Customer analytics maturity of Dutch SME finance banks

Designing a maturity assessment framework for customer analytics implementation at the Small and Medium-sized Enterprises finance banks in the Netherlands

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Abstract

Big data has become an important issue for the SME financial sector. The amount of data stored by banks is expanding and growing fast. These trends provide SME finance banks with a huge opportunity to enhance their businesses. Combining predictive analytics with automatic decision making, popularly known as customer analytics, makes it possible for the SME finance bank to understand their SME clients. In the Netherlands there is a lack of adoption regarding the use of customer analytics, what could be explained by an immaturity of banks. This paper aims at designing a maturity assessment framework for customer analytics implementation for the SME finance banks in the Netherlands. Aiming at assessing the maturity of SME finance banks at different domains, regulation, organization, technology and governance. This has not been done before. A framework is proposed by following the systems engineering design approach. Technology, data governance, organization and regulation are the main domains of the framework. The framework is designed according to the Capability Maturity Model Integration theory and is able to assess both technical and organizational components. However ,the framework should be expanded and more elements should be included into the framework. This enhances the assessment of maturity at Dutch SME finance banks.

Keywords: Customer analytics; Finance and data-analytics; Big data; Maturity assessment; SME finance; Data governance; Data management

I. INTRODUCTION

1.1 Research problem

The financial sector is crucial for the economy (Norden, 2015). Banks finance the economy, from (small and large) businesses to individuals, by transferring money from the central bank into the economy. SMEs (Small and medium-sized enterprises) are of key importance to the Dutch economy (Norden, 2015; MKB, 2014), since 99% of all Dutch firms are SMEs. SMEs are firms with fewer than 250 employees, with turnover of less than 50 million euro, (European Commission, 2006). SMEs are opaque (Norden, 2015; Berger and Udell, 1998; Cole et al, 2004;), which means that it is difficult to ascertain if a SME has the capacity or the willingness to pay (De la Torre et al, 2010). Therefore, financing SMEs is more risky, more financially constrained, and more bank-dependent than large firms (Norden, 2015). Because SMEs do not have the access to capital markets or the ability to issue stocks or bonds, they are largely dependent on bank loans and trade credit to raise external finance.

In recent years, the interest from the financial sector in big data increased (Set and Chaudhary, 2015). The phenomenon 'big data' describes the exponential growth in volume, storage and availability, as well as the variety of data and speed at which it is produced and transferred (Fohm, 2015; Amudhavel et al, 2015). The amount of stored customer data is expanding fast for the financial sector (Fohm, 2015). This large amount of stored customer data provides the SME finance banking sector with a huge opportunity to enhance their businesses (Sun et al, 2014), by obtaining an enterprise view of the SME customer. This is done by integrating predictive data analytics with automatic decision-making (Sun et al, 2014), which is called customer analytics. Customer analytics is about collecting, cleansing, validating, integrating and analyzing raw data gathered from various touch points and analyzing them to draw meaningful insights about the organization's customers (Sathyanarayanan, 2012, pp 46).

Customer analytics is widely used by banks in the financial sector in the United States of America, China and India (Srivastava and Gopalkrishnan, 2015; Sun et al, 2014). Regarding the use of customer analytics in the Dutch financial sector, there is a certain *'lack of adoption'*. What is caused due to different regulations, technological development and organizational structures in the Dutch financial sector. This may be explained by an *immaturity* of SME finance banks regarding the implementation of customer analytics. Maturity describes the state of being complete or ready to reach a certain state of technological development, from an initial to a desired state of development (Lahrmann et al, 2011). Maturity models help organizations with measuring their maturity (Iversen et al, 1999; Salah et al, 2014). In the Netherlands there are no existing maturity assessment framework for assessing customer analytics at SME finance banks. Based on this information the following scientific research question and sub-questions will be answered in this paper:

How can a maturity assessment framework be designed for customer analytics implementation at SME finance banks in the Netherlands?

SQ1. What maturity assessment theory is suitable for designing a maturity assessment framework for customer analytics implementation?

SQ2. What are the requirements for conducting customer analytics at Dutch SME finance banks?

The aim of this research, is to design a maturity assessment framework that is able to

assess both organizational and technical aspects of customer analytics implementation at Dutch SME finance banks. This research is unique due to the multi-perspective approach of the design process.

The main scientific contribution is the design of a new maturity assessment framework with an academic foundation, which has not been done before. Existing customer analytics frameworks focus on either technology or organizational aspects of customer analytics implementation. While this research focusses on different elements of customer analytics implementation: regulation, organization, governance and technology. Also, this research aims at assessing the maturity of customer analytics implementation, while existing research aims to implement customer analytics or create awareness for customer analytics. This research provides the opportunity to conduct case studies at two out of four major Dutch SME finance banks. Providing the possibility to compare the maturity of their customer analytics implementation and their competitive position in the local Dutch market, by making a benchmark between two banks.

In order to answer the research questions, the research approach will be explained in the next section.

1.2 Research approach

Given the fact that this research field has not been explored before, the research approach is of an explorative nature (Baxter and Jack, 2008). To formulate an approach for designing such a maturity assessment framework, systems engineering theory from Sage and Armstrong (2000) is conducted. The systems engineering method defines three phases: (1) definition and conceptualization, (2) develop and testing and (3) evaluation. The first phase results in the identification of the needs, activities and objectives for the end-product (Sage and Armstrong, 2000). Information is a necessary ingredient; it serves as the input to the rest of the process. The second phase, the develop and testing phase, the framework is tested by conducting case studies at two SME finance banks in the Netherlands. In the third phase, the framework will be evaluated (Sage and Armstrong, 2000).

Following from research approach, section 2 will describe the theoretical foundations for designing a maturity assessment framework. Based on the theoretical foundations the framework is developed in section 3. Section 4 provides the results from the case studies and shows the testing of the framework, and section 5 presents the conclusions and evaluation of this paper.

II. THEORETICAL FOUNDATION

2.1 Existing customer analytics frameworks

In the introduction it is stated that there are no existing maturity assessment frameworks for customer analytics implementation at Dutch SME finance banks. However, frameworks that assess the value of customer analytics exist. These frameworks have different focusses. See the table 1 for an overview of existing frameworks.

As can be seen in table 1, the frameworks from Sun et al (2014) and Bose (2009) aim at implementing customer analytics. These frameworks have a technical focus and try to develop a method that makes the actual technical implementation of customer analytics possible. Bekmamedova and Shanks (2014) developed a framework that provides insights on the organizational awareness for using analytics, aiming at creating organizational awareness at organizations. The integrated CRM model from Chan (2005) combines different CRM frameworks to one single framework, aiming at enhancing the relationship between the customer and the enterprise.

Table 1: overview of different customer analytics frameworks

Customer analytics framework	Aim of the method
iCare for big data-based banking customer analytics (Sun et al, 2014).	*The Intelligent Customer Analytics for Recognition and Exploration (iCARE) framework is presented as a method to efficiently analyze customer behavior using banking big data* (Sun et al, 2014, pp 1)
Advanced analytics: opportunities and challenges (Bose, 2009)	*This study aims to investigate these three mining technologies in terms of how they are used and the issues that are related to their effective implementation and management within the broader context of predictive or advanced analytics* (Bose, 2009, pp 154).
Social Media Analytics and Business Value: A Theoretical Framework and Case Study (Bekmamedova and Shanks, 2014).	*A framework that provides insights on how organizations can achieve value with social media analytics (*Bekmamedova and Shanks, 2014).
Toward a Unified View of Customer Relationship Management (Chan, 2005).	*The CRM enterprise model proposed in this paper provides the integrated framework for the creation of a unified customer view amongst disparate systems, processes and channels across the enterprise* (Chan, 2005, pp 32).

2.2 Measuring maturity

Measuring maturity is always difficult for organizations (de Bruijn, 2002). It is a trade-off between competing values within the organization, a multi-value problem. In large organizations actors are dependent of each other, what makes it more difficult to measure maturity. The measurement of maturity is static, while maturity itself is dynamic (de Bruijn, 2002). De Bruin (2002) defines three justifications for the difficulty of measuring maturity: co-interaction between actors, multi-value character of maturity and dynamics in organizations.

To explore the complexity within organizations, the Mintzberg (1993) model is used. Different departments, with different actors, create complexity in organizations. This explains he multi-value, co-interaction and the dynamic elements of the organization. What makes it difficult to measure maturity. See the figure 1for the Mintzberg (1993) model.

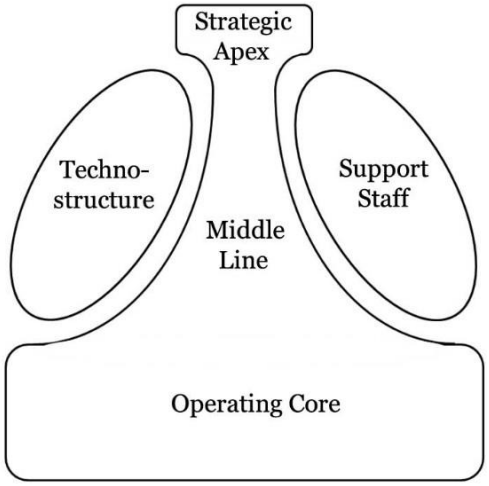

Figure 1: The Mintzberg (1993) model.

A SME finance bank typically consists of different organizational components, see the figure above. According to Mintzberg (1993) every component aims to pull the organization in a specific direction:

Strategic Apex: The top management level of the organization. In practice this is also called the C-level. Aims to pull for centralization,

Middle Line: The middle management is responsible for the operationalization and implementation of the strategy which is set out by top management. The strategy & organization part of a bank is typically the

middle line of the organization. Aims to pull for Splitting the organization

Support staff: The administrative staff. Traditionally the IT department belongs to the support staff. Aims to pull for collaboration.

Technostructure: This is also called the technical support level. The marketing and data science department of a bank are part of the technostructure. Standardization is their preference.

Operating core: This includes the people that do the basic or production work in the organization. From a bank perspective this encompasses the finance and risk department. Aiming to pull for professionalism.

2.3 Maturity models

As stated in section 2.1, measuring maturity is difficult for organizations. Maturity models could help organizations with measuring maturity (Salah et al, 2014). Basically, maturity models are characterized by several patterns or levels, typically with level 1 *initial* to level 5 optimized (Beckert et al, 2009; Gottschalk, 2009; Röglinger et al, 2012).

Different maturity model theories exist, with different purposes. See table 2 for an overview of existing maturity model theories. Every maturity model theory has its own scope of assessing maturity.

Based on research from Röglinger et al (2012), Solar et al (2013) and Ozcan-Top and Demirors (2013), different theories were reviewed. The Business Process Management Maturity Model (BPPM) from Roseman and de Bruijn (2005) aims at assessing the maturity of businesses and management processes, this holds also for the PPI from Rummler and Brache (1990) and the BPMM from Fischer (2005). The Process and Enterprise Maturity model (PEMM) from Hammer (2007) aims at measuring maturity for software development and legacy IT-systems. Pathel and Ramachandran (2008) create a maturity model has the purpose of enhancing the adaptability of agile software, the AMM model. The Capability Maturity Model Integration from CMMI (2006) aims at measuring maturity at both technical and organization level. In the case of this research, the CMMI theory is suitable for designing the maturity assessment, since the aim of this research is to measure maturity at both organizational and technical aspects of the SME finance bank.

The CMMI model has a hierarchical structure (Solar et al, 2013). Starting with leverage domains, which consists of key domain areas. These are measurable and controllable and related to the critical variables. The critical variables are assessed in the maturity model from level 1 to level 5. To define the key domain areas, the requirements for customer analytics implementation has to be identified.

Table 2: Overview of existing maturity model theories

Maturity assessment model	Scope	Author
Business Process Management Maturity Model (BPMMM)	Business and Management processes	Rosemann and de Bruijn (2005)
Process Performance Index (PPI)	Business and management processes	Rummler and Brache (1990)
Business Process Maturity Model (BPMM)	Business and management processes	Fischer (2005)
Process and Enterprise Maturity Model (PEMM)	Software development and legacy IT-systems	Hammer (2007)
Agile Maturity Model (AMM)	Enhancing the adaptability of agile software	Pathel and Ramachandran (2008)
Capability Maturity Model Integration (CMMI)	Organizational and technical aspects	CMMI (2006)

III DEVELOPING A FRAMEWORK

3.1 Requirements

To define the requirements for conducting customer analytics at SME finance banks in the Netherlands, experts from the financial sector were interviewed. These experts were asked what the technical and institutional requirements are. The next step is to review the requirements from the expert interviews. This is done by conducting a literature search on the given requirements, what enhanced the internal validity of the requirements (Alexander et al, 2015).

In table 3 the reviewed requirements are presented. Based on this research, the technical requirements for deploying customer analytics are data sharing, data governance, data quality, central distribution (data warehouse), technical knowledge and using the correct software. The lack of adoption may be explained by the low maturity of the technical requirements. Regarding the institutional requirements the experts mentioned that regulation, PSD2, GDPR, the awareness (people) and data management are the most important requirements for deploying customer analytics. This is also supported by the literature.

The requirements from the table below serve as the key domain areas in the maturity assessment framework, since the key domain areas are the core elements of the CMMI theory.

Table 3: The reviewed requirements

Requirements	**Literature source**
Privacy	Interviews and EC (2015 a,b)
PSD2	Interviews and EC (2015 c,d)
People	Interviews, Chen et al (2012) and Bus and Zimmerman (2011)
Management	Interviews, Chen et al (2012) and Bus and Zimmerman (2011)
Data quality	Interviews, Han et al (2011) and Chen et al (2011)
Internal rules regarding data	Interviews, Han et al (2011), Mazumder (2016), Fang and Zhang (2016) and Lavelle et al (2011)
Consultation regarding data	Interviews, Han et al (2011), Mazumder (2016), Fang and Zhang (2016) and Lavelle et al (2011)
Data sharing	Interviews, Han et al (2011), Mazumder (2016) and Chen et al (2011)
Software tools	Interviews and Mazumder (2016)
Technical knowledge	Fhan and Zang (2016), Han et al (2011) and Chen et al (2011)

3.2 Conceptualizing the framework

Following from the research methodology (Sage and Armstrong, 2000), a conceptual design is made. The maturity assessment framework should be able to assess both technical and organizational elements of a SME finance bank. In Appendix A the conceptual framework is visualized. According to the CMMI theory, the key domain areas are classified in leverage domains: Regulation, Organization, Data governance and Technology. See table 4 for the relationship between the leverage domains and the key domain areas.

Other important elements are the multi-level and multi-criteria aspects of the proposed framework. Due to the complexity of organizations (Mintzberg, 1993; de Bruijn, 2002), single score maturity measurements have limited use (Maheshwari and Janssen, 2013). Therefore it is necessary to measure maturity using multiple scores. This is done by measuring maturity at different departments, with different domains, the leverage domains, and different criteria, the key domain areas. In the section 4 the measurement will be presented.

3.2 Process of use

Marketing is the department where banks get in contact with their customers and potential customers (Vorhies and Morgan, 2005). Data science department is the innovative department of the bank regarding data analytics and the use of data. They use data form the IT or DWH department, the support staff (see the Mintzberg (1993) model), to perform analytics. Both the marketing and data science department are the ‘core’ users of the maturity assessment framework, since they are strongly involved in the use and the development of customer analytics.

The core result of the maturity assessment framework is twofold. Firstly, the maturity assessment framework results in a measurement, see section 4. Secondly, the process of interaction between the involved actors (de Bruijn, 2002). With the process of interaction, the discussion around the maturity measurement is meant. Based on Mulgan (1997) and de Bruijn (2002), the interaction between involved stakeholders carry advantages like: (1) Both manager and professional are given the opportunity to give their meaning to the measurement, (2) when the different opinions are confronted, the ultimate meaning will be richer than if there was just one single opinion and (3) if the manager and the professional fail to arrive at one meaning. These advantages make the discussion also important.

3.3 Positioning the framework

In table 1 and in section 2.1 different existing customer analytics frameworks were reviewed. The next step is to examine where the conceptual maturity assessment framework belongs.

The framework from this research differs from the reviewed frameworks in the sense that it considers customer analytics as a multi-criteria phenomenon, looking at customer analytics from different viewpoints: technology, organization, regulation and governance. Existing frameworks focus on one single element. Another difference is that the reviewed frameworks, define a process that organization have to follow: from gathering data to conducting analytics or from awareness motivation to awareness benefits (Bakmamedova and Shanks, 2014). In this research, no process is defined. The maturity assessment framework is independently designed. Another difference is the fact that this framework aims at assessing the maturity of customer analytics implementation. Contradictory to the other frameworks, what aim at implementation customer analytics or creating organizational value for customers analytics.

Table 4: The leverage domains and their key domain areas

				ML		
Domain	**KDA**	**1**	**2**	**3**	**4**	**5**
Regulation	Privacy (GDPR)					
	PSD2					
Organization	People					
	Management					
Data governance	Data quality					
	Internal rules regarding data					
	Consultation regarding data					
Technology	Data sharing					
	Software tools					
	Technical knowledge					

IV. TESTING THE FRAMEWORK

4.1 Defining the case studies

The aim of conducting case studies is to test the maturity assessment framework (Sage and Armstrong, 2000). Case studies are mostly questionnaire based studies (Venkatesh & Morris, 2000). In our case using fixed questionnaires may be problematic, because it is difficult to determine what good questions are. This might result in missing insights. Questionnaires may not be very feasible, as there are a limited number of people involved in the case studies (Bartlett et al, 2001). Therefore interviews are used.

For conducting interviews instead of questionnaires it is important that one knows the interviewees (Gillham, 2000). The desired method for interviewing experts is to have 'natural occurring conversations'. The idea behind this concept is to decide on a small amount of questions (preferably three or four) where you want answers to and ask these questions as the opportunity naturally arises (Gillham, 2000). The experts in the setting know the purpose of the interview, so they expect questions to be asked. Because the experts are formally not interviewed, they may give revealing answers (Gillham, 2000).

In the Netherlands there are four SME finance banks that finance SMEs of all the segments. Case studies are conducted at two Dutch SME finance banks.

These SME finance banks will be called bank A and bank B. To deal with the organizational complexity and create a multi-level measurement, four departments participated in the case study, namely: marketing, data science, data warehouse and finance/risk. As stated earlier, marketing and data science are strongly involved in customer analytics deployment and development. Data warehouse provides the departments with data. Finance/risk department use customer data for other purposes than the marketing department. This gives a more complete view of the SME finance bank.

4.2 Assessment dashboards

The outcomes of the assessment are visualized by using dashboards. Visualization of different elements is required to enable organizations to evaluate the effects of their actions (Maheshwari and Janssen, 2013). Visualization supports the interpretation. Using an index for

showing the measurement scores, for example, does not provide enough insights and can easily be interpreted differently from the original meaning (Bannister, 2007; Petrovic et al, 2012). Dashboards are used to support interpretation of the outcomes. A dashboard is a visual display of the most important information needed to achieve one or more objective, consolidated and arranged on a single screen so the information can be monitored at a glance (Few, 2004, pp 31). This means that the outcomes of the assessment and the benchmark need to be visualized in an easy to understand way (Maheshwari and Janssen, 2013). See figure 2 for an example of an assessment dashboard.

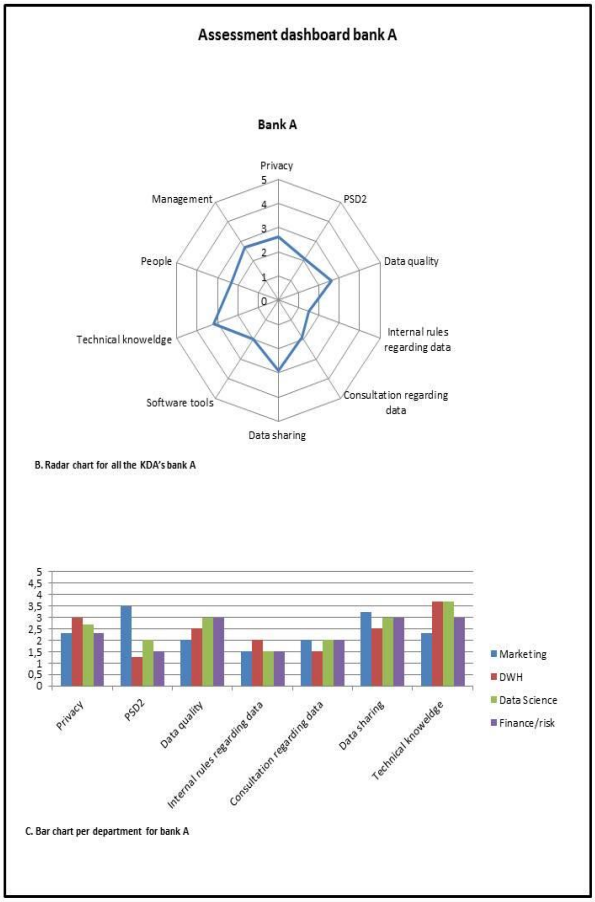

Figure 2: Assessment dashboard bank A

The assessment dashboards show the maturity measurement of the different departments and the total maturity of the bank. This is done by using a radar chart. The maturity of each key domain area is included in the radar chart. Also a bar chart is included to visualize the different maturity measurements for each department. The bar chart shows the internal differences between departments. The same dashboard is made for bank B, see figure 3.

These dashboards allow for internal benchmarking, using bar charts. External benchmarking is also possible, by using dashboards where a comparison is made between bank A and bank B.

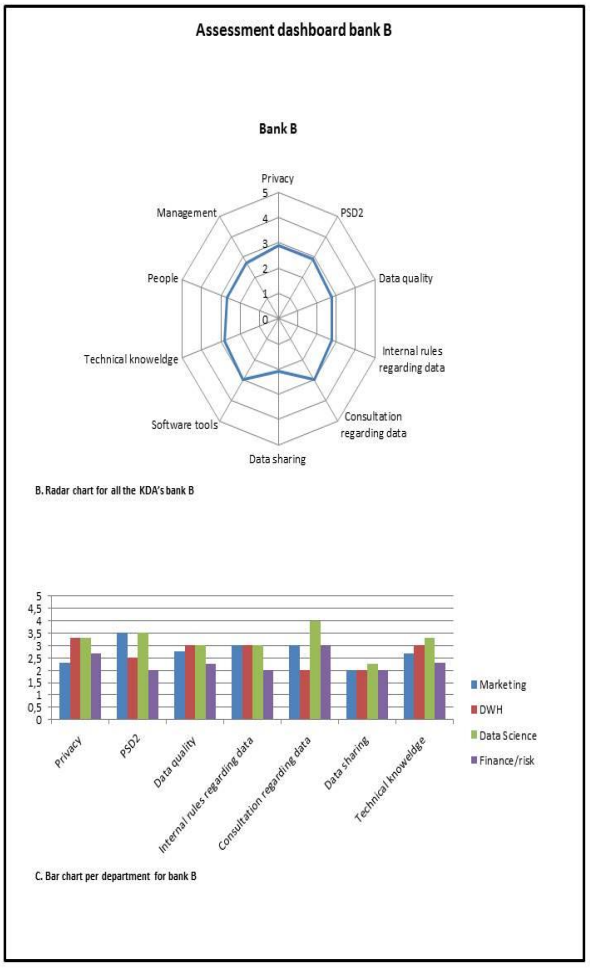

Figure 3: Assessment dashboard bank B

For the external benchmarking process Maheshwari and Janssen (2014) defined several steps. Step 1 is to define the indicators. Before anything can be measured good indicators need to be defined (Maheshwari and Janssen, 2014). In this research these are the Key Domain Areas. Step 2 is measuring, data collecting using multiple data sources

(Maheshwari and Janssen, 2014), what is presented in figure 2 and 3, different departments and different criteria. The last step is benchmarking, comparison with some kind of yardstick (Maheshwari and Janssen, 2014). A single maturity level measurement allows bank A and B to determine the current status of the key domain areas per department, where the benchmark provides useful insights for improvements suggestions. See figure 4 for the external benchmarking between bank A and bank B.

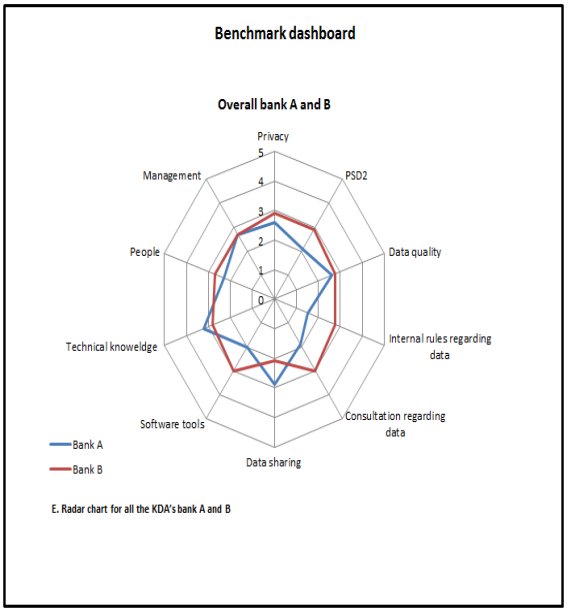

Figure 4: Benchmark between bank A and bank B

4.3 Evaluation

Assessment and benchmark dashboards should be evaluated (Maheshwari and Janssen, 2013). This framework contains three main benefits, that are summarized below.

The first benefit is that this framework contains multiple measurement levels, containing organizational, technical, regulation and governance indicators. The use of multiple measurement levels, different domains and different departments, enhances the benchmark ability and it allows for customization (Maheshwari and Janssen, 2013).

The second benefit is that the dashboard also allows for internal benchmarking. Because of the assessment per department, the differences in maturity level scores per key domain area are presented in the bar chart.

The last benefit is that the benchmarking facilities a comparison between two organizations and enables SME finance banks to learn from each other (Maheshwari and Janssen, 2013). Benchmarking on a single score of an organization often has limited use, whereas benchmarking on similar aspects can provide much more insights (Maheshwari and Janssen, 2013).

V. CONCLUSIONS

The aim of this paper is to propose a new method for designing a maturity assessment framework for customer analytics implementation at Dutch SME finance banks. This is done by using the systems engineering approach from Sage and Armstrong (2000). Following from the design steps, a theoretical foundation is given for the maturity assessment framework. Also expert knowledge is used to define the requirements. Based on the theoretical foundations, a maturity assessment framework is conceptualized. Case studies at two SME finance banks were conducted to test and evaluate the framework. See figure 5 for an overview of the design process of the maturity assessment approach.

The framework is characterized by a variety in domains. It focusses at different domains of customer analytics implementation at SME finance banks: regulation, organization, technology and governance. This is also the main contribution to the research field, since existing frameworks focus on one single element, like technology or organizational awareness. The framework also aims at measuring maturity at different departments, to deal with organizational complexity. It is important to measure maturity at different levels, with different domains and different criteria. This multi-level and multi-criteria

character of the framework is new in the research field. Also, existing frameworks aim at implementing customer analytics or creating organizational awareness for customer analytics, while this framework aims at assessing the maturity of customer analytics implementation. This research provides insights on the requirements for conducting customer analytics.

The maturity model theory that is suitable to design a maturity assessment framework for customer analytics implementation at SME finance banks is the Capability Maturity Model Integration (CMMI) theory. This theory is able to assess the maturity of a certain technological development on both organizational and technical level. The requirements for conducting customer analytics at SME finance banks are: Privacy, PSD2, people, management, data quality, internal rules regarding data, consultation regarding data, data sharing, software tools and technical knowledge.

The lack of adoption regarding the use of customer analytics by SMEs finance banks could be explained by an immaturity of the requirement. Using the maturity assessment framework identifies and indicates the weaknesses and strengths of the SME finance bank regarding implementation of customer analytics. What may explain the lack of adoption. When certain key domain areas are considered as immature, the banks should improve these key domain areas to enhance their business to adopt customer analytics.

Since this research field has not been explored before, this research should be seen as a start for future research. Reliability of qualitative research is inherently limited as compared to quantitative research, which is also applicable on the case studies. For the generalizability the main limitation is that more experts have to be interviewed.

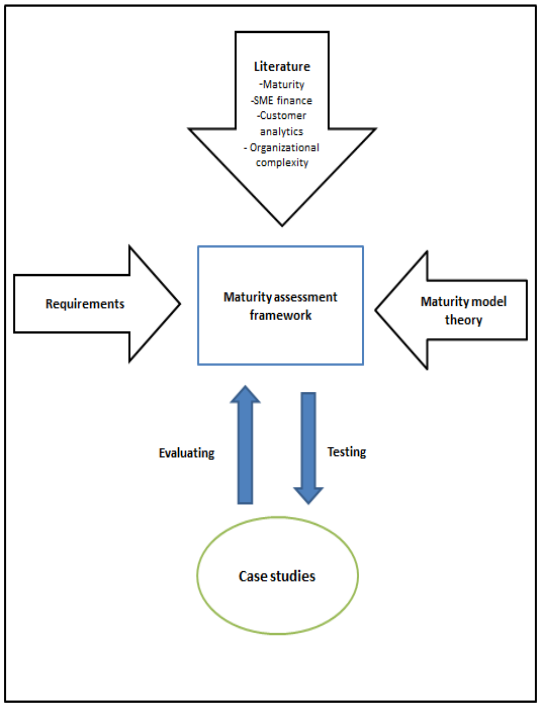

Figure 6: Design process of the maturity assessment framework

More research is required on the requirements of the framework. Extending the framework is the main recommendations for further research Key domain areas like new regulations, technical knowledge and data warehouse, should be rethought over time. Due to the IT development and regulatory changes, these key domain areas will change over time. Some elements are excluded from the framework. These are: the interactions between departments, the current regulations, compliancy with the new regulations, recruiting and no quantitative elements are included in the framework. Cost is excluded from the framework. Meaning that being mature according to the framework, does not necessary imply that a SME finance bank is able to adopt customer analytics, due to high costs.

Therefore, this paper is the start for further research on maturity assessments for customer analytics implementation at the Dutch financial sector

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Appendix A. Overview maturity assessment framework