Data Mining and Risk Management in Banking
A case study within banking industry:
A Critical Realist perspective on customer retention

Bachelor Thesis within Business Informatics
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Abstract

This research investigation looks into decisions related to Risk Management and Data Mining in relation to banking industry. It identifies how valuable Information Technology has become to the competitive banking environment in order to retain customers. The current bank under investigation is Swedbank whose main objective is to maintain a close relationship with its customers.

The investigation sought to identify factors which may have an impact on the decision making process between Data Mining and Risk Management that could affect Swedbank in achieving customer retention or lead to loss of customers.

The perspective adopted in finding out the possible factors was Critical Realism where abduction, retroduction and causal analysis were applied to a single holistic case study.

The findings based on the analysis have identified five possible factors which can affect customer retention in banking environment. These factors are identified as causal mechanisms and these are: Pressure of responsibility, Employee competence, Bias judgment, Complexity of Services and Customer Behavior.

Between Data Mining and Risk Management are a high number of factors which contribute to customer retention. The five factors identified were based on criteria of lending services by private customers. As Swedbank is considered to be an open social system from the perspective of Critical Realism, the nature of the factors revealed may change their powers and liabilities over time.

Key Words: Risk Management, Data Mining, Customer Retention, Critical Realism, causal mechanisms, Scoring Model.
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1 Introduction

Risk Management and Data Mining in the context of the banking industry

The background of this research lies in Risk Management and Data Mining in relation to the banking industry in times of market instability. Many organizations become victims of instability in such a fast paced environment while the ones that anticipate risk within their daily operations minimize loss (Andersen, et al., 2007).

Risk Management (RM) is a process which seeks to determine the risks that affect business operations and thus eliminating these threats. Essentially, the process identifies any type of situation that could result in damage to any tangible or intangible resource within the possession of the company, including personnel, then takes steps to correct factors that are highly likely to result in that damage. RM addresses not only risks which are involved in insurance, but also business risks related from a competitive threat, poor product quality and customer attrition (loss of customers). One of the tools which can support RM into minimizing the risks of losing customers and to manage customer retention is Data mining (DM) (Hormazi, et al., 2004). With the help of DM banks can manage risks for credit approval, issuing credit cards, determine customer behavior and whether or not customers are reliable and thus should be retained or customers present the risk of defaulting their accounts (The Chartered Accountant, 2006).

DM is a tool which creates models to find patterns in large collections of data. By using these models the end user extracts data to analyze and predict customer behavior while gaining competitive advantage, reduce risks of losing customers and identifying what attracts customers. According to (Cabena, et al., 1997, p. 12), “data mining is defined as the process of extracting previously unknown, valid, and actionable information from large databases and then using the information to make crucial business decisions.” DM in banking industry supports not only customer retention, but also customer acquisition (The Chartered Accountant, 2006). This is an important matter for banks since competition is high and customers have so many options to choose where to do their business. Hence, this demands from executive management to give full attention to their customers. DM helps the banks to discover purchasing patterns of behavior which in return sustain the banks in offering incentives that are individually designed to fulfill the customer needs, (Hormazi, et al., 2004).

Due to the fact that the competition is increasing rapidly, the commercial banks need to adopt new strategies and tools such as DM to remain competitive. The banks can develop methods and analysis in DM to determine fraud detection, failure analysis, demand forecasting and assess risk management (Hormazi, et al., 2004).

Swedish banking industry perspective

In Sweden the financial system is the fundamental base for a well structured economic life both for private consumers and business functions (Swedish Bankers’ Association,
Swedbank offers a reliable system for savings, finance and payment intermediation. Risk Management is an important part in this system. The financial system supports production, welfare and employment and is managed by banks, credit institutions and companies which operate within the financial sector. According to (Swedish Bankers’ Association, 2012) the financial sector is one of the most growing industries in Sweden in terms of capital. It employs about 100 000 people and represents about four percent of total production output.

In March 2007 ECON issued an article which states the following: “The Swedish retail banking market is undergoing substantial changes. Introduction of foreign firms, entry from other lines of business, and new technology have influenced the development on the Swedish banking market for both producers and consumers.” (ECON, 2007, p. 3). Furthermore, the article suggests that the major changes are in the initial phase and there is more to come. The predicted changes describe the intrusion of foreign establishments which will affect the competitive environment on the Swedish banking market. According to the article (ECON, 2007), recent developments have shown that a high number of traditional bank branches are decreasing and customers now prefer the new era of technologies and with that its services such as internet banking.

**Banks in Sweden**

According to (Swedish Bankers’ Association, 2011) there are four categories of banks in Sweden as follows: Swedish commercial banks, foreign banks, saving banks and cooperative banks. One sub-category of interest in this research lies under the category of commercial banks in Sweden. Here there are four main players as follows: Swedbank, Handelsbanken, Nordea and SEB. The bank chosen for investigation in this research is Swedbank. The reason for choosing Swedbank is that according to Annual report 2011 (Swedbank, 2011), Swedbank is the largest bank in Sweden in terms of customers. The report states that Swedbank has 9.6 million in private customers in Sweden and 630,000 in corporate and organizational customers in the Baltic (Swedbank, 2011).

**1.1 Problem**

In the last ten years there has been an incredible growth in database technology and the amount of data stored. Business transactions are computerized and invaded with large amounts of data. This has become an opportunity to analyze, extract and discover useful information and determine patterns of data (Sumathi & Sivanandam, 2006). The banking industry invests large amounts of capital in IT systems in order to evaluate the effectiveness and efficiency of various tools in Information Systems to collect the data. This is the case of DM as well but there is not enough information and research on how the complexity of DMS (Data Mining Systems) and if they play an important role in the context of legal, social, political, cultural together with organizational goals, structures, management and other internal operations (Lin, et al., 2008). All these factors are considered important “relevant” issues which determine the way DM is used as a competitive tool to support decisions within the organizational envi-
ronment. These include: organizational goals, structures, and various departments such as Knowledge Discovery in Database (KDD) and RM (Lin, et al., 2008).

The aspects presented above are described from a banking environment point of view in which technological tools such as methods in DM are brought up together with organizational issues to identify risks in order to retain customers. Customer retention is considered to be a challenge within banking industries in comparison to other industries. Customers need to feel secure when it comes to their financials and is very important to understand and value the customer demands. Bank services play an important role in this concern and it affects customer retention. As a result banks need to assess how to support customer retention (HubPages Inc., 2012).

1.2 Purpose

The purpose of this research is to explain what factors affect customer retention in the banking industry when Data mining supports Risk management in the decision making process. By factors the authors will look into decisions taken within the Risk Management department and the quality of knowledge derived from the DM tools more specifically, Scoring Models.

The reason for choosing customer retention is because Swedbank priorities for 2012 are: “Improve customer satisfaction by continuing to adapt our offering to various customer groups; Gain a larger share of our existing customers’ banking business.” (Swedbank, 2011).

1.3 Research Question

RQ. What factors affect customer retention in banking industry when Data mining supports Risk management in the decision making process?

In the research question the authors have used the terms factors as a replacement for the technical term causal mechanism for readability purposes. In essence these two terms have the same meaning in this investigation; hence factor is the same as cause.
This chapter identifies the scientific research beyond the decisions taken by the authors and the methods that lead the thesis work conducted in this report.

The choice of research philosophy has fundamental importance in any research as it determines the way the research is conducted. It provides tools for evaluating the results. In the research methodology the authors have defined the research approach and argued for the choice of philosophy of Critical Realism. The methodology includes: research design, units of analysis, methods of data collection, methods for evaluation of analysis and a model for the empirical data. The disposition of methodology is described below in Figure 1:

![Disposition of Research Methodology](image-url)

Figure 1. Disposition of Research Methodology
2.1 Research Philosophy

**Ontology** is the study of “what there is” (Thomas, 2012). Ontology is concerned with *whether or not a certain thing, or more broadly entity, exists* (Thomas, 2012). There are two parts in ontology: to identify if a certain thing exists i.e., *what there is* and what are the features and relationships of the entity (thing), with other entities (things) (Thomas, 2012).

**Epistemology** is the study of knowledge and justification of believes. It is concerned with questions such as: *What are the necessary and sufficient conditions of knowledge? What are its sources? What is its structure, and what are its limits?* (Matthias, 2005).

**Epistemological and Ontological position in Critical Realism**

From an epistemological point of view Sayer says, “The world exists independently of our knowledge of it.” (Sayer, 1992, p. 5) “Our knowledge of that world is fallible and theory-laden....”. (Sayer, 1992, p. 5). From an ontological point of view Sayer says, “The world is differentiated and stratified, consisting not only of events, but objects, including structures, which have powers and liabilities capable of generating events.” (Sayer, 1992, p. 6).

2.1.1 Critical Realism Perspective

The philosophical perspective adopted in this paper is Critical Realism. It is also called Bashkar’s philosophy because it was Roy Bhaskar in 1975 that first developed the concept of Critical Realism from Realism (Mingers, 2000).

Critical Realism is relatively new in Information Systems research. According to author (Easton, 2009) by conducting a search on ISI Web of Science database there were only 334 papers which included Critical Realism in a title or abstract. In February 2012, the authors of this paper have searched Google Scholar from Jönköping University Library Search Engine for papers which have adopted Critical Realism perspective to evaluate Information Systems. The search words were “critical realism in IS” and it returned only 58 results. Out of these, 14 were written by Sven A. Carlsson.

Critical Realism is a realist philosophy which states that there is a world outside and independent of our perception and we as humans are only capable of viewing some aspects of this world by using our own senses (Easton, 2009). Since events are independent of our sensing, the causes that generate those events are also not perceived (Easton, 2009). There are three levels of reality, ontological domains (Mingers, 2004). Although they are separated domains i.e. fields, the *empirical* field is a subset of the field *actual*, and the latest is subset to the field *real* (see Figure 2).
Experiences (Empirical): Represent our experience about the world and what we see in it. This view can be subjective and limited to the perspective view. This is a level considered to be nominalist and our experiences as individuals are not mirrors of reality. We use our own perspective to view things that we experience (Fisher, et al., 2007).

Events (Actual): Events occur in the world whether we perceive them or not. They are independent of our view on reality and thus objective. When they are perceived, investigators observed them within experiences. They belong to the second level of reality (Fisher, et al., 2007) (Easton, 2009).

Mechanisms (Real): Mechanisms are the causes or reasons of events within the deepest and third level of reality. However, at this level Critical Realism sustains that there are multiple mechanisms which may occur and they cannot be directly experienced, instead they need to be logically inferred from events, respectively, the events that we experience (Fisher, et al., 2007).

Critical Realism differs from other approaches because it allows investigators to understand why events occur the way they do. According to (Easton, 2009) the Interpretivism approach in research argues for the sensitive way to capture data and for elaborated analysis on data. Researchers taking this perspective, do not have the possibility of knowing what is real, as well as there is no clear standard in which way is better to interpret the data. On the other hand, researchers taking the epistemological stance of Positivism, sustain that regularities exist and low like generalizations which in return provide basis for explanation and prediction. But this does not answer the questions of why things are the way they are (Easton, 2009).

The reason for choosing Critical Realism approach is that only from this perspective the investigators are able to identify the real causes behind the events and to understand why things are the way they are, i.e., what causes the events observed by us? What factors affect customer retention at Swedbank? What are the necessary and contingent re-

Figure 2. *The three domains of the real*. Source: (Mingers, 2004, p. 98)
lations for these events to have an outcome? Which structures from Risk Management and Data Mining support customer retention or determine loss of customers?

The difference between Critical Realism and strict empiricism is shown by the authors in Fel! Hittar inte referenskälla. (Appendix E).

In strict empiricism (Positivism), investigators seek to define regular pattern of behavior of the phenomena under investigation in a closed system (Easton, 2009), (WUISMAN, 2005). The pattern of behavior is identified based on the measurement of the events which take place and based on those strict empirical observations, investigators draw conclusions. On the other hand, in Critical Realism the pattern of behavior of the phenomena under investigation takes place in open system and it becomes interrupted by factors which affect it (Easton, 2009). These factors are not visible to investigators because they take place at the third level of reality which is the real. In order to uncover these factors the authors must use abduction and retroduction (WUISMAN, 2005). Abduction will be used in the initial phases of the investigation, literature review and retroduction when conducting the analysis of empirical data. Both abduction and retroduction are explained in the following section.

2.1.2 Research Approach Stance

Abduction

Abduction is a logical inference which maintains its conclusions only by inferring that certain conditions apply for it to be true. Is a procedure which assumes an explanatory hypothesis under certain conditions while these conditions are accepted and applied (Commens Pierce Dictionary, 2003). The form of inference states: “The surprising fact, C, is observed; But if A were true, C would be a matter of course. Hence, there is reason to suspect that A is true” (Pietarinen, et al., 2003).

There are six modes of abduction inference (Cunningham, et al., 2001).

1) Omen/Hunch (A sign of something about to happen): This type of inference considers the possibility of a potential similarity. Our initial observations as investigators might attend for possible evidence. This can be defined as a “hunch” about something.

2) Symptom: This type of inference addresses possible resemblances. Investigators should decide if actual observations should be considered a case or not. Do observations represent a larger phenomenon or not?

3) Metaphor/Analogy: This type of inference addresses the manipulation of similarities in order to create or detect a possible rule.

4) Clue: This type of inference considers possible proof of whether or not our views as investigators are the clues for a general phenomena or not.

5) Diagnosis/Scenario: This type of inference establishes if it is possible to shape a possible rule based on the evidence available. Scenarios can be built on available clues.

6) Explanation: This type of inference involves the possibility of creating a formal rule as reasoning in order to create a general plausible explanation.
Examples of how Abduction was applied according with the different modes above: Modes 1, 2) and 3) were applied while conducting literature review and searching for information, clues and similarities between the concepts under investigation. Modes 4) and 5) were applied after gathering information from interviews and trying to identify possible hypothesis for the causes of events. Mode 6) was applied when identifying structures and entities with their powers and liabilities as well as the necessary and contingent relations between them. In this mode the investigators have triangulated data in order to develop the rationale of inference based on multiple sources such as, empirical data from the interview (see Appendix B), secondary data collection issued by Swedbank (Swedbank, 2012), (Swedbank, 2011), (Tudre & Adamson, 2007 – 2011) and the literature review.

Retroduction:

The meaning of *retroduction* is to get beyond the identification of surface observations which develops changes and to understand what is it about the object which enables this change, (Sayer, 1992). Knowing that ‘C’ has generally been followed by ‘E’ is not enough: we want to understand the continuous process by which ‘C’ produced ‘E’, if it did, (Sayer, 1992). This is a mode of logical judgment in which one can help the events by identifying the mechanisms that produce them. *Retroduction* in Critical Realism can be seen as (Piekkari & Welch, 2011) have described it with the help of Sayer’s view on causation (Sayer, 2000) (see Figure 3).

![Figure 3 Three domains of reality and retroduction logic. Source: (Piekkari & Welch, 2011, p. 68)](image)
The retroduction process helps the authors to seek for complex details in order to build an explanation of what has caused the events to come into being. The investigators have taken the empirical observations and hypothesized with the help of abduction a possible mechanism which helped them to explain particular events. These mechanisms are derived from the nature of the object of investigation while conducting literature reviews and other sources of secondary data such as: (Swedbank, 2012) (Swedish Bankers’ Association, 2012), (Swedbank, 2011), (Tudre & Adamson, 2011). Retroduction has helped the investigators to go beyond the chronology of events (Bygstad, 2000).

2.2 Research Design

2.2.1 Case study

According to (Yin, 2003) using case studies for research investigation continues to be one of the most challenging of all social endeavors. There are three types of strategies when conducting case study analysis as follows: a) exploratory case studies, b) descriptive case studies, and c) explanatory case studies. There are three conditions for each of the strategies – the types of research questions used in the investigation, the extent of control an investigator has over actual behavioral events, and whether or not is more concentrated on contemporary events as opposed to historical events. (Yin, 2003). This investigation uses an explanatory case study together with and archival analysis based on business records issued by Swedbank to its stakeholders (Swedbank, 2011) (Tudre & Adamson, 2007–2011). The reason for conduction an explanatory analysis is because the authors will explain the causal link in real life interventions that are too complex for the survey or experimental strategies. The business records together with the frame of reference and empirical data will support the authors to identify the “what factors”, whereas the explanatory analysis strategy will guide the authors to explain the nature of these factors.

The strengths with case study research design are that it considers multiple sources of evidence such as documentation, archival records, and interviews. (Yin, 2003). This in turn assures the process of data triangulation. In this investigation the authors have used multiple sources of data such as: interview (see Appendix B), archival records (Tudre & Adamson, 2007–2011), business records issued by Swedbank (Swedbank, 2012), (Swedbank, 2011) and frame of reference. The triangulation of data has provided support into measuring the factors based on multiple sources of evidence.

2.2.2 Single, holistic case study

The authors of this investigation have decided to adopt single-case study (holistic). The following are arguments which support this selection: Swedbank commercial bank fulfills all the criterion of investigation defined by investigators such as: it uses DM in RM to remain competitive on a local market by retaining customers; seeks to efficiently respond to changes in risk factors by managing risks associated with competition; is a representative, typical case, (Yin, 2003), which pro-
vides: the conditions - deals with customer retention, context - banking environment, and phenomena – Data Mining, Risk Management and Customer Retention. According to the Swedish Financial Supervisory Authority (ECON, 2007), Swedbank has been ranked as the bank with the second highest turnover in Sweden on a national level.

2.2.3 Unit of analysis

We are considering our object of investigation as a social open system where boundaries are crossed in both directions by material flows and information. In a closed system the information only flows in one direction (Vercellis, 2009). DM and RM are considered to be subsystems where customer retention is considered to be input and output into the subsystems. The units of analysis are: “Data mining”, “Risk Management” and “Customer Retention”.

2.3 Data Collection Design

Primary data: Interviews

Interviews – Interviews are considered to be the most crucial source of information in case study research. Interviews are rather guided conversations and not structured queries. The streams of questions are more likely to be fluid and not rigid. In an interview process investigators must pose questions in an unbiased manner which supports the purpose of the inquiry. It is important for investigators to distinguish the difference between how and why and the effect that these have on the respondents. The “how” questions do not place the respondent in a defensive status and are more friendly, whereas the “why” questions do the opposite to the respondent. While in the process of designing the interview guide for this investigation, the authors have assessed the questions with “how”, “which”, “does” and “what” (see Appendix A) (Yin, 2003).

The type of interview conducted in this investigation is open-ended where investigators have used open discussions with the respondent. The respondent was the regional manager at Jönköping branch of Swedbank. The interview lasted 40 minutes and was recorded (see Appendix B). The regional manager is the highest authority working for Swedbank in Jönköping.

The authors have decided to conduct only one interview. Reason for this is that in Critical Realism primary data is needed only for identifying the initial point of departure of the research, i.e. for identifying the final events for retroductive reasoning as described in Figure 3. Hence, the possible factors which affect customer retention are derived from the analysis of frame of reference and secondary data issued by Swedbank.

Secondary Data Collection

For secondary data collection the investigators used Google Scholar Archival Records released from Swedbank to its stakeholders and the literature review.
Google Scholar- was accessed to identify secondary data collection the authors used the Google scholar from Jönköping University with search words such as: Data Mining; Data Mining + Risk Management; Data Mining + Risk Management + banks; Data Mining + Risk Management + Swedbank; Data Mining + Risk Management + Knowledge discovery in Data bases (KDD); Risk Management + Swedbank; KDD + banks; KDD + Swedbank, Advisor + banks, Customer Retention + Banks, Customer Loyalty, Customer Behavior + Banks, Scoring Models.

By using the search words above, the authors have uncovered various journals, online books, news papers and white papers which were used as references while investigating the phenomena. The number of references used based on the above search words are seventy eight.

Archival Records- This type of records are relevant to our investigation because they contained computer files and records issued by Swedbank directly to its stakeholders.

- **Service Records** – information showing the number of customers served over a given period of time (Yin, 2003). The records the authors have accessed were to identify information about Customer Retention and services offered by Swedbank in a given period of time. The documents used by the authors for this type of service were records of the Annual Reports from 2010 and 2011 issued by Swedbank to its stakeholders, (Swedbank, 2011), (Swedish Bankers’ Association, 2011), (Tudre & Adamson, 2011).

- **Organizational records** – organizational charts and budgets over a period of time, (Yin, 2003). The investigators have accessed organizational charts in order to determine: if the number of customers have increased or decreased over a period of time; how were internal processes divided. The documents used by the authors for this type of organizational records were the Annual Reports from 2011 issued by Swedbank to its stakeholders, (Swedbank, 2011) and Oracle Data Integrator ETL software in Swedbank EDW, 2007-2011 (Tudre & Adamson, 2011). Organizational charts were used from the documents to show the fluctuation of customers, the internal organizational charts of employees and the information process between departments.

### 2.4 Methods for results evaluation

#### 2.4.1 Construct Validity

Construct validity in the language of Critical Realism is a judgment of evaluating if the empirical data collected during the investigation can be empirically traced back to the actual events of research interest that operates below the empirical surface (Hart & Gregor, 2010). Both the empirical data and the actual events are considered real. On the other hand construct validity in strict empiricism, such as positivism, is concerned with the empirical data collected (the measurement) and the theoretical concept beyond of
the construct (Hart & Gregor, 2010). The difference between strict empiricism and Critical Realism is described below.

Table 1 *Differences between Strict Empiricism and Critical Realism for construct validity.*

<table>
<thead>
<tr>
<th>Construct validity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Strict Empiricism (positivism)</strong></td>
</tr>
<tr>
<td>Theory concept → Empirical</td>
</tr>
</tbody>
</table>

Another way to pass a validation on construct validity under Critical Realism is to create a line of evidence when conducting interviews on the site under investigation. The events described by the respondent were identified with the help of causal mechanisms identified during the analysis. The test was passed (see 5.7.1) by using the line of evidence received from the respondent, empirical data (see Appendix B) and with the help of secondary data (Swedbank, 2011).

### 2.4.2 Internal Validity

Internal validity in Critical Realism entails to establish if the actual events which are being uncovered by investigators are being caused by the generative mechanisms which are discovered while theory building process. There are three main factors which contribute to internal validation in Critical Realism, and they are: “(a) explanation of the mechanism, (b) confirmation that the mechanism has operated as described, and (c) elimination of alternative explanations” (Hart & Gregor, 2010, p. 40). One way to deal with internal validity in Critical Realism is to compare the views and comprehension of each investigator on generative mechanisms. There are three investigators which collaborated on this research. Internal validity has been tested to ensure the evidence that all three investigators have revealed the same generative mechanisms which have emerged the events (see 5.7.2).

### 2.4.3 External Validity

External Validity in Critical Realism entails to demonstrate that the generative mechanisms caused by an event in a research setting are also applicable to other areas of investigation in the same domain, but on a larger scale. The external validity tests are described in section 5.7.3. One consideration is to assess if the units of analysis under investigation are representative to the context on phenomena. Hence, can the same generative mechanism be uncovered in the same setting of research area; are these generative mechanisms representative to other settings? This is one sensitive matter since the investigators adopt a subjective stance of experiences during empirical data collection. (Hart & Gregor, 2010).
2.5 Model for analysis of empirical data

The model used to identify the causal mechanisms is Sayer’s model on causal explanation (Sayer, 1992, p. 213) (see Figure 4).

The model includes two tests: Test A and Test B which will be described below.

![Diagram](image)

Figure 4 Evaluation of testing of causal hypothesis. Source: (Sayer, 1992), p 213

Test A and Test B are not independent tests, rather, they are connected. Test A is identification of Objects/Entities and Structures. This test identifies causal powers and liabilities for the entities and structures involved in the analysis. While identifying objects/entities the investigators are already aware of the structures, compositions and properties of these objects/entities. One way to check the causal powers and liabilities (general mechanisms) of the object X can be detected by observation, but under some conditions (necessary and contingent). As a result Test A deals with analyzing the causal explanations in relation to object X (Sayer, 1992).
Test B deals with evaluating the events which are created by the causal powers and liabilities from object X. Investigators may be able to anticipate the type of event \( e \) by having a wide range of conditions \( c \) in which the object X is located.

The components of the model are described below (Sayer, 1992):

- **Objects/entities** – or more broadly speaking-entities, are the building blocks for Critical Realism explanation. Can be things such as: organizations, people, relationships, attitudes, resources, inventions, ideas and etcetera (Easton, 2009).

- **Causal Powers and liabilities** - Entities have causal powers and liabilities. While identifying causal powers pragmatic concepts can be used such as: “To ask for the cause of something is to ask ‘what makes it happen’, what ‘produces’, ‘generates’, ‘creates’ or ‘determines’ it, or, more weakly, what ‘enables’ or ‘leads to’ it” (Sayer, 1992, p. 104). “A liability may be regarded as susceptibility to the action of other entities…..” (Easton, 2009, p. 120).

- **Events** – Constitute what critical realist focus on investigation, such as the external behavior of the objects as they occur or have happened. Usually the data under investigation is reported, rather than directly observed, which means the investigator does not directly participate during the event itself rather experiences the event through a recorded way, one which is close to the event (Easton, 2009).

- **Structure of Entities** – Entities are normally structured and by structure it is meant that objects are internally related. “Structures are nested within structures. For example entities can be organizations that have departmental structures and relations and, within them, individuals who have particular characteristics such as gender and psychological structures.” (Easton, 2009, p. 120).

- **Emergence** – In Critical Realism entities can be analyzed at a number of different levels of aggregation. It implies that the properties of entities at a high level of aggregation are not inferred to by grouping them in a summative concept such as top down (reductionist approach), rather these properties come forth from the properties on a lower level (Easton, 2009).

- **Necessary Relations** – Defines the concept beyond a relation on which one substance cannot be without another. Change in one entity leads to change in another entity with which it has necessary relations. But these changes may not be regular. For example, one entity can be able to exist without the other, while the formal may not (Easton, 2009).

- **Contingent Relations** – This type of relation applies to entities which have necessary relations and may also have contingent (dependent) relations that may affect one another. They are not neutral and are the result of causal processes as well as have their own causal processes and liabilities (Easton, 2009).

- **Mechanisms** - Mechanisms are “nothing other than the ways of acting of things” (Easton, 2009), pg. 122. The events which occur can be found by identifying the causal explanation between entities and the mechanisms. Mechanisms are the focal point of causal explanation. A simpler definition can be regarded as ways
in which structured entities together with their powers and liabilities enact and determine particular events (Easton, 2009).

In order for the reader to understand how the model will be applied in the analysis is taken from (Easton, 2009, p. 122).

“Objects (a salesperson) having structures (knowledge and personality traits etc) and necessarily possessing causal powers (to persuade a buyer, who is another object) and liabilities (to be rejected by technical buyers, to get tired towards the end of the day) will, under specific condition $c1$ (the buyer has a need for the product and the offering is suitable) result in an event $e1$ (a sale), or alternatively under specific condition $c2$ (the buyer has a need for the product but the offering is not suitable) will result in an event $e2$ (no sale).”
3 Frame of reference

3.1 Risk Management

“Risk” derives from the Italian work risicare which means “to dare” making “risk” (Bernstein, 1998, p. 8) an option and the choice depends on the actions we dare to take. The term Risk is used more frequently to financial risk or the uncertainty of financial loss (Raghavan, 2003). Most often Risk is defined in terms of probability of occurrence frequently thus it is measured on a scale with occurrence frequently at one end and certainty of non-occurrence at the other (Raghavan, 2003). Risk itself has the most impact where the probability of occurrence or non-occurrence is equal (Raghavan, 2003). Whilst (Besis, 2011) states, Risk refers to the unfavorable cause on wealth and its outcomes. If there are none there are no risks but only uncertainty since risk is not identical to uncertainty. Risk only exists as a repercussion of uncertainty when risk has an unfavorable effect that can lead to a financial loss (Besis, 2011). Risk management (RM) has a range of definitions depending on which business sector it is applied to. Ultimately it has the same purpose across any organization with its aim to reduce an organizations exposure to risk with a planed and controlled systematic approach (Das, 2006).

Types of Risk Management

With the emergence of the Information Technology (IT) and the internet leading to a globalized market, organizations are daily exposed to risk. The nature of the risk depends on the organizational nature but organizations all share financial risk as a priority of assessment. Banks in particular share a business environment which is rapidly changing leaving banks vulnerable to risk (Das, 2006). The most common risks categorized by organizations are credit, market, operational and strategic risks with operational risk being the most extensive risk category (Das, 2006). Strategic risk deals with mid to long-term environmental changes with its primary aim to define risks and pounce on opportunities. Across organizations risk management should be integrated so that it creates transparency across all divisions while sustaining competitiveness (Basak & Shapiro, 2001).

Credit Risk

Credit risk is essential for banks in establishing guidelines for associates to honor their payment obligations (Das, 2006). As such a credit analysis is followed this includes financial and non-financial factors that are interrelated. Types of these factors include, the environment, the industry, competitive position, financial risks, management risks and a loan structure and documentation issues (Fitch, 2004). At its simplest form credit risk is defined as the potential that a borrower or counterparty of credit will fail to meet the banks obligations in accordance to the agreed terms thus lead to default (Bank for Internatioanal Settlements, 1999). If the borrower fails to follow the binding contract
and its guidelines then credit lender can seek to credit default swap (CDS). In case of a CDS, very similar to factoring within finance, the initial borrowers invoice, the bank sells its accounts receivable to a factor with discount since the factor now takes a risk with the borrower (Fight, 2004).

**Market Risk**

Fluctuation in exchange rates, changes in product price determine change in market conditions that excels to change in the net asset value of banks. Market risk is concerned with the risk of an investment portfolio or a trading portfolios decrease due to alterations in value of market risk factors (Raghavan, 2003). These market risk factors are summed up as stock prices, interest prices, foreign exchange rates and commodity prices. Stock risks are associated with fluctuation and its volatile environment while interest rate risk is concerned with inflation as such. The global environment which banks operate in sees the ever changing currency and its risks while commodities such as corn, oil and copper are defined as commodity risks (Das, 2006). The author (Raghavan, 2003) continues to state that market risk management assures a comprehensive and dynamic framework for measuring, monitoring and managing the market risks while it must be integrated with the overall business strategy and its processes.

**Operational Risk Management**

Operational risk derives from organizations executions of business functions which consist of people, systems and processes. Furthermore operational risk stretches to assess fraud risk, legal risk, physical and/or environmental risk (Bank for International Settlements, 1999). In that sense there are complications in defining operational risk due to its lack on natural existence. The factors involving operational risk (OP) are often intangible and thus remain hidden to the transactions and activities. According to the author (Ghosh, 2012) operational risk is mentioned in Basel II Regulations stating that “operational risk is the risk of loss resulting from inadequate or failed internal processes, people and systems, or from external events.” (Ghosh, 2012, p. 11). Banks must identify operational risks in order to identify bank wide OR’s on a consistent basis and thus increase risk awareness employees and enhance the organizations processes. OR’s are often categorized as people, processes and system-related failures or due to the occurrence of external events. The ability of manager to allocate sufficient resources to manage OR and provide economical capital to cover unforeseen losses is a necessity. As defined in the following “Operational risk management should be recognized as a significant element of the corporate governance process” (Ghosh, 2012, p. 11).

**Strategic Risk Management**

Due to globalization and the ongoing quest for greater financial returns, risk management has become a major concern within organizations (Clarke & Varma, 1999). Organizations are daily faced with internal and external changes that consequentially become risks (Hellwig, 1995). Organizational awareness towards tackling these risks has be-
come an on-going practiced philosophy within many enterprises adopting enterprise risk management, (ERM). ERM is compiled by the methods and processes to measure, manage risk and to seize opportunities related to the organizations objectives. Still embedding and tackling risk is a difficult task (Clarke & Varma, 1999).

3.1.1 Advisor

Financial Advisor

From the start of the new millennium and onward, households have increased their exposure in financial risk taking due to the free market globalization. Due to this, the role of the financial advisor has played an important role in handling private customers’ finances (Hackethal, et al., 2011). Commercial banks have seen the need for an ongoing demand of private financial investors to facilitate to the financial security and comfort the customer seeks. This creates a greater satisfaction and loyalty for the customer and in turn contributes to customer retention for banks (Hackethal, et al., 2011). The role of the advisor varies depending of the needs of the client but their main objective from a customer’s point of view is to create the possibility for individual investors to improve portfolio performance. There is a common misunderstanding that financial advisors are more often used by unsophisticated investors and thus these investors are easy to manipulate, this is not the case (Hackethal, et al., 2011).

Role of the Advisor

Advisors interacting with customers are in the position to either increase customer satisfaction or risk it. Their communication skills and their comprehending of customer expectations are mandatory in order to achieve a positive result (Hansemark & Albinsson, 2004). The experience and attitude of the advisors affect the satisfaction of customer and thus customer retention is gained. When financial advisors come in direct contact with customers it confirms the level of interest towards reaching customer expectations. Customer satisfaction increases customer retention while customer retention depends on the relationship among advisors and client (Hansemark & Albinsson, 2004). Advisor objectives are establish trust levels between the parties, define financial possibilities and advise on the direction the organization intends to commit to (Hansemark & Albinsson, 2004).

3.2 Customer Relationship Management

Customer Relationship Management (CRM) is a model which organizations use for managing their interactions with customers while adding value to the customer. It utilizes technology to organize, automate and synchronize Business Processes for marketing techniques and customer services in retaining customers and acquiring new ones. It specifies in nurturing the customers as the organization facilitates to their needs while the organization aims to lower cost although increasing customer satisfaction. CRM is
organization wide business strategy measuring the business to consumer relationships within product sales and services (Shaw & Reed, 1999).

### 3.2.1 Customer Retention

The authors (Reichheld & Teal, 1996) note that customer retention is a term used to describe organizational activity and emphasize the importance of offering a service to customers with little or no defections. Scholars (Hansemann & Albinsson, 2004) have a more elaborated definition towards customer retention in defining emotional-cognitive retention constructs as customers linking, identification, commitment, and trust while behavioral activities are recommendation to others and repurchase intentions. The customer and organization form a relationship were an advisor acts as the communicator between customer and the organization in fulfilling and exceeding customer expectations through organizational offerings (Reichheld & Teal, 1996). CRM contributes to nourishing and catering to customer expectations in order to create customer satisfaction and customer loyalty (Shaw & Reed, 1999). Moreover, customer retention is recognized as the factor to profitable organizations in acquiring market share among service organization (Hansemann & Albinsson, 2004).

### 3.2.2 Customer Behavior and Customer Loyalty

#### Customer Behavior

*Customer behavior* is based on consumer purchasing patterns were the customer acts as the user, payer and purchaser. A great deal of importance is placed on consumer retention as it is more beneficial for firms to keep customers than to target new ones. Relationship marketing is also an influential factor in analyzing customer behavior since it has an interest in rediscovering the aspects and patterns of customers or buyers (Blackwell, et al., 2006). In producing services, organizations and the service providers interact in one form or another with the customer. These interactions are either indirect in forms of email, telephone or web based activities or direct communications, hence personal meetings. According to author (Grönroos, 2000) a firm must expand the idea of good service to create customer loyalty in such a manner in which customers feel as they can trust the service provider at all times. In acquiring customer loyalty firms must set a performance standard with zero trust defects, that is to say that customers must never feel betrayed by a mediocre service encounter and wrong or incomplete information. In achieving this, banks must appoint a direct link of communication between them and the customer, hence a financial advisor.

#### Customer Loyalty

There are various definitions of customer loyalty with multiple points of views as well as in which context it is applied. According to the article *Customer Loyalty - Meaning and its Important Concepts* (Guide, Management Study, 2008-2012) customer loyalty is defined as the measure of success by the organization offering a product or service to the customer with the aim of retaining a long term relationship and gaining rewards for
its efforts in interacting with the customer. The customer finds comfort and assurance with the specified organization, product or service offered as it caters to the customer’s expectations.

**Psychological**

Customers have the tendency to develop loyalty and comfort the certain people working at companies. Clients can build relationships with financial advisors and trust them to meet expectations. Psychological reasoning and pattern thinking plays an important role in customer loyalty as well (Ltd, The Financial Times, 2012).

**Economic Loyalty**

Economic customer loyalty is mostly seen in B2B markets as it defines the economic spectrum perceived by customers. A customer might switch products / services if competition offers better prices in relations to value. Here loyalty has its basis on economic grounds (Ltd, The Financial Times, 2012).

**Technical / Functional Loyalty**

The change of internal technical procedures might change user interface experience for customer and thus discomfort him/her. This causes frustration and customer loyalty to service might be lost as customer seeks old way of working. (Ltd, The Financial Times, 2012)

**Contractual Loyalty**

In this case the customer is bound to the bank as a contract has been signed by both parties. This can be during loans or other financial credits (Ltd, The Financial Times, 2012).

### 3.3 Components of the Decision making process

**Data, Information, Knowledge**

*Data* represents inputs and outputs into the system which are usually codified and are considered primary entities. (e.g. Customers, points of sale), (Vercellis, 2009).

*Information* is the result of a processed activity which was conducted on the data. Information is valuable according to which department or domain receives it (e.g. Amount of hours per week, percentage of daily amount spent in the last 6 month), (Vercellis, 2009).

*Knowledge* deals with how the information is used for decision making and what actions should be taken. Knowledge supports departments in dealing with complex problems. The department which integrates the decision-making processes and IT is called Knowledge Management (Vercellis, 2009).

**3.3.1 Business Intelligence**

Business intelligence (BI) may be defined “as a set of mathematical models and analysis methodologies that exploit the available data to generate information and knowledge useful for complex decision-making processes” (Vercellis, 2009, p. 3). Knowledge workers working with BI are provided with tools and methodologies which allow them to make “effective and timely decisions” (Vercellis, 2009). Effective decisions are taken
by applying in depth analytical methods which allow decision makers to optimize knowledge and information that is received through various models. Timely decisions are key factors in the economic environment as competition is high. As a result companies need to respond quickly and react with high dynamism in order to maintain market share. One of the most important benefits of having a BI system is that the decision makers with the help of mathematical models and algorithms can analyze the possible solutions to take precise and effective decisions which in return increases effectiveness and rapid time responses in the decision making process (see Figure 5).

![Diagram](image)

**Figure 1.1 Benefits of a business intelligence system**

Figure 5 Benefits of a business intelligence system. Source: (Vercellis, 2009, p. 5)

### 3.3.2 Data Mining Review

Despite the fact that some form of data mining techniques have been used in the business world since 90-s, there is not a consolidated definition of this term in the scientific literature. The definitions given vary a great deal depending on the perspective taken by authors. Amir M Hormazi and Stacy Giles (Hormazi, et al., 2004) provides us with a comprehensive review of definitions throughout the scientific literature as one of these is given by (Hand, et al., 2001, p. 2): “Data mining is the analysis of (often large) observational data sets to find unsuspected relationships and to summarize the data in novel ways that are both understandable and useful to the data owner”.

This definition shows three major differences between data mining and traditional statistical analysis (Hand, et al., 2001):

a. “Observational” data refers to data which is collected as a result of normal operations by the organization for the purposes other than data mining as it differs from traditional statistics where specific data collection strategies are used for collecting “experimental” data.
b. In data mining as opposed to traditional statistics, analysis is aimed at revealing previously unknown relationships meaning there is no predefined hypothesis.

c. Data sets being analyzed are usually large.

The term *Data mining* is sometimes used interchangeably with the broader term *Knowledge discovery in databases* (KDD), but in strict sense data mining is part of KDD and does not include the process of data collection and preparation (Sumathi & Sivanandam, 2006). Even given the definition it is difficult to define the boundaries of the field of data mining because it is an interdisciplinary field involving statistics, database technologies, machine learning, artificial intelligence, pattern recognition and so far. Throughout the literature DM operations are described in different ways. And terminology for the operations is diverse.

**Data Mining usage in the process of Knowledge Discovery**

An urgent necessity has risen for a new generation of IT solutions to assist users in extracting useful information among the vast volumes of data. This new emerging field is recognized as knowledge discovery in databases (KDD) (Fayyad, et al., 1996). According to (Dunham, 2003) KDD is viewed as a process of discovering useful knowledge based on its entire process which comprises of five steps. These include data selection, data preprocessing, data transformation, data mining and interpretation/evaluation. In order for the KDD methodology to function these steps must seamlessly support each other for data to be transparent. Data Selection- obtain data from multiple sources

- Data Preprocessing- cleanse data
- Data Transformation- Convert data to common format
- Data Mining- obtain designed results
- Interpretation/ Evaluation- Present results to user in relevant matter

The authors (Fayyad, et al., 1996) continue to explain that the KDD methodology is rather complex and thus can be categorized into two statements. The type of data searched and what form does the result of the search shows can be seen in Figure 6.

KDD is designed on finding correlations or comprehensible patterns which may be useful for the user while it works with real time data. (Hernandez-Orallo, 2004) states that prior to any KDD project a business and data understanding through data integration is a necessity in order to recognize the requirements thus aligning business processes, business goals with the desired outcome of data to solve the issues at hand.
3.3.3 Scoring Models

“A scoring model is a formula that assigns points based on known information to predict an unknown future outcome.” (Perrine, 2007). The most used scoring model is the “credit score” which supports decision makers to make a prediction on the probability if a customer will default a loan or not. The Scoring models help to determine if a loan application will be accepted or rejected (Perrine, 2007).

Data mining applications create models which can be used to make predictions for new data (Kurt, 2010). Historical data lay the foundation for the model is it derives decision making at later processes. DM and predictive modeling tools aim to apply historical data to new data in order to predict customer behavior. The process of prediction making about unseen behavior is called scoring as the output will be defined as score. Scores are most often numbers that define probability but they can also be strings or data structures (Kurt, 2010). This process is illustrated in Figure 7.

Once a model has been created by a data mining application, the model can then be used to make predictions for new data. The process of using the model is distinct from the process that creates the model. Typically, a model is used multiple times after it is created to score different databases. For example, consider a model that has been created to predict the probability that a customer will purchase something from a catalog if it is sent to them. The model would be built by using historical data from customers and prospects that were sent catalogs, as well as information about what they bought (if anything) from the catalogs. During the model-building process, the data mining application would use information about the existing customers to build and validate the model. In the end, the result is a model that would take details about the customer (or prospects) as inputs and generate a number between 0 and 1 as the output (Kurt, 2010), as shown in Figure 7.
Scoring is often a technique that fits inside a much larger process such as DM or database marketing the process consists of six steps as follows; (Kurt, 2010)

- The initiation of the process starts off with DB containing information about customers. The DB might be part of a larger data warehouse or a smaller grind.
- A marketer identifies a segmented target group of customers within the DB. A segment is a defined group of customers with similar attributes. For instance, a segment might be defined as existing customers between the ages 18-30 with an account balance of 1000USD and no overdue payments over the last year. To the bank these might be the new customer base they target and a marketing plan is built especially according to them.
- The segmented group is the scored using a predictive model as the bank scores the customers using 0 and 1’s in establishing the probability. These scores are entered in a DB table in relevance to customer ID.
- Having finished with the scoring customer must be sorted according to their value. For instance, top 15% will receive a discount offer to their credit card and a DB data will be made with just these customers.
- Identifying these top 15% all their contact information, (names and addresses) will be extracted from the DW.
- At last these customers and their contact information will be sent to a mailing company or an internal part of the company that handles mailing in order to offer the customer the discount.

3.3.4 Critical Success Factors in Data Mining

According to (Hermiz, 1999), “Data mining is an evolving technology whose implementation in the future will become mandatory in order for business organizations to remain competitive. Data warehousing was perceived as providing a competitive advantage during its dawning. It has now become a competitive imperative”.

The article mentions four main critical success factors which organizations need to consider in a given situation for a successful data mining initiative (Hermiz, 1999):
• The organization needs to have a sound business problem which it acquires a solution for, and data mining technology is the right choice for solving this problem. Example in banking: Who are my best customers? How do my customers behave in transactions? How many customers are in debt and how many are using credit cards less frequently?

• The banks need to make sure that there is enough data to analyze as well as assure quality of data. The organizations have to know which methods are the best to use in analyzing algorithms. Example: for detecting a credit card fraud, the banks need historical data on the consumer, such as the history of the transactions.

• The data mining process needs to be managed as exploratory data analysis. Organizations must ensure that the analysts are trained well and deduct the correct information which serves the purposes of the problem in the first place. Example: If the analysis is about searching for customer attrition, the organization needs a time frame with checkpoints on which data transformation can be difficult to attain as data changes and fluctuates, thus proceeding with prediction.

• The process of using data mining should be a learning experience. There are no guarantees that the projects which involve the usage of data mining will yield successful outcomes. Knowledge and experience are key skills which support people who seek to extract information which delivers valuable opportunities for organizations.

3.3.5 Previous Research in Data Mining projects

Two of the authors who have conducted research about the use of DM in various contexts related to organizational environment are: Coppock (2003), and Hermiz (1999), (Pechenizkiy, et al., 2008). Coppock (2003), (Pechenizkiy, et al., 2008, p. 18) has analyzed what the failure factors of DM-related projects are and he found four main factors as follows: “(1) persons in charge of the project did not formulate actionable insights, (2) the sponsors of the work did not communicate the insights derived to key constituents, (3) the results do not agree with institutional truths, and (4) the project never had a sponsor and champion.” Based on these findings, he concluded, that communication, the organizational culture and leadership are as important as the technological aspects of the use of DM when data extracted delivers value. On the other hand Hermiz (1999) (Pechenizkiy, et al., 2008) found four critical success factors for DM projects as follows: 1) organizations have a sound business problem and DM is the right tool to for it, 2) when pursuing the problem, the organization need to ensure the right type of data and sufficient quality and quantity of data is delivered to DM, 3) DM is a complex process and needs to be managed accordingly, and 4) the project of using DM as a tool to control the business problem should be a process of learning, regardless of the outcome, as well as there is no guarantee that the process will be successful.
Company Description—Swedbank

Company Background - Swedbank

Swedbank was created in 1820. Its main purpose from the beginning was to work close to its customers. Swedbank offers a wide variety of services for both private individuals and companies in Sweden, Estonia, Latvia and Lithuania. Swedbank focuses more on a traditional bank model which employees close relationships with customers and emphasizes personal advice as stated by Swedbank in the Annual Report 2011 (Swedbank, 2011, p. 46) “to promote a sound and sustainable financial situation for the many households and business – is based on close customer relationships, a strong presence in the local community and outgoing employees who are attentive to customers’ needs and wishes”. Swedbank has 9.5 million retail customers and around 622,000 corporate customers and organizations with 317 branches in Sweden and over 200 branches in the Baltic countries. The group is also present in other Nordic countries, the U.S., China, Russia and Ukraine. As of 31 December, 2011 the group had total assets of SEK 1 857 billion (Swedbank, 2011).

Swedbank is organized in six business areas: Retail, Large Corporations and Institutions, Baltic Banking, Asset Management, Russia & Ukraine and Ektornet. Each of these business areas is supported by seven group functions as follows: Group functions: Accounting & Finance, Risk, Compliance, Corporate Affairs, HR, Legal Affairs and Group Business Support.

Swedbank Strategy

- **Swedbank is a bank for the many** – The main purpose of Swedbank is to serve as many households and businesses as possible with simple and complex financial needs. Long-lasting customer relationship is a main aim at Swedbank when it comes to its markets (Swedbank, 2011).

- **“We shall be close to our customers”** (Swedbank, 2011, p. 9). Swedbank in well aware of the fact that it needs to serve its best services and needs to the customers. It focuses on getting close to the customers by understanding complex situations and find solutions on how to support them in solving these issues. Swedbank enforces advisors to coordinate and construct services through dialog with customers in order to build closeness and long term profitability for both the bank and the customers. The closeness is achieved through various service channels and innovations solutions such as Internet Bank, Telephone Bank and Mobile Bank (Swedbank, 2011).

- **Maintaining a low risk level** – Swedbank maintains its low risk level by ensuring a sound risk management in plan which supports decisions and takes a proactive stance in mitigating various types of risks that can threaten the bank (Swedbank, 2012).
5 Analysis

In the analysis section the authors will identify with the help of the empirical data (see Appendix B), theoretical literature review and secondary data what factors affect customer retention in banking industry when Data mining supports Risk management in the decision making process in order for customers to be retained at the bank.

The framework for conducting the analysis from a Critical Realist perspective was created by the authors and has the following steps;

1. Identification of levels of aggregation
2. Identification of causal powers and liabilities of entities/structures (Test A)
3. Identifying relations between entities in order to identify causal mechanisms (Test A + Test B) (Sayer’s model)
4. Identification and evaluation of possible causal mechanisms
5. Assessment of Causal Mechanisms
6. Finalized conceptual model based on resulted findings
7. Validation of findings

During the process of scrutinizing the primary data and due to the limitations on the scope of research the authors have chosen to make two assumptions on two variables which describe final events. They are as follows;

- If customer receives a loan, the customer will stay with the bank, thus the customer is retained.
- If customer does not receive the loan, the customer might leave the bank thus the customer is not retained.

These assumptions were made based on Symptom mode of abducting reasoning and with the assistance of the theoretical framework. Theses inferences can be validated by arguing that if the customer receives a loan, he/she is already bound to stay with the bank, hence customer retention. If the customer does not receive the loan, the risk or possibility of customer leaving the bank will emerge and will imply that the customer is not being retained.

5.1 Identification levels of aggregation

When determining how many levels of aggregation should be analyzed, the authors have first considered the final events which are; customer being retained and customer not being retained. The next step was to scrutinize the empirical primary data (see Appendix B). Words such as advisor, scoring model, customer behavior, customer loyalty and Upplysningscentral were constantly repeated by the respondent in the context of customer retention. Based on the evidence available from the empirical data these concepts have become keywords structures in the analysis. Prior to the interview, entities were identified from the research question as follows: Data Mining (DM), Risk Management (RM) and Customer Retention (CR). The remaining structures Decentralized
**Decision making and Services Offered** were revealed from secondary data issued by Swedbank (Swedbank, 2011) and (Tudre & Adamson, 2011) while trying to understand the information flow process between Data Mining, Risk Management and Critical Realism. Entities are essential concepts in analysis of Critical Realism. An entity can have numerous structures and structures can have other structures within. An example is shown bellow in Figure 8.

![Risk Management - entity](image)

**Figure 8 Entities and Structures.**

The next step was to identify the boundary of the system and how it was set to the organization (Swedbank). To reveal all the entities and the structures involved, the authors have modeled the information flow process between entities with the assistance of empirical data (see Appendix B) and secondary data from Swedbank (Swedbank, 2011), (Tudre & Adamson, 2011). The picture below (see Figure 9) describes the information flow process between Data Mining, Risk Management and Customer Retention.

![High Level of Abstraction](image)

**Figure 9 Information flow process between Data Mining-Risk Management-Customer Retention**

The model contains: Data Mining (DM), Scoring model (SM), Risk Management (RM), Advisor (A), Customer Retention (CR), Customer (C), Upplysningscentral (UP). The model is explained as follows:

1. Customer requests loan.

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2. Advisor inquires information about customer’s financial situation from UP.
3. UP sends information back to the advisor.
4. Based on the information from UP, advisor inquires information from Scoring Model.
5. Scoring Model requests data from Data Mining.
6. Data Mining sends data to Scoring Model compiling it into information.
7. Scoring Model sends information back to advisor.
8. Advisor assesses risk with the help of information received from Scoring Model.
9. Risk Management delivers knowledge to advisor.
10. Advisor takes a decision if customer receives the loan, hence customer is retained in the bank or if customer does not receive the loan, thus customer is not retained in the bank.

The next step was set the levels of aggregation where Data Mining, Risk Management and Customer Retention are on a higher level of aggregation while the Scoring Model, Advisor and Customer are on a lower level of aggregation as explained below and shown in Figure 10:

- Entity Data Mining (DM) has structure Scoring Model (SM) and within structure SM there are structures: “Customer Behavior” and “Customer Loyalty”
- Entity Risk Management (RM) has structure Advisor and within structure Advisor there are structures: “Services Offered” and “Decentralized Decision Making”
- Entity Customer Retention (CR) has structure “Customer”
- Entity UC (Upplysningscentral) is an entity outside the boundary system which can cause changes that affect the outcome of the process between DM-RM to support CR

![Figure 10 Levels of aggregation between Data Mining (DM), Risk Management (RM) and Customer Retention (CR)](image-url)
5.2 Identification of causal powers and liabilities of entities and structures (Test A)

After scrutinizing the information flow in the context of entities and structures, the authors used abductive reasoning to identify possible causes and inferred hypothesis on possible causal powers and liabilities. The process was complex, iterative and derived from empirical data (see Appendix B), secondary data (Tudre & Adamson, 2007 – 2011), (Swedbank, 2012) and the frame of reference. This procedure was considered Test A in analysis (see 9.1). One example is illustrated below in Table 2 where the Scoring Model has the power to provide predictive information for Decision Making Authority with the liability to be misinterpreted and to be poorly developed.

Table 2 Example of Test A

<table>
<thead>
<tr>
<th>Causal Powers(CP)</th>
<th>Liabilities(l)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CP1. Provide predictive information for Decision Making authority</td>
<td>l1. Be misinterpreted</td>
</tr>
<tr>
<td>CP2. Reduce loan approval processing time</td>
<td>l2. Be poor developed</td>
</tr>
<tr>
<td>CP3. Control risk selection</td>
<td></td>
</tr>
<tr>
<td>CP4. Streamline the loan approval process</td>
<td></td>
</tr>
</tbody>
</table>

5.3 Identifying relations between entities in order to identify causal mechanisms (Test A + Test B) (Sayer’s model)

In this step Diagnosis/Scenario mode of inference was used to create possible scenarios and identify the necessary and contingent relations between the entities. This was based on the combinations between causal powers and liabilities of entities and structures identified in Test A (see 9.1). The authors picked only the relevant combinations of causal powers and liabilities. Test B (see 9.2) was about identifying if the relations between structures were necessary or contingent. The purpose for test B was to involve the possibility to reason in order to create a general plausible explanation. The causal powers from structures can only generate an event if they are triggered when specific conditions are met. An example is shown in Table 3.
### Table 3 Example of Test A + Test B

| Structures Customer loyalty, Customer Behavior – Structure Decentralized Decision making |
|---|---|---|
| **Test A** | **Test B** | **Events-Non Events** |
| **Object X having structure S………necessarily possessing causal powers(CP) and liabilities(l)** | **Under specific conditions(c ) will produce** | **e1, e2- customer request is sent to higher decision making authority** |
| **Object SM with structures Customer loyalty, Customer Behavior** | **C1 If Object Advisor with structure Decentralized decision-making** |  |
| o. CP1. Generates data to be used by advisor | o. CP1. Enable fast decision making |  |
| o. CP2. Provide information about customer behavior | o. CP2. Enables local decision making |  |
| - 11 no prior credit history with the bank | - 11. Local Decision making authority unable to take a decision about customer request |  |
| - 12 Customer changes behavior | - 12 bias judgment |  |
| - 13 Advisor adopts bias judgment |  |  |

In the example above, there are two entities which can affect the outcome of an event. Object Scoring Model with structure customer loyalty with its causal powers and liabilities has the power to affect the outcome of an event only if the object Advisor with structure Decentralize decision-making with its causal powers and liabilities “enables fast decision making” would result in e3 “customer receives the loan”.

### 5.4 Identification and evaluation of possible causal mechanisms

This stage of analysis was conducted in three steps:

1. Creating a set of all combinations of powers and liabilities of two entities
2. Create a subset of plausible causal mechanisms and test them by using retroduction.
3. Chose the plausible causal mechanisms that might result in the events under investigation from subsets created in step 2.

These stages were not followed strictly as the authors had to iterate some steps while trying to identify possible causal mechanisms.

The authors took two entities, Entity1 and Entity2 simultaneously while treating Entity 2 with its causal powers and liabilities as a condition to see if the powers and liabilities of E1 triggers the event under investigation (customer receives loan/customer does not receive loan). This procedure was repeated for all structures involved in the lower level.
of aggregation. Each causal power from a structure was tested to see if it triggers some event under the conditions from another structure with its powers and liabilities. The relations which did not match were eliminated. During this process retroduction was used to understand if the generated events have emerged under the conditions triggered. After considering all possible relations, the causal mechanisms were described by using metaphorical concepts. It was a process of identification and evaluation at the same time. The following abbreviations and concepts will be used in the causal explanations: Objects, structures, conditions (c), liabilities (l), and causal powers (CP), and causal mechanisms (CM), and events (e). All the acronyms and concepts are explained in the section 2.5. The relations between entities and structures are described in 9.2 where necessary and contingent relations are identified.

5.4.1 Causal Analysis of relations between entities and structures

The analysis is based on the tables in appendix 9.2.

a. Table 14 Test A + Test B (Customer Loyalty, Customer Behavior, Decentralized Decision Making)

Object Scoring Model having structures Customer Loyalty, Customer Behavior and necessarily having the powers to generate data to be used by Advisor, who is another object and provide information about customer behavior with liabilities: no prior credit history with the bank; customer changes behavior; advisor adopts bias judgment will, under specific conditions (c):

- If the Object Advisor with Structure Decentralized Decision Making enables fast decision making and local decision making authority is unable to take a decision about customer request will result in e1 customer request is sent to higher decision making authority.

Test A (CP1, l1) + Test B (CP1, l1, l2) = e1 CM – Pressure of responsibility

- If Object Advisor with Structure Decentralized Decision Making enables local decision making with liability that local decision making authority is unable to take a decision about customer results in e2 customer request is sent to higher decision making authority

Test A (CP2, l2, l3) + Test B (CP2 l1, l2) = e2, CM- Pressure of responsibility

b. Table 15 Test A + Test B (Decentralized decision Making, Customer Loyalty, Customer Behavior)

Object Advisor having structure Decentralized Decision Making and necessarily possessing causal powers to enable fast decisions making; enable local decision making and liabilities: local decision making authority unable to take a decision about customer request; bias judgment will under specific conditions(c):

- If object Scoring Model with structure Customer Loyalty generates data to be used by the advisor with the liability that there is no prior credit history with the
bank will result in e1 customer request is sent to a higher power of decision making authority
Test A (CP2, l1, l2) + Test B (CP1, l1) = e1, CM - Pressure of Responsibility

- If object Scoring Model with structure Customer Behavior provides information about customer behavior with the liability that customer changes behavior result in e2 customer does not receive the loan
Test A (CP1, l2) + Test B (CP1, CP2, l2) = e2, CM – Customer Behavior

- If object Scoring Model with structure Customer Behavior provides information about customer behavior with liability advisor adopts bias judgment will result in e3 customer does not receives the loan
Test A (CP2, l2) + Test B (CP2, l2, l3) = e3, CM - Pressure of Responsibility

c. Table 16 Test A + Test B (Customer Loyalty, Customer Behavior, Services Offered)

Object Scoring Model having structures Customer Behavior, Customer Loyalty and necessarily possessing causal powers to generate data to be used by the advisor and provide information about customer behavior and liabilities: no prior credit history with the bank; Customer changes behavior; Advisor adopts bias judgment, will under specific conditions(c):

- If the object Advisor with structure Services Offered motivates consumer to consume more services but the services may be affected by employee competence and if entity Customer Retention with structure Customer and causal powers to request a loan and liability to not be satisfied with the service, it will result in e1 customer does not receive loan.
Test A (CP1, l1, l3) + Test B c1 (CP1, l1,) + c2 (CP1, l2) = e1, CM – Employee competence

- If the object Advisor with structure Services Offered fulfills customer expectation but the services might be affected by employee competence, it will result in e2, customer does not receive loan. (Advisor makes bias decision)
Test A (CP1, CP2, l1, l3) + Test B (CP2, l1, l2) = e2, CM – Employee competence

d. Table 17 Test A + Test B (Services Offered, Structures Customer Loyalty, Customer Behavior)

Object Advisor having Structure Services offered and necessarily possessing causal powers to: motivate customer to consume more service; to fulfill customer expectation; to overwhelm customers by complexity and liabilities: might be affected by employee competence; might be affected by internal processes, will under specific conditions(c):

- If object Scoring Model with structure Customer loyalty, Customer Behavior generates data to be used by the advisor and the liability that the advisor adopts bias judgment and if object Advisor with structure Decentralized Decision Mak-
ing with causal power to enable decision making, it will result in \( e_1: \) customer receives the loan.

Test A (CP1, l1) + Test B c1 (CP1, l1) + c2 (CP1,) = e1, \( CM - Bias \) judgment, employee competence

- If object Scoring Model with structures Customer loyalty, Customer Behavior provides information about customer behavior with liabilities: no prior credit history with the bank; advisor adopts bias judgment, and if object Advisor with structure Decentralized Decision Making with causal power to enable local decision making and liability bias judgment, it will result in \( e_2 \) customer does not receive loan

Test A (CP1, l1) + Test B (CP1, CP2, l3) + c2 (CP2, l2) = e2, \( CM - Bias \) judgment

- If object Scoring Model with structures Customer loyalty, Customer Behavior generates data to be used by the advisor with liabilities no prior credit history with the bank, it will result in \( e_3 \) customer receives loan

Test A (CP2, l2) + Test B (CP1, l1) = e3, customer is retained

- If object Scoring Model with structures Customer loyalty, Customer Behavior provides information about customer behavior with liability that advisor adopts bias judgment, it will result in \( e_4 \) customer does not receive loan

Test A (CP1, CP3, l1, l2) + Test B (CP2, l2, l3) = e4, \( CM - Bias \) judgment

- If object Scoring Model with structures Customer loyalty, Customer Behavior generates data to be used by the advisor with liabilities that advisor adopts bias judgment, it will result in \( e_5 \) customer does not receive loan

Test A (CP3, l1) + Test B (CP1, l3) = e5, \( CM - Bias \) judgment

e. Table 18 Test A + Test B (Customer, Services Offered)

Object Customer Retention having structure Customer and necessarily possessing causal powers to: request a loan; inquire about services; and overwhelms the customer by complexity and liabilities: incapable of paying back; not satisfied with the service, will under specific conditions (c):

- If object Advisor with structure Services Offered motivates customer to consume more services and overwhelms customer by complexity with the liability to be affected by employee competence, it will result in \( e_1 \) customer does not receive loan

Test A (CP1, l3) + Test B (CP1, CP3, l1) = e1, \( CM - Employee \) competence

- If Object Advisor with structure Services Offered overwhelms the customer by complexity with the liabilities: to be affected by employee competence; to be affected by internal processes, it will result in \( e_2 \) customer refuses loan

Test A (CP2, l2) + Test B (CP3, l1, l2) = e2, \( CM - Employee \) competence
• If Object Advisor with structure Services Offered overwhelms the customer by complexity with liabilities to be affected by employee competence and to be affected by internal processes, it will result in e3, customer does not receive loan
  Test A (CP1, CP2, l1, l3) + Test B (CP1, CP3, l1, l2) =e3, CM - Employee competence

d. Table 19 Test A + Test B (Services- Structure Customer)

Object Advisor having Structure Services Offered and necessarily possessing causal powers to: motivates customer to consume more service; fulfill customer needs; overwhelms customers by complexity and liabilities: may be affected by employee competence; may be affected by internal processes, will under specific conditions(c):

• If object Customer Retention with structure Customer requests a loan with liabilities: not satisfied with the service; customer might be overwhelmed by the complexity of the services, it will result e1 customer does not receive a loan
  Test A (CP1, l1) + Test B (CP1, l2, l3) = e1, CM – Complexity of Services Offered

• If object Customer Retention with structure Customer inquires about services with liabilities not satisfied by the service; customer might be overwhelmed by the complexity of the services, it will result in e2 customer does not receive the loan
  Test A (CP3, l3) + Test B (CP2, l2, l3) = e2, CM – Complexity of Services Offered

• If object Customer Retention with structure Customer inquire about services with the liabilities: incapable of paying back; not being satisfied with the service; customer might be overwhelmed by the complexity of services, it will result in e3 customer does not receive loan
  Test A (CP2, l1, l2) + Test B (CP2, l1, l2, l3) =e3, CM – Complexity of Services Offered

g. Table 20 Test A + Test B (Scoring Model, Advisor)

Object Data Mining having structure Scoring Model and necessarily possessing causal powers to: provide predictive info for Decision Making authority; reduce loan approval processing time; control risk selection and Streamline the loan approval process with liabilities: to be misinterpreted, be poor developed will under specific conditions(c):

• If object Risk Management with structure Advisor makes a loan decision and Inquire information from Upplysningscentral with liabilities: advisor adopts bias judgment and pressure of responsibility, it will result in e1 customer does not receive the loan
  Test A (CP1, l1) + Test B (CP1CP2, l1, l2) = e1, CM - Employee competence

• If object Risk Management with structure Advisor inquires information from Scoring Model with liabilities: advisor adopts bias judgment; pressure of re-
sponsibility; misinterpret scoring model, it will result in **e2 customer does not receive the loan**
Test A (CP2, CP3, l2) + Test B (CP3, l1, l2, l3) = e2, **CM – Pressure of Responsibility**

- *If* object **Risk Management** with structure **Advisor** has the power to enable decision making with liability pressure of responsibility, it will result in **e3 customer request is sent to a higher power of decision making authority**
Test A (CP4, l1) + Test B (CP4, l2) = e3, **CM – Pressure of Responsibility**

Some causal powers in the SM Structure such as “Provide predictive info for Decision Making authority” and “Reduce loan approval processing time” are causal powers which have emerged from a lower level. The powers of the structures (customer loyalty and Customer Behavior) within structure(SM) are not to be considered summative when defining the causal properties at the higher level structure such as the Scoring Model. There are other causal powers and properties emerging from other structures which affect the way a higher structure causes changes within its properties. In this case “controlling risk selection and affect time decision are emerging powers in the SM structure.

**h. Table 21 Test A + Test B (Advisor, Customer)**

Object **Risk Management** having structure **Advisor** and necessarily possessing causal powers to: make loan decisions; inquire information from Upplysningscentral; inquire information from Scoring Model; to enable decision making and liabilities; advisor adopts bias judgment; pressure of responsibility; misinterpret scoring model; unable to make a decision will under specific conditions(c):

- *If* object **Customer Retention** with structure **Customer** requests a loan, inquire about services with liabilities: not satisfied with the service; customer might be overwhelmed by the complexity of the services, it will result in **e1 customer does not receive loan**
Test A (CP1, CP2, l1, l2) + Test B (CP1, CP2, l2, l3) = e1, **CM – Complexity of Services**

- *If* object **Customer Retention** with structure **Customer** requests a loan with liability customer might be overwhelmed by the complexity of the services, it will result in **e2 customer does not receive the loan**
Test A (CP3, l3) + Test B (CP1, l3) = e2, **CM - Employee Competence**

- *If* object **Customer Retention** with structure **Customer** requests a loan; inquire about services with liability customer might be overwhelmed by the complexity of the services, it will result in **e3 customer request is sent to higher decision making authority**
Test A (CP4, l4, l2, l3) + Test B (CP1, CP2, l3) = e3, **CM – Pressure of Responsibility**
5.5 Assessment of Causal Mechanisms

Each of the causal mechanisms (CM) was tested with the help of retroduction by going back chronologically. Because CMs are multi-explanatory in their nature and adopt a “rich source of explanatory devices” (Easton, 2009, p. 122) a linguistic form can be used and assign metaphorical expressions to each of the CM. Figure 11 (Sayer, 1992, p. 117) describes which causal mechanisms generate which events according to the results from the causal analysis, whereas in Table 4 acronyms are explained.

<table>
<thead>
<tr>
<th>Events(e)</th>
<th>Causal Mechanisms(CM)</th>
<th>Structures(S)</th>
<th>Entities</th>
</tr>
</thead>
<tbody>
<tr>
<td>E1 - Customer request is sent to higher decision making authority</td>
<td>CM1 - pressure of responsibility</td>
<td>S1 - Advisor</td>
<td>Entity 1 - DM</td>
</tr>
<tr>
<td>E2 - Customer does not receive the loan</td>
<td>CM2 - Employee competence</td>
<td>S2 - SM</td>
<td>Entity 2 - RM</td>
</tr>
<tr>
<td>E3 - Customer receives</td>
<td>CM3 - Bias judgment</td>
<td>S3 Customer Behavior/Customer Loyalty</td>
<td>Entity 3 - Customer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>S4 - Decentralized Decision Making</td>
<td></td>
</tr>
</tbody>
</table>

Figure 11 Structures, mechanisms and events. Source adapted from (Sayer, 1992, p. 117)
CM1 - *pressure of responsibility* causes **E1** (Customer decision is sent to higher decision making authority), **E2** (Customer does not receive loan).

When the advisor is under pressure of responsibility he/she might be avoidant to take risks and the decision is sent to a higher authority power. On the other hand, under the pressure of responsibility the advisor might take the decision to deny a customer loan.

**CM2 – Employee competence** causes **E2** (Customer does not receive the loan), **E3** (Customer receives loan)

This causal mechanisms when triggered results in one of two events. If the employees (in this case the advisor) are incompetent, he/she might be inclined to make decision based on his/her subjective judgment. This way it creates a condition for CM3.

**CM3 – Bias judgment** causes **E2** (Customer does not receive the loan), **E3** Customer receives loan

This causal mechanism results in any of the two events of interest, depending on the conditions present. These conditions determine which of the two events will occur. If the advisor decides to base his decision on the SM and if the SM is poorly developed he/she makes biased decision and it will result in one of the two events E1, E2.

**CM4 - Complexity of Services** causes **E2** (Customer does not receive the loan), **E4** (Customer refuses loan)

The result of this mechanism might not be directly observable. If the services are too complex for the customer to use and the employee is not competent, customer might feel intimidated and he/she refuses to use the service (E4), consequently he/she does not receive the loan (E2)

**CM5 – Customer behavior** causes **E2** (Customer does not receive the loan)

This causal mechanism causes the event customer does not receive loan only if the advisor take a decision based on the information received from data storage and If the customer behavior is not acceptable.

**5.6 Finalized conceptual model based on resulted findings**

The resulted conceptual model based on the findings of causal analysis is defined Figure 12.
The model is based on the three layers from Critical Realism:

- **Real**: indicates where the causal mechanisms were identified. The *real* includes the powers and liabilities from all entities and structures involved in the analysis where entities Data Mining (DM) contains structures: Scoring Model(SM), Customer Behavior and Customer Loyalty, entity Risk Management (RM) contains structures: Advisor, Services Offered and Decentralized Decision Making, and entity Customer Retention contains structure Customer. The cubicles represent the 5 causal mechanisms (CM) identified by the authors: **CM1** - pressure of responsibility, **CM2** - Employee competence, **CM3** - Bias judgment, **CM4** - Complexity of services, **CM5** - Customer behavior.

- **Actual**: indicates the actual events triggered by the causal mechanism under contingent conditions and they are: **E1** - Customer request is sent to higher decision making authority, **E2** - Customer does not receive the loan, **E3** - Customer receives loan, **E4** - Customer refuses loan. According to empirical data gathered from the interview some of these events are visible on the empirical level as well. This is the case of **E1**.

- **Empirical**: indicates the empirical events experienced by investigators: *Customer is retained* and *Customer is not retained*.

Figure 12 *Causal mechanisms which affect customer retention*
5.7 Validation of findings

5.7.1 Validation assessment for Construct Validity

To pass this test the authors have used the empirical data from the respondent and secondary data collection issued by Swedbank (Swedbank, 2011). Identification of empirical traces to the actual events uncovered by the authors can be seen in Table 5.

Table 5 Construct Validity

<table>
<thead>
<tr>
<th>Empirical evidence</th>
<th>Actual events generated by Mechanisms</th>
</tr>
</thead>
<tbody>
<tr>
<td>We have personal meetings with customers to examine the loan seekers financial situation.</td>
<td>• Decision making is sent to a higher authority.</td>
</tr>
<tr>
<td></td>
<td>• Customer receives loan</td>
</tr>
<tr>
<td></td>
<td>• Customer does not receive loan</td>
</tr>
<tr>
<td>if the loan seeker wants to borrow money to purchase a house, the banks consultant examines various factors to match the risk of lending the capital</td>
<td>• decision making is sent to a higher authority</td>
</tr>
<tr>
<td></td>
<td>• Customer receives loan</td>
</tr>
<tr>
<td></td>
<td>• Customer does not receive loan</td>
</tr>
<tr>
<td>Two parts determine if the loan seeker is allowed to borrow money. The ability to pay the loan back (risk management)</td>
<td>• Customer does not receive loan</td>
</tr>
<tr>
<td></td>
<td>• Customer receives loan</td>
</tr>
<tr>
<td>What’s the amount, and for what? (the amount is matched with the borrowers intentions to give the bank security in case of default)</td>
<td>• Customer does not receive loan</td>
</tr>
<tr>
<td></td>
<td>• Customer receives loan</td>
</tr>
<tr>
<td>The decision if a customer is granted a loan is made by duality. Either a consultant takes a decision based on information or a committee takes the decision when larger amount are asked for.</td>
<td>• customer request is sent to a higher power of decision making authority</td>
</tr>
</tbody>
</table>

5.7.2 Validation assessment for Internal Validity

There are three main factors which contribute to internal validation in Critical Realism, and they are: “(a) explanation of the mechanism, (b) confirmation that the mechanism has operated as described, and (c) elimination of alternative explanations” (Hart & Gregor, 2010, p. 40).

a) Explanation of the mechanism. The mechanisms were explained thoroughly by the authors in section 5.5.

b) Confirmation that the mechanisms have operated as described.
Because it is not possible to test the causal mechanisms in natural setting such as bank environment, the authors have used the tool “thought experiment”\(^1\). The authors have taken the correct steps and avoided fallacy in testing the causal mechanisms when using “thought experiment”.

c) **Elimination of alternative explanations.**

For elimination of the alternative explanations, all three investigators were involved in the analysis and the causal mechanisms were tested individually by each one of them. “Thought experiments” were used by triggering the possible causal mechanism to see if it generates the event of interest. If a given causal mechanism did not generate the expected event, it was ruled out. This meant that if there was no association between the given causal mechanism and the event then the possible causal mechanism was ruled out.

### 5.7.3 Validation assessment for External Validity

The validation test within External validity is to demonstrate that the causal mechanisms identified in this research can be uncovered in the same setting of research areas or if they are representative to other settings. The causal mechanisms identified under this investigation may or may not be applicable to the same settings such as banking environments. The powers and liabilities for each of the structures and entities were identified by reviewing the theoretical framework and secondary data collection. In open systems the elements of a social open system might change by learning even though some powers and liabilities might persist over time. Data Mining, Risk Management and Customer Retention are key entities in the banking industry. These entities may have the same structures within other banking environments settings and between the structures there may be the same necessary relations, but the contingent relations from one banking environment to another changes.

\(^1\) *Stanford Encyclopedia of Philosophy* “**Thought experiments** are devices of the imagination used to investigate the nature of things. Thought experimenting often takes place when the method of variation is employed in entertaining imaginative suppositions.” Retrieved from [http://plato.stanford.edu/entries/thought-experiment/](http://plato.stanford.edu/entries/thought-experiment/)
6 Conclusions

The purpose of this research was to find out what factors affect customer retention in the banking industry when Data mining supports Risk management in the decision making process. The factors identified by the authors based on the analysis conducted under Critical Realism perspective are the following:

- Pressure of responsibility
- Employee competence
- Bias judgment
- Complexity of services
- Customer behavior

These factors are considered possible reasons identified within the limits of this investigation for why banks succeed or fail in achieving customer retention. As Swedbank is an open social system and its constituents are capable of learning and changing over time. The entities and factors uncovered in the analysis will also change over time.

6.1 Main Contribution of the thesis

Main contributions of this research concern two main fields as follows:

Contribution to scientific methodology

Within scientific methodology the contribution is to demonstrate the application of Critical Realism philosophy in research practice and to prove it as a powerful tool for conducting scientific research in Information Systems. Previous research investigations within data mining and risk management have considered technological issues and statistical analysis on determining the potential of data mining in organizations and how the value derived from data mining supports organizations in the decision making process. Throughout this investigation the authors have presented another perspective on how data derived from data mining together with the decision making authority from risk management can support the bank in customer retention.

Contribution from practical perspective

The results derived from this investigation can support banking industry to assess a better understanding on how to value customer satisfaction in order to achieve customer retention. Additionally this research can support the banking industry to understand internal communication conflicts between departments that may lead to taking the wrong decisions in regards to retaining customers. The hidden factors revealed in this investigation belong to both data mining and risk management. Both of them support the bank into the decision making process when it comes to retaining customers. As a result, it is important for the bank to understand the nature of these factors. In concluding, this research can support the banking industry to assess a more efficient way to understand internal communications issues. These issues affect the way departments such as Risk
Management and Data mining carry the wrong decisions when it comes to retaining customers.

6.2 Limitations

During the research the authors have made the area of investigation as narrow as possible. The reason for that is because banking environment is vast and complex with large number of interactions between intra-organizational departments which might affect customer retention. The authors have only considered the lending services to private customers in order to determine if customers are retained or not. Since the authors have only chosen the lending services and Swedbank offers more than lending services to its customers, then the number of factors which affect customer retention is higher. That also implies that additional departments from the bank need to be investigated. As a result a further research proposal is discussed by the authors below.

6.3 Further Research proposal

This research does not claim for completeness as the authors have chosen few of the structures within the process between Data Mining and Risk Management decisions. As a result the authors are suggesting a research proposal for identifying additional structures from marketing department which will have an impact on how additional entities contribute to customer retention.
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[Accessed March 2012].


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Appendices

Appendix A  Interview questions

Table 6 Interview questions

<table>
<thead>
<tr>
<th>Questionnaire design for Swedbank</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Which is more important for Swedbank Sweden and brings more value, to retain customers and/or to attract new customers?</td>
</tr>
<tr>
<td>2. How does the flow of information spread from the lowest level database to risk management and finally decision making to achieve customer retention?</td>
</tr>
<tr>
<td>3. Which are the main departments involved in taking decisions about customer retention between Data Mining &amp; Risk Management?</td>
</tr>
<tr>
<td>4. How often does Swedbank analyze Customer Retention?</td>
</tr>
<tr>
<td>5. Which specific Risk Management techniques are used to retain customers through the usage of knowledge discovery in databases?</td>
</tr>
<tr>
<td>6. Can you name the support systems in knowledge discovery in databases?</td>
</tr>
<tr>
<td>7. How do you know that the extracted data will be accurate to resolve the risks at hand when it comes to Customer Retention?</td>
</tr>
<tr>
<td>8. How do you identify customer churn?</td>
</tr>
<tr>
<td>9. Are there other departments besides Risk Management that corroborate data to insure customer retention?</td>
</tr>
</tbody>
</table>

Appendix B  Summary of the interview with Swedbank

Interview Summary with Swedbank

Interview – with regional manager from Jönköping's Swedbank- Fredrik Jutnas
The interview was recorded on the 29 of March, 2012 and lasted for 40 minutes.

Transcript summary
“More important to retain customers Swedbank’s current customers are important to us. We must commit ourselves to attend to the relationship with our customers. This is done in various ways”.

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We have personal meetings with customers to examine the loan seekers financial situation.

Swedbank attain multiple types of services for private customers, banking, housing, credit, loans, etc.

During private loan appeals, the customer contacts the bank through phone, email, or personal contact. A background check is done through UC (Upplysningscentral) to verify the customer’s financial situation and then a meeting is booked. Also, if the loan seeker is a current customer at the bank, the bank has a better understanding over the seekers financial income and spending. For example, if the loan seeker wants to borrow money to purchase a house, the bank’s consultant examines various factors to match the risk of lending the capital.

Two parts determine if the loan seeker is allowed to borrow money

- The ability to pay the loan back (risk management)
- What is the amount, and for what? (The amount is matched with the borrowers intentions to give the bank security in case of default)

The decision if a customer is granted a loan is made by duality. Either a consultant takes a decision based on information or a committee takes the decision when larger amount are asked for.

Analyzing customer loyalty

- By recognizing the services used or purchased from Swedbank.
- How long they’ve been customers
- The communication and interaction
- Through meetings and consultancy with customers

(These are some measures mentioned to determine customer loyalty)

There is a scoring model used by the bank designed with parameters

- UC-Upplysningscentral, check loan seekers current ability to pay back loans, current financial situation.
- Consultant
- The banker
- The customers and attitude towards bank
- Duality- the decision makers

There is an emphasis on the importance of meetings with the loan seekers. Information is swapped between the parties.

**Appendix C  Abbreviations**

**DM** – Data Mining

**DMS** – Data Mining Systems

**RM** – Risk Management

**IS** - Information System

**KDD** – Knowledge Discovery in Databases
Appendix D Gantt Chart

Gantt Chart

- Topic Research
- Brainstorm Research Questions
- Plan Research Approach
- Literature Research On Topic
- Design Research Question
- Search Literature On Methodology Approach
- Design Preliminary Methodology Approach
- Gather Data From Interview
- Finalize Theoretical Framework &...
- Cross Reference Data With Theoretical...
- Prepare For PM3
- Review Theoretical Framework &...
- Submit & Prepare For Presentation

# of Days to Complete
Appendix E

**Critical Realism**
Reality is non linear, but stratified.

**Empirical**
Experiences - investigator comes in contact with experiences

**Actual**
Experiences - investigator comes in contact with experiences
Events - Investigators identify the actual events.

**Real**
In this level of reality there are mechanisms which cause the events to take place which the investigator comes in contact through experiences.

Experiences – experiences of the events as investigators subjectively experiences them in the field
Event – events caused by mechanisms objective
Mechanisms – the cause of events

**Strict Empiricism**
Reality is linear.

Empirical – investigator comes in contact with experiences in the investigation field - subjective stance

Actual – investigators perceive only some events based on the experiences in the investigation field.

Figure 13 Differences between Strict Empiricism (Positivism) and Critical Realism
9 Tables

9.1 Identifications of causal powers and liabilities of entities and structures

Table 7 Test A (*Customer Behavior, Customer Loyalty*)

<table>
<thead>
<tr>
<th>Structure <em>Customer Behavior, Customer Loyalty</em> from Entity SM (information from the central data store)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Causal Powers (CP)</strong></td>
</tr>
<tr>
<td>CP1 Provide information about customer behavior</td>
</tr>
<tr>
<td>CP2 Generates data to be used by advisor</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

Table 8 Test A (*Services Offered*)

<table>
<thead>
<tr>
<th>Structure <em>Services Offered</em> from Entity <em>Advisor</em></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Causal Powers (CP)</strong></td>
</tr>
<tr>
<td>CP1 Motivates customer to consume more services</td>
</tr>
<tr>
<td>CP2 Fulfills customer expectation</td>
</tr>
<tr>
<td>CP3 Overwhelms the customer</td>
</tr>
</tbody>
</table>

Table 9 Test A (*Decentralized Decision Making*)

<table>
<thead>
<tr>
<th>Structure <em>Decentralized Decision Making</em> from Entity <em>Advisor</em></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Causal Powers (CP)</strong></td>
</tr>
<tr>
<td>CP1 Enable fast decision making</td>
</tr>
<tr>
<td>CP2 Enables local decision making</td>
</tr>
</tbody>
</table>

Table 10 Test A (*Customer*)

<table>
<thead>
<tr>
<th>Structure <em>Customer</em> from Entity <em>Customer Retention</em></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Causal Power (CP)</strong></td>
</tr>
<tr>
<td>CP1 Request a loan</td>
</tr>
<tr>
<td>CP2 Inquire about services</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
Table 11 Test A (*Scoring Model*)

<table>
<thead>
<tr>
<th>Structure Scoring Model from Entity Data Mining</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Causal Powers (CP)</strong></td>
</tr>
<tr>
<td>CP1. Provide predictive information for Decision Making authority</td>
</tr>
<tr>
<td>CP2 Reduce loan approval processing time</td>
</tr>
<tr>
<td>CP3 Control risk selection</td>
</tr>
<tr>
<td>CP4 Streamline the loan approval process</td>
</tr>
</tbody>
</table>

Table 12 Test A (*Advisor*)

<table>
<thead>
<tr>
<th>Structure Advisor from Entity Risk Management</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Causal Powers (CP)</strong></td>
</tr>
<tr>
<td>CP1 Make loan decision</td>
</tr>
<tr>
<td>CP2 Inquire information from Upplysningscentral</td>
</tr>
<tr>
<td>CP3 Inquire information from Scoring Model</td>
</tr>
<tr>
<td>CP4 Power to enable decision making</td>
</tr>
</tbody>
</table>

Table 13 Test A (*Upplysningscentral*)

<table>
<thead>
<tr>
<th>Entity Upplysningscentral</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Causal Powers (CP)</strong></td>
</tr>
<tr>
<td>CP1. Provide information</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
9.2 Relations between structures

Table 14 Test A + Test B (Customer Loyalty, Customer Behavior, Decentralized Decision Making)

<table>
<thead>
<tr>
<th>Structures Customer loyalty, Customer Behavior – Structure Decentralized Decision Making</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Test A</strong> Object X having structure S………necessarily possessing causal powers(CP) and liabilities(l)</td>
</tr>
<tr>
<td><strong>Test B</strong> Under specific conditions(c ) will produce</td>
</tr>
<tr>
<td><strong>Events-</strong> Non Events</td>
</tr>
<tr>
<td><strong>Object SM with structures Customer loyalty, Customer Behavior</strong></td>
</tr>
<tr>
<td>- CP1. Generates data to be used by advisor</td>
</tr>
<tr>
<td>- CP2. Provide information about customer behavior</td>
</tr>
<tr>
<td>- l1 no prior credit history with the bank</td>
</tr>
<tr>
<td>- l2 Customer changes behavior</td>
</tr>
<tr>
<td>- l3 Advisor adopts bias judgment</td>
</tr>
<tr>
<td><strong>c1 If Object Advisor with structure Decentralized Decision Making</strong></td>
</tr>
<tr>
<td>- CP1. Enable fast decision making</td>
</tr>
<tr>
<td>- CP2. Enables local decision making</td>
</tr>
<tr>
<td>- l1 Local Decision making authority unable to take a decision about customer request</td>
</tr>
<tr>
<td>- l2 bias judgment</td>
</tr>
<tr>
<td><strong>e1, e2-</strong> customer request is sent to higher decision making authority</td>
</tr>
</tbody>
</table>
Table 15 Test A + Test B (*Decentralized decision Making, Customer Loyalty, Customer Behavior*)

| Structure *Decentralized Decision Making* – Structures Customer Loyalty, Customer Behavior |
|---|---|---|
| **Test A** Object X having structure S………necessarily possessing causal powers(CP) and liabilities(l) | **Test B** Under specific conditions(c ) will produce | **Events** **Non Events** |
| **Object Advisor with structure *Decentralized Decision Making*** | **c1 If** Object SM with structure *Customer loyalty, Customer Behavior* | **e1 Customer request is sent to a higher power of decision making authority** |
| • CP1. Enable fast decision making  
  • CP2. Enables local decision making  
  - 11. Local Decision making authority unable to take a decision about customer request.  
  - 12 bias judgment | • CP1. Generates data to be used by advisor  
  • CP2. Provide information about customer behavior  
  -11 no prior credit history with the bank  
  -12 Customer changes behavior  
  -13 Advisor adopts bias judgment | **e2, e3 Customer does not receive the loan** |


Table 16 Test A + Test B (*Customer Loyalty, Customer Behavior, Services Offered*)

| Structures *Customer Loyalty, Customer Behavior* - Structure Services Offered |
|--------------------------------------------------|----------|----------------|
| **Test A** Object X having structure S… unnecessarily possessing causal powers(CP) and liabilities(l) |
| **Test B** Under specific conditions(c ) will produce |
| **Events** Non-events |
| **Object SM with structures Customer loyalty, Customer Behavior** | **c1 If Object Advisor with Structure Services Offered** | **e1.e2 Customer does not receive loan.** |
| - CP1. Generates data to be used by advisor | - CP1. Motivates customer to consume more services. | |
| - 11 no prior credit history with the bank | - CP3. Overwhelms the customer by complexity. | |
| - 12 Customer changes behavior | - 11. May be affected by employee competence. | |
| - 13 Advisor adopts bias judgment | - 12. May be affected by internal processes. | |
| **c2 if Object Customer Retention having structure Customer** | **Non-events** | |
| - CP1. Request a loan | | |
| - CP2. Inquire about services | | |
| - 11. Incapable of paying back | | |
| - 12. Not satisfied with the service | | |
| - 13. Customer might be overwhelmed by the complexity of the services | | |
### Table 17 Test A + Test B (*Services Offered, Structures Customer Loyalty, Customer Behavior*)

<table>
<thead>
<tr>
<th>Structure <em>Services Offered</em> – Structures <em>Customer Loyalty, Customer Behavior</em></th>
<th>Test A</th>
<th>Test B</th>
<th>Events</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Object X having structure</strong> S………necessarily possessing causal powers(CP) and liabilities(l)</td>
<td><strong>Object Advisor with Structure Services Offered</strong></td>
<td>Under specific conditions(c ) will produce</td>
<td><strong>Non Events</strong></td>
</tr>
<tr>
<td></td>
<td>● CP1. Motivates customer to consume more services</td>
<td><strong>c1 If</strong> Object SM with structures Customer Loyalty, Customer Behavior</td>
<td><strong>e1, e3</strong> Customer receives the loan</td>
</tr>
<tr>
<td></td>
<td>● CP2. Fulfills customer expectation</td>
<td>● CP1. Generates data to be used by advisor</td>
<td><strong>e2</strong>, e4, e5 customer does not receive loan</td>
</tr>
<tr>
<td></td>
<td>● CP3. Overwhelms the customer by complexity.</td>
<td>● CP2. Provide information about customer behavior</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- 11. May be affected by employee competence</td>
<td>- 11 no prior credit history with the bank</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- 12. May be affected by internal processes</td>
<td>- 12 Customer changes behavior</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>c2 If</strong> Object Advisor with structure Decentralized Decision making</td>
<td>- 13 Advisor adopts bias judgment</td>
<td></td>
</tr>
<tr>
<td></td>
<td>● CP1. Enable fast decision making</td>
<td><strong>e2</strong>, e4, e5 customer does not receive loan</td>
<td></td>
</tr>
<tr>
<td></td>
<td>● CP2. Enables local decision making</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- 11. Local Decision making authority unable to take a decision about customer request</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- 12 bias judgment</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 18 Test A + Test B (*Customer, Services Offered*)

<table>
<thead>
<tr>
<th>Structure <em>Customer</em> - Structure <em>Services</em></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Test A</strong></td>
</tr>
<tr>
<td>Object X having structure <em>S</em>...necessarily possessing causal powers(CP) and liabilities(l)</td>
</tr>
<tr>
<td><strong>Object Customer Retention having structure <em>Customer</em></strong></td>
</tr>
<tr>
<td>- CP1. Request a loan</td>
</tr>
<tr>
<td>- CP2. Inquire about services</td>
</tr>
<tr>
<td>- 11. Incapable of paying back</td>
</tr>
<tr>
<td>- 12. Not satisfied with the service</td>
</tr>
<tr>
<td>- 13. Customer might be overwhelmed by the complexity of the services</td>
</tr>
</tbody>
</table>

Table 19 Test A + Test B (*Services- Structure Customer*)

<table>
<thead>
<tr>
<th>Structure <em>Services</em> - Structure <em>Customer</em></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Test A</strong></td>
</tr>
<tr>
<td>Object X having structure <em>S</em>...necessarily possessing causal powers(CP) and liabilities(l)</td>
</tr>
<tr>
<td><strong>Object Advisor with Structure <em>Services Offered</em></strong></td>
</tr>
<tr>
<td>CP1. motivates customer to consume more services</td>
</tr>
<tr>
<td>CP2. fulfills customer expectation</td>
</tr>
<tr>
<td>CP3. Overwhelms the customer by complexity</td>
</tr>
<tr>
<td>- 11. May be affected by employee competence</td>
</tr>
<tr>
<td>- 12. May be affected by internal processes</td>
</tr>
</tbody>
</table>
### Scoring Model - Advisor

<table>
<thead>
<tr>
<th>Test A</th>
<th>Test B</th>
<th>Events</th>
<th>Non Events</th>
</tr>
</thead>
<tbody>
<tr>
<td>Object X having structure S… unnecessarily possessing causal powers (CP) and liabilities (l)</td>
<td>Test B Under specific conditions (c) will produce</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Object DM with Structure SM</td>
<td>If Object RM with Structure Advisor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- CP1. Provide predictive info for Decision Making authority</td>
<td>- CP1. Make loan decision</td>
<td></td>
<td>e1, e2 customer does not receive a loan</td>
</tr>
<tr>
<td>- CP2. Reduce loan approval processing time</td>
<td>- CP2. Inquire information from Upplysningscentral</td>
<td></td>
<td>e3 customer request is sent to a higher power of decision making authority</td>
</tr>
<tr>
<td>- CP3. Control risk selection</td>
<td>- CP3. Inquire information from Scoring Model</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- CP4. Streamline the loan approval process</td>
<td>- CP4. Power to enable decision making</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- 1. Be misinterpreted</td>
<td>- 11. Advisor adopts bias judgment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- 2. Be poor developed</td>
<td>- 12. Pressure of responsibility</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- 13. Misinterpret scoring model</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- 14. Unable to make a decision</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Table 21 Test A + Test B (Advisor, Customer)

<table>
<thead>
<tr>
<th>Test A</th>
<th>Advisor - Customer</th>
<th>Test B</th>
<th>Events</th>
<th>Non event</th>
</tr>
</thead>
<tbody>
<tr>
<td>Object X having structure S………necessarily possessing causal powers((CP)) and liabilities((l))</td>
<td>Test B Under specific conditions((c)) will produce</td>
<td><strong>e1</strong> If Object Customer Retention with structure <em>Customer</em></td>
<td><strong>e1, e2</strong> Customer does not receive loan</td>
<td><strong>e3</strong> Customer request is sent to higher decision making authority</td>
</tr>
<tr>
<td><strong>Object RM with Structure Advisor</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- CP1. Make loan decision</td>
<td></td>
<td><strong>e1</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- CP2. Inquire information from Upplysningscentral</td>
<td></td>
<td><strong>e2</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- CP3. Inquire information from Scoring Model</td>
<td></td>
<td><strong>e3</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- CP4. Power to enable decision making</td>
<td></td>
<td><strong>e4</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- 11. Advisor adopts bias judgment</td>
<td></td>
<td><strong>e5</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- 12. Pressure of responsibility</td>
<td></td>
<td><strong>e6</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- 13. Misinterpret scoring model</td>
<td></td>
<td><strong>e7</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- 14. Unable to make a decision</td>
<td></td>
<td><strong>e8</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>