sales/Services/Marketing - Mobility
ERP	- Avanade ERP, built on Microsoft Dynamics AX, integrates with the heterogeneous IT environment, allowing decision makers to have a comprehensive view of the enterprise - Avanade ERP also provides a familiar Microsoft Office interface that users can quickly adopt	- Health/Hospitals - Retail - Utility/Energy - Large / complex European roll outs
Technical Infrastructure	- Helps to implement virtualization and cloud-based computing schemes - Windows XP being end of life and the transformation to Windows 8 - BYOD and Mobility implementations	- Messaging and Transformation - Elastic Datacenter - Desktop transformation (Windows 8)
Data & Analytics	- Helps to build great and valuable insights. - Provides the right information at the right time throughout the entire organization, using the Microsoft Business Intelligence suite. - Helps to achieve better and quicker decisions that will give the organization a competitive advance	- Big data - Analytics

Table 5. Avanade service lines

The company tried to implement these type of services before, however, they didn't have the bandwidth nor the skillset to do it and the technology (Microsoft tools for predictive analytics) were not mature enough. Nowadays, the market is becoming ready for predictive analytics and Avanade sees that it is being considered in their customers' agendas, also, Microsoft will probably have the right technology in place soon.

3.3. Business drivers

As their name suggest, business drivers are those principles or bases that the organization has always present in order to operate. If an organization such as Avanade Netherlands decides to provide new services, in this case, predictive analytics services, then it's important to get to know their business drivers.

Business drivers were analyzed in a workshop with one of the managers of the Data & Analytics Service Lines. The first step during the workshop was to analyze Avanade's value drivers, one by one. These apply to all the company and services lines and are considered more global, however, they were a good starting point. Next, the manager was asked to explain which business drivers he considered as those that are always taking into account when delivering projects or developing new services. As a result, Seven different business drivers were identified all of them explain here:

- *Chargeability*: this refers to the amount of hours that are actually charged directly to customers. The more chargeability a project has, the more accepted it will be
- *Revenue*: a project or service in Avanade Netherlands BV is relevant to the extent that is contributes to the company's future revenue
- *Do more with less customers*: one of Avanade Netherlands BV's current drivers is to do more with few customers, this means, that the main strategy is to achieve bigger and more projects with the same clients the company has right now instead of increasing the customer base.
- *Innovation*: this is also part of the company's value drivers. Avanade Netherlands BV is not just an innovative company but it also fosters and promotes innovation among their employees
- *Good quality people*: when hiring new people, more than quantity Avanade Netherlands BV focuses on the quality of people
- *Employees' satisfaction*: Avanade Netherlands BV thinks that a motivated employee will produce better results. For this reason the company promotes the satisfaction of their employees constantly.
- *World leading*: Avanade is the world leader in Microsoft technology. They want to keep this status in the near and long term, not just in the Netherlands but also worldwide, being focused exclusively in Microsoft solutions.

3.4. Business capabilities: SWOT analysis

In order to assess the business capabilities, a SWOT analysis was conducted with a manager of the Data & Analytics Service. There were two main aspects considered in the process:

- It was mainly focused on the Data & Analytics Service Line, since this is the service line that will provide predictive analytics services in the future

- It was having in mind the possibility of providing predictive analytics services in the future

The manager was asked to analyze each dimension and provide what he considered the relevant points to be taken into account in the future provision of predictive analytic services. Each strength, weakness, opportunity and threat was analyzed and explained in detail by him. A guide used during the process was a set of questions adjusted from Lee et al (Appendix A.3). These questions were taken as reference when analyzing each strength, weakness, opportunity and threat.

The results of the workshop are explained in the following sections. Figure 10 shows a graphic summary of them.

3.4.1. Strengths

Experts in Microsoft technologies

Avanade Netherlands BV is an IT consulting company which is exclusively specialized in Microsoft technologies, therefore, they have achieved to hold the highest concentrations of Microsoft certified professionals in the world. This fact has positioned them as "the best in the business on the Microsoft platform" [39].

Eager workforce

One of the value drivers within the company is called "Build the Avanade experience". In such value, the company promotes positive work environment and fosters a results-oriented culture. According to one of their managers, Avanadi (that's how Avanade employees are called internally) "are eager to walk the extra mile" when it comes to satisfy their customers. This type of initiatives and way of thinking have positioned Avanade Netherlands BV as one of the best places to work, meaning more productivity and results. For example, recently, Avanade Netherlands BV was awarded the Top Employers Europe 2014 and Top Employers ICT 2014 certification [40]

Strengths

- Experts in Microsoft technologies
- Eager workforce
- Relationship with Accenture
- Long term relationships with clients
- Microsoft technologies are cheap
- Microsoft technologies are easy to use

Weaknesses

- Microsoft predictive analytics solution is considered not mature
- Skills for predictive analytics

Opportunities

- Global presence with IDC/GDN
- More broad expertise on analytics
- More industry offerings (as a service)

Threats

- Pricing
- Too much demand impacting service/delivery

S W O T

Figure 10. SWOT analysis performed on Avanade Netherlands BV's D&A Service Line

Relationship with Accenture

The company started as a joint venture between Microsoft and Accenture and currently the latter owns 80% in that agreement. This fact has implications for Avanade Netherlands BV, and one of them is the good relationship the company has with Accenture. Both of them share resources such as knowledge databases, but also, they help each other to find new clients or event work in conjunction to achieve better results.

Long term relationships with clients

Part of its "Build the Avanade experience" value is also cultivate long-term relationships with their customers. Actually, the company has built relations with nine customers for five years or longer.

Microsoft technologies are cheap

According to Avanade Netherlands BV, there are two main phases in the delivery process of services: the project phase, and the running and maintenance phase (a broader explanation of them is provided in chapter [TODO]). In the second phase, part of the contract that the company has with its clients is getting also the licenses for Microsoft software. Since Avanade has strong connections with Microsoft they are able to find such licenses for a cheaper price.

Microsoft technologies are easy to use

Products such as Microsoft Word, Excel or Project are broadly use around the world. This implies that when it comes to learning new technologies, Microsoft is easier because users are more familiar with

their products. Since Avanade is fully oriented towards Microsoft technologies, this is an advantage that positively affects them as well.

3.4.2. Weaknesses

Microsoft predictive analytics solution is considered not mature

Rankings and studies consider SQL Server as a platform that is not mature in the field of predictive analytics. In fact, it is not even considered as the top predictive analytics technologies, a field in which SAP, SAS and IBM are the leaders [41]. This is a disadvantage that affects directly Avanade Netherlands BV interests towards providing predictive analytics services in the future, because they are exclusively focused on Microsoft technologies.

Skills for predictive analytics

Due to the fact that the company currently does not offer predictive analytics they have not hired people expert in the topic, therefore, there is lack of skills on the field within Avanade Netherlands BV. It's important to mention that this fact applies for Netherlands only.

3.4.3. Opportunities

Global presence with GDN/IDN

Avanade's Global Delivery Network (GDN) and Accenture India Delivery Network are diversified groups of management consulting, technology, business process and outsourcing professionals in the world that serves their clients globally. Avanade Netherlands BV can take great advantage of these networks in the future if they want to deliver a new service globally.

More broad expertise on analytics

Avanade Netherlands BV sees the fact of not having the expertise on predictive analytics as an opportunity to expand their expertise in analytics in the future.

More industry offerings (as a service)

By introducing predictive analytics in the future, the company forecasts that they will be able to reach new industries where they never had presence before.

3.4.4. Threads

Pricing

According to one of his managers, the prices that the company offers are slightly higher than the competence. This could be seen as a threat for getting new customers or projects.

Too much demand impacting service/delivery

More than the competition itself, Avanade Netherlands BV thinks the real threat is the current over demand on the services. This might impact future opportunities of business with new customers or even new projects with current clients.

3.5. How do Avanade Netherlands BV delivers services

In order to provide predictive analytics services it's important to know how Avanade Netherlands BV currently deliver services to their customers. Information about the customers, type of services, and focus and enabling technologies were collected by means of a semi structured semi structured

questionnaire that was sent to one of the managers of the Data & Analytics Service Line (the complete listed questions are included in appendix A.2.2). Detail information, product of such questionnaire, is specified in the following three sections.

3.5.1. Customers

The D&A service line currently has presence in 9 industries: banking, energy, financial services, insurance, media and entertainment, oil and gas, retail, telecom, and chemical and fashion products. The companies within such industries belong to both, public and private sector, and they are usually multi-nationals or considered as one of the biggest nationals in Netherlands.

When it comes to find new businesses or projects, Avanade prefers to have customer preference instead of customer diversity[7], this means they prefer to do more with less customers. They target the top 500 enterprises worldwide, with a footprint in Netherlands. There are two ways to approach new customers: 1) through Accenture, where Avanade Business Developers reach out Accenture managers, or 2) Business Developers directly get in touch with new customers through their network. These works the same for all service lines.

When a customer is contacted, there is a timeframe from that moment to the moment the contract is signed. The length of such timeframe depends on the type of customer. For existing customers the contracting might be faster if there is an existing agreement. For most enterprises there is practically an onboarding procedure that can take from one day to a couple of weeks – especially in public and banking industries.

3.5.2. Services

Avanade Netherlands BV, through its D&A Service Line currently provides different services around Big Data and Analytics. Some of them are more demanded than others (i.e. designing and implementing analytics projects).

To provide a service, Avanade Netherlands BV uses the framework named Avanade Connected Methodology (ACM) for waterfall, agile and service providing. This framework takes the Scrum construction lifecycle and extends it to show the full delivery lifecycle from the beginning of the project to the release of the solution to production. The Avanade Agile Framework lifecycle is organized into three distinct phases (Envision and Prepare, Construct and Evolve, and Accept and Release) with explicit milestones.

The Avanade Agile Framework strives to provide sufficient guidance for consultants to understand the process framework without being overly prescriptive. Therefore, the Avanade Agile Framework is goals-driven. A goals-driven, suggestive approach provides just enough guidance for Delivery Teams and is flexible so that teams can tailor the process to fit the situation they find themselves in.

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[7] Customer preference refers to choosing certain customers that are usually big and develop several projects with them. Customer diversity refers to find several customers without focusing on specific ones and develop few projects with them.

3.5.3. Technologies

Avanade is focused exclusively in technologies Microsoft, therefore, all of their service lines work with the same goal in mind. The D&A Service Line, is not the exception and they provide services in three different ways:

- Services for enterprise Microsoft technologies (SQL Server, Azure, and SharePoint), however, they do not support Microsoft Dynamics Navision because this product is for the mid-market
- Solutions for integration with other common technologies on the interfacing part. For example, how to extract data from SAP systems.
- Solutions for integration with products that are related to Microsoft technologies like OSISoft, Predixion, etc.

Besides the technologies Avanade is focused on, there are also in-house tools that enable the delivery of services. These are:

- Microsoft Enterprise software such as Office (Word, Excel, PowerPoint, etc.), Project, Visio, among others
- Microsoft developer software and software licenses to develop the solutions they provide (.NET, SharePoint, SQL Server developing frameworks, etc.)
- In-house estimator tool that Avanade Netherlands BV uses to estimate all the tasks of their projects
- The D&A Service Line has an ETL[8] framework to accelerate and build consistent ETL processes. Also, they have an ETL generation tool specifically from SAP extractions.

3.6. Summary

This chapter of the thesis exposed important information regarding Avanade Netherlands BV which will be considered as an input for the next chapter. First of all, a brief introduction about the company was provided, giving information about their goals and how it is organized in seven different service lines: Application Development, Collaboration, Outsourcing, CRM, ERP, Technical Infrastructure and Data & Analytics. Also, part of this introduction was explaining the needs of the company for providing predictive analytics services in the future.

Second, seven business drivers where described in detail, named chargeability, revenue, do more with less customers, innovation, good quality people, employee's satisfaction and world leading. The main reason to explore such business drivers was that they are considered principles or bases that the organization has always present in order to operate and they have to be considered as an input in the creation of new services such as PAS.

Third, in order to identify the strengths, weaknesses, opportunities and threats around the future provision of predictive analytics services, a SWOT analysis was conducted with one of the managers of the Data & Analytics Service Line.

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[8] "Extract, Transform, and Load (ETL) refers to a process in database usage and especially in data warehousing that: Extracts data from outside sources, Transforms it to fit operational needs, and Loads it into the end target (database, more specifically, operational data store, data mart, or data warehouse)" [46]

Finally, diverse information about the way Avanade deliver their current services was revealed. This was regarding to the type of customers they have, how they approach them, the type of services they provide, the deliver model they use, and the technologies they utilize (enabling technologies) and the technologies they are focused on, which are part of Microsoft solutions.

4. TECHNOLOGY ROADMAP FOR PREDICTIVE ANALYTICS SERVICES

4.1. Introduction

The third research question ***RQ3: How should be a technology roadmap model for providing predictive analytics services based on the information gathered in RQ1 and how should this model be applied to Avanade Netherlands BV, considering the information collected in RQ2?*** has to be answered taking as input the information gathered in research questions 1 (RQ1) and 2 (RQ2).

First of all, Section 2 explained predictive analytics and predictive analytics services, and also described how a technique such as technology roadmapping can help in the implementation of such services. The information collected in this part is going to be the main input to design a roadmap model for providing predictive analytics services. This model, described in section 4.2 contains four main layers: choices, market, technology, and company. Each of them are explain in detail and also how to apply the roadmap model.

Once the model is developed, the next step is to implement it in Avanade Netherlands BV, using the information collected in section 3 and combining it with extra information gathered in a workshop called 'the game of choices'. The idea is that during the workshop, the participants have to make choices in regards to the type of services Avanade Netherlands BV needs to provide, the industries to which they will be targeted and the possible line of business and potential solutions that Avanade will be able to focus in each of those industries. Section 4.3 explains in detail the process of implementing the model in Avanade Netherlands BV.

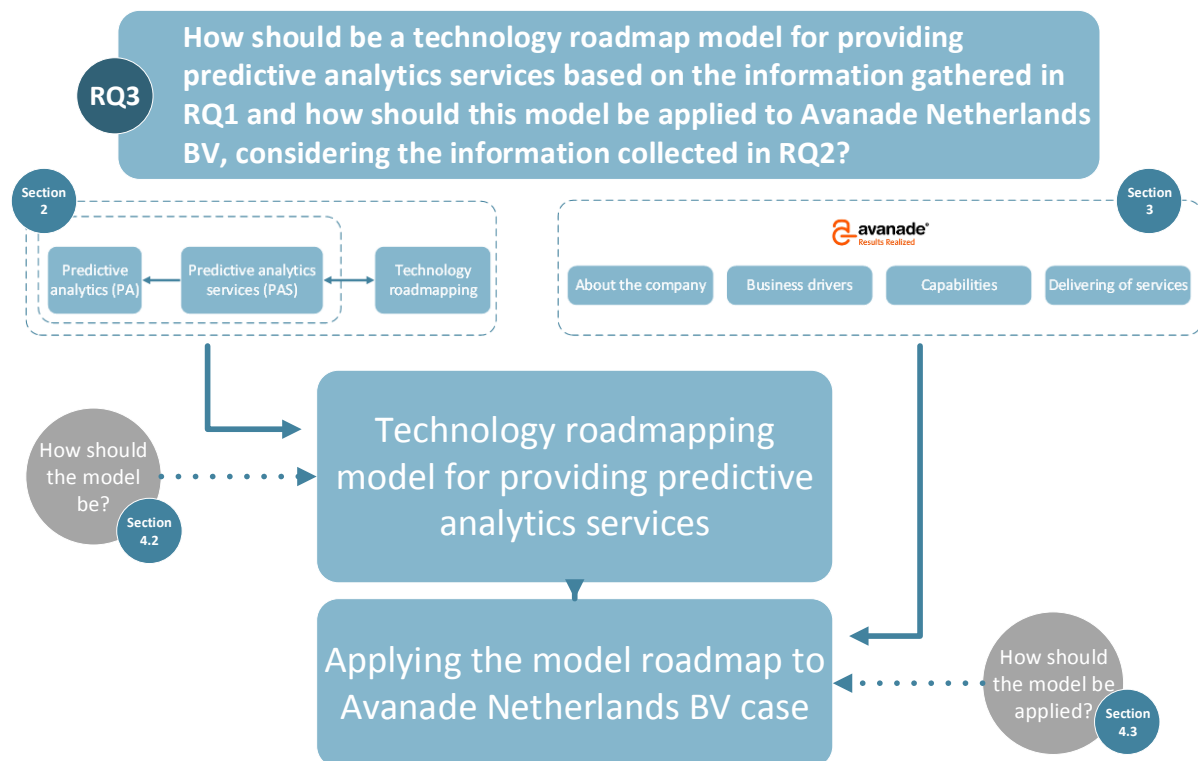Figure 11 shows a graphic representation of the approach of this chapter.

Figure 11. Section 4 approach. Designing the model roadmap and applying it to Avanade's case

4.2. Technology roadmap model for providing predictive analytics service

As mentioned in section 2.4, the roadmap format proposed for providing predictive analytics services is the multilayer type. In this specific case there will be three different layers –Market, Technology, and Company - which show all the elements that have to be considered in regards to the choices for providing PAS and an auxiliary layer named Choices which shows the main steps of the roadmapping process.

Figure 12 shows the technology roadmap model for providing predictive analytics services, considering the layers mentioned above. Section 4.2.1 describes the requirements considered to design the roadmap, section 4.2.3 describes the three main layers – Market, Technology and Company – while section 4.2.3 explains the Choices layer and how it helps in the application process.

4.2.1. Requirements for the Technology Roadmap

According to section 2.3 there are four main points in which a company has to decide in order to provide predictive analytics: the type of services, the technology to focus on, the industries and the lines of business. But also, there are two other issues that the company has to consider in the decision making process. One is prior to analyze the four main points and it's related to the possibility of providing PAS. The other one is done after the company makes the choices and it's related to the things the company should do next once making all the decisions. Based on these points a total of six requirements were identified in order to be used in the roadmap design.

Requirement 1: know if it is possible to provide PAS
The first thing a company must realize before providing predictive analytics is to know if it is capable of doing it and also if the market is ready for those type of services. Aspects such as opportunities and threads, company strategy and industries of the market should be considered as part of the analysis.

Requirement 2: choose the technology to focus on
As seen in section 2.3.4 there are four different approaches when focusing on the type of predictive analytics technology. According to this, one of the requirements in the decision making process is to know how to choose one of those approaches.

Requirement 3: choose the type of services to be provided
Section 2.3.1 explained in detail the six different types of services found in the market. Also, section 2.3.3 showed how those services are grouped. Taking into consideration both aspects, another requirement is to know how to choose the type of services a company wants and is able to provide but also how those services are going to be grouped.

Requirement 4: choose the industries to target
Section 2.3.2 showed the type of industries that are targeted by IT companies when providing predictive analytics services. It is difficult for a company to target all of those industries because there are aspects that should be considered such as the know-how of the provider company or the capability of reaching those industries. Due to this reason, it is important to know how to choose which industries to target.

Requirement 5: choose the lines of business to focus on
Section 2.3.1 explained how some IT consultancy companies focus their services to certain lines of business within the industries they serve. Eight types of lines of business were identified. In the same

way as in the industries, an IT consultancy company has to know which of those lines of business focus.

Requirement 6: identify what should be next after making the decisions

Once an IT consultancy company has made all the decisions regarding the provision of predictive analytics services it's important to know what should be next. Some aspects must be considered: acquisition of technologies and resources, improvement of weaknesses, adjustments of process, training of people, among others.

4.2.2. Market, Technology and Company layers

The main three layers - Market, Technology, and Company – contain sublayers which allow to focus in certain elements. The Market layer contains two sublayers: industries and trends. The Technology layer contains two sublayers: Predictive Analytics technologies and other IT technologies. Finally, the Company layer contains four sublayers: resources, capabilities, strategy and services.

Each sublayer contains several elements to be assessed during the process. These elements are considered when performing the steps of the Choices layer. This process is explained in detail in section 4.2.3. The idea is to gather information about the company in regards to each of those elements. Table 6 contains the list of elements per layer and sublayer and the assessing questions that must be considered when looking for that information. Besides the elements mentioned in Table 6 there are also four special elements that where considered within the roadmap and are related to the each of the four customers' needs explained in section 2.3.5.

Finally, each layer contains two type of outputs. The choices, which are the result of the application process of the roadmap, and the activities to execute, which are the lists of activities that the company must perform once the choices are made. Each of these type of outputs is explained in section 4.2.3.

4.2.3. The Choices layer and the application process

The Choices layer is the fourth and last layer in the roadmap. It is located in the upper part of Figure 12 because its main goal is to lead the users of the model thru the application process. This layer contains a set of steps which take the elements in the other layers and use them as input for making choices. It is important to clarify that this type of layer appears in roadmaps for program planning where there are layers in form key decision points [10], in this case those are called 'steps'.

There is a total of 6 steps included in the Choices layer which are based in each of the requirements presented in section 4.2.1. Step 2 until step 4 use the information gathered in the market study (sections 2.3.1, 2.3.2 and 2.3.4) as another input. There is a description of each step below.

Step 1: It is possible to provide PAS?

In the first step main objective is to assess if the company is ready to provide predictive analytics services. The idea is to analyze the state of the art of predictive analytics and how is the demand of the industries for such technology. Also, part of this step is to take into account the company's current resources, capabilities and strategy, and compare them versus the market opportunities and threats. Some of the questions that the company must answer are:
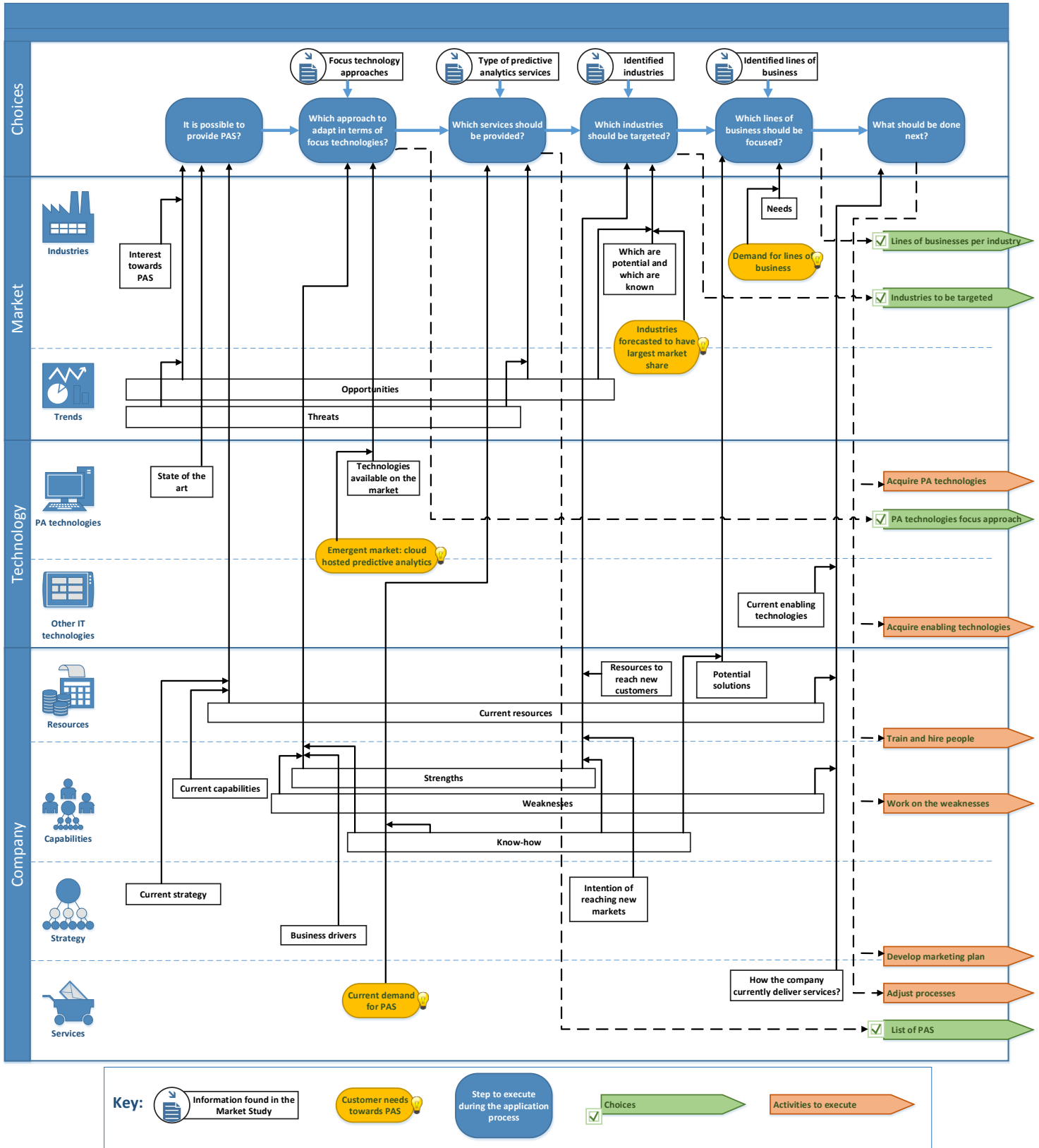
Figure 12. Technology roadmap model for providing predictive analytics services

Layer	Sublayer	Element	Assessing questions
Market	Industries	Interest towards PAS	How interested are the companies in using predictive analytics services? (Demand for predictive analytics services)
		Which are potential and which are known	Which are considered as potential industries for the company? Which industries are known by the company, due to the previous or current projects?
		Needs	Which are the needs of the industries?
	Trends	Opportunities	Which opportunities see the company in terms of PAS?
		Threats	Which threats see the company in terms of PAS?
Technology	PA technologies	State of the art	What is the state of the art of predictive analytics?
		Technologies available on the market	Which technologies and vendors are found in the market?
	Other IT technologies	Current enabling technologies	Which are the current enabling technologies that the company possess and uses in its processes?
Company	Resources	Current resources	Which are the current assets that the company possess and could be of help when implementing PAS? How are the current human resources?
		Resources to reach new customers	Which resources do the company possess to reach new customers?
		Potential solutions	Which potential solutions could the company provide for the current needs of the industries?
	Capabilities	Current capabilities	Which are the current capabilities of the company?
		Strengths	Which are the strengths of the company in regards to PAS?
		Weaknesses	Which are the weaknesses of the company in regards to PAS?
		Know-how	Which aspects of the know-how of the company might affect the future provision of PAS?
	Strategy	Current strategy	How is the current strategy related to the future provision of PAS?
		Business drivers	Which are the business drivers and how are they related to the future provision of PAS?
		Intention of reaching new markets	During the process, is the company interested on reaching new industries or wants to stick to the current industries it serves?
	Services	How the company currently deliver services?	How the company currently deliver services in terms of their process, customers and technologies?

Table 6. Layers, sublayers, elements and assessing questions

- Is the market (industries/companies) ready for predictive analytics?
- Which opportunities and threats are in the market of predictive analytics that might affect the company?
- Does the company have the resources and capabilities to provide predictive analytics services?
- Is the strategy of the company aligned with the idea of providing predictive analytics services?

Once these questions are resolved the company will have a clear idea of the possibility of offering PAS. One possible outcome of this first step is to stop the application process simply because the company can't provide PAS, for example, because it is not aligned with the company's future goals stated in its strategy. The other type of outcome is that the company indeed is able to provide PAS. At this point, the idea is to start thinking about the possible adjustments that must be done in order to reach the final objective, these adjustments will become clearer in the later steps of the process.

Step 2: which approach to adapt in terms of focus technologies?
The goal of this step is to choose one of the four approaches explained in section 2.3.4 (focusing on their own analytics technology, focusing exclusively on third-party technologies, focusing on both their own analytics technology and third-party technologies, and do not focusing in a specific predictive analytics technology).

The idea is that the company analyzes the four possibilities taking into account their own features (strengths, weaknesses, business drivers and know-how) and see what is the best option in terms of the available predictive analytics technologies on the market. It's important to mention that part of these analysis is also considering the new emergent market (cloud hosted predictive analytics). According to the findings in section 2.3.4, it is recommended for companies which do not provide exclusively IT consulting services but also other types that choose the fourth approach: not focusing in a specific predictive analytics technology.

The questions that must be answered in this step are:

- Is the company exclusively focused on IT consulting services?
- Is there any politic, driver or know-how related issue that forces the company to choose certain strategy?
- Is there a strength or weakness that plays a key role in selecting the technology approach?
- Does the company has a strong connection (strength) with a PA technology vendor that could use in the future?

Step 3: which services should be provided?
The third step goal is to choose the type of services to provide, how are they going to be grouped and which is the priority of each of those services. The main input of this step is the type of services described in section 2.3.1.

Based on the opportunities and threats of the market and on the know-how, the company must choose first which type of services to provide. For example, if the company does not have experience with the technical part but on the contrary its main focus is on the advising then they should focus on the assessment of the strategic role of predictive analytics.

Another important input for the analysis in this step are the findings about the type of services in section 2.3.5. According to the customers there is need for three type of services: (1) operational/developer support, (2) training, mentoring and/or certification for tools or platforms, and (3) integration of tools into operational environment.

The questions to be asked in this part of the step are:

- Which type of services are related to what the company does?
- Which type of services require to develop new know-how?
- Which type of services offer more opportunities in the future?

Base on the answers found for those questions the company must choose the services it wants to provide in the future. Once the services are clear, the next question is:

- How should those services be grouped?

Finally, the last questions to answer are:

- What is the order of priority in developing those services?
- Which is the service that must be launch in the market? Which are the next ones?

Step 4: which industries should be targeted?

The main goal of this step is to identify the industries in which the services must be targeted. To do so, it's important to consider the potential new industries and the opportunities they offer, but also those industries in which the company has already presence. The base list of industries to choose from is the one provided in section 2.3.2.

In order to make the proper selection, the company has to consider its own know-how, strengths and resources to reach new customers, but also the industries in which it has intention to participate in the future. Also, it's important to take into account those industries which are considered to share the largest market share during the coming years: banking, financial services and insurance, and retail industry which will have the faster growth within the same timeslot. The questions that must be answered here are:

- In which industries does the company have presence?
- In which industries is the company strong?
- Which are the potential industries in which the company wants to have presence?
- Does the company has resources to reach those industries?
- Which are the industries that offer more opportunities?

As it was done with the services, the final step is to determine the prioritization of those industries, that is, which industries will be contacted first. The questions to be answered here are:

- What is the order of priority of targeting those industries?
- Which is the industry that must be contacted first? Which are the next ones?

Step 5: which lines of business should be focused?

This step attempts to determine, per each industry, which are the lines of business that should be focused. The first input to use here is the list of line of businesses detected in section 2.3.1: customer,

sales and marketing, operations, risk management, fraud management, financial processes, product/service improvement and pricing, network performance/security and supply chain.

Next, the idea is to analyze per each industry the specific needs and the potential solutions that could be offered in each line of business. Also, it is good if during the process the company also considers those lines of business that are forecasted to be more demanded, named customer, sales and marketing, financial processes, risk management and fraud management (section 2.3.5).

The questions to be answer per each industry in this step are:

- In which lines of business does the company have experience?
- Which lines of business are more critical within that industry?
- Which needs there are per each of the business lines?
- Which potential solutions can be offered?

Step 6: what should be done next?

The last step of the application process is to analyze the gaps between what the company wants (based on the choices made in the previous steps) and what the company currently has. To do so, it is necessary to take the current enabling technologies and resources, and determine which resources must be acquired. Also, the weaknesses detected in the previous step should be listed in order to work on them. Finally, the company must analyze how it currently deliver services to their customers and see what changes should be done in order to provide the PAS they want to provide. The questions that must be answered in this step are:

- Which enabling technologies should the company acquired in order to provide PAS?
- Which people should the company hire in order to provide PAS and improve its knowledge about predictive analytics?
- Which are the weaknesses that must be improved in order to provide PAS?
- Which adjustments must be done on the current processes in order to provide PAS?
- Which type of human capital must be acquire in order to provide PAS?

This step has a special type of output named activities to execute. These are the activities the company must perform to finally complete the process of providing predictive analytics services. Each of these activities uses all the information gathered from the previous steps.

The first activity, *acquire PA technologies,* consists on obtaining the necessary assets regarding the PA technologies which the company wants to focus on. This output is closely related to the output of the second step. For example, if the company wants to focus in third party technologies then it must acquire the licenses and software needed for that matter.

The second activity*, acquire enabling technologies*, consists on buying, renting or leasing the enabling technologies that are necessary to provide PAS. For example, if the company needs to acquire a software that helps to manage ticket/incidents when providing operational/developer support services.

The third activity, *train and hire people*, consists on training the people in predictive analytics in order to achieve the level of knowledge the company requires to provide the services. A valid alternative is also hiring new people, if that's more convenient for the company.

The fourth activity, *work on the weaknesses*, consists on taking one by one the weaknesses detected in the previous steps and elaborate a plan to work on them. The ideal final state is to convert them into strengths in the future.

The fifth activity, *develop marketing plan*, consists on doing all the activities required to 'spread the word' of the new services. Part of this marketing plan is designing the marketing campaign for the services, including brochures, webpages updates, among others. Also, contacting the companies within the industries that were previously chosen.

The sixth and final activity, *adjust processes*, consists on making the necessary changes in the company's processes in order to provide predictive analytics services in the future. It's important to mention that the company could identify changes at this point but also when as the PAS they provide evolve new changes will appear.

4.3. Applying the model roadmap to Avanade Netherlands BV case

As explained in the previous subchapter, in order to apply the roadmap model it was important to follow the steps of the Choices layer. The information collected in chapter 3 was used thru all the steps but in order to make the choices in steps 3, 4 and 5 it was necessary to do an extra workshop called the Game of Choices, which was divided in three sub-sections: services, industries, and business lines.

In the first and second sections of the workshop related to steps 3 and 4 respectively, two participants from the Data & Analytics Services line were invited: the director and the analytics manager. For the first section, services, a list of predictive analytics services was introduced to both of them. This list was based on the services found on the market (section 2.3.1). Once the services were chosen, both participants were asked to choose a priority assigning numbers to each of the services. Finally, both participants were asked to choose a grouping strategy. For the second section, industries, the mechanics of the workshop were similar: first, select the industries to target from the list provided in section 2.3.2, and then select a priority for those industries. Figure 13 shows some of the cards used during the Games of Choices.

For the final section of the workshop which is related to the 5th step of the application process, five different Business Developers (salesmen of the company) were interviewed in order to get information about the trends and possible solutions that Avanade could provide in each industry and focusing in specific line of business.

One of the big advantages of interviewing the 7 different participants was that each had access to diverse information, had different perspectives and connections. The D&A Director has the strategic perspective of the company and is in constant contact with the high management. The D&A Manager has a business-technical perspective and is involved in projects with other companies as well as he is in touch with new technologies. Both of these participants have contact also with the other Service lines of the company. Finally, each of the Business Developers have a market-global perspective and are in continuous contact with customers from different industries (they know the needs and trends in those markets). Figure 14 shows this information graphically.
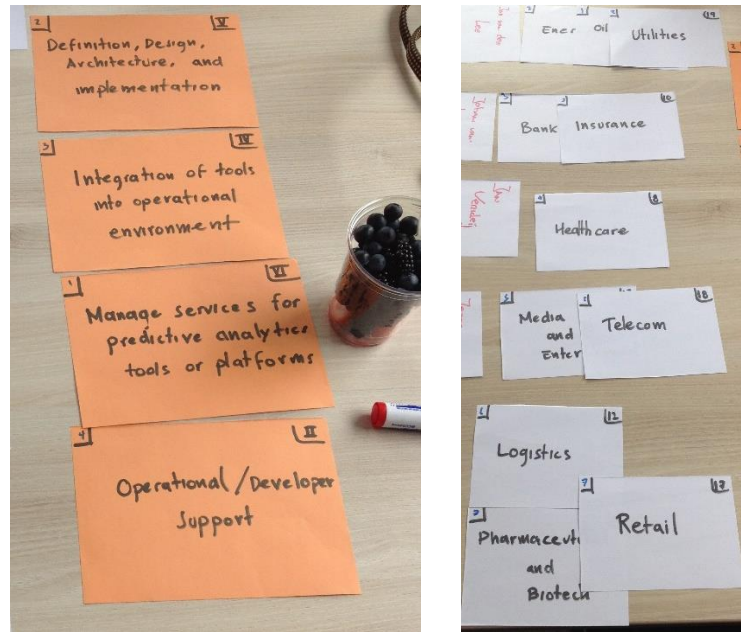
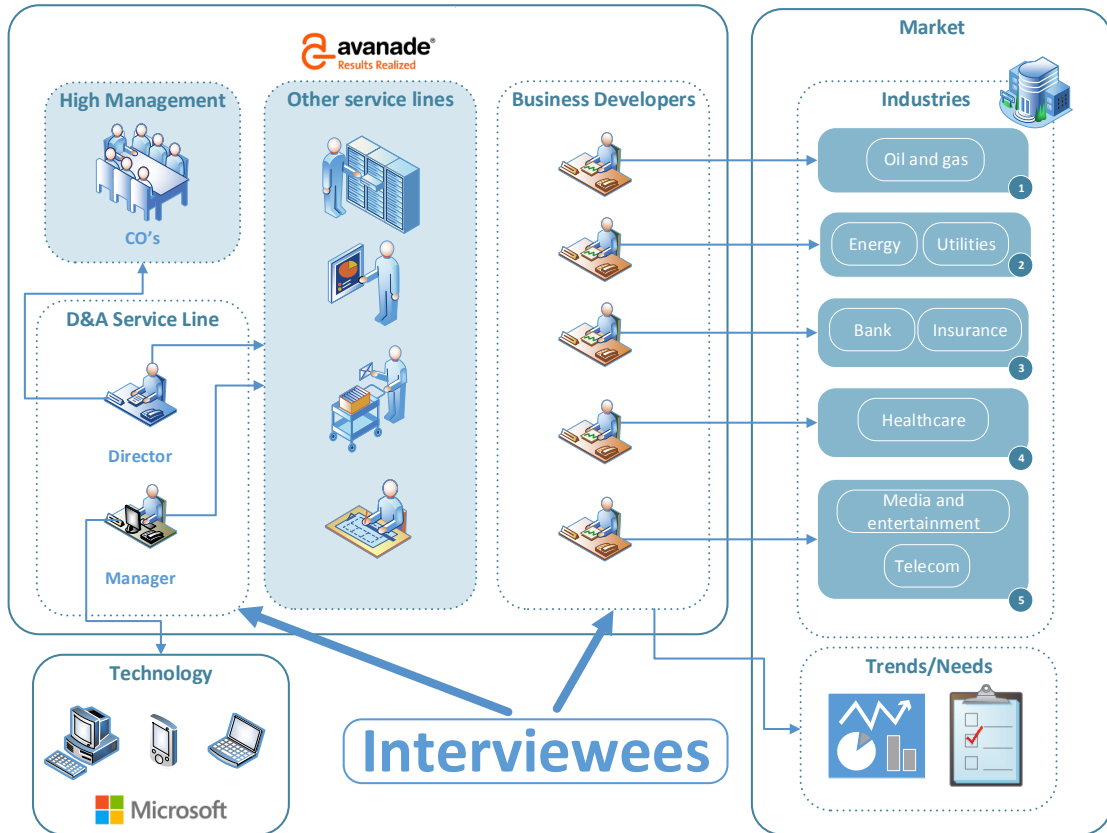*Figure 13. List of chosen services (left) and industries (right)*

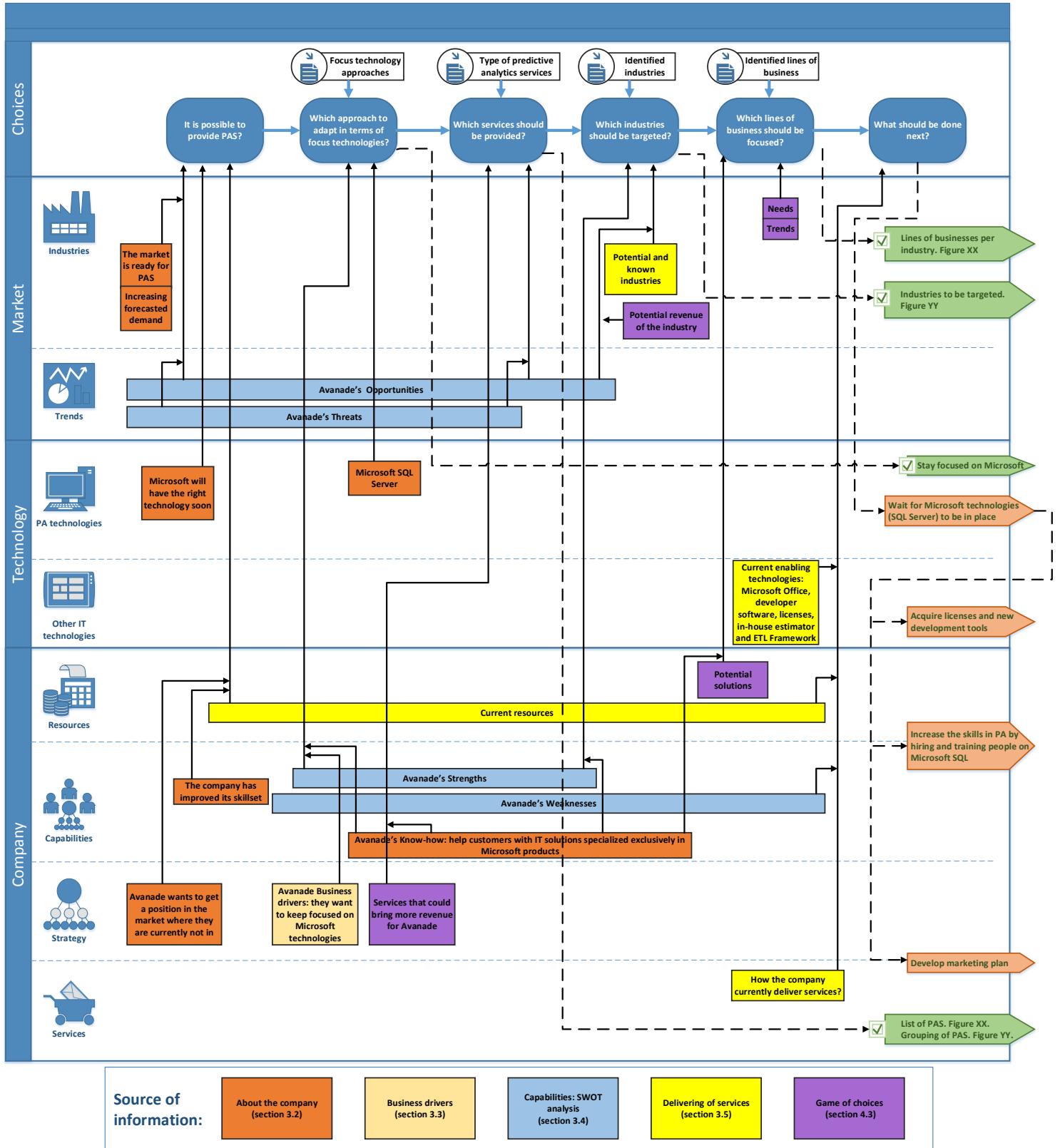*Figure 14. Interviewees and information of which they have knowledge*

Figure 15. Roadmap applied to Avanade Netherlands BV case

The following sections describe step by step the application process of the roadmap model. Figure 15 shows the roadmapping model applied to Avanade case specifying the sources of information from each element.

4.3.1. Step 1: It is possible for Avanade Netherlands BV to provide PAS?

This step was not exactly performed during the internship period at Avanade Netherlands BV. In fact, the company took the decision of providing predictive analytics services and that's why this research was conducted. However, despise this facts and as shown in section 3.2.1, some questions were performed in order to get to know more details regarding Avanade decision.

First of all, they believe the market is ready for predictive analytics and, moreover, there is a forecasted demand for the technology. Also, the company sees that Microsoft will put in place the right solutions in the coming year. Finally, the Avanade knows than in order to keep its position on the market it's important to venture into predictive analytics. Due to all these reasons, it's valid to say that Avanade Netherlands BV is ready to provide PAS.

4.3.2. Step 2: which approach should Avanade Netherlands BV to adapt in terms of focus technologies?

This step of the roadmap was resolve once the business drivers (subchapter 3.3) of the company were analyzed. One of the them, **World leading** (Avanade wants to keep the status of being the world leader in Microsoft technology in the near and long term, not just in the Netherlands but also worldwide, being focused exclusively in Microsoft solutions) constrained the selection of approach.

According to this business driver the approach that Avanade Netherlands BV wants to adopt is the second one: focusing exclusively on third-party technologies. In this specific case the third party technology is obviously Microsoft.

4.3.3. Step 3: which services should be provided by Avanade Netherlands BV?

For this step, the Game of Choices first section was introduced. Here, the director and manager of the D&A service line were introduced with a list that was based on the services found on the market (section 2.3.1). Each of the services were explained and both of the participants were asked to choose which of those services Avanade should and could offer in the future. They discussed several aspects such as importance of the services, how they are aligned with the company's future vision and strategy, and which of them could bring more revenue for the company.

Out of the six services introduced at the beginning two were discarded: Assessment of the strategic role of predictive analytics, and Training, mentoring and/or certification for tools or platforms. The reason for this is that Avanade currently doesn't provide those type of services and they are not interested on providing them in the future, nor for predictive analytics or other type of services. In fact, both participants said that Assessment of strategic role of predictive analytics is a service in which Accenture already has experience and they don't plan to compete with them in that aspect

Next, both participants were asked to choose a priority giving numbers from 1 to 4 to each of the services, taking into account which of them should be on the market first (due to their demand), and based on Avanade's capabilities and goals which could be developed first (Figure 16). The final prioritized list was: 1) Manage services for predictive analytics tools/platforms, 2) Definition, design,

architecture, and implementation, 3) Integration of tools into operational environment, and 4) Operational/developer support.
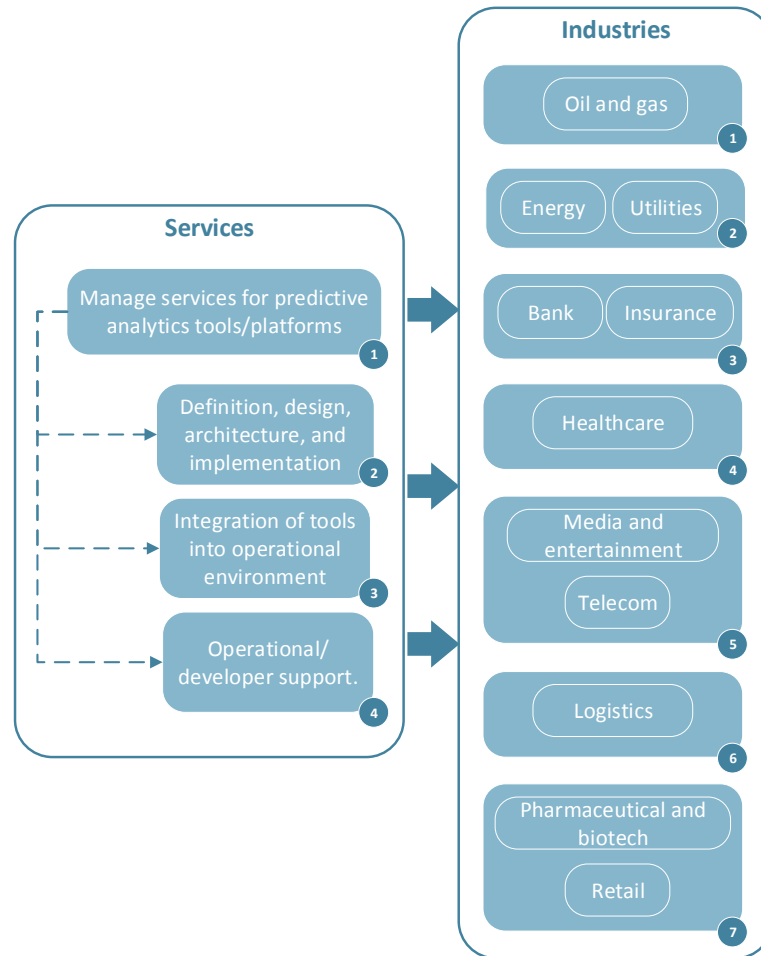
Figure 16. Priority of services and industries

Finally, both participants were asked to choose a grouping of those 4 services, if possible, and they actually explained a grouping strategy which is described as follows. Both participants explained that the idea of the company is to provide at the very beginning Manage services for predictive analytics tools/platforms which include the rest of the services as part of the package. Once Avanade gains experience in providing this type of service they will be also able to provide each of the rest (Definition, design, architecture, and implementation; Integration of tools into operational environment; and Operational/developer support) separately. Figure 17 shows the evolution of this grouping strategy.

4.3.4. Step 4: which industries should be targeted by Avanade Netherlands BV?

In this step, the second section of the workshop – industries – was introduced. Here, a list of pre-selected services were placed on the table, and next to them a list of 19 industries (product of the market study in section 2.3.2) were shown too. Both participants were asked to choose the industries that Avanade should target on the future to provide the previously selected services. They discussed aspects such as Avanade's experience on each of the industries, potential revenue of the industry,

possibility of offering valuable predictive analytics solutions to each industry, and the focus and strategy of Avanade towards each industry.

Initial state

- One service
- Immature
- Manage services include the rest

Desired state

- Four different services
- More mature
- Manage services include the rest, but also there is the possibility of offering all of them as separated services

Manage services for predictive analytics tools/platforms

Definition, design, architecture, and implementation

Integration of tools into operational environment

Operational/ developer support.

1

Manage services for predictive analytics tools/platforms
1

Definition, design, architecture, and implementation
2

Integration of tools into operational environment
3

Operational/ developer support.
4

Figure 17. Evolution of the services according to the grouping strategy

Out of the 19 industries listed originally 11 were selected finally: energy, oil and gas, utilities, banks, insurance, healthcare, media and entertainment, telecom, logistics, retail, and pharmaceutical and biotech (Figure 16). The reasons to discard the rest of industries were basically that they don't provide a good opportunity (in terms of revenue) or there are not enough possible solutions to offer in those industries.

Finally, as done in the first section, both participants were asked to choose a priority for each of those industries, in this case, they were free to choose the same priority for several industries, if applicable. The final prioritized list of industries was the following: 1) oil and gas; 2) energy and utilities; 3) banks and insurance; 4) healthcare; 5) media and entertainment, and telecom; 6) logistics; and 7) Retail, and pharmaceutical and biotech.

4.3.5. Step 5: which lines of business should be focused by Avanade Netherlands BV?

For the fifth step, the final section – business lines - was introduced. Originally this section was going to be conducted with the same participants of the previous sections of the workshop. The list of pre-selected services and industries where place together on the table and next to them a list of 8 line of

business were introduced (found in section 2.3.1). Both participants were asked to choose combinations of services, industries, and line of businesses according to Avanade's capabilities and considering the goals the company has in mind for the provision of predictive analytics in the future. Instead of doing this, the director of the D&A Service Line proposed a better idea: to get a more precise grasp of the trends and possible solutions, he suggested that this part of the workshop should be done with each of the Business Developers (salesman of the company) for each industry. Then, further meetings were schedule according to each industry.

Due to time constrains, only five extra meetings where schedule with Business Developers in charge of the first five industries (according to the priority): oil and gas, energy and utilities, bank and insurance, healthcare, and media and entertainment and telecom. With each Business Developer the mechanics were the same: first, the project was introduced explaining the outcome of the first two sections of the workshop, then they were asked to provide information about the trends and needs in each industry and the possible solutions that Avanade could provide to each of the 8 line of business. As a result, many lines of business were discarded because they didn't apply to the industry of because there are not feasible implementations of predictive analytics. Figure 18 contains which industries are connected to each of the line of business. Appendix A.4 explain in detail the trends and needs of each industry and the possible solutions that Avanade could provide in the future.
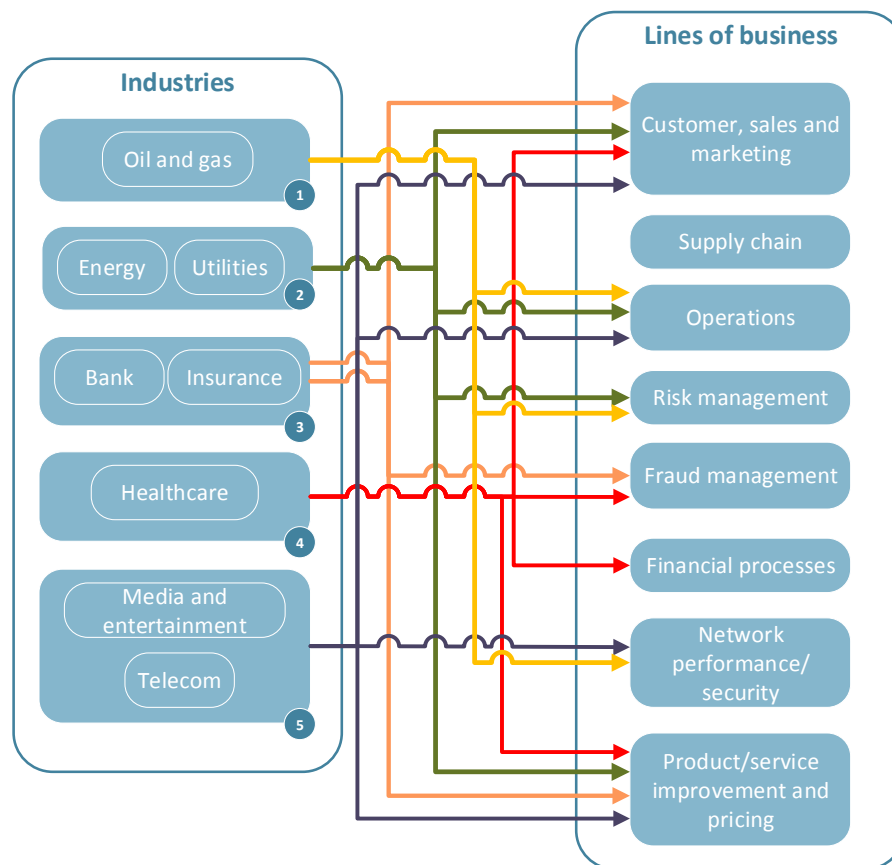

Figure 18. Line of business to be targeted according to each industry

4.3.6. Step 6: what should Avanade Netherlands BV do next?

As the roadmap model suggests, it is at this point that once every choice is made the company must analyze which are the activities to perform according to what they lack. However, when doing the SWOT analysis (section 3.4.2) the manager has already identified which were the main two weaknesses in regards to providing predictive analytics: first, the technology – Microsoft – is not mature and the company has to improve the skillset for predictive analytics.

This two weaknesses have two implications. First, instead of acquiring the PA technologies and licenses Avanade Netherlands must wait for Microsoft to improve SQL Server and offer a more powerful option to compete in the market. According to the D&A service line manager, this will be done by the end of the present year. Second, once the technology is in the right place Avanade must increase its knowledge of predictive analytics by hiring people expert in the topic or training the employees they already have.

Finally, developing the marketing plan has also as pre-requirement that the technology is in the right place. This part of the implementation is not considered on this thesis because the creation of a complete marketing plan requires more time and other type of resources not analyzed here.

4.4.   Summary

First of all, this chapter took all the information gathered in the chapter 2 and with it a roadmap model for providing predictive analytics services was developed. This roadmap consisted of three main layers named Market, Technology and Company, and an additional layer named choices.

Each main layer is subdivided in sublayers. The Market layer contains two sublayers: industries and trends. The Technology layer contains two sublayers: predictive Analytics technologies and other IT technologies. Finally, the Company layer contains four sublayers: resources, capabilities, strategy and services. Each sublayer contains, at the same time, elements that must be analyze in the decision making process and outputs such as choices or activities to execute.

The Choices layer's main goal is to lead the users of the model thru the application process. It contains 6 steps which take into account the elements of the other three layers and using the information gathered in the market study (subchapter 2.3) the idea is to make choices in terms of the focus technology approach, the services to provide, industries to target and lines of business to focus on.

The second part of this chapter was applying the roadmap model in Avanade Netherlands BV case. To do so, the 6 steps proposed in the model where followed. Information gathered in chapter 3 was the main input but also, in order to choose the services, industries and lines of business a workshop named the Game of Choices was introduced.

Several decisions where taken during the application process. First of all, Avanade Netherlands BV decided to keep its position of being focused on Microsoft technologies and therefore they want to focus the services in SQL Server. Also, four services and eight industries were selected and prioritized. Then, several trends/needs and potential solutions according to the business lines were identified per each industry. Finally, the company realized that there are two main weaknesses in which it has to work before providing predictive analytics services: waiting for the technology to be in place (Microsoft) and improve the skillset in regards to predictive analytics.

5. ANALYSYS

5.1. Introduction

In order to answer the fourth research question *RQ4: Which aspects should need special attention during the process of implementation of the roadmap and what is the level of usability of the roadmap in an organization such as Avanade as well as in other type of companies in the industry?* It is necessary to realize three steps. Figure 19 shows the approach followed in this chapter.
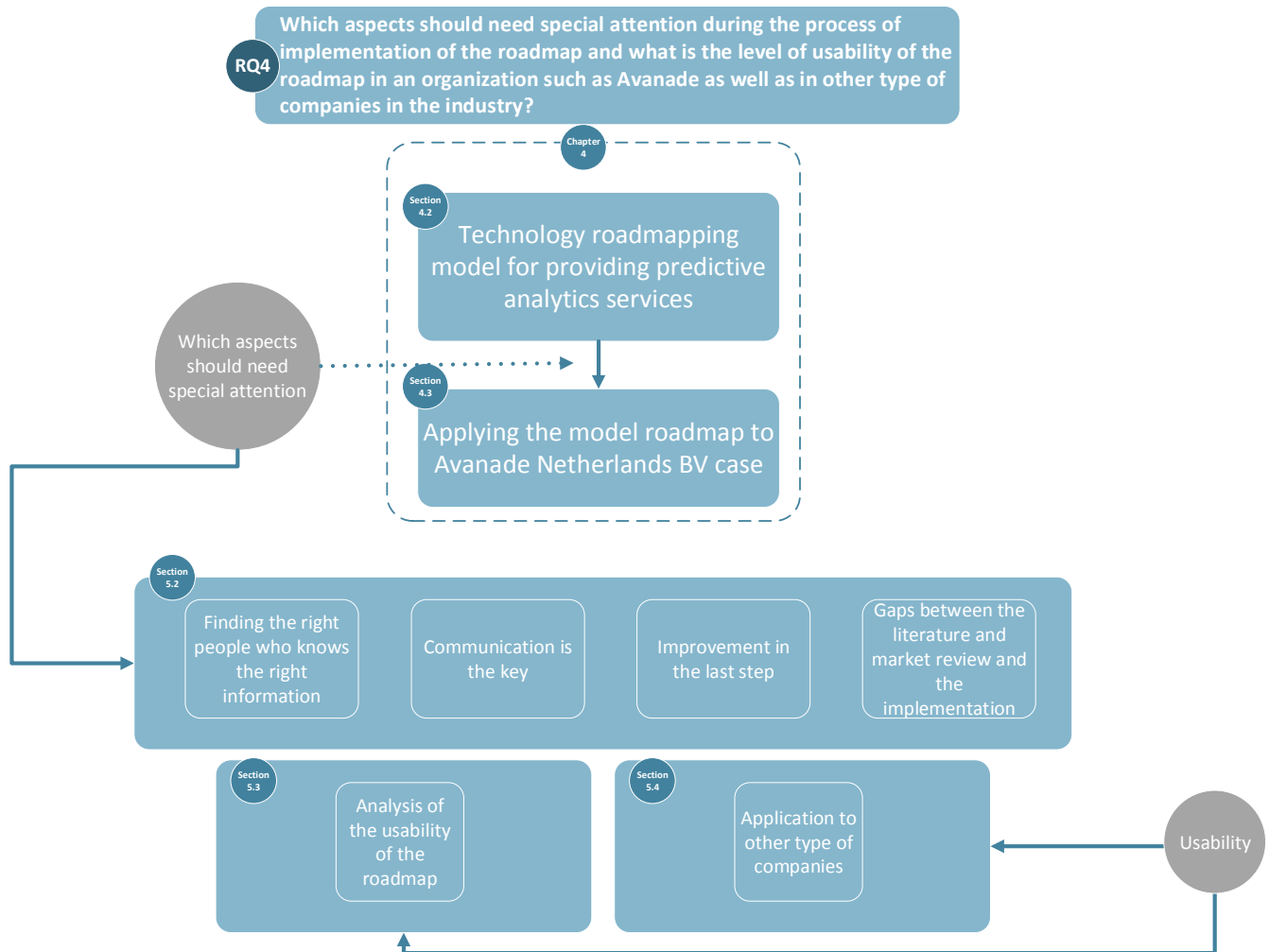
Figure 19. Chapter 5 approach

First, section 5.2 explains four different aspects that were relevant in the implementation and are worth mentioning: finding the right people who knows the right information, the importance of the communication during the process, the need for improvement in the last step of the roadmap and the gaps that were identified between what the literature and market suggest and what Avanade think is relevant.

Second, section 5.3 shows an analysis on the usability of the roadmap in Avanade case. For doing this, a questionnaire was performed with one of the managers of the company and the reflection on such questionnaire is presented as well.

Finally, section 5.4 details two aspects that justify the usability of the roadmap in other type of companies different from Avanade.

5.2. Analysis of the implementation

5.2.1. Finding the right people who knows the right information

During the implementation of the roadmap one of the key aspects that were identified was the importance of the stakeholders involved in each of the steps in the decision making process.

For the step 3 - which services should be provided? –, step 4 - which industries should be targeted? – and step 5 which lines of business should be focused? – of the implementation, a director and manager were considered to be part of the decision making process, however, when choosing the industries one of the participants suggested that for the next step (choosing the lines of business based on the trends and needs of each industry) it should be better to involve the business developers (salesmen of the company) because they were the experts in each type of industry. At the end of the process seven people were involved, instead of the original two participants. This, of course, implied scheduling of more meetings and dealing with more people agendas.

Also, one of the aspects that influenced the implementation of the roadmap in Avanade was the fact that the company already has clarity in regards to the type of technology they support (Microsoft), due to this reason, step 2 - which approach to adapt in terms of focus technologies? – was practically easy to perform and didn't need the participation of many stakeholders. Despite the fact that this was as it happened in Avanade case it is more likely that in other type of companies there will be need of involving expert technical people who might help to analyze the different type of technologies available and reachable.

Finally, another aspect that was relevant during the implementation process of the roadmap was the fact that in some workshops it was important to have different stakeholders in order to discuss diverse points of view. For example, during the workshop for analyzing step 3 - which services should be provided? – two different stakeholders were involved: the director of the Data & Analytics Service Line and one manager of the same service line. The advantage of doing this is that the manager had expertise in the technology while the director had a clearer view of the company's strategy (due to the fact that he has more contact with the high management of Avanade). Also, both of them had had interaction with the business developers and therefore the industries they're responsible for. At the end, involving both of those stakeholders brought knowledge in multiple layers of the roadmap in order to choose the right services: the director had more specialized knowledge in regards to the company layer and the manager in regards to the technology layer.

Based on the aforementioned observations it would be good for the implementation in other type of companies if a stakeholder analysis is performed. This analysis should be focused on the impact that providing predictive analytics might have on the stakeholders but also on the knowledge needed to analyze each of the steps in the roadmapping process. This previous step might help to plan better the scheduling of meetings and involvement of people.

5.2.2. Communication is the key

One of the key aspects during the roadmapping process is the communication of the objectives to the stakeholders in each of the steps. It is important to mention them at the beginning of every meeting.

It is also useful to give a brief summary of where the process is so in this way each stakeholder knows which decisions were already taken and don't need further discussion.

During one of the meetings with a business developer when analyzing the possible solutions that Avanade could provide according to the market needs, he began to suggest some possible solutions but in a technical level that was not part of the decision making process. His suggestions were more related to how the technical implementation of the predictive analytics solution should be instead of the general solution the company could provide to the market need. In this case it was necessary to clarify not just the decisions previously taken during the process and the objectives of the roadmap but also the level of technical detail that is going to be used during the process.

To wrap up, it is important to take into account three different aspects in the communication with the stakeholders involved: the objectives of the roadmap, the decisions/choices made so far during the process and the level of technical detail that is needed during the process.

5.2.3. Improvement in the last step – what should be done next?

As describe in the previous chapter, the roadmapping process at Avanade were focused specially in the first five steps of the process where decisions are taken. During the last step two weaknesses where identified in which Avanade must work before providing predictive analytics services - waiting for Microsoft to improve its solution for predictive analytics and increase the knowledge by hiring expert people or training their current employees – but due to time constrains the marketing plan for the new services was not developed.

In fact, it is important to mention that the last step need further improvement to specify more clearly the plans for acquiring the new technologies, hiring/training people, adjustments in the current process and developing of the marketing plan itself. Actually, this is one of the aspects that is considered as part of the future research proposed in the last chapter.

5.2.4. Gaps between the literature and market review and the implementation

Some gaps were found between the information found in the literature and the market (section 2) and the implementation at Avanade. A total of three gaps were identified during the implementation process of the roadmap.

First, the challenges mentioned in the literature are not considered as potential threats to Avanade. Some challenges for providing predictive analytics services are directly related to the predictive modeling itself. One of them, pointed out in section 2.2.2, was that the customers want to implement predictive analytics but they constantly commit the error of approaching IT consultancy companies without having a clear goal in mind. Also, another challenge before implementing the predictive analytics models is exploring and preparing the data.

One might think that those challenges were going to be mentioned during the workshop sessions of the SWOT analysis at Avanade Netherlands BV, however, the participant of the workshop didn't considered them as potential threads in the future provision of predictive analytics services. On the contrary, the company identify two threads that were related directly with the marketing of the services, instead of the process of implementation: the pricing (which is exclusively related to Avanade), and the current increasing demand for IT services which could affect the relation with potential customers of the company if they don't have the capabilities to supply it.

Second, not always the most demanded services can be provided. One of the services most demanded by the customers is the training of their people in regards to predictive analytics services (section 2.3.5). This information would suggest that a company which wants to provide PAS such as Avanade has to try to provide this type of services in order to supply the demand, however, that service was discarded since the very beginning.

The main reason behind this choice is that in order to provide training, mentoring and/or certifications for tools or platforms the company would have to change its strategy. Currently, Avanade Netherlands BV is focused in providing enterprise business technology solutions and managed services; they don't provide services of training, mentoring or certification even for technologies they currently support such as ERP, CRM or Data warehouse. If they would have chosen to provide those services for predictive analytics they would have to develop a new capability and even have to change their strategy. At the end, the time and money that acquiring that new capability requires exceeds the benefits that a demand for such service could bring.

Finally, Avanade sees a lot of potential in industries that are not forecasted to be as strong as others. According to the information found in section 2.3.5 three industries are forecasted to have the largest market share between 2013 and 2019: baking, insurance and financial services. In fact, Avanade plans to focus predictive analytics services to two of those industries (see section 5.3.3). However, in none of them was mentioned the oil and gas sector.

On the other hand, when analyzing the target industries with the director and manager of the D&A service line, the first industry they chose was Oil and Gas. The two reasons to do so were that one of the biggest customers that the company has belongs to that industry and also they see that the opportunities in that sector were higher than in others. Moreover, when analyzing the lines of business per each industry, one of the Business developers pointed out several trends and needs in the oil and gas industry (the increasing amount of declining fields, unconventional wells as the next target for oil and gas companies, interest in preventive maintenance, security of the network of facilities, shale gas wells increasing demand), which offered opportunities for predictive analytics implementations (detailed information can be found in appendix A.4).

5.3. Analysis of the usability of the roadmap

In order to evaluate the usability of the roadmap in the company, a survey was conducted with Joris Valkonet, one of the managers of the Data & Analytics service line who was present in all the process during the six months in Avanade. He was the supervisor assigned in the company and also he participate in almost all the workshops (the only ones in where he didn't participate were the workshops with the business developers). Appendix A.2.3 contains the questionnaire sent to manager. Below there is an analysis on the answers he provided.

5.3.1. Connecting external with internal factors

As mentioned in section 1.3.1, when comparing roadmapping for predictive analytics services in comparison with other type of software products, one of the key differences is the fact that it is necessary to analyze external factors more in depth and connect them with the internal factors in the company. Regarding this point, the manager thinks that roadmapping helps to connect external with internal aspects in a high level. In fact, he thinks that it was more useful when connecting external

factors such as Industries and market analysis with internal factors such as readiness/ skills of staff and technical readiness of products available.

Also, it is worth mentioning that besides the two main factors mentioned as differentiators between predictive analytics services and other type of software products, the manager also highlights aspects such as the services offered by competitors and the advanced skills of consulting staff in technology and business understanding that are present in predictive analytics services.

5.3.2. Regarding the benefits of using roadmapping

The manager in Avanade thinks that roadmapping integrates different aspects such as product/service, business and market perspectives in a high level. However, on the other side, he thinks that think roadmapping explore and communicate the dynamic linkages between technological resources, organizational objectives and the changing environment in a medium level. Also, he thinks that roadmapping helped in the decision making process in a medium level.

There are two main reasons to justify the aforementioned opinions. First of all, he thinks that there are extra steps that were omitted in the process to make more tangible the objective of providing predictive analytics. All of them are related to the last step – what should be done next? In which there was less time and resources spend. He says that aspects such as internal selling of the need to get into the predictive analytics market, align with other service lines/ offerings internally to go to market together and finding launching customer(s) and celebrate success were missing in the process. He mentioned that these activities could be part of the marketing plan. Second, he actually thinks the most important step during the process is designing and implementing the marketing plan in order to do it "in real life". Since this last step was not implemented in the company then it was not possible for him to see the complete benefits of the decision making process.

5.4. Application to other type of companies

5.4.1. Some steps could be more useful in other type of companies

As mentioned before, there were two steps in which no big analysis was done due to the nature of the company and the decisions taken before beginning the roadmapping process. The *first step – it is possible to provide PAS?* didn't have broad discussion because Avanade analyzed beforehand the decision of providing predictive analytics services. The *second step – which approach to adapt in terms of focus technology?* didn't need analysis because the company had in mind the idea to keep its strategy in terms of being a Microsoft partner and only focusing in Microsoft technology. Actually, one of the things Avanade need to do in order to provide predictive analytics is to wait for Microsoft to improve its predictive analytics solutions.

Despite the aforementioned fact, it is important to mention that the roadmap model could be implemented in other type of companies in which those two first steps could be of more use. For example, a company which has the idea of providing PAS but haven't analysis the possibility could benefit of performing that first step. On the other hand, an IT consultancy company which provides support to different type of technologies (say SAP, Microsoft, SAS, etc.) could be benefited by performing the analysis in the second step.

5.4.2. Different possibilities in the criteria to analyze decisions

As mentioned in section 5.2.4 some gaps were found between the literature and market and the implementation at Avanade. These gaps were present because the company utilize different criteria to take the decisions based on the knowledge and information they manage (for example, they see more future in some industries different from those that were forecasted to have more market share).

One of the aspects that might help other type of companies different from Avanade is the possibility of using the information gathered from the market study (the one that is circled in yellow clouds in the roadmap) and match it with the information each company has. Since other companies might have different criteria to analyze each decision, there could be the possibility that a company might find such information more useful than Avanade.

5.5. Summary

This chapter analyzed three different parts of the implementation of the roadmap: aspects to be considered for next implementations, usability of the roadmap for Avanade and the application of the roadmap to other type of companies.

First of all, four different aspects were considered worth of mentioning regarding the implementation. One of them is the importance of finding the right people when looking for making the right decisions. In order to improve this, a stakeholder analysis is suggested prior to implement the roadmap. Another important aspect was the communication of the information and decisions previously taken, this helps the participants so focus on the decisions that need more attention. Third, due to the fact of time and other resources constrain, the last step of the process needs improvement. Finally, several gaps were found between what the literature and the market suggest and how Avanade took the decisions: PA challenges regarding the process of predictive modeling are not considered as threats to Avanade; there are services that, despite being the most demanded, it is not always possible to provide, mostly, because of the capabilities and strategy the company has; finally, Avanade sees a lot of potential in the oil and gas industry, despite the fact this industry is not forecasted as one of the largest for the coming years.

Secondly, regarding the usability of the roadmap in Avanade there were some points mentioned. Avanade thinks that roadmapping helps to connect external with internal aspects in a high level, however, on the other side, they considered that roadmapping helped in the decision making process in a medium level. The reasons for considering this are that extra steps that were omitted in the process to make more tangible the objective of providing predictive analytics. All of them are related to the last step and could be part of the marketing plan. Also, Avanade thinks the most important step during the process is designing and implementing the marketing plan in order to do it "in real life" and since this last step was not implemented in the company then it was not possible to see the complete benefits of the decision making process.

Finally, the roadmap usability level in other companies could be considered as high because the first two steps of the roadmap could be more useful in companies different from Avanade. Also, other type of companies can make use of the information provided by the roadmap model in regards to the customer needs and by using different decision criteria they could take different decisions from those taken in Avanade.

6. CONCLUSIONS AND FUTURE RESEARCH

6.1. Introduction

This final chapter describes the conclusions of the research and the points to be considered in a possible future research agenda.

6.2. Conclusions

- Predictive analytics services are enabling services delivered/tailored specifically for predictive analytics. The market study conducted in this thesis found that there are 6 different types of predictive analytics services currently offered in the market: (1) assessment of the strategic role of predictive analytics, (2) operational/developer support, (3) training, mentoring and/or certification for tools or platforms, (4) integration of tools into operational environment, (5) definition, design, architecture and implementation, and (6) manage services for predictive analytics tools/platforms.

- IT consultancy companies have different strategies in regards to provide predictive analytics services. First of all, they may choose a technology approach, which they can select from: (1) focusing on their own analytics technology, (2) focusing exclusively on third-party technologies, (3) focusing on both their own analytics technology and third-party technologies, and (4) do not focusing in a specific predictive analytics technology. Also, they may decide to which type of industries targeting the services, the market study revealed a total of 19 variety of industries. Finally, IT consultancy companies may focus PAS to specific needs within the lines of business such as Customer, sales and marketing, Operations, Risk management, Fraud management, Financial processes, Product/service improvement and pricing, Network performance/security and Supply chain.

- In order to help IT consultancy companies in the process of providing predictive analytics services, a model roadmap was proposed. This model roadmap contains a layer named Choices which main goal is to lead the users of the model thru the application process. This layer contains a set of steps which take the elements in other 3 main layers and use them as input for making choices. The main three layers named Market, Technology, and Company contain sublayers which allow to focus in the elements. Besides such elements, each sublayer contains two type of outputs: the choices, which are the result of the application process of the roadmap, and the activities to execute, which are the lists of activities that the company must perform once the choices are made. The Choices layer describes the six steps that an IT consultancy company must follow in order to provide predictive analytics services: (1) it is possible to provide PAS? (2) Which approach to adapt in terms of focus technologies? (3) Which services should be provided? (4) Which industries should be targeted? (5) Which lines of business should be focused? And (6) what should be done next?

- Once the model was implemented in Avanade Netherlands BV, the choices were clarified: first, the company stayed focused on its strategy of being the biggest leader in Microsoft technology and decided to choose the approach of focusing in third-party technology; second, considering Avanade's capabilities they decided to provide four types of PAS, listed by their priority: (1) manage services for predictive analytics tools/platforms, (2) definition, design, architecture and implementation, (3) integration of tools into operational environment, and (4) operational/developer support; third, Avanade chose to target such services to 8 different industries, in which oil and gas is the most important to address; finally, the company sees

potential in 7 lines of business in which Customer, sales and marketing, Operations is the one that is more relevant

- Avanade Netherlands identified to main weaknesses in which they have to work before providing predictive analytics services: first, instead of acquiring the PA technologies and licenses Avanade Netherlands must wait for Microsoft to improve its PA technology and offer a more powerful option to compete in the market; second, once the technology is in the right place Avanade must increase its knowledge of predictive analytics by hiring people expert in the topic or training the employees they already have.

- One of the key aspects identified during the process of implementation of the roadmap was the importance of finding the right people to make the right choices. While performing the workshops, additional stakeholders were considered because they had access to specific information that were important in order to make the correct decisions. Due to this fact a stakeholder analysis is suggested when implementing the roadmap in other type of companies. This analysis should be focused on the impact that providing predictive analytics might have on the stakeholders but also on the knowledge needed to analyze each of the steps in the roadmapping process.

- Another important aspect to take into account when implementing the roadmap is the communication. In fact, three different topics should be considered in the communication with the stakeholders involved: the main objectives of the roadmap – to have a clear view of the final goal, the decisions/choices made so far during the process – in order to focus exclusively in those aspects that have not being define - and the level of technical detail that is needed during the process – to avoid going into details that do not matter during the roadmapping process.

- When comparing roadmapping for predictive analytics services with other type of software products, one of the key differences is the fact that it is necessary to analyze external factors more in depth and connect them with the internal factors in the company. When evaluating this point with one of the participants of the roadmapping process he mentioned that roadmapping, indeed, helps to connect external with internal aspects in a high level. In fact, he thinks that it was more useful when connecting external factors such as Industries and market analysis with internal factors such as readiness/ skills of staff and technical readiness of products available.

- According to the evaluation performed in Avanade, it was possible to conclude that roadmapping integrates different aspects such as product/service, business and market perspectives in a high level. However, on the other side, roadmapping helped in the decision making process in a medium level. There are two main reasons to justify this are: there are extra steps that were omitted in the process to make more tangible the objective of providing predictive analytics. All of them are related to the last step – what should be done next? In which there was less time and resources spend. Also, the most important step during the process is designing and implementing the marketing plan in order to make it "real" and since this last step was not implemented in the company then it was not possible to see the complete benefits of the decision making process.

- As mentioned before, there were two steps in which no big analysis was done due to the nature of the company and the decisions taken before beginning the roadmapping process. The first step – it is possible to provide PAS? didn't have broad discussion because Avanade analyzed beforehand the decision of providing predictive analytics services. The second step – which approach to adapt in terms of focus technology? didn't need analysis because the company had in mind the idea to keep its strategy in terms of being a Microsoft partner and only focusing in

Microsoft technology. Actually, one of the things Avanade need to do in order to provide predictive analytics is to wait for Microsoft to improve its predictive analytics solutions.

- Regarding the usability of the roadmap model for the rest of the industry, it is important to mention that it could be more useful in other type of companies in which the two first steps have more impact. For example, a company which has the idea of providing PAS but haven't analyzed the possibility could benefit of performing that first step. On the other hand, an IT consultancy company which provides support to different type of technologies (say SAP, Microsoft, SAS, etc.) could be benefited by performing the analysis in the second step. Also, another of the aspects that might help other type of companies different from Avanade is the possibility of using the information gathered from the market study and match it with the information each company has. Since other companies might have different criteria to analyze each decision, there could be the possibility that a company might find such information more useful than Avanade.

6.3. Future research

First, regarding predictive analytics services, further research should be done, analyzing other aspects that were not considered in depth in this thesis. Some of them are: the power and influence of competitors in the predictive analytics market, technical issues and restrictions of the services provided by each company, comparison or bench marketing of the technologies available on the market (SAP HANA, ORACLE R, SAS, etc.).

Regarding the model itself, and in order to get more insights about its usefulness, further research can be done implementing the roadmap in other consultancy companies. The idea is that such companies should have different characteristics compare to Avanade. For example, it could be implemented in IT consultancy companies that provide services in diverse types of technologies, of different vendors, and not just only technology as Avanade case with Microsoft. Also, the roadmap could be applied to companies that do not provide exclusively IT consulting services but also other type of consulting services such as audit or tax services. Another important aspect that need further research is the way other companies use different criteria to make decisions.

Finally, future research can be focused in the limitations that this thesis had. First of all, a stakeholder analysis could be included in the roadmap model as it was suggested in section 5.2.1. Second, since the first two steps didn't require deep analysis in the Avanade case it would be interesting to focus on those two steps in another different companies where they involve more attention. Third, due to time and resources constrains, the last step of the roadmap could not been implemented in Avanade and needs further research. Further research can be done in the implementation of the services, focusing in aspects such as how to develop a marketing plan for providing predictive analytics services, or even going into depth in the technical aspects of the services, such as architecture or software implementation.

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APPENDICES

A.1 Services offered by consultancy companies

Company	Service Name[9]	Service description[10]	Webpage
IBM	N/A	IBM offers support to their main analytic product SPSS	
IBM	Training		http://www-304.ibm.com/services/learning/ites.ws/zz/en?pageType=page&c=a0011023
IBM	BAO Jumpstart for Strategic Alignment & BAO Jumpstart for Information Management Foundation	The BAO Jumpstart for Strategic Alignment offerings are designed for organizations that are interested in accelerating their analytics initiatives and want to understand how to best get started. These short-term strategic engagements help the clients to identify areas of opportunity, evaluate current capabilities and provide a roadmap and next steps for achieving their objectives.	http://www.ibm.com/common/ssi/cgi-bin/ssialias?subtype=SP&infotype=PM&appname=GBSE_GB_BO_USEN&htmlfid=GBD03151USEN&attachment=GBD03151USEN.PDF
IBM	IBM Business Analytics	Business Analytics solutions enable companies to identify and visualize trends and patterns in areas, such as customer analytics, that can have a profound effect on business performance. They can compare scenarios, anticipate potential threats and opportunities, better plan, budget and forecast resources, balance risks against expected returns and work to meet regulatory requirements. By making analytics widely available, organizations can align tactical and strategic decision-making to achieve business goals.	http://public.dhe.ibm.com/common/ssi/ecm/en/ytw03189usen/YTW03189USEN.PDF
IBM	BAO Jumpstart for Risk, Finance and Fraud & BAO Jumpstart for Customer Insight	The BAO Jumpstart for Risk, Finance, and Fraud services provide clients with a range of opportunities to deliver insight and business outcomes. Current engagements include diagnostic assessments of an organization's performance and fraud management capabilities along with tactical offerings focused on helping clients gain greater business value from their current enterprise analytics investments. The BAO Jumpstart for Customer Insight offerings provide prescriptive guidance to help an organization develop actionable customer insights and improve their ability to capture, retain and service their customers/patients/citizens.	http://www.ibm.com/common/ssi/cgi-bin/ssialias?subtype=SP&infotype=PM&appname=GBSE_GB_BO_USEN&htmlfid=GBD03151USEN&attachment=GBD03151USEN.PDF
Terada	Operationalizing for Hadoop, Data Processing and Archive for Hadoop & Developer support	To products such as Teradata Unified Data Architecture™ and environment and Hadoop	
Terada	Managed services for Hadoop	Service provides operational support for the Teradata Unified Data Architecture™ environment, includes platform, DI, and reporting support	http://www.teradata.com/brochures/Big-Analytics-and-Hadoop-Services/

[9] This information was extracted from each of the webpages
[10] This information was extracted from each of the webpages

Terada	Instantiation and Mentoring for Hadoop & Teradata Workshop for Hadoop and the Teradata Unified Data Architecture™	Teradata Workshop for Hadoop and the Teradata Unified Data Architecture: Service designed to provide detailed information around Hadoop, its capabilities and integration points within the Teradata Unified Data Architecture Instantiation and Mentoring for Hadoop: Service to size, configure, and instantiate a Hadoop system and core tools that are part of the Hortonworks distribution.	http://www.teradata.com/brochures/Big-Analytics-and-Hadoop-Services/
Terada	Data Integration Architecture and Strategy Assessment	Assessment service to show how to drive efficiency and performance optimization into data integration processes.	http://www.teradata.com/brochures/Big-Analytics-and-Hadoop-Services/
Terada	Big Analytics Design and Delivery & Data Processing and Archive for Hadoop	Big Analytics Project Definition: Service to identify a new data source and determine objectives for the analytics, best analytic tool, and platform for the job. Big Analytics Design and Delivery: Service designed to deliver an architecture and implementation of big analytics. Processing and Archive for Hadoop: Service to deliver an architecture and implementation of a data processing and storage for Hadoop use case(s).	http://www.teradata.com/brochures/Big-Analytics-and-Hadoop-Services/
Terada	Operationalizing for Hadoop	Service to architect and design solutions required to integrate Hadoop into your operational environment.	http://www.teradata.com/brochures/Big-Analytics-and-Hadoop-Services/
Ernst & Young	Advisore services - Customer & Supply Chain	Develop and help implement insightful customer analytics that allow you to understand and anticipate customer needs Provide insight into the health of supply chains by using a robust set of data analytics	http://www.ey.com/GL/en/Services/Advisory/Performance-Improvement http://www.ey.com/Publication/vwLUAssets/Predictive_analytics:_the_CIO%E2%80%99s_key_to_the_boardroom/$FILE/EY-Predictive-analytics.pdf http://www.ey.com/Publication/vwLUAssets/Predictive_analytics:_shortcut_to_tomorrow's_business/$FILE/EY_5_Insights_for_executives-Predictive_analytics_USversion.pdf
Deloitte	Deloitte Analytics	Deloitte Analytics' comprehensive approach to analytics is fueled by our deep industry knowledge, broad functional experience, and mastery of technology. We collaborate with you to help you understand which questions matter most to your business, and we help you answer them. And that's just the beginning. We also bring a fresh perspective on the role your organizational culture plays in the success of technology projects. We recognize that, to drive value from analytics, the ethos of fact-based decision-making must be embedded into the culture. We'll work with you to build that culture and maximize the value of your data—from the inside out.	http://www.deloitte.com/view/en_NL/nl/services/deloitte-analytics/index.htm http://www2.deloitte.com/content/dam/Deloitte/global/Documents/Deloitte-Analytics/dttl-analytics-us-ba-advancedanalytics3mingudie.pdf
KPMG	IT Advisory Services	Developing an appropriate IT strategy — we work with clients to develop a clear IT strategy that fully supports their business objectives	http://www.kpmg.com/Global/en/services/Advisory/management-consulting/IT-Advisory-Services/Pages/default.aspx http://www.kpmg.com/Global/en/IssuesAndInsights/ArticlesPublications/Frontiers-in-Finance/Pages/unlocking-opportunity-within.aspx

SAP	Predictive Analytics Services	Evolve your business activities from sense-and-respond to predict-and-act – with our industry-specific consulting services for predictive analytics. Accurately forecast demand, efficiently assess alternative business strategies, and cost-effectively implement optimization tools – to shape your ideal future, today.	http://www.sap.com/services-support/svc/business-analytics/consulting/predictive-analytics/index.html http://sap50analyticstips.com/predictive-analytics
SAP	Training by solution		http://www.sap.com/training-education/overview/solution.html
SAP	SAP support and maintainance		http://www.sap.com/services-support/support.html
Cognizant	Customer, Risk and Operation Analytics	How do you prepare for what is next? Adapting quickly to change is becoming a make-or-break proposition for many companies worldwide — whether that change is in risk management, revenue stream, cost increases, or other business challenges. We can guide you in using the latest business analytics tools to add incremental value, drive positive operational outcomes and deliver results that are both definitive and measurable.	http://www.cognizant.com/enterprise-analytics/customer-risk-operations
Cognizant	Enterprise Information Management	Strategic, advisory and management consulting across Enterprise Information Management, business intelligence and analytics. Data to Foresight (D2F) is an end-to-end information management solution from Cognizant that integrates EIM and advanced analytics service delivery in a hosted environment. Central to Cognizant's strategy around discovering and driving business value in big data is our innovative suite of solutions. Each leverages big data technologies to deliver enhanced insight and analytics to various industries.	http://www.cognizant.com/enterprise-analytics/enterprise-information-management
Cognizant	Big Data and Business Intelligence	Business Strategy and Enterprise Metrics: Enterprise information management strategy and roadmap development, business information health assessments, business case development, platform and tool evaluations, architecture definition, and enterprise metrics management. Business Process Application: Event monitoring, BI adoption, organizational deployment, and user empowerment. BI Capabilities: BI rationalization and consolidation, data visualization and analytic applications development, BI Center of Excellence, cloud reporting. Analytic Applications: Enterprise analytics services, industry solutions, and web analytics.	http://www.cognizant.com/enterprise-analytics/business-intelligence
CGI	Predictive Analytics & Advance Analytics	We help you reduce costly customer churn, increase customer profitability and reduce bad debt and fraud. We can support you in performing social networking analysis to identify key influencers and optimize sales and marketing efforts.	http://www.cgi.com/sites/default/files/brochures/Predictive-Analytics.pdf http://www.cgi.com/en/business-intelligence-services http://www.cgi.com/en/health/health-analytics http://www.cgi.com/en/us-federal/advanced-analytics

CGI	Full IT Outsourcing	Freeing business executives from managing daily IT operations Faced with considerable economic and competitive pressures, more and more business executives are turning to full IT outsourcing. With CGI's model, we oversee the execution of IT operations while the client retains full control over their IT strategic functions, enabling them to focus on aligning IT strategies with their organization's business objectives.	http://www.cgi.com/en/it-outsourcing-services/full-it-outsourcing
Tech Mahindra	Consultancy services	Due Diligence on Big Data driver for enterprise Recommendation of relevant analytics to benefit business Provide direction on the technical architecture.	http://www.techmahindra.com/en-us/wwd/new_gen_services/pages/big_data/service_offerings/solution_offerings.aspx
Tech Mahindra	Business Analytics & Implementation Services	Business Analytics helps transform organizational data across silos into useful business insights and drive the business value by leveraging our business consulting capabilities.	http://www.techmahindra.com/en-US/wwd/services/Pages/Consulting/Business_Consulting_Services/business_analytics.aspx
Tech Mahindra	Implementation Services	Design and Develop on Hadoop technologies	http://www.techmahindra.com/en-us/wwd/new_gen_services/pages/big_data/service_offerings/solution_offerings.aspx
Tech Mahindra	Implementation Services	Installation and Administration of Hadoop	http://www.techmahindra.com/en-us/wwd/new_gen_services/pages/big_data/service_offerings/solution_offerings.aspx
Tech Mahindra	Support and operation	Knowledge Transition Process Documentation Major and Minor Enhancements Production Support Support Performance Metrics	http://www.techmahindra.com/en-us/wwd/new_gen_services/pages/big_data/service_offerings/solution_offerings.aspx
Tech Mahindra	Implementation Services	Installation and Administration of Hadoop	http://www.techmahindra.com/en-us/wwd/new_gen_services/pages/big_data/service_offerings/solution_offerings.aspx

HCL	Predictive Analytics & Retail Analytics	Cut-throat competition, too many products and releases, and inadequate market and consumer behavior related research to target the right prospects with the right products results in very poor success rates for movies, music, and publishers, which can be extremely costly to companies. Predictive analytics help predict future events, trends, and behaviors and provide companies with just the tool to increase their success rate by providing critical insights at every point of the value chain - right from new artist/author find, market research, to customer insight, and marketing effectiveness. HCL service Offerings include: Consumer Analytics - Consumer Performance Analytics - Web, Churn, Social and Campaign effectiveness. Other analytics include CSAT, Survey, and Subscription Analytics etc. Enterprise Performance - Financial Analysis, Channel and Marketing RoI, Sales Performance, Scorecards/Dashboard, and Consumer share. Social CRM/ Community Intelligence - Social Media listening and response to consumer issues, identifying communities of success for audience development. Global Sales/ Consumer Data Ingestion – Collection and aggregation of data from multiple sources; cleansing, transformation, and loading of clean data into a central repository.	http://www.hcltech.com/media-entertainment/predictive-analytics http://www.hcltech.com/retail-consumer/retail-analytics
HCL	Decision Support Services	HCL BPO's Decision Support Services (DSS) business is not about labor arbitrage, but about truly making an impact on our customers' top and bottom line. This service is based on business knowledge expertise rather than process expertise, and typically involves application of domain knowledge for research and development, analytical and interpretive skills. It draws heavily on advanced statistical and econometric knowledge and strategy development to provide value-added knowledge based services to Clients. HCL BPO's DSS capabilities cater not only to corporate Clients but also to world-level market research firms and organizations, who can now take the advantage of our high quality and well-equipped research and analytics services. Overall, HCL BPO's DSS team is inherently more specialized, comprising of highly educated university students with varied backgrounds and professionals with domain expertise across a wide range of industries.	http://www.hcltech.com/business-services/decision-support-services
Infosys	SAP and Oracle Services		http://www.infosys.com/SAP/offerings/Pages/services.aspx http://www.infosys.com/Oracle/offerings/Pages/services.aspx
Infosys	Building Customer Loyalty using Predictive Social Analytics	Infosys advanced predictive analytics model developed on Oracle Business Intelligence Enterprise Edition (OBIEE) enables cross-selling and up-selling on social media. Real-time customer insights and social data driven predictive analytics enable accurate product recommendations to customers, thereby maximizing sales revenue and building enduring customer loyalty. Social insights blended with enterprise customer data alerts sales and support teams to take preventive actions. The solution helps enterprises evolve from customer information visibility (reporting and analysis model) to knowledge/ intelligence enabled (predict and act model) decision making enterprise.	http://www.infosys.com/CRM/offerings/Pages/social-crm.aspx

Infosys	Management Consulting Services	Strategic Insights — by extracting actionable insights from enterprise data through research, analytics tools, and innovative frameworks to empower business users by enabling them to make more effective business decisions. IT Strategy — developed to help CIOs identify and cultivate critical IT capabilities needed to better align with and fulfill business goals, improve performance, and deliver value to stakeholders and shareholders.	http://www.infosys.com/management-consulting-services/offerings/Pages/index.aspx
Tata Consultancy Services	IT Strategy Consulting	IT Strategy Consulting Achieve business excellence by partnering with TCS and leveraging our IT Strategy Consulting Services to transform your IT into an agile organization that will fully enable and influence business transformation.	http://www.tcs.com/offerings/consulting/it-strategy/Pages/default.aspx
Tata Consultancy Services	Enterprise Solutions - Analytics	TCS' competence for providing you with the highest performing real-time Big Data analytics solutions and services is anchored on strong partnerships with leading product vendors. Our dedicated Centers of Excellence and research and innovation labs collaborate with research universities and draw from an expert Big Data team. Our resources include a large pool of certified Big Data specialists - data scientists, engineers and computer scientists - and a confluence of traditional analytics and next generation analytics capabilities.	http://www.tcs.com/offerings/it-services/Pages/default.aspx http://www.tcs.com/offerings/enterprise_solutions/Pages/Services-Analytics.aspx
Tata Consultancy Services	SAP and Oracle	Oracle Exadata Database Machine: TCS is the first Oracle PartnerNetwork member to launch a global CoE dedicated to Oracle Exadata solution development—and the first to achieve advanced Exadata specialization. We help you capture, organize and analyze diverse data sources using Exadata's high-speed flash-memory capabilities. TCS SAP HANA Center of Excellence (CoE) Solutions: TCS was one of the early system integrators to focus R&D capabilities on SAP HANA. We now have a team of experts honing a deep understanding of SAP HANA and showcasing successful customer case studies. Our robust and proven industry-specific solutions offer you gain rapid business insights using high-speed in-memory capabilities.	http://www.tcs.com/offerings/enterprise_solutions/Pages/Services-Analytics.aspx
Wipro	Business Analytics	To build a truly significant competitive advantage, the approach to Business Analytics needs to be three pronged - draw insights from past data, respond in real time to current business needs and use predictive analytics to stay ahead of the curve. Wipro's Analytics Services have helped our customers effectively combine deep industry knowledge, cutting edge mathematical & statistical methods, technology tools like SAS, SPSS and software environments like R to implement an analytics culture in their organizations.	http://www.wipro.com/services/analytics-information-management/business-analytics.aspx
Wipro	Business Transformation Solutions	Our Business Transformation Solutions use innovative tools and frameworks to help you leverage your core business competencies as you develop new operating models built around workforce, technology, and business processes. Our solutions can help you to, for example, reduce the time-to-market for new products, accelerate accurate order fulfillment, and improve customer interactions.	http://www.wipro.com/services/consulting-services/Business-Transformation.aspx
Capgemini	Transform - Strategy	Our Strategy Development teams deliver sustainable competitive advantages for clients, through long-term vision and immediate actionable tactics. Our work spans the crafting of strategies from growth to business portfolio optimization and the attainment of competitive advantage through strategy planning and execution.	http://www.capgemini-consulting.com/strategy-transformation/strategy

Capgemini	Business Analytical Services	Analytics Strategy Design: data analysis to optimize operational performance, and strategy design to improve in-house capabilities Analytics Proof-of-Concept: prototype analytical models to support business operations and define detailed requirements and design Analytical Model Build and Deployment: analytical models and implementation of interfaces to operational systems	http://www.capgemini-consulting.com/strategy-transformation/strategy
Capgemini	Analytical Solutions	Customer Analytics: Understand what your customers really think about you and your products and interact with them more effectively to raise customer satisfaction levels Marketing Analytics: Make your marketing more targeted and effective through campaign appraisal and analysis Predictive Asset Maintenance: Increasingly sophisticated intelligent devices give you a wealth of data that can be analyzed to provide major changes in availability and operational cost management Enterprise Performance Analytics: Understand the core value drivers of your business and on how and in which areas they impact profitability and financial performance Social Media Analytics: Effective analysis of social media is a vital new information stream for today's business. Delivered as an outsourced social media management service or an integral business process through Social Insight into Action Advanced Planning & Scheduling: Optimize your operations, workforce and service levels for improved efficiency and reduced carbon footprint and cost Fraud Management: Protect against tax and welfare fraud by finding patterns in data and alert for new potential attacks in Financial Services and Public Sector (tax and welfare) Risk Analysis: Understand the risks facing your business and model risk scenarios to set the right business strategy CFO Analytics (BPO Services): Analyze the performance of your core financial processes to stem revenue leakage, improve cashflow and margin, and achieve tighter operational control	http://www.capgemini.com/big-data-analytics/analytical-solutions
Capgemini	Business Analytical Services - Analytical Operational Support	Analytical Operational Support: support for existing analytical model deployments and in-house analytical operation	http://www.capgemini.com/big-data-analytics/business-analytical-services
Capgemini	Business Analytical Services -Analytical Process Outsourcing	Analytical Process Outsourcing: business reporting, data refresh and model management outsourcing, and Analytics-as-a-Service for solutions hosting	http://www.capgemini.com/big-data-analytics/business-analytical-services
HP Enterprise Services	Big Data IT Strategy and Architecture Services	HP Big Data IT Strategy and Architecture services feature: Big Data Infrastructure Transformation Experience Workshop: In this workshop we help you understand the benefits and challenges of Big Data, assess your existing data sources, and help you plan an IT architecture to deal efficiently with structured, semi-structured and unstructured data. HP Roadmap Service for Hadoop: Our experts introduce a four-step approach to deploy Hadoop, a cost-effective platform for handling and analyzing large volumes of data.	http://www8.hp.com/us/en/business-services/it-services.html?compURI=1407349#.UwNrrPl5NUU

HP Enterprise Services	Big Data System Infrastructure Services	With HP Big Data System Infrastructure services, you can choose from options such as design services for Hadoop and implementation services for reference architectures or your own architecture. Our infrastructure solutions include: HP Enterprise Design for Hadoop HP Reference Architecture Implementation Service for Hadoop HP Implementation Service for Hadoop	
HP Enterprise Services	Analytics and Data Management Services & Operations Analytics	Supply Chain Analytics Services HP Supply Chain Analytics Services deliver the advanced analytics clients need to determine when to buy goods and how much to buy - prior to entry into the supply chain - and how to optimize procurement spend, cost of goods sold (COGS) and "inventory turnover days". Experienced data scientists provide analysis and systemic recommendations across inventory operations, distribution operations and contract management. Through our analytics approach, we help clients evaluate supply and demand requisites, minimize inventory and optimize lead times. Our recommendations identify areas where clients can improve profitability, compliance, and seek new areas of cost-savings. Operations Analytics capabilities: Harness the power of predictive analytics to uncover trends to stop catastrophes.	http://www8.hp.com/us/en/software-solutions/operations-analytics-operations-analysis/index.html http://www8.hp.com/us/en/business-services/it-services.html?compURI=1173085#.UwNue_l5NUU
HP Enterprise Services	HP Solutions for SAP HANA	Accelerate access to your business data with HP AppSystems for SAP HANA®, built on HP Converged Infrastructure. The in-memory computing technology allows you to process massive quantities of data in the main memory of the server to provide immediate results from analysis and transactions. The portfolio offers complete, pre-integrated solutions that are tuned and optimized to deliver maximum performance for SAP applications.	http://h17007.www1.hp.com/us/en/converged-infrastructure/converged-systems/appsystems/sap-hana.aspx#.UwNwWPl5NUU
Oracle	Analytic Applications	Accelerate business innovation by drastically reducing the time it takes to deploy BI solutions. Oracle BI Applications are preconfigured for a variety of data sources. These solutions enable organizations to extend the value of their existing IT investments with intuitive, role-based intelligence and power better decisions. They support business functions and industry-specific processes with best-practice analytics based on Oracle's experience across hundreds of CRM and ERP automation.	http://www.oracle.com/us/solutions/business-analytics/analytic-applications/industry/overview/index.html http://www.oracle.com/us/technologies/big-data/index.html http://www.oracle.com/us/solutions/business-analytics/overview/index.htm
Oracle	Analytic Applications for Your Business Role	How is your latest project performing? Trying to answer this question inevitably leads to more: What could you change to lower costs? To increase profitability? What are the latest market developments that could affect your business? Get answers to all these questions and more with comprehensive business analytics that correspond to your role and responsibilities. You can decide what information you need and in what form you'd like to see it. Answer questions, identify priorities, and stay on track.	http://www.oracle.com/us/solutions/business-analytics/analytic-applications/business-role/overview/index.html
Oracle	Oracle Support		http://www.oracle.com/us/support/index.html
Oracle	Oracle University		http://education.oracle.com/pls/web_prod-plq-dad/db_pages.getpage?page_id=3

Computer Sciences Corporation	Fraud Analytics Suite: Fraud Detection Software, ClimatEdge & Integral	Fraud Analytics Suite allows you to: Detect fraud early Identify the right claims to focus on Automate time-consuming processes Streamline workflow Quickly identify suspicious participants or patterns in claims. ClimatEdge is a data service that uses advanced predictive analytics and data sets from NASA and NOAA to deliver expected probabilities of occurrence of tornados for next year	http://www.csc.com/big_data/offerings/82345/57633-fraud_analytics_suite_fraud_detection_software http://www.csc.com/insurance/insights/93449-on_demand_integral_demo_predictive_analytics http://www.csc.com/big_data/offerings/82345/103961-climatedge_for_general_insurance
Computer Sciences Corporation	CSC Information Strategy and Governance	CSC's Information Strategy and Governance consulting service can help you: Identify the information you need to tune your business - Through a series of workshops, we'll help you identify and prioritize your most important information sources, data governance issues and key technologies, so you can develop a roadmap of change. Improve data quality and consistency - Volumes of data won't deliver value if it's of poor quality, inaccurate or redundant. This service reviews the effectiveness of your information governance plan and recommends changes to improve and align data quality. Reveal new opportunities to grow revenue - A CSC Information Strategy and Governance engagement identifies the information needed to make better-informed decisions, who needs it, and what changes need to be made in policies, processes, tools and technologies. Our recommendations help you get the best information to the right people in the business to maximize revenue.	http://www.csc.com/big_data/offerings/82345/101741-csc_information_strategy_and_governance

A.2 Questionnaires

A.2.1 Questionnaire about the need of providing predictive analytics services

1) Why Avanade has the need for providing predictive analytics services*? [Explain in your own words why Avanade and the D&A service line need to provide services around predictive analytics]*

2) There was a trigger for taking the decision of providing predictive analytics services? An event (i.e. a customer who approached Avanade asking for this type of services) or a fact (you studied market numbers and saw a business possibility)?

3) Where did the idea came from? High management (CEO, executives), middle management, other?

4) Why this decision was taken up till now, why not before? *[Mention for instance if there are technical, knowledge or competitors-related reasons for not taking this decision before]*

A.2.2 Delivery of services questionnaire

Customers - Current customers (4 questions)

1) What are the industries in the market where D&A service line has presence? Choose the applicable options:

[Mark with an X the options that apply]

Aerospace and Defense		Energy		Manufacturing		Public Sector	
Airlines		Financial Services		Logistics		Retail	
Automotive		Health care		Media and Entertainment		Telecom	
Banking		Hospitality and Leisure		Pharmaceutical and Biotech		Utilities	
Education		Insurance		Oil and gas		Other(s)?	

If other(s), specify which ones:

2) How are the companies within those industries? Big, small? National, international? Public, private? Are there any other features that are worth mentioning?

[If the companies are few and it is possible to mention them then please specify such information. If that's not the case, then simply answer the questions in a general/average kind of way]

3) Does the company have "VIP customers" (those that receive special attention because they have more business or are considered as key stakeholders)?

4) What is the approach within the D&A service line: customer preference or customer diversity?

[Customer preference refers to choosing certain customers that are (usually) big and sign several contracts/projects with them. Customer diversity refers to find several customers without focusing on specific ones and sign few contracts/projects with them. It could be also possible that the company has a mixture of both approaches. If that's the case, please specify]

Customers - Potential customers (4 questions)

1) What are the potential industries that the D&A service line has in mind?

[Mark with an X the options that apply]

Aerospace and Defense		Energy		Manufacturing		Public Sector	
Airlines		Financial Services		Logistics		Retail	
Automotive		Health care		Media and Entertainment		Telecom	
Banking		Hospitality and Leisure		Pharmaceutical and Biotech		Utilities	
Education		Insurance		Oil and gas		Other(s)?	

If other(s), specify which ones:

2) What are the potential customers that the D&A service line has in mind? Big, small? National, international? Are they new to the company or new to the D&A service line?

3) How does Avanade approach **new customers** to offer them their services? Does this process vary within the D&A service line? If yes, how different it is.

[Please specify how does the company approach when it is a completely new customer (Avanade does not have any project or contract with it) but also when it is a customer new to the D&A service line (Avanade has other projects or contracts in other service lines]

4) How long does it take (in average) from first contact with the potential customer to the moment the contract is signed? Is there a difference depending on the type of customer (for example if the customer is from the public sector)?

Services – Current services (5 questions)

1) What type of services does Avanade currently offer (within the D&A service line)? Choose one depending on the type of objective of the service:

Assess the strategic role of data analytics	
Operational/developer support	
Training/mentoring for tools or platforms	
Integration of tools into operational environment	
Definition, Design, Architecture and Implementation	
Manage services for data analytics tools/platforms	
Others?	

If others, please specify which:

[Explanation of the type of services

Assessment of the strategic role of predictive analytics
These type of services are focused on advising companies to identify the strategic impact that certain IT solutions/products can have on their businesses. The idea is to help them to recognize areas of opportunity, evaluate current capabilities and choose which are the most suitable IT tools/platforms to use according to their needs.

Operational/developer support
These services are oriented to deliver operational/developer support to customers who already have a tool/platform or product. Operational support focuses on the operation of the company addressing specially incidents that occurs in the day-to-day business. Developer support focuses on how to solve specific problems from a design and architectural perspective.

Training, mentoring and/or certification for tools or platforms
These services provide clients with detailed information around technologies or tools. Clients learn how to how to size, configure, instantiate and use their predictive analytics tools.

Integration of tools into operational environment

Nowadays companies have complex and diverse operational environments where different applications and technologies interact between each other. Integrating a new tool or platform into such systems is a task that requires advice. These type of services are intended to support the process of integration of tools/platforms or solutions into the operational environment. It's important to clarify that integration does not only refer to technology but also to management and decision processes.

Definition, Design, Architecture and Implementation

Services designed to help clients in the process of definition, design and implementation of IT solutions. In occasions, part of the service includes the delivery of architecture or implementation. In these cases, other services such as operational/developer support, training for tools and platforms, and integration of those tools into the operational environment are (usually) included as part of the main package.

Manage services for predictive analytics tools/platforms

The aim of this type of services is to provide operational support for platforms or environments in an outsourced scheme.]

2) What is the most and least demanded services and why?

3) Does the D&A service line follows a procedure/framework for delivering their services?

4) What is D&A focus: tailored services or pre-define services?

5) Does the D&A service line offer special services for certain industries? For example, development of CRM systems for retail

Services – New services (4 questions)

1) Does the company plan to develop new services in the near future (1-2 years)? If yes, which type?

2) Does the company plan to develop new services in the long term (3-5 years)? If yes, which type?

3) Does the D&A service line follow a procedure/framework for the development of new services?

4) How long does it take (in average) to develop a new service?

Technologies – Supporting technologies (2 questions)

1) What are the D&A technologies Avanade support? What's the level of knowledge versus the market (for example, in terms of certifications)?

2) Does Avanade's have knowledge of Microsoft's solution for predictive analytics? If yes, what level? Low, medium, high?

Technologies – Enabling technologies (2 questions)

1) What are the enabling technologies that Avanade uses for delivering their services?

   [Of course there are tools/technologies such as the e-mail or word that enable the delivery of the service, but this question is more focused in those specific tools that distinguish Avanade from other companies or also technologies/tools that play a key role in the process of service delivery]

1) What is the level of experience in their use? Low, medium, high?

A.2.3   Evaluation of implementation questionnaire

Using technology roadmap for predictive analytics versus other type of software products

When developing roadmaps for software products there are usually two approaches. The first approach is focusing on a need of a company and implementing a software product to tackle that need. In this case the roadmap is focused mainly in the internal aspects of the company. An example of this approach is a roadmap for developing a specialized database for a medical department. The second approach is using roadmapping to implement a software product as an enabler to achieve a goal within a company, for example, a roadmap to achieve green supply chain in an organization through Enterprise Resource Planning (ERP) implementation. In the case of providing predictive analytics services, however, those two approaches differ. First, since the idea is to provide a new type of service to the market then it is more important to focus in the external factors of the company rather than the internal (first approach). Second, in this case, the technology - predictive analytics - is not an enabler but a tool that is part of the service provision process (second approach). Taking this into consideration please answer:

- In which level do you think roadmapping helps to connect external with internal aspects? For example: external such as market needs, internal such as the company's capabilities.

   [Mark with an X the box]

Very Low	Low	Medium	High	Very High

- Which external and internal factors did you see more relevant when doing the workshops?

- When applying roadmapping to the provision of predictive analytics, which other aspects do you consider worth of mentioning when comparing with other type of software products?

Benefits of using a roadmap

- In which level do you think roadmapping explore and communicate the dynamic linkages between technological resources, organizational objectives and the changing environment?

[Mark with an X the box]

Very Low	Low	Medium	High	Very High

- In which level do you think roadmapping integrates different aspects such as product/service, business and market perspectives?
[Mark with an X the box]

Very Low	Low	Medium	High	Very High

After finalizing the workshops various decisions were taken in regards to the type of services, the industries to tackle and the line of business. Taking this into consideration, please answer:

- In which level do you think roadmapping helps in the decision making process?
[Mark with an X the box]

Very Low	Low	Medium	High	Very High

Based on the implementation of the roadmap at Avanade (see attached image), focusing specially on the Choices layer (first layer) and in the fact that the last step – what should be next? requires more resources such as time and money (for the marketing plan, for example), please answer:

- Which additional choices were omitted in the process? For example, which other decisions should be considered
- Which is the choice that you consider the most important and why?

A.3 Guide questions for the SWOT analysis workshop

Strengths

- A distinctive competence?
- Well-thought-of by stakeholders?
- An acknowledged leader?
- Well conceived operational strategies?
- Location advantages?
- Insulated from competitive pressures?
- Propietary technology?
- Adequate financial resources?
- Access to economics of scale?
- Cost advantages?
- Product innovation abilities?
- Proven Management?
- Other?

Weaknesses

- No clear strategic direction?
- Obsolete facilities?
- Weak image?
- Falling behind in R&D?
- Too narrow ranges of services offered?
- Lack of managerial depth and talent?
- Missing any essential skills or competencies?
- Poor track record?
- Plagued with internal operating problems?
- Vulnerable to competitive pressures?
- Competitive disadvantages?
- Bellow-average marketing skills?
- Unable to finance needed changes in strategy?
- Other?

Opportunities

- Serve additional customer groups?
- Enter new market segments?
- Expand services to meet broader range of customer needs?
- Diversity into related services?
- Add complementary services?
- Vertical integration?
- Ability to move to better strategic group?
- Complacency among other companies?
- Faster market growth?
- Other?

Threats

- Likely entry of new competitors?
- Growing of substitute services?
- Slower client growth?
- Adverse government policies?
- Vulnerability to recession and business cycle?
- Growing bargaining power of customers or suppliers?
- Changing stakeholder needs and tastes?
- Adverse demographic changes?
- Other?

Figure 20. Questions used as reference in the SWOT workshop. Adjusted from [42]

A.4 List of trends/needs and potential solutions found in the Game of Choices workshop

Oil and gas

Trends/needs:

- In order to extract oil from the wells it is important to pump up the oil with the use of pressure, in fact, fields are considered pressure systems that have a lifespan in which the pressure increases over long periods of time but then at the end it decrease until a point where it's impossible to extract the oil using pressure and new methods have to be used. A declining field is a field which is in the period where its pressure is declining over time. The amount of declining fields is increasing all over the world.

- Oil and gas companies can exploit two types of fields: conventional fields, which extract gas and oil from pockets within the earth which are covered by impermeable layer, and unconventional fields, which extract the materials from thick layers of rock which contains gas or oil. This layers must be drilled horizontally in a way that the element is extracted at the same time injecting sand so the rock don't close up again. Unconventional wells are going to get more attention in the coming years since they are considered as the next step in the oil and gas exploitation, but this process is costly and risky.
- The cost of replacing a part of the equipment once it has been broken is higher than replacing it before it breaks. Due to such reason oil and gas companies are very interested in preventive maintenance.
- Currently, all facilities and equipment in oil and gas companies are connected to internet, which means that they can be target of cyber-attacks (for example, an oil plant could be shot down remotely). Those companies have realized that they have become vulnerable and therefore they want to invest in network security.
- Shale gas wells are increasing all over the world with US as the forecasted leader by 2015. There are several challenges in these type of wells such as reducing their high infrastructure costs, managing of the labor, and high environmental risks.

Potential solutions:

- Companies can implement predictive analytics models in order to determine when a declining field is going to reach its 'zero-pressure' point and in that way start using other techniques and saving costs in production.
- Developing small focused predictive models for each part within the equipment installed in a well. The idea is to measure all the variables that affect such part and being able to determine when it's going to break down in order to replace it before.
- Develop solutions for network monitoring specially tailored for oil and gas industry. This type of solutions scan the network constantly looking for patterns which might indicate the probability of cyber-attacks and prevent them before hackers actually do any type of damage.
- Predictive analytics could be used in shale gas or unconventional wells production taking certain characteristics such as pressure, temperature, and speed in which the drill breaks the rock and compare them between different wells in order to identify cost saving measures. Also, PA could be used to perform risk management in new potential sites for exploitation, analyzing variables such as suitability for extraction of shale gas or oil and likelihood of delay caused by local oppositions.

Energy and utilities
Trends/needs:

- Need for customer retention
- Water and energy companies have to monitor their infrastructure (i.e. pipe lines, or cable lines). They need to know the precise moment to replace a switch, because the replacement costs are higher when it get damaged than when it is old and changed

Potential solutions:

- Customer/marketing solutions that make use of customer data in order to provide products or services tailored according to their needs and features
- Develop systems to support call centers, which provide information about each customer. This info should be showed at the moment of contact suggesting the agent/salesman the best procedure for attending the customer
- Use predictive analytics in order to calculate the expiration (damage) date of a switch. As mentioned before, it's much cheaper to replace it when it is old but not still damaged.

Bank and insurance

Trends/needs:

- Digital insurance: re-conceptualization of insurers business model using digital technologies as the main enabler
- Smart banking: "collection of scenarios to inspire what is possible today that banks can do to transform customer and employee experiences and loyalty. These scenarios include: ATM, banking hospitality, front office and mobile banking" [43]
- Customers are the main focus, therefore, banks and insurers need to retain them and offer them better products/services
- Banks and Insurers keep critical information, therefore they are target of constant attacks from hackers or criminals
- Despite the fact that they are service providers by nature, and their main focus is the customer, the reality is that banks and insurers are also product-based type of companies. They offer pre-configured products/services to their customers with few custom features
- There is always need for fraud management in insurance companies. Claim management is one of the process that requires more of it

Potential solutions:

- Solutions are not clear enough. Maybe some cases could be proposed if trends/services are discussed with Avanade's customers. Lines such as fraud management and product pricing require more attention
- In general, customer and marketing techniques applied in other industries (such as retail) or event to the existent ones applied to bank and insurers, could be implemented in the future in other banks or insurance companies

Healthcare

There are two different markets that need to be separated: cure and care

Cure: related to hospitals, clinics and taking care of illness and diseases that are mostly not chronic

Trends/needs:

- Clinics and hospitals are investing a lot of money in data warehouses to get more data from their patients
- There is a need of applying the precise procedure according to the symptoms of the patients. Something more customized. Hospitals and clinics want to switch from the traditional "standard procedure" to a procedure which is suitable according to symptoms, patient clinic history, etc.

- There is a boom of applications that monitor patients and gather a lot of health data such as heartbeat scans, weight, pressure, etc. This information is send to the cloud, however, there are not applications that process such information

Potential solution/applications:

- Provide medical staff with customized treatment procedures based on the patient data. This data can be gathered not just from the clinics or hospitals records but also form those cloud applications that contains daily patient information
- Study daily patient information to get inside on potential illnesses or medic conditions, and elaborate specialized services to offer them even before the first symptoms of the illness appear.
- Provide medical staff with precise information on the patients right in the moment they check in the medical institution, so in this way they can calculate more accurately the time the patient will spend in the medical institution and also the proper medical procedure that should be administrated

Care: related to institutions which take care of special patients such as elder people, or people with certain illnesses that requires more specialized treatment.

Trends/needs:

- Many of these care institutions recently acquired facilities for renting to their patients. The services they used to offer included all the package: facilities, staff services, medical equipment, etc. However, due to change in Dutch regulation these institutions have to change their way of charging separating the rent of the facilities from the staff services and medical equipment. After such change, they detected that it might impact negatively the numbers of the companies
- Some markets such as elder people are willing to pay for specialized services according to their income

Potential solutions:

- Care institutions could take advantage of predictive analytics in order to attract and retain more patients and compensate the potential loses the legislation brought. It's important to note that marketing and sales are the business lines that are more advanced in predictive analytics.

Media and entertainment, and telecom

Telecom industry

Trends/needs:

- Telecom operators are good at marketing and selling but they fail when it comes to delivery. One of the causes behind these is that for each service they offer they have to perform several steps, some of them are done by the same company and others are done by external providers. When one of those steps takes more time than the optimal then the whole change is affected. For example, when a person changes of residence there is a special service for transferring the telephone lines, internet connection, etc. One step in this service is changing the billing information from place to the other. Another step is to change the physical equipment (i.e.

router). If one of those steps takes more time than required then the whole service is affected, no matter if the rest of steps are done optimally.

- Telecom operators such as KPN have access to huge amounts of information of their customers. For example, in which type of services they spend more time, or where do they go (this is possible to know thanks to the location of the mobile phone within the company's network). Such companies want to use and sell this information in different ways.

Potential solutions:

- Provide solutions that make use of customer data in order to provide predictions. A company such as Albert Heijn, for instance, can tell if a customer is going to visit again one of their shops based on his recent activity within a specific area.

Media and entertainment industries

Trends/needs:

- Concert organizers such as Mojo have detected that in average a person attends a concert only once in every three years. They want to increase this number.
- Also, concert organizers have seen an opportunity of selling tickets abroad Netherlands to Dutch residents. For example, they can sell tickets for a concert in Belgium or Germany to someone who lives in Amsterdam.
- News publishers have seen the decrease on the demand for print publications and they want to switch to digital publications. This movement brings a challenge to the way of doing business and gaining money, because their main source of income, the advertisement, would be dramatically changed.
- News local publishers believe there is big potential in local markets. For example, they can focus their publicity strategies to a walking community in order to offer products related to walking or sporting. The claim they have the information to get insights but they still don't have the tools to exploit it.
- News local publishers want to offer their publications as services, similar to the scheme proposed by Netflix. Instead of selling one item (in this case a newspaper, or magazine) they want to offer a subscription in which the customer has access to services and products. With this, they will keep a closer relationship with the customers.

Potential solutions:

- Based on attendance information, concert organizers could use predictive analytics solutions to predict the next concert a person might like to attend, and offer them promotions, tickets and services. Also, they could use the same information to determine if a person is keen to attend a concert outside of the Netherlands.
- Once a pay-per-subscription scheme is developed, predictive analytics will play a key role for providing suggestions of services, products, or advertisement.
- Use the information of news local publishers to get insights of the customer behavior and develop publicity strategies based on that.