THESIS OF THE DOCTORAL DISSERTATION

HUNGARIAN UNIVERSITY OF AGRICULTURE AND LIFE SCIENCES | KAPOSVÁR CAMPUS

DOCTORAL (PhD) SCHOOL OF ECONOMICS AND REGIONAL SCIENCES

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BIG DATA ANALYTICS AS AN ELEMENTARY CUSTOMER LOYALTY INSTRUMENT FOR BANKS

AN EMPIRICAL INVESTIGATION

DOI: 10.54598/004340

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KAPOSVÁR

2023

Abstract

Due to the digital transformation, the banking sector in Germany is undergoing massive change. This structural change is massively influenced by technological progress, regulation and supervision, the low-interest phase and demographic change. These changes have an impact on many aspects of how bank customers demand, evaluate and ultimately purchase financial services. Credit institutions can only be fit for the future if they manage to combine tradition and innovation.

When talking about technical innovations, the term big data analytics is often mentioned. Big data analytics refers to methods and procedures that can be used to discover possible structures, patterns and correlations in large amounts of data. With the help of these, model-based forecasts can be made for future developments relevant to decision-making, such as a product proposal. Big Data Analytics is cited as one of the forces significantly driving digitalisation. On the one hand, banks are demonstrably forced to take drastic measures such as mergers, branch closures and staff reductions. On the other hand, banks have more data about their customers than other industries, so that some publications talk about a treasure trove of data.

Although Big Data Analytics is becoming more and more prevalent, there is still a need for empirical research in the German banking sector to better penetrate the application possibilities from different perspectives. The aim of this dissertation is to contribute to closing this gap. An overview of the German banking sector and the current market environment is to be given in order to subsequently work out the challenges and opportunities with regard to digitalisation and to be able to point out possible innovations through the use of big data analytics. For this purpose, a three-part research approach is chosen. These are a.) the analysis of banks in Germany, b.) the online survey of bank customers and c.) standardised interviews with bank experts. Furthermore, arguments and counter-arguments within the academic discussion on the topic of big data analytics in the German banking market will be compiled in order to enable conclusions and implications on the basis of a systematic literature research.

In the first research section, "Analysis of Banks in Germany", the focus is on the business development of German banks. The aim is to examine the extent to which real business indicators (data on the development of the number of employees, number of credit institutions, operating result, balance sheet total and cost-income ratio) have changed due to the prevailing competitive pressure caused by the digital transformation. This research section summarises the analysis of German banks on the basis of real key figures for the period 2003 - 2019. The

aim is to derive the pressure for action and the necessity of data-driven strategic instruments for credit institutions in Germany.

In the second research section, "Online survey of bank customers", the customer perspective is taken into account with the help of an online questionnaire and a large sample of bank customers in Germany. In addition to the question of the influence of big data analytics on customer loyalty, a possible improvement in customer service is examined in connection with big data analytics and the "principles of customer advice" model. This model states that bank customers should be advised objectively, comprehensively, individually and actively. These principles serve as "value-based" guardrails for people who are training to become bankers (or completing a dual course of study). Within the framework of inductive statistics, hypotheses on the research part are refuted or confirmed in order to be able to prove a representative customer perspective.

In the third and final research section, "Interviews with banking experts", the picture is expanded using the results of standardised surveys. For this purpose, answers from numerous banking experts who have been trained in a credit institution in Germany and are also currently working in the financial services industry are evaluated. With the aim of gaining a broader perspective, the question of the influence of big data analytics on customer loyalty and a possible improvement in the quality of advice in the context of big data analytics and the "principles of customer advice" model will also be examined from the perspective of bank advisors.

Furthermore, the bank experts are asked to what extent they consider investments in big data analytics projects to be strategically necessary and recommendable for banks in Germany. In order to ensure the successful implementation of big data analytics projects, various personnel development measures such as training, coaching or a combination of training and coaching could be helpful. This aspect is also addressed in the third research section through concrete questions.

The present research not only closes an existing gap in the academic discussion on Big Data Analytics in German banking, but also contributes to practical knowledge from different perspectives. For the first time, the relationship between the "principles of customer advice" model in the context of Big Data Analytics from the bank customer perspective and the bank advisor perspective was examined for banks in Germany.

The results show that big data analytics increases customer loyalty from the perspective of bank customers and bank advisors. Furthermore, further targeted investments in Big Data Analytics projects are strategically necessary and advisable for banks in Germany in the age of

digitalisation. The research work provides a viewpoint on the specific necessary measures of digitalisation in the German banking industry to strengthen customer loyalty. Furthermore, the work provides results on sensible personnel development measures to ensure the successful implementation of big data analytics projects in the customer business.

The main contribution of this research and its originality are results to better understand the use of big data analytics as an elementary customer loyalty instrument for banks in Germany and to show directions to use or expand it.

Keywords:

Big Data Analytics, Digital Transformation, German Banking Sector, Customer Engagement

1 Table of contents

2 Research background and objectives

2.1 Objectives and structure of the work

The aim of this research is to provide an overview of the German banking sector and the current market environment in order to then elaborate the challenges and opportunities regarding digitalisation and to highlight possible innovations through the use of Big Data Analytics (BDA). Another aim of the submissions is to close an existing gap in the academic discussion on Big Data Analytics in the German banking sector. For the first time, the relationship between the "principles of customer advice" model in connection with Big Data Analytics from the bank customer perspective and the advisor perspective is examined for banks in Germany. Furthermore, the findings of this work will also contribute to practical knowledge from different perspectives. In the context of this work, different perspectives are considered separately (see Figure 1). These are: (01) the banks' perspective, (02) the bank clients' perspective and (03) the bank advisors' perspective. The bank is usually interested in a lifelong relationship with the bank client. The bank client is a customer of the bank and has usually consciously chosen this partnership. The bank advisor is employed by the bank and sells its products to bank clients.

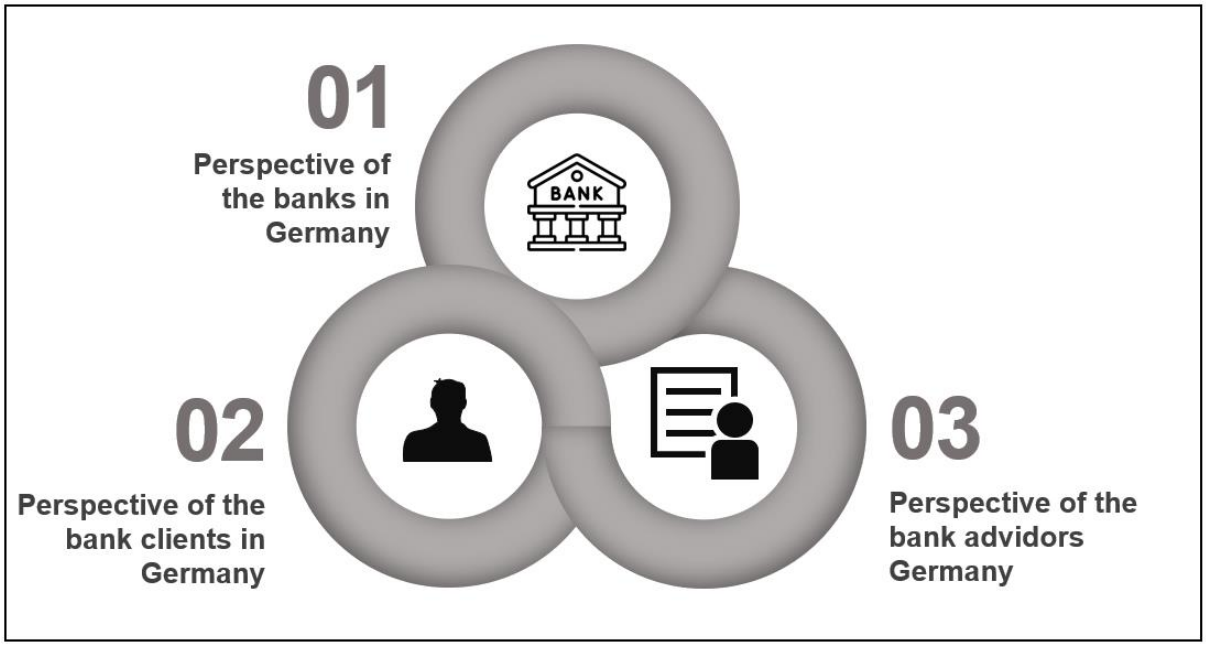

Figure 1: Own illustration, different perspectives

2.2 Systematic literature research

As a basic work explaining the methodology of a systematic literature review, the article "Analyzing the Past to Prepare for the Future - Writing a Literature Review"by Webster and Watson from 2002. In this article, the procedure and documentation for a systematic literature review are described scientifically (Webster & Watson, 2002).

For the dissertation, such a systematic literature search according to Webster and Watson (2002) was conducted between August 2018 and March 2022. The aim was, on the one hand, to find, review and evaluate current and relevant literature (see Figure 2). On the other hand, the status quo in research was to be surveyed and research gaps identified. The basic idea was to use the literature survey to look at the research areas as comprehensively as possible. The established scientific databases such as Wiso-Net, EconBiz, Google Scholar, Springer or ResearchGate were searched for keywords and relevant sources. The focus of the literature used was on scientific journals, working papers, and occasionally also on books, book chapters and practical reports. Keywords describing the situation of German banks (*Banken in Deutschland, deutsche Bankensektor, Sparkassen, Genossenschaftsbanken*), keywords describing the digital transformation or digitalisation in the German banking sector (*Digitale Transformationen/ Digitalisierung und Banken/ Sparkassen/ Genossenschaftsbanken*), keywords on big data analytics (Big Data, *Big Data Analytics, Predictive Analytics, Business Analytics*) and keywords on knowledge transfer, training and coaching (*Wissenstransfer, Lerntransfer*, Training, Coaching) were linked. The keyword search was conducted in German and English. In addition to the search in databases, statistical evidence (in the form of key figures from banks in Germany) was included to concretise the research subject. Original German and English-language papers, systematic literature reviews and grey literature were included. The most important results, which are intended to fundamentally underpin the author's research sections, are summarised narratively in the form of an overview.

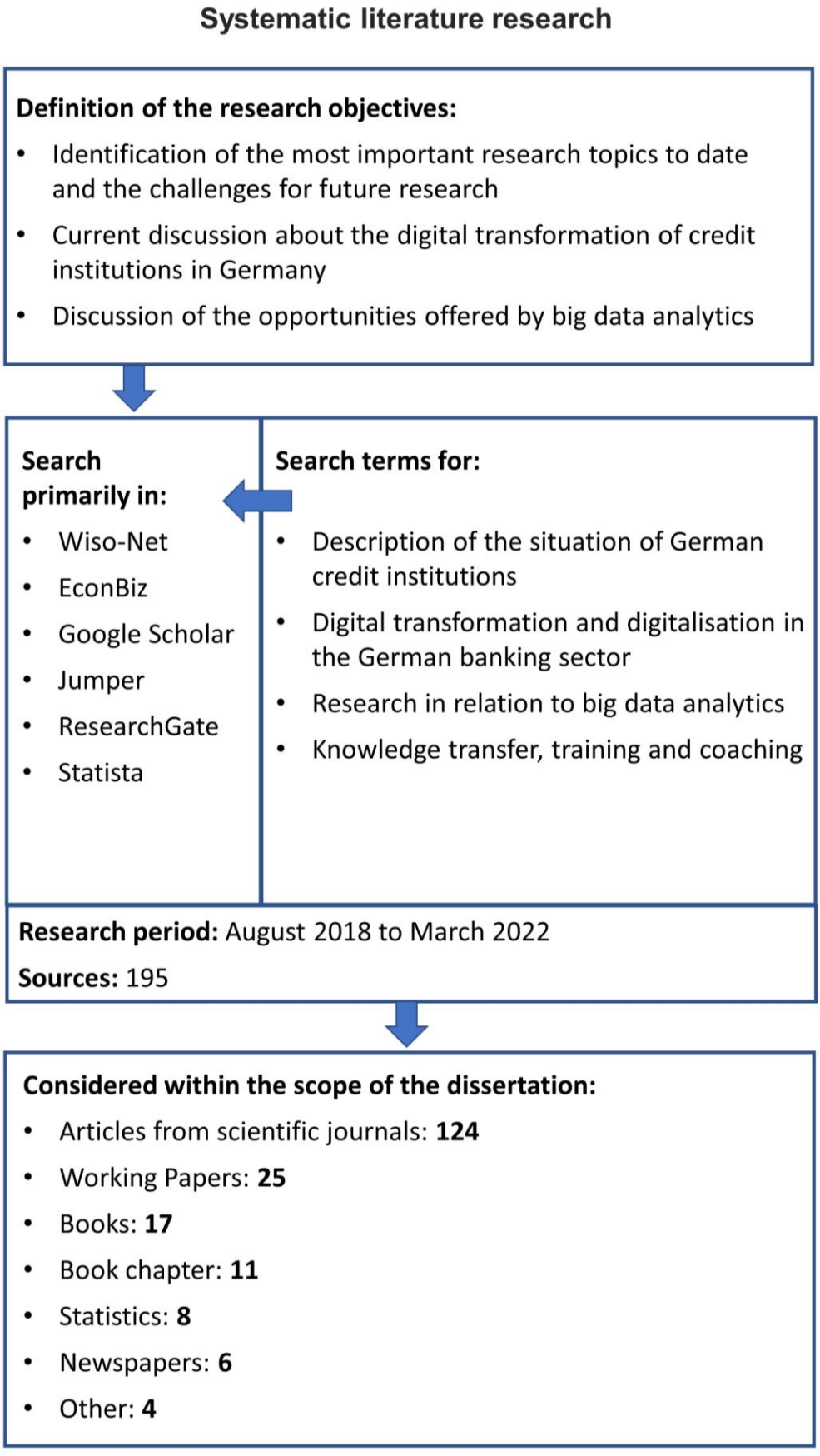

Figure 2: Own representation, systematic literature search

Literature was reviewed for the following four research areas:

1. Situation of German banks
2. Digital transformation in the German banking sector
3. Big Data Analytics
4. Knowledge transfer, training and coaching

A total of 195 sources were used for the dissertation. These can be broken down into 124 articles from scientific journals, 25 working papers, 17 books and 11 book chapters. Furthermore, 8 statistical data sets, 6 reports from newspapers and 4 other sources were included.

For the four research areas mentioned, the main articles and research papers researched are listed below in chapters 3.2 (literature research on the situation of German banks), 3.3 (literature research on digital transformation in the German banking sector), 3.4 (literature research on big data analytics) and 3.5 (literature research on knowledge transfer, training and coaching).

2.3 Research questions

Based on the contents elaborated and described so far, the following research question arises for the empirical part I, the analysis of the banks in Germany:

1. *What is the business development of German banks under the influence of the digital transformation?*

The aim of this research question is to provide an overview of the German banking sector and the current market environment.

Based on the contents elaborated and described so far, the following research question arises for the empirical part II, the online survey of bank customers:

2. *Does big data analytics improve the quality of advice from the client's perspective (measured against the principles of client advice) and has an impact on client retention?*

The aim of this research question is to investigate the relationship between Big Data Analytics and the "Principles of Customer Advice" model (see Figure 3) from the perspective of bank customers.

Based on the contents elaborated and described so far, the following research questions arise for the empirical part III, the standardised interviews with bank experts:

3. *Does big data analytics improve the quality of advice from the advisor's perspective (measured against the principles of client advice) and has an impact on client retention?*
4. *To what extent can big data analytics make a positive contribution to the situation of banks in Germany in the age of digitalisation*?
5. *From an advisor's perspective, which aspects of human resources development should be applied when imparting knowledge on the use of big data analytics in the client business in order to ensure successful implementation?*

The aim of this research question is to investigate the connection between Big Data Analytics and the "Principles of Client Advisory Services" model (see Figure 4), the strategic necessity as well as necessary aspects of human resources development from the perspective of bank advisors.

Figure 3: Own illustration, model: principles of client counselling

3 Materials and methods

In order to be able to pursue the research approach described, a three-stage procedure was realised (see Figure 4). The banks' perspective is ensured by quantitative research, the analysis of banks in Germany (Empirical Part I). The perspective of bank customers is implemented through quantitative research, the online survey of bank customers (Empirical Part II). Finally, quantitative research, standardised interviews with bank experts (Empirical Part III), was conducted for the perspective of bank advisors.

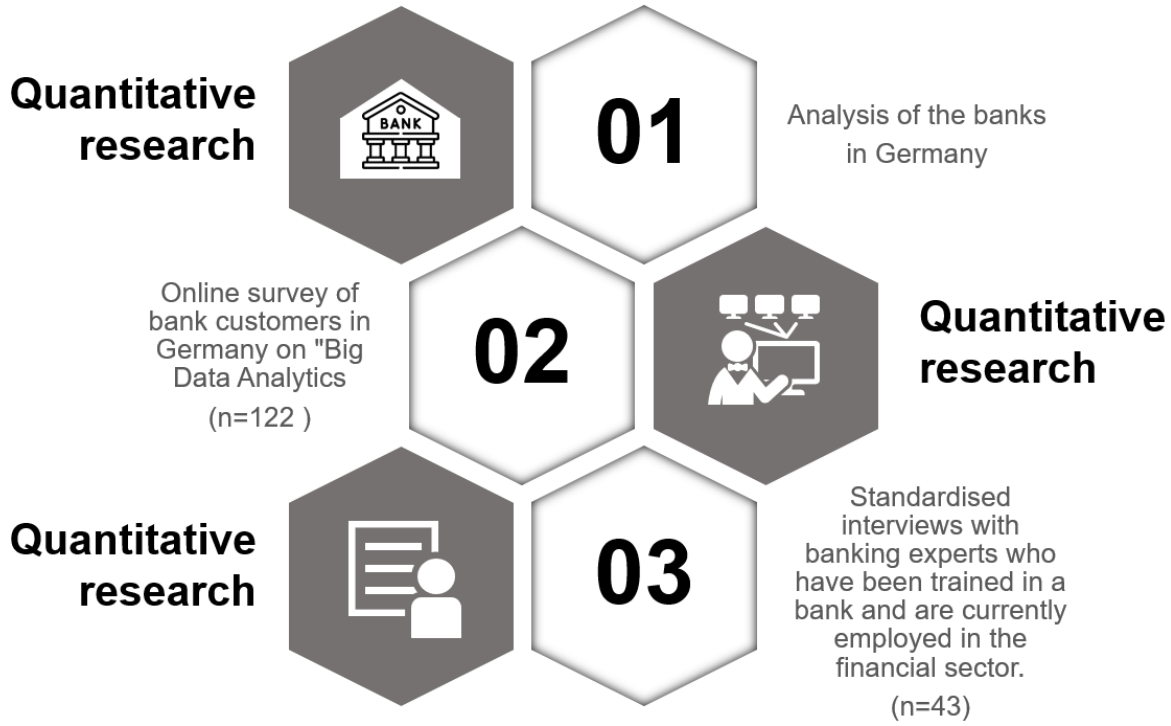

Figure 4: Own illustration, three-part research approach

In the first research section, "Analysis of Banks in Germany" (see Chapter 5 of the dissertation), the focus is on the business development of German banks. The aim is to examine the extent to which real business indicators (data on the development of the number of employees, number of credit institutions, operating result, balance sheet total and cost-income ratio) have changed due to the prevailing competitive pressure caused by the digital transformation. This research section summarises the analysis of German banks on the basis of real key figures for the period 2003 - 2019. The aim is to derive the pressure for action and the necessity of data-driven strategic instruments for credit institutions in Germany.

In the second research section "Online survey of bank customers" (see chapter 6 of the dissertation), the customer perspective is taken into account with the help of an online questionnaire and a large sample of bank customers in Germany. In addition to the question of the influence of big data analytics on customer loyalty, a possible improvement in customer service is examined in connection with big data analytics and the "principles of customer advice" model. This model states that bank customers should be advised objectively, comprehensively, individually and actively. These principles serve as "value-based" guardrails for persons undergoing training as bankers (or dual studies). Within the framework of inductive statistics, hypotheses on the research part are refuted or confirmed in order to be able to prove a representative customer perspective.

In the third and final research section, "Interviews with banking experts" (see chapter 7 of the dissertation), the picture is expanded using the results of standardised surveys. For this purpose, answers from numerous banking experts who have been trained in a credit institution in Germany and are also currently working in the financial services industry are evaluated. With the aim of gaining a broader perspective, the question of the influence of big data analytics on customer loyalty and a possible improvement in the quality of advice in the context of big data analytics and the "principles of customer advice" model will also be examined from the perspective of bank advisors. Furthermore, the bank experts are asked to what extent they consider investments in Big Data Analytics projects for banks in Germany to be strategically necessary and recommendable. In order to ensure the successful implementation of big data analytics projects, various personnel development measures such as training, coaching or a combination of training and coaching could be helpful. This aspect is also addressed in the third research section through concrete questions.

4 Empirical Part I: Analysis of Banks in Germany

4.1 Material and attachment

For the quantitative research section "Analysis of banks in Germany", data was researched on the website of the statistics portal Statista (https://de.statista.com/). In order to answer the research question and make developments in the German banking market measurable from 2003 to 2019, available key business figures were used. These are data on the development of the number of employees, the number of credit institutions, the operating result,

the balance sheet total and the cost-income ratio. In each case, the status at the end of the year is shown. These key figures are available for download and cover different time periods. Consequently, they were limited to a common observation period from 2003 to 2019. The aim of this part of the research is to provide an overview of the German banking sector and the current market environment in order to then work out the challenges and opportunities with regard to digitalisation and to highlight possible innovations through the use of big data analytics. Based on the listed, typical key figures from the banking environment, the developments in the German banking market in the period from 2003 to 2019 will be statistically evaluated. On the one hand, this should enable a discussion on the influence of big data analytics on the developments of these key figures. On the other hand, this part of the research forms the basis for the analysis.

4.2 Hypotheses and methodology

As has been pointed out, the euro area and Germany are experiencing a historically unprecedented environment of very low and negative interest rates. This low interest rate environment is putting considerable pressure on banks and savings banks in Germany (Deeken & Specht, 2017; Wolgast, 2016). Based on this assessment (lower demand for skilled workers), the business development of German banks is examined. The aim is to explore the extent to which real business indicators have changed due to the prevailing competitive pressure caused by the digital transformation.

Therefore, to structure this part of the research, the following hypotheses about the developments in the German banking sector are made and examined:

H :$_0^1$ The number of employees at banks in Germany changed significantly between 2003 and 2019.

H$_0^2$: The number of credit institutions in Germany has changed significantly in the years 2003-2019.

H$_0^3$: The operating result of credit institutions in Germany has changed significantly in the years 2003-2019.

H_0^4 : The balance sheet total of credit institutions in Germany has changed significantly in the years 2003-2019.

H_0^5 : The cost-income ratio of credit institutions in Germany has changed significantly in the years 2003-2019.

To test the hypotheses, the developments of the key figures for the years 2003 to 2019 are presented graphically in each case. The direction of each development can be read from these visualisations. The visualisations were generated and the data analysed using the programming language R and ggplot2.

To test the significance of the assumed positive (increase in the ratio) or negative (decrease in the ratio) trend, the correlation between time (in years) and the respective ratio was determined as a test statistic and tested to see if it was significantly different from zero. The required significance level remained fixed at $\alpha = 0.05$ across all tests. This means that a probability of error of up to 5% is acceptable. The significance level is used to examine how probable an alternative measurement would be that speaks even more strongly against the hypothesis. The smaller the probability, the more it can be assumed that it is not a coincidence.

Depending on the direction of the suspected trend (increase or decrease of the respective bank ratio), either a left- or right-sided test has then been carried out.

The rank correlation coefficient according to Spearman was used as a correlation measure in this research section. Spearman's correlation evaluates the monotonic relationship between two continuous or ordinal variables. In a monotonic relationship, the variables (here time and the respective bank ratio) tend to change together, but not necessarily at a constant rate. The rank correlation coefficient according to Spearman is suitable for examining time series, as only a monotonic temporal relationship is assumed. The correlation can assume values from -1 to +1. If two variables tend to increase or decrease simultaneously, the correlation value is considered positive. If one variable increases and the other decreases at the same time, the correlation value is considered negative. In Spearman correlation, an absolute value of 1 indicates that the ranked data are perfectly monotonically increasing. With an example Spearman correlation of -1, the highest value of variable A is associated with the lowest value of variable B. Should the Spearman correlation have a value of 0, for example, all points lie on a horizontal line or are alternately positive and negative.

The doctoral student has chosen to use the Spearman correlation test in Research Part I because of the interest in a possible monotonic correlation. In contrast to Pearson's correlation matrix, the Spearman correlation of 1 only indicates the continuous slope (independent of an exact measured variable). The advantage of the method is that any correlation between two pairs of variables can be measured (Pearson only measures the degree of the linear relationship) and that it is insensitive to possible outliers. The disadvantage, in contrast to the Pearson correlation (correlation coefficient can be interpreted e.g. by large or small correlation), is that there is no direct metric interpretation option, since only whether a ratio is increasing or decreasing is examined (without the exact amount of the increase or decrease).

5 Empirical part II: Online Survey of bank customers

5.1 Material and Approach

In order to answer the research question (Does Big Data Analytics improve the quality of advice from the client's perspective, measured against the principles of client advice, and does it have an impact on client retention?), a randomised survey was arranged. This survey was conducted online at www.surveymonkey.de and published via the survey platform www.surveycircle.de (details on the survey can be found in Appendix II). The premise was a simple and quick response. The survey period was from 01.09.2019 to 30.09.2019. The assumption is that each of the respondents is of age and also a bank customer in Germany. A total of 122 bank customers participated in the survey. A four-point Likert scale was used for scaling because no "abstentions" and no "tendency towards the middle" were to be allowed. In order to examine the following six statements, statistical hypotheses were formulated, the significance of which was subsequently tested.

The following statements are evaluated by the subjects:

1. *Big Data Analytics ensures higher customer loyalty from the perspective of bank customers.*
2. *Big Data Analytics ensures more objective advice for bank customers.*
3. *Big Data Analytics ensures more comprehensive advice for bank customers.*
4. *Big Data Analytics ensures more individualised advice for bank customers.*

5. *Big Data Analytics ensures more active advice for bank customers.*

6. *The age of the customer does not play a role in the evaluation of customer loyalty.*

5.2 Hypotheses and methodology

Within the framework of inductive statistics, the statistical software "R" was used to be able to refute or prove hypotheses with statistical tests. These statistical tests were carried out with a significance level $\alpha = 0.05$. For the data preparation, the data were downloaded from www.surveymonkey.de and the expressions of the questions with answer options "Yes" and "No" were binary coded ("Yes" corresponds to value 1 and "No" corresponds to value 0 for the question on customer loyalty). The answers to statements 2-5 were coded numerically according to the values of the Likert scale ("Agree" corresponds to value 1; "Rather agree" corresponds to value 2; "Rather disagree" corresponds to value 3 and "Disagree" corresponds to value 4).

To structure this part of the research, the following hypotheses are made and examined:

$\mathbf{H}_0^1$: Bank customers think that BDA ensures higher customer loyalty.

$\mathbf{H}_0^2$: Both groups ("Yes" and "No" - respondents to the question about higher customer loyalty through BDA) answered the same to the statement "BDA ensures more objective advice".

$\mathbf{H}_0^3$: Both groups ("Yes" and "No" - respondents to the question about higher customer loyalty through BDA) answered the same to the statement "BDA provides more comprehensive advice".

$\mathbf{H}_0^4$: Both groups ("Yes" and "No" - respondents to the question about higher customer loyalty through BDA) answered the same to the statement "BDA provides more individualised advice".

$\mathbf{H}_0^5$: Both groups ("Yes" and "No" - respondents to the question about higher customer retention through BDA) answered the same to the statement "BDA ensures more active consultation".

$\mathbf{H}_0^6$: The age of the customer does not play a role in answering the question on customer loyalty.

6 Empirical part III: Interviews with banking experts

6.1 Material and approach

In order to answer the research question, a standardised series of interviews was arranged and successfully implemented in the period from 01.08.2021 to 31.10.2021 (details on the interviews can be found in Appendix III). The occupational profile of the bank clerk is the relevant training occupation in the banking sector. The majority of employees in the banking sector complete this vocational training (Frank et al., 2014). For this reason, participants were randomly selected from the author's network for the survey who had successfully completed vocational training as a bank clerk (or a dual course of study) in a credit institution in Germany. In the end, personal interviews were conducted with a total of 43 trained bank clerks. In addition to this aspect, another premise was that the subjects were currently employed in the financial services industry. With these attributes, the interview partners can be ascribed the status of "banking expert" from the author's point of view. The doctoral student conducted the standardised interviews in person, by telephone or by video conference, and the interviews were evaluated anonymously. The premise for this research section was that the test persons had successfully completed their training as bank clerks (or a dual course of study) at a German credit institution. Secondly, all subjects confirmed that they were currently employed in the financial services sector.

To answer the first research question: (Does big data analytics improve the quality of advice from the advisor's perspective - as measured by the principles of customer advice - and does it have an influence on customer loyalty?), the same methodology from the previous part of the research (online survey of bank customers) was used. A four-point Likert scale was also used for scaling. In order to examine the following six statements, statistical hypotheses were also formulated in this research section, the significance of which was subsequently tested.

The following statements are evaluated by the subjects:

1. *From the point of view of bank advisors, big data analytics ensures higher customer loyalty.*
2. *big data analytics provides more objective advice from the perspective of bank advisors.*

3. *big data analytics provides more comprehensive advice from the perspective of bank advisors.*

4. *Big Data Analytics provides more individualised advice from the perspective of bank advisors.*

5. *Big Data Analytics ensures more active advice from the perspective of bank advi sors.*

6. *The age of the banking expert does not play a role in the assessment of customer loyalty.*

Complementary aspects of the research part

Information on the strategic necessity of big data analytics

Furthermore, the research question (To what extent can big data analytics make a positive contribution to the situation of banks in Germany in the age of digitalisation? In order to be able to answer the strategic necessity of big data analytics as a customer loyalty instrument for banks from the perspective of banking experts in Germany, the 43 respondents were asked to answer the following question with "yes" or "no" in the standardised interviews (in addition to the questions known from research part II):

Do you agree with the statement that investments in big data analytics projects are strategically necessary and advisable for banks in Germany in the age of digitalisation (only one answer possible)?

Information on aspects of personnel development in the use of big data analytics

Furthermore, the research question (From the consultant's perspective, which aspects of human resources development should be applied when imparting knowledge on the use of big data analytics in customer business in order to ensure successful implementation? In order to investigate which aspects of human resources development should be applied from an advisor's perspective when imparting knowledge on the use of big data analytics in customer business in order to ensure successful implementation, the 43 interview participants were asked to answer the following question (only one answer possible):

"What would be useful in this project (only one answer possible)?" there were four possible answers: [1] training, [2] coaching, [3] training and coaching and [4] neither?

6.2 Hypotheses and methodology

The statistical software "R" was also used in this part of the research to be able to disprove or prove hypotheses with statistical tests. A significance level $\alpha = 0.05$ was also chosen for the statistical tests. For the data preparation, the data of the answers from the interviews were documented in an Excel file. The expressions of the questions with answer options ""Yes" and "No" were also coded here in binary form. The answers to statements 2-5 were also coded numerically according to the values of the Likert scale ("Agree" corresponds to value 1; "Rather agree" corresponds to value 2; "Rather disagree" corresponds to value 3 and "Disagree" corresponds to value 4). Again, different statistical tests were applied and selected according to the respective scale level.

To structure this part of the research, the following hypotheses are made and examined:

$\mathbf{H}_0^1$: Banking experts think that BDA ensures higher customer loyalty.

$\mathbf{H}_0^2$: Both groups ("Yes" and "No" - respondents to the question about higher customer loyalty through BDA) answered the same to the statement "BDA ensures more objective advice".

$\mathbf{H}_0^3$: Both groups ("Yes" and "No" - respondents to the question about higher customer loyalty through BDA) answered the same to the statement "BDA provides more comprehensive advice".

$\mathbf{H}_0^4$: Both groups ("Yes" and "No" - respondents to the question about higher customer loyalty through BDA) answered the same to the statement "BDA provides more individualised advice".

$\mathbf{H}_0^5$: Both groups ("Yes" and "No" - respondents to the question about higher customer retention through BDA) answered the same to the statement "BDA ensures more active consultation".

$\mathbf{H}_0^6$: The age of the banking experts does not play a role in answering the question on customer loyalty.

$\mathbf{H}_0^7$: In the view of the banking experts, investments in BDA projects are strategically necessary and advisable for banks in Germany in the age of digitalisation.

7 Results

The results of the three consecutive research parts, divided into "Descriptive Results" and "Hypotheses and Findings", are presented below.

8 Empirical Part I: Analysis of Banks in Germany

8.1 Descriptive results

The exact ratios can be found in Appendix I for the analysis of banks in Dt.

8.2 Hypotheses and results

In research part I, the following hypotheses were investigated and processed. It was possible to work out a result for each thesis (see Table 1).

Hypotheses	Result
H_0^1 : The number of employees of banks in Germany has changed significantly in the years 2003-2019.	**Result:** The hypothesis is confirmed, the number of employees has changed significantly.
H_0^2 : The number of credit institutions in Germany has changed significantly in the years 2003-2019.	**Result: The** hypothesis is confirmed, the number of credit institutions has changed significantly.
H_0^3 : The operating result of credit institutions in Germany has changed significantly in the years 2003-2019.	**Result: The** hypothesis is rejected, the operating result of the credit institutions has not changed significantly.
H_0^4 : The balance sheet total of credit institutions in Germany has changed significantly in the years 2003-2019.	**Result: The** hypothesis is confirmed, the balance sheet total of the credit institutions has changed significantly.
H_0^5 : The cost-income ratio of credit institutions in Germany has changed significantly in the years 2003-2019.	**Result: The** hypothesis is confirmed, the cost-income ratio of the credit institutions has changed significantly.

Table 1: Own representation: Hypotheses and results of the research part I

9 Empirical Part I: Online Survey of bank customers

9.1 Descriptive results

Information on the age structure of the participants in the Big Data Analytics survey

In response to the question "How old are you?", survey participants were asked to name their age. Among the 122 participant votes, the top three entries were the following ages: [1] with 9 participants, age "33 ", [2] with 8 participants, age "39 and [3] with 7 participants, age "40". Bringing up the rear with only one vote each were the age groups: 26, 38, 44, 48, 50, 54 and 60. A representation in clusters can be seen below (see Figure 5).

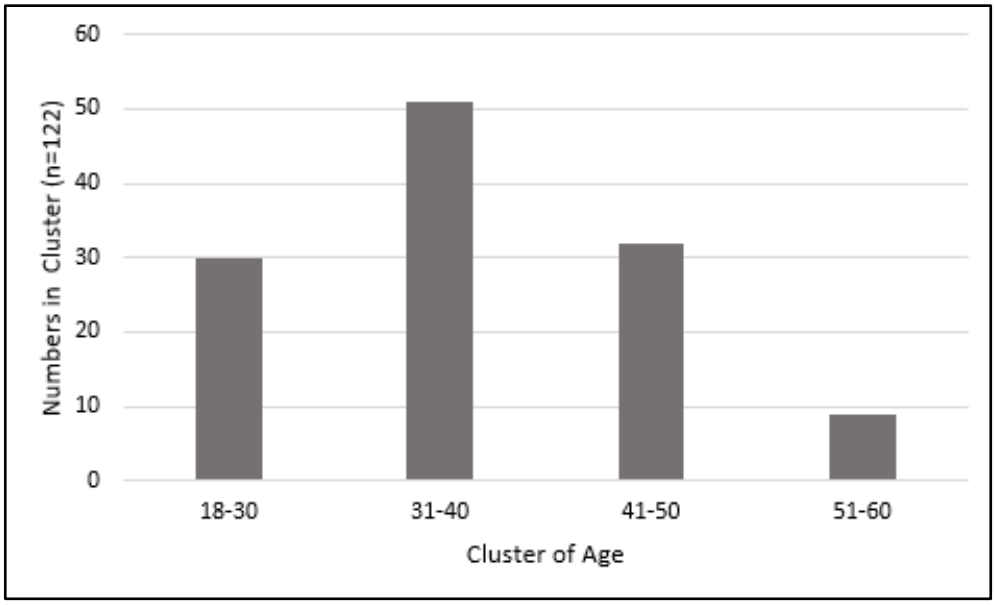

Figure 5: Own representation, distribution of the age of the test persons

There were two possible answers to the question "Do you agree with the statement that big data analytics increases customer loyalty? [1] "Yes" and [2] "No" (see Figure 6). As the graph shows, 66.39% of the survey participants chose the answer "Yes" and 33.61% of the survey participants chose the answer "No".

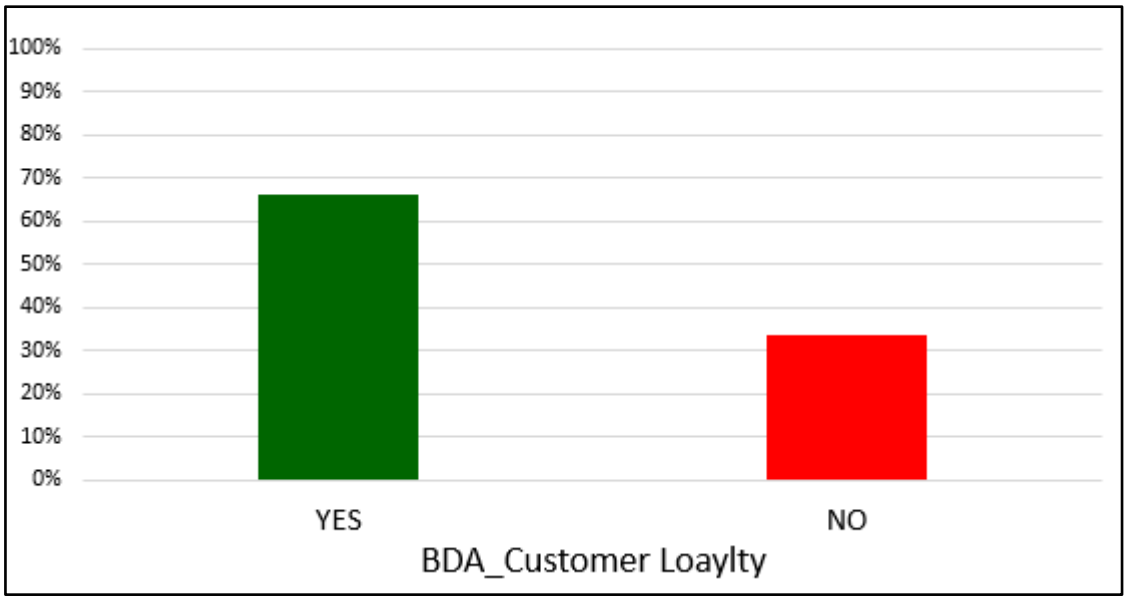

Figure 6: Own illustration, BDA ensures higher customer loyalty

The answers to statements 2-5 (BDA provides more objective advice from the bank customers' point of view; BDA provides more comprehensive advice from the bank customers' point of view; BDA provides more individualised advice from the bank customers' point of view; and BDA provides more active advice from the bank customers' point of view) are consolidated and explained below (see Figure 7).

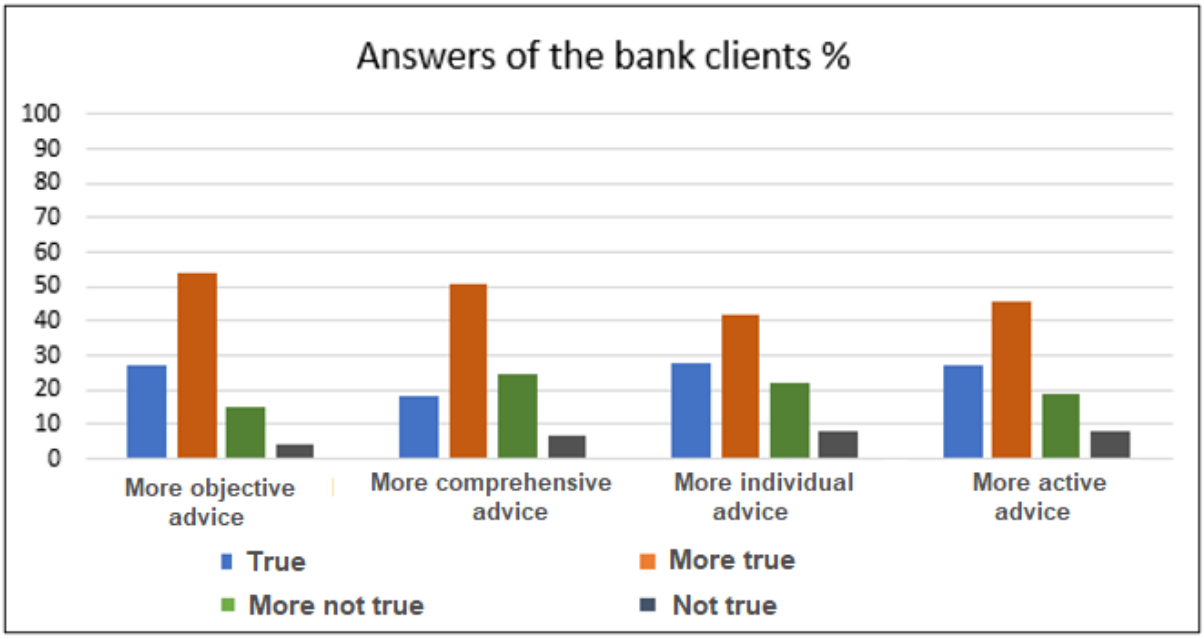

Figure 7: Own representation, responses of bank customers

9.2 Hypotheses and results

In research part II, the following hypotheses were investigated and processed. It was possible to work out a result for each thesis (see Table 2).

Hypotheses	Result
H_0^1 : Bank customers think that BDA ensures higher customer loyalty.	**Result: The** hypothesis is confirmed, BDA ensures higher customer loyalty from the perspective of bank customers.
H_0^2 : Both groups ("Yes" and "No" - Respondents to the question about higher customer loyalty through BDA) gave the same answer to the statement "BDA provides more objective advice".	**Result: The** hypothesis is confirmed, more objective advice has no influence on customer loyalty from the perspective of bank customers**.**
H_0^3 : Both groups ("Yes" and "No" - respondents to the question about higher customer loyalty through BDA) answered the same to the statement "BDA provides more comprehensive advice".	**Result: The** hypothesis is rejected that more comprehensive advice has an influence on customer loyalty from the perspective of bank customers.
H_0^4 : Both groups ("Yes" and "No" - respondents to the question about higher customer loyalty through BDA) answered the same to the statement "BDA provides more individualised advice".	**Result: The** hypothesis is rejected that more individualised advice has an influence on customer loyalty from the perspective of bank customers.
H_0^5 : Both groups ("Yes" and "No" - respondents to the question about higher customer retention through BDA) answered the same to the statement "BDA ensures more active consultation".	**Result: The** hypothesis is rejected that a more active advisory service has an influence on customer loyalty from the perspective of bank customers.
H_0^6 : The age of the customer does not play a role in answering the question on customer loyalty.	**Result: The** hypothesis is confirmed, the age of the customer does not play a role in

	answering the question on customer loyalty.

Table 2: Own representation: Hypotheses and results of the research part II

Measured against the principles of client counselling, more comprehensive, more individual and more active counselling have an influence on client loyalty. More objective customer advice, on the other hand, does not (see Figure 8). In the figure, the factors that have an influence on customer loyalty are shown in green. Factors that have no influence on customer loyalty, on the other hand, are shown in red.

Figure 8: Own illustration: Influences on customer loyalty from the perspective of bank customers

10 Empirical Part III: Interviews with banking experts

10.1 Descriptive results

Information on the age structure of the banking experts

In response to the question "How old are you?", survey participants were asked to name their age. Among the 43 participant votes, the top three entries were the following age groups: [1] with 4 participations each, ages 41 and 44; [2] with 3 participations each, ages 29, 36, 37 and 42; and [3] with 2 participations each, ages 30, 31, 32, 35, 43 and 45. Bringing up the rear with only one vote each were ages: 25, 27, 28, 33, 38, 40, 46, 47, 49, 54 and 60. A representation in clusters can be seen below (see Figure 9).

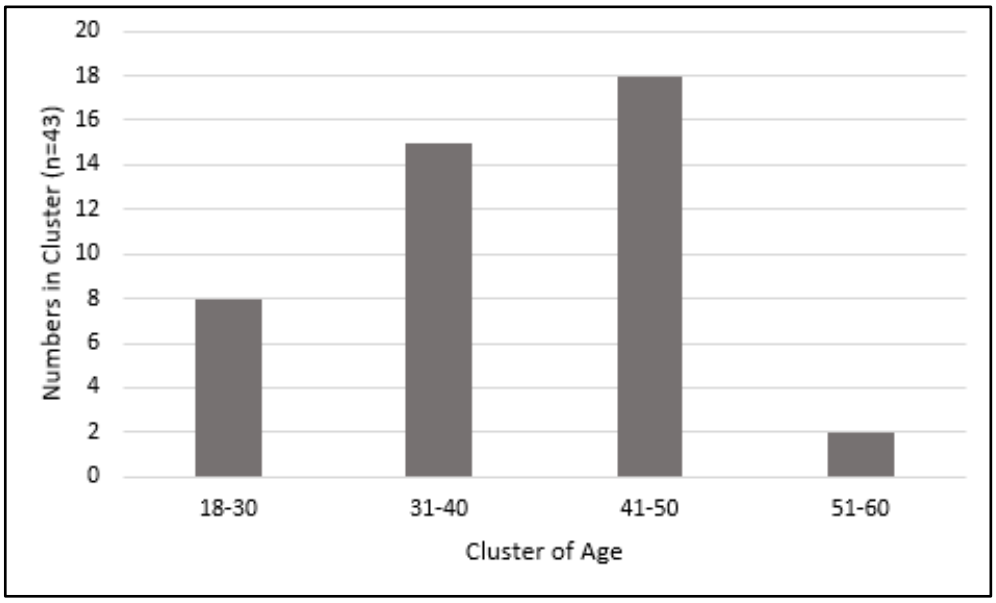

Figure 9: Own representation, distribution of the age of the test persons

There were two possible answers to the question "Do you agree with the statement that big data analytics increases customer loyalty? [1] "Yes" and [2] "No" (see Figure 10). As the graph shows, 90.70% of the interview participants chose the answer "Yes" and 9.30% of the interview participants chose the answer "No".

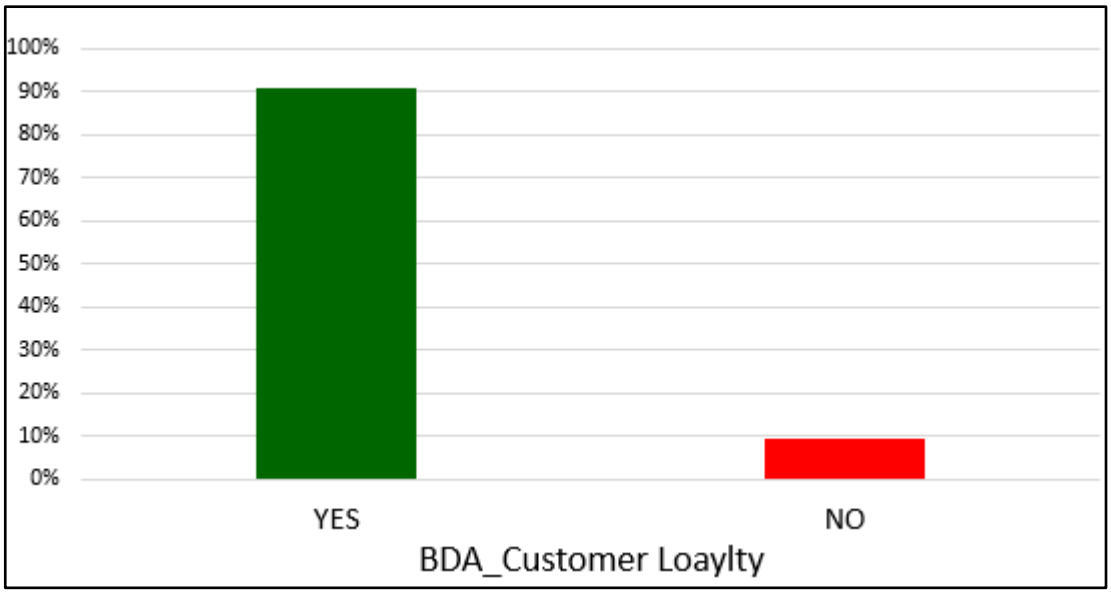

Figure 10: Own illustration, BDA ensures higher customer loyalty

The answers to statements 2-5 (BDA provides more objective advice from the point of view of bank advisors; BDA provides more comprehensive advice from the point of view of bank experts; BDA provides more individualised advice from the point of view of bank experts; and BDA provides more active advice from the point of view of bank experts) are consolidated and explained below (see Figure 11).

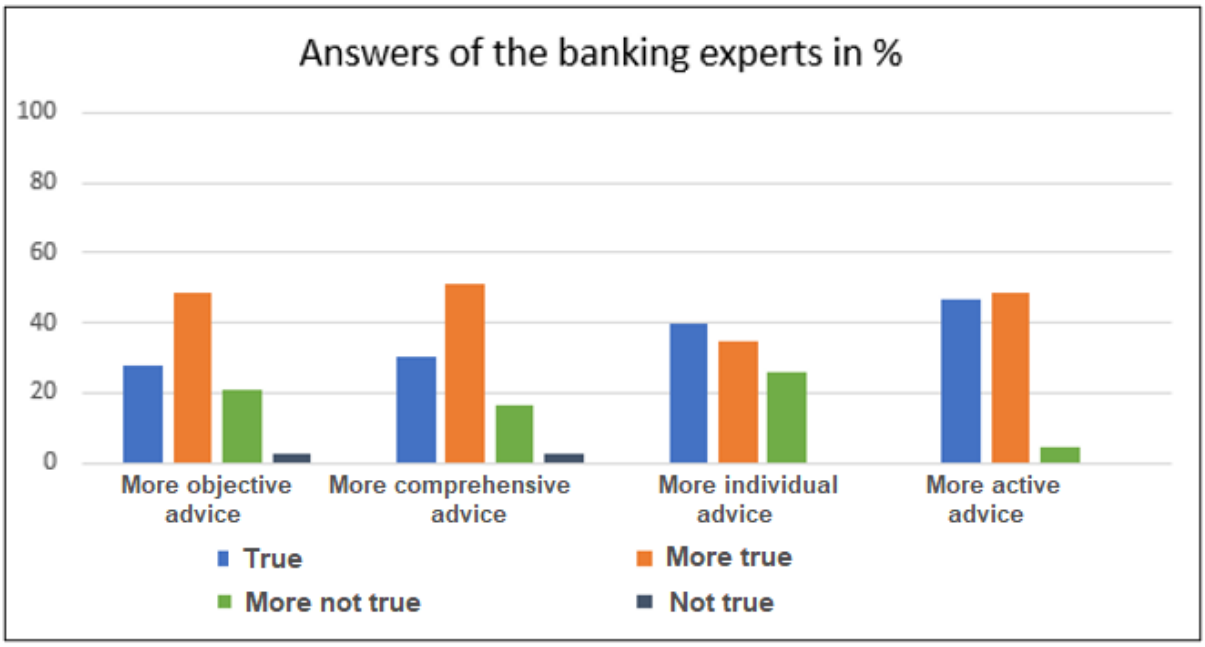

Figure 11: Own illustration, responses of the banking experts

Information on the strategic necessity of big data analytics

To the question " Do you agree with the statement that investments in big data analytics projects are strategically necessary and recommendable for banks in Germany in the age of digitalisation?", all 43 respondents answered "Yes" and no one answered "No" (see Figure 12), which corresponds to a rate of 100%.

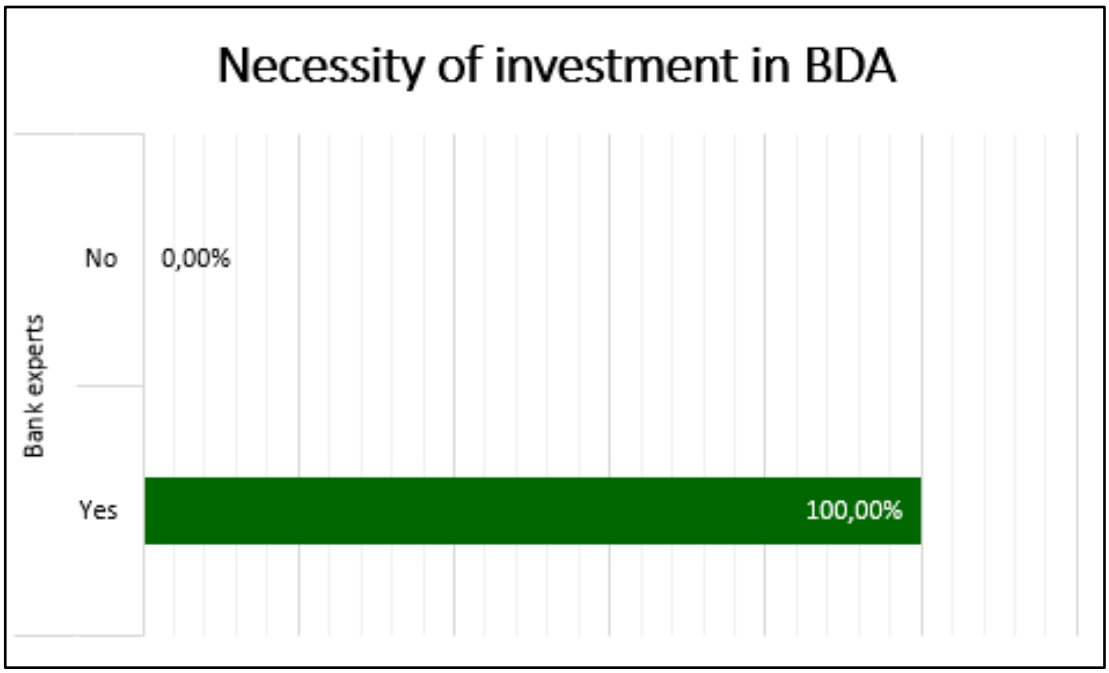

Figure 12: Own illustration, necessity of investments in BDAs

Information on aspects of personnel development in the use of big data analytics

Answers to the question "What would be useful in this project (only one answer possible)?": As Figure 13 shows, 18.60% of the 43 survey participants chose the answer "Training", 6.98% of the survey participants chose the answer "Coaching", 72.09% of the survey participants chose the answer "Training and Coaching" and 2.33% of the survey participants chose the answer "Neither".

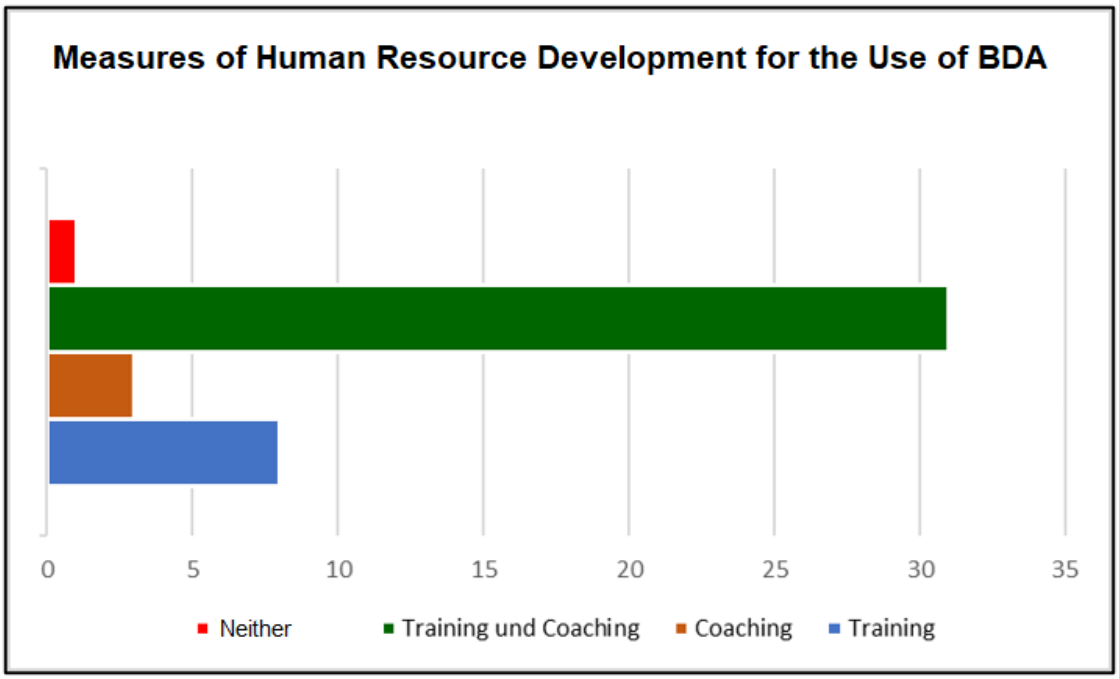

Figure 13: Own illustration, personnel development measures for BDA projects

10.2 Hypotheses and results

In research part III, the following hypotheses were investigated and processed. It was possible to work out a result for each thesis (see Table 3).

Hypotheses	Result
H_0^1 : Banking experts think that BDA ensures higher customer loyalty.	**Result: The** hypothesis is confirmed, BDA ensures higher customer loyalty from the perspective of the bank experts.
H_0^2 : Both groups ("Yes" and "No" respondents to the question about higher customer loyalty through BDA) answered the same to the statement "BDA provides more objective advice".	**Result: The** hypothesis is confirmed, more objective advice has no influence on customer loyalty from the perspective of the banking experts.

H_0^3 : Both groups ("Yes" and "No" - respondents to the question about higher customer loyalty through BDA) answered the same to the statement "BDA provides more comprehensive advice".	**Result: The** hypothesis is confirmed, more comprehensive advice has no influence on customer loyalty from the perspective of the banking experts.
H_0^4 : Both groups ("Yes" and "No" - respondents to the question about higher customer loyalty through BDA) answered the same to the statement "BDA provides more individualised advice".	**Result: The** hypothesis is confirmed, more individualised advice has no influence on customer loyalty from the perspective of the banking experts.
H_0^5 : Both groups ("Yes" and "No" - respondents to the question about higher customer retention through BDA) answered the same to the statement "BDA ensures more active consultation".	**Result: The** hypothesis is confirmed, a more active advisory service has no influence on customer loyalty from the perspective of the banking experts.
H_0^6 : The age of the banking expert does not play a role in answering the question on customer loyalty.	**Result: The** hypothesis is confirmed, the age of the banking expert does not play a role in answering the question on customer loyalty.
H_0^7 : In the view of the banking experts, investments in BDA projects are strategically necessary and advisable for banks in Germany in the age of digitalisation.	**Result: The** hypothesis is confirmed. In the view of the banking experts, investments in BDA projects are strategically necessary and recommendable for banks in Germany in the age of digitalisation.

Table 3: Own representation: Hypotheses and results of the research part III

Since the "Yes" and "No" respondents answered the questions about the better advice in each case similarly on average, there is an assumption that the principles of customer advice (more objective, more comprehensive, more individual and more active advice) do not have a direct

influence on customer loyalty (see Figure 14). In contrast, the factors that have no influence on customer loyalty are shown in red in the figure.

Figure 14: Own illustration: Influences on customer loyalty from the perspective of banking experts

11 Conclusions (answering the research questions)

Research Part I (Analysis of Banks in Germany):

Research question 1: *What is the business development of German banks under the influence of the digital transformation?*

The research question can be answered as follows: In the period 2003-2019, the emerging cost pressure led to drastic cost-cutting measures at German banks. These include, for example, staff reductions, mergers or the closure of credit institutions. In addition to a declining trend in the number of banks and the number of employees, the operating result from the operational banking business stagnated. The balance sheet total grew in the period under review. The cost-income ratio has deteriorated sharply in recent years (see chapter 6 of the dissertation).

Research Part II (online survey of bank customers):

Research question 2: *Does big data analytics improve the quality of advice from the customer perspective (measured against the principles of customer advice) and has an impact on customer loyalty?*

The research question can be answered with "yes". From the perspective of bank customers, BDA provides more objective, more comprehensive, more individual and more active advice (see Figure 7). More comprehensive, more individual and more active advice has a positive influence on customer loyalty, whereas objective customer advice does not (see Figure 8). It can be assumed that bank customers do not attach any particular value to objectivity in advice. It is possible that a degree of subjectivity (e.g. through a tip from the advisor) is desired, but this was not the subject of the survey.

Research Part III (interviews with banking experts):

Research question 3: *Does big data analytics improve the quality of advice from the advisor's perspective (measured against the principles of client advice) and has an impact on client retention?*

The research question can be answered with "YES". From the perspective of the bank advisors, BDA provides more objective, comprehensive, individualised and active advice (see Figure 11). More objective, comprehensive, individualised and active advice has no positive influence on customer loyalty (see Figure 14). It can be assumed that the banking experts consider the use of big data analytics alone to be a success driver for customer retention. From the author's point of view, it is necessary to understand the confirmed better customer advice through BDA also in connection with the principles of customer advice as an elementary customer retention instrument. Here, personnel development measures would lend themselves to addressing the importance of the principles of customer advice in the BDA context.

Research question 4: To *what extent can big data analytics make a positive contribution to the situation of banks in Germany in the age of digitalisation*?

The research question can be answered with "yes". The interview participants unanimously confirmed that they consider investments in big data analytics projects to be strategically necessary and recommendable for German banks in the age of digitalisation (see Figure 12).

Research question 5: *From an advisor's perspective, which aspects of human resources development should be applied in the transfer of knowledge on the use of big data analytics in the client business in order to ensure successful implementation?*

The research question can be answered with "training and coaching measures". The interview participants expressed this with a rating of 72.09% (see Figure 13).

12 New scientific results

This dissertation fills research gaps from the perspective of banks, the perspective of bank customers and the perspective of bank advisors in the banking centre of Germany.

Research Part I (Analysis of Banks in Germany):

Due to the massive change described above, German credit institutions have significantly changed the number of their employees, the number of their institutions, the operating result and the cost-income ratio in the period 2003-2019. Only the balance sheet total did not change significantly in the full stop described. Thus, the pressure to act and the necessity of data-driven strategic instruments were derived for credit institutions in Germany.

Research Part II (online survey of bank customers):

Big Data Analytics increases customer loyalty from the customer's perspective (see Figure 7). The age of the customers does not play a role in answering the question on customer loyalty. For the first time, the relationship between the "Principles of Customer Advisory Services" model in connection with Big Data Analytics was examined from the bank customer perspective. From the bank customers' perspective, BDA provides more objective, comprehensive, individualised and active advice (see Figure 7).

Research Part III (interviews with banking experts):

Big Data Analytics increases customer retention from the relationship manager perspective (see Figure 10). The age of the banking experts does not play a role in answering the question on customer retention. For the first time, the relationship between the "Principles of Client Advice" model in connection with Big Data Analytics was examined from the bank advisor perspective. From the perspective of the bank advisors, BDA provides more objective, comprehensive, individualised and active advice (see Figure 11).

In the view of the banking experts, investments in big data analytics projects are strategically necessary and recommendable for banks in Germany in the age of digitalisation (see Figure 12).

Within the framework of personnel development measures, "training and coaching measures" should be applied in the transfer of knowledge on the use of big data analytics in customer business from an advisor perspective to ensure successful implementation (see Figure 13).

Thus, from the author's point of view, evidence has been provided that big data analytics can be described as an elementary customer loyalty instrument for banks in Germany. In the following (see Figure 15), the new scientific findings are presented as an iceberg model. For reasons of banking strategy, the practical findings on the surface are considered to be of essential importance in the research context. The findings that are below the water's surface have a research-theoretical significance.

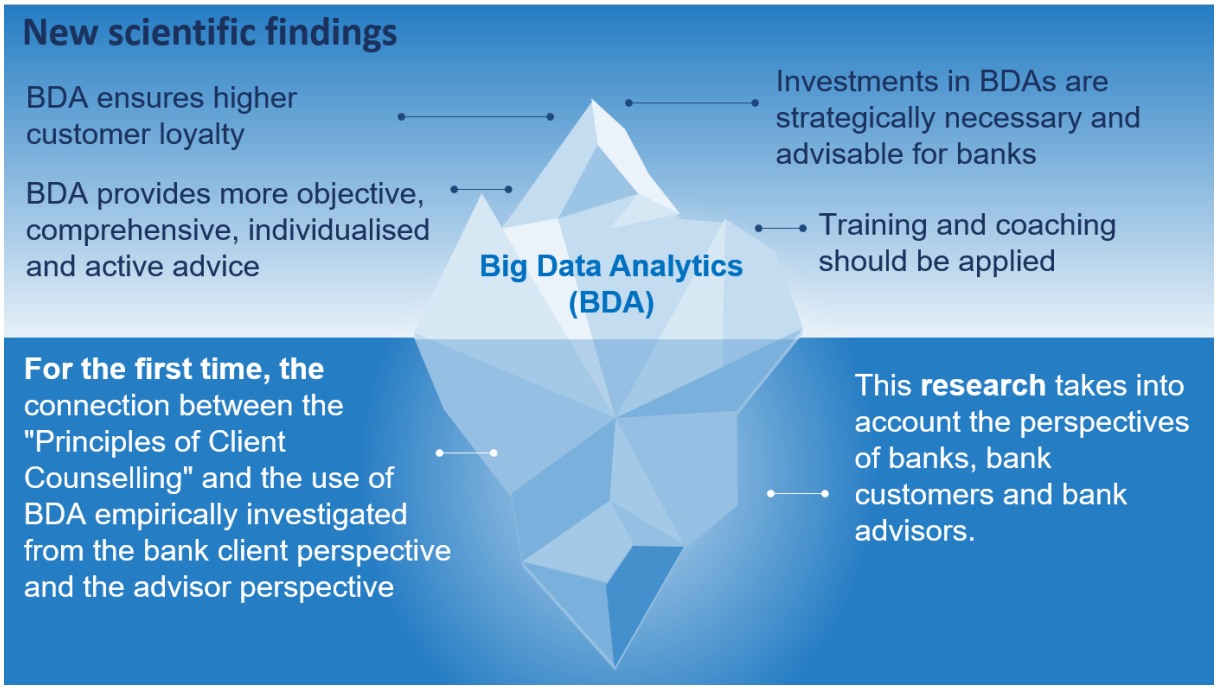

Figure 15: Own illustration, iceberg model "BDA" - new scientific findings

13 Conclusions and suggestions

The results of the three empirical research parts show, on the one hand, that the described cost pressure in the banking sector has led to a consolidation of banks, as can be seen from the continuous decline in the number of institutions and employees throughout the period under consideration. In the author's view, these drastic measures are due to the banks' struggle for survival in a difficult market environment. It can be stated that the pressure on banks in Germany is enormous. The digital transformation offers extraordinary opportunities for traditional players and new market participants. Process optimisation is considered a prerequisite for economic success. In order to take advantage of the opportunities of the digital economy, traditional banks must become digital banks to a large extent (Ilie et al., 2017).

The main purpose of this research project was initially to investigate the extent to which Big Data Analytics can be described and used as a customer retention instrument. The relevance of the findings on this scientific problem is that the effectiveness of customer retention could be answered from the bank customer's and the advisor's perspective. It was proven that the use of big data analytics can ensure higher customer loyalty from the perspective of bank customers as well as bank advisors in Germany.

And it can be stated that the age of the test persons did not play a significant role in answering the questions about customer loyalty. The author would have assumed that older subjects would answer the question (about higher customer loyalty through BDA) in the negative to a greater extent, which was not the case.

Furthermore, the interview participants of research part III confirmed that they consider investments in big data analytics projects to be strategically necessary and recommendable for German banks in the age of digitalisation. Therefore, the use of BDA is recommended to increase customer loyalty.

It was also investigated in the third part of the research which personnel development options should be applied from an advisor's perspective when imparting knowledge on the use of big data analytics in customer business in order to ensure successful implementation. The answer given by the interview participants was "training and coaching measures". In HR, talent management, performance management and compensation management play a key role in the implementation of the digitalisation strategy. As elaborated in this dissertation, it is

recommended that training and coaching measures be applied as HR development measures when imparting knowledge on the use of BDA (see Figure 16).

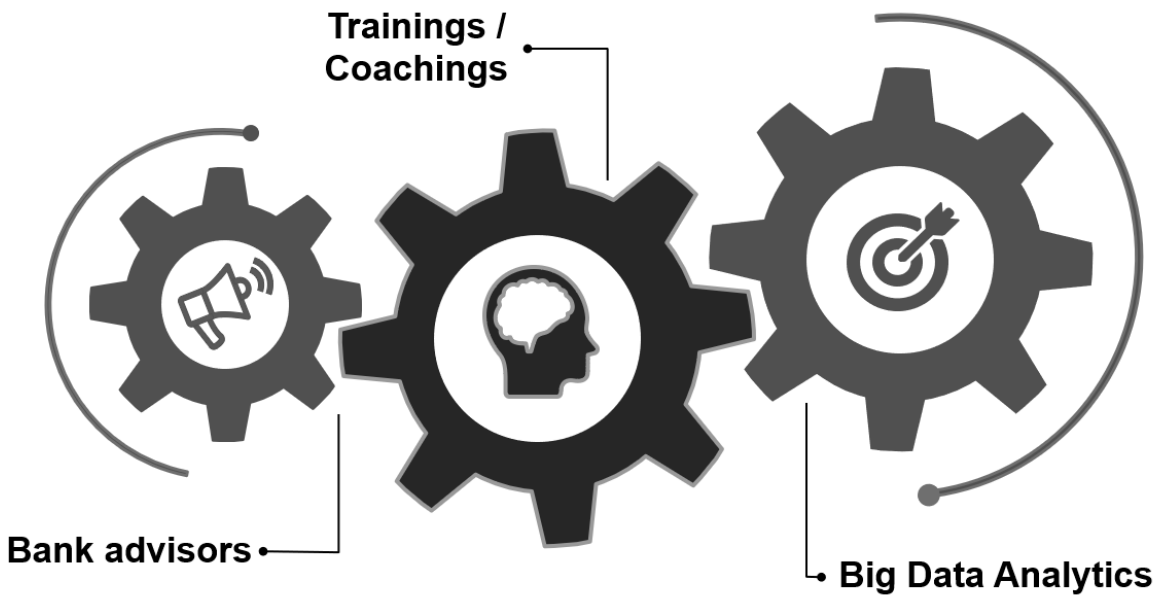

Figure 16: Own illustration, training and coaching measures for BDAs

The traditional business model of credit institutions is traditionally based on personal customer contact. Due to the influence of digitalisation, an entire industry has been facing massive changes for years. These changes have an impact on many aspects of how bank customers demand, evaluate and ultimately purchase financial services. Therefore, the consideration of the principles of customer advice are still justified. And BDA can (as has been worked out from the perspective of bank customers as well as bank advisors) provide more objective, comprehensive, individualised and active advice. In the author's view, the question of customer loyalty should be examined more closely.

14 Publications written in the topic of the dissertation

Giebe, C. (2022). Big Data Analytics and the Discovery of the Hidden Data Treasure from Savings Banks in Germany, In: Sun, Z. & Wu, Z. (Eds.), *Handbook of Research on Foundations and Applications of Intelligent Business Analytics (pp. 350-373)*. IGI Global, Pennsylvania, USA. https://doi.org/10.4018/978-1-7998-9016-4.ch016

Giebe, C. (2019). The Chief Digital Officer - Savior for the Digitalization in German Banks? *Journal of Economic Development, Environment and People, 8*(3), 6-15. http://dx.doi.org/10.26458/jedep.v8i3.633

Giebe, C., Hammerström, L., & Zwerenz, D. (2019). Big Data & Analytics as a sustainable Customer Loyalty Instrument in Banking and Finance. *Financial Markets, Institutions and Risks, 3*(4), 74-88. http://doi.org/10.21272/fmir.3(4).74-88.2019

Giebe, C., Löffler, L., & Menrad, M. (2022). Future Role of Bank Advisors and Traditional Bank Branches in the Age of Digitalization-An Empirical Investigation. *Open Journal of Business and Management, 10*(3), 1569-1582. https://doi.org/10.4236/ojbm.2022.103082

Giebe, C., & Menrad, M. (2023). Human Resources Development for the Use of Big Data Analytics in the Customer Business of German Banks. In: *Handbook of Research on Driving Socioeconomic Development With Big Data* (pp. 197-223). IGI Global Pennsylvania, USA. https://doi.org/10.4018/978-1-6684-5959-1.ch009

Giebe, C., & Schulz, K. (2021). Cost Cutting Measures at Cooperative Banks in Germany as a Result of Digitalization and their Consequences. *Journal of Economic Development, Environment and People, 10*(2), 29-45. https://dx.doi.org/10.26458/jedep.v10i2.693

Giebe, C., & Schulz, K. (2021). Digitalization and its Rapid Impact on Savings Banks in Germany. *Global Journal of Management and Business Research, 21*(4), 1-11, https://doi.org/10.34257/GJMBRBVOL21IS4PG1

Giebe, C., & Schulz, K. (2021). Economic Effects of the Digital Transformation on the Banking Market Using the Example of Savings Banks and Cooperative Banks in Germany. *International Journal of Economics and Finance*, *13*(6), 34-45. https://doi.org/10.5539/ijef.v13n6p34

Giebe, C., Zwerenz, D. & Hammerström, L. (2023). Big Data Analytics as an elementary Customer Loyalty Instrument for German banks - an empirical approach from a banker's perspective. *Financial Markets, Institutions and Risks*, *7*(1), 96-108. https://doi.org/10.21272/fmir.7(1).96-108.2023

Hammerström, L., Giebe, C., & Zwerenz, D. (2019). Influence of Big Data & Analytics on Corporate Social Responsibility. *SocioEconomic Challenges, 3*(3), 47-60. https://doi.org/10.21272/sec.3(3).47-60.2019

Hammerstöm, L., Zwerenz, D., & Giebe, C. (2019). Taxonomy of an IIot Device Based upon Production Functions. *European Journal of Economics and Business Studies, 5*(2), 6-22, http://dx.doi.org/10.26417/ejes.v5i2.p6-22

Hock, K., & Giebe, C. (2022). Big Data Analytics in the German Banking Sector Using the Example of Retail Banking. *Account and Financial Management Journal, 7*(2), 2601-2616. https://doi.org/10.47191/afmj/v7i2.01

Löffler, L., & Giebe, C. (2021). Generation Z and the War of Talents in the German Banking Sector. *International Journal of Business Management and Economic Review, 4*(6), 1-18, http://doi.org/10.35409/IJBMER.2021.3319

15 Annexes

Appendix I to the Analysis of Banks in Germany

Number of employees in the German banking sector 2003 to 2019

Year	Number of employees
2003	722.000
2004	702.750
2005	693.050
2006	681.300
2007	680.450
2008	675.000
2009	663.000
2010	657.700
2011	653.550
2012	648.950
2013	645.550
2014	640.050
2015	627.150
2016	609.100
2017	586.250
2018	571.700
2019	561.450

Table 4: Own representation, development of the number of employees in the German banking industry

Number of credit institutions in the German banking sector 2003 to 2019

Year	Number of credit institutions
2003	2.466
2004	2.400
2005	2.344
2006	2.301
2007	2.277
2008	2.169
2009	2.128
2010	2.093
2011	2.080
2012	2.053
2013	2.029
2014	1.990
2015	1.960
2016	1.888
2017	1.823
2018	1.783
2019	1.717

Table 5: Own presentation, development of the number of credit institutions in Germany

Development of the operating result in the German banking sector 2003 to 2019

Year	Operating result (in billion euros)
2003	18,13
2004	23,50
2005	37,26
2006	35,50
2007	21,04
2008	-7,66
2009	18,03
2010	31,17
2011	49,28
2012	42,65
2013	31,23
2014	31,51
2015	34,36
2016	30,60
2017	30,91
2018	25,69
2019	21,77

Table 6: Own presentation, development of operating profit in the German banking industry

Development of total assets in the German banking sector 2003 to 2019

Year	Balance sheet total
2003	6.471
2004	6.664
2005	6.903
2006	7.188
2007	7.626
2008	7.956
2009	7.510
2010	8.352
2011	8.467
2012	8.315
2013	7.604
2014	7.853
2015	7.708
2016	7.836
2017	7.755
2018	7.824
2019	8.359

Table 7: Own presentation, development of total assets in the German banking industry

Development of cost-income ratios in the German banking sector 2003 to 2019

Year	Cost-income ratio (in %)
2003	66,60
2004	65,60
2005	61,20
2006	62,70
2007	65,00
2008	73,30
2009	65,10
2010	63,80
2011	64,00
2012	64,30
2013	69,20
2014	69,20
2015	70,40
2016	69,30
2017	71,90
2018	73,10
2019	76,00

Table 8: Own presentation, development of the cost-income ratio in the German banking industry

Appendix II on the online survey of bank customers

The original text of the survey read:

"Big Data Analytics" (the analysis of large amounts of data) is a collective term for statistical-mathematical methods that enable bank advisors to predict, for example, which customers have an affinity for a certain product. If you are a customer of a bank in Germany, we would be pleased if you would participate in the survey, which consists of six questions. Only one answer is possible for each question. With the help of this survey, the influence of big data analytics (as opposed to the approach without the use of big data analytics) on customer loyalty is to be examined.

1st statement: AGE - How old are you?

□ Indication of the respective age

Statement 2: Big data analytics makes for more objective advice.

□ Applies

□ More likely to apply

□ Rather not applicable

□ Does not apply

3rd statement: Big Data Analytics provides more comprehensive advice.

□ Applies

□ More likely to apply

□ Rather not applicable

□ Does not apply

Statement 4: Big Data Analytics ensures more individualised advice.

□ Applies

□ More likely to apply

□ Rather not applicable

□ Does not apply

5th statement: Big Data Analytics ensures more active counselling.

□ Applies

□ More likely to apply

□ Rather not applicable

□ Does not apply

Statement 6: Do you agree with the statement that big data analytics increases customer loyalty?

□ Yes

□ No

Appendix III to the standardised interviews with the bank experts

The original text of the announcement of the interviews read:

Dear Survey Participant.

Thank you for being available for an expert interview as part of my dissertation. The evaluation of this research will be anonymous.

The following premises exist among the interview partners:

I: Successful training as a bank clerk (or a dual study programme) in a German credit institution

II: Currently working in the financial services industry

In the follow-up to the interviews, the following research questions will be answered (I):

1.) *Does Big Data Analytics (BDA) improve the quality of advice from the advisor's perspective (measured against the principles of client advice) and has an impact on client retention?*

2.) *To what extent can big data analytics make a positive contribution to the situation of banks in Germany in the age of digitalisation?*

PART 1 (Information on the test person)

1. How old are you (please state your age)?

Age: _____

2. How long ago did the training (or banking study) relationship end (one answer possible)?

( ) 1-5 years

( ) 6-15 years

( ) > 15 years

3. Are you currently employed in the financial services industry in Germany)?

Please state your employer?

□ Yes

At: _____

PART 2 (Big Data Analytics - Influence on Counselling Quality)

"Big Data Analytics" (BDA) -the analysis of large amounts of data- is a collective term for statistical-mathematical methods that enable bank advisors to predict, for example, which customers have an affinity for a certain product.

(Further explanations on the mode of action of BDA are available during the interview if required).

With the help of this research part, on the one hand, the influence of Big Data Analytics (in contrast to the approach without the use of Big Data Analytics) on customer loyalty is to be examined. Secondly, the influence on the principles of customer advice (which state that bank customers should be advised objectively, comprehensively, individually and actively). Finally, the strategic necessity of big data analytics will be examined.

1st statement: Big Data Analytics ensures more objective advice (only one answer possible).

□ Applies

□ More likely to apply

□ Rather not applicable

□ Does not apply

2nd statement: Big Data Analytics provides more comprehensive advice (only one answer possible).

□ Applies

□ More likely to apply

□ Rather not applicable

□ Does not apply

3rd statement: Big Data Analytics ensures more individualised advice (only one answer possible).

□ Applies

□ More likely to apply

□ Rather not applicable

□ Does not apply

4th statement: Big Data Analytics ensures more active counselling (only one answer possible).

□ Applies

□ More likely to apply

□ Rather not applicable

□ Does not apply

5. statement: Do you agree with the statement that big data analytics is

customer loyalty (only one answer possible)?

□ Yes

□ No

6. Do you agree with the statement that investments in big data analytics projects are strategically necessary and advisable for banks in Germany in the age of digitalisation (only one answer possible)?

□ Yes

□ No

PART 3 (Big Data Analytics - Human Resources Development)

In the follow-up, the following further research question is to be answered:

3.) *From an advisor's perspective, which aspects of human resources development should be applied when imparting knowledge on the use of big data analytics in the client business in order to ensure successful implementation?*

To answer this, some differences between training and coaching will be briefly explained

The function of training is to develop specific behaviours. Coaching, on the other hand, is often about attitudes and values that underlie concrete behaviour. The trainer is more of a fact-oriented instructor and expert, the coach more of a relationship-oriented listener and reflection partner. The training target group is broad, the content of training is often predefined or standardised (e.g. sales training). Coaching, on the other hand, focuses on managers who have usually already completed several training courses but now want to work individually on their attitude (Webers & Zickermann, 2019)**.**

The aim is to examine which aspects of human resources development should be applied from an advisor's perspective when imparting knowledge on the use of big data analytics in client business in order to ensure successful implementation.

1. what would be useful in this project (only one answer possible)?

□ a) Training

□ b) Coaching

□ c) Both

□ d) Neither