

## **Chances and Challenges of Business Intelligence: Insights from the German Insurance Market**

*Theresa Eden, Oliver Werth, Claus Marcus Aschenbach  
and Michael H. Breitner*

### **Abstract**

In the context of digital transformation, new analysis and visualization methods and tools offer insurance companies the opportunity to support existing and enable new business processes and acquire new clients. In particular, competitive advantages can be generated through fast and intuitive high-quality data processing. Business Intelligence (BI) systems support and enable data processing and create significant value for financial services companies, as large amounts of customer data can be used profitably. Based on qualitative interviews with experts from the German insurance industry, this paper examines possible applications of BI in insurance companies and, moreover, opportunities

---

Theresa Eden (korrespondierende Autorin)  
Gottfried Wilhelm Leibniz Universität Hannover  
Institut für Versicherungsbetriebslehre  
Otto-Brenner-Straße 7  
D-30159 Hannover  
Deutschland  
E-Mail: [te@ivbl.uni-hannover.de](mailto:te@ivbl.uni-hannover.de)  
Dr. Oliver Werth  
OFFIS e. V. – Institute for Information Technology  
<https://orcid.org/0000-0002-6767-5905>  
Escherweg 2  
D-26121 Oldenburg  
Deutschland  
Claus Marcus Aschenbach  
Gottfried Wilhelm Leibniz Universität Hannover  
Institut für Versicherungsbetriebslehre  
Otto-Brenner-Straße 7  
D-30159 Hannover  
Deutschland  
Prof. Dr. Michael H. Breitner  
Gottfried Wilhelm Leibniz Universität Hannover  
Institut für Wirtschaftsinformatik  
Königsworther Platz 1  
D-30167 Hannover  
Deutschland

and challenges resulting from BI implementation and use. Our results and findings show that the use of BI is beneficial and an expansion in the insurance sector is expected, as potential use cases currently are not fully exploited. Our research also supports decision-making of practitioners to implement new BI tools and processes.

## **Zusammenfassung**

Im Rahmen der digitalen Transformation bieten neue Analyseverfahren und Visualisierungen für Versicherungsunternehmen die Möglichkeit bestehende Geschäftsprozesse zu unterstützen, neue Geschäftsprozesse zu ermöglichen und neue Kunden zu gewinnen. Insbesondere infolge einer schnellen, hochwertigen und intuitiven Datenaufbereitung können erhebliche Wettbewerbsvorteile generiert werden. Business Intelligence (BI) Systeme unterstützen und ermöglichen dabei die Datenverarbeitung und sind in Finanzdienstleistungsunternehmen von besonderem Interesse, da große Datenmengen an Kundeninformationen wertschöpfend genutzt werden können. Mit qualitativen Interviews mit Experten aus der deutschen Versicherungsbranche untersucht dieser Beitrag die aktuellen Einsatzpotentiale von BI in Versicherungsunternehmen sowie die mit der Einführung und Nutzung resultierenden Chancen und Herausforderungen. Die Ergebnisse und Erkenntnisse zeigen, dass der Einsatz von BI als vorteilhaft angesehen wird und die Nutzung in Versicherungsunternehmen deutlich zunehmen wird, da potentielle Einsatzmöglichkeiten derzeit ungenügend ausgeschöpft werden. Unsere Forschung unterstützt auch den Entscheidungsprozess von Praktikern, in welchem Umfang die Implementierung von BI sinnvoll ist.

## **1. Introduction**

Digital transformation and the enduring value of information as a crucial success factor affect all business areas and sectors, e.g., insurance, in these times. In a world of big data, companies are urged to analyze and use it profitably (e.g., Davenport 2014). New analytics procedures and visualizations allow companies to support existing business processes and acquire new clients (Keller 2018). However, without appropriate relating or visualization, the volumes of data do not deliver any immediate intended use but rather represent pure information. Competitive advantages thus arise from fast and high-quality data processing. Business intelligence (BI) systems support processing this information and can therefore be seen as a useful technology within insurance companies (Gehra et al. 2005). With the help of statistical and visualization options, the data volumes can be processed and evaluated for business purposes. BI is particularly interesting to financial services companies because they are technology-driven, collect a high quantity of data about their customers, and the customer information received can be used profitably in various ways (Rostek 2009). Overall, there are several possible BI applications. This paper addresses the question of how insurance companies can benefit from the use of BI applications. Past liter-

ature on BI investigated it in the context of, e.g., in higher education (Gupta et al. 2015) and its effective usage (Trieu et al. 2022). However, BI has been neglected so far by exploratory and recent investigations of useful use cases tailored to the specificities of the (German) insurance sector, e.g., lack of use of the potential of digital technologies (Catlin et al. 2015), changing value creation due to digitalization, competitive pressure (Eling and Lehmann 2017), and regulatory requirements (Schmidt 2018). From a theoretical perspective, we shed light on possible use cases and their associated chances and challenges of BI within this business area. In doing so, we interviewed eight (n=8) experts from the insurance sector in Germany. Interviewees were invited to talk about possible and already existent use cases, their observations, and their understandings of BI in the German insurance sector. Interview transcripts were analyzed with qualitative content analysis (Kuckartz 2018) and discussed. In this context, qualitative research offers the opportunity to generate new insights through systematically analyzing experts' practical experiences. With this work, we support the decision-making process for practitioners as to whether and to what extent BI can be implemented within insurance companies. Also, practitioners in the insurance sector can use the findings provided in this study for a more focused discussion on BI for insurance. Motivated by these statements, we answer the following research questions (RQs) with this study:

*Which established and new BI tools and processes exist in insurance companies?*

*Which chances and challenges are associated with the implementation and usage of BI?*

The rest of our paper is structured as follows: First, we provide the theoretical background of BI and its relationship to insurance companies. Then, we introduce our research design and research methods. Results, our discussion, findings, and implications presented subsequently. Finally, limitations, further research directions, and conclusions conclude our paper.

## 2. Business Intelligence in Insurance Companies

BI and their associated systems “combine data gathering, data storage, and knowledge management with analytical tools to present complex internal and competitive information to planners and decision-makers” (Negash 2004, p. 178). However, there is no common definition of BI available (Philips-Wren et al. 2021). An influential review of BI by Chee et al. (2009) identifies various definitions in the academic literature. They found that the interpretations of the term fall into three aspects: the management aspect, the technological aspect, and the product aspect. For example, according to Petrini and Pozzeborn (2008), in the management aspect, the focus is on the coordination and management of the process, which ensures that the data from various sources of information,

both internal and external, is integrated and analyzed to sources are integrated and analyzed to support the decision-making process. The technological aspect focuses on finding, collecting, organizing, and accessing information from different data sources; it is directly related to the software. In line with Davenport (2014, p. 46), BI uses “tools to support data-driven decisions, with emphasis on reporting,” while the term Business Analytics (BA) “focuses on statistical and mathematical analysis for decisions.” With the help of Big Data and/or data mining, the BI software should generate insights that are not immediately apparent. For this case, external and/or internal, as well as structured and/or unstructured data, can be used. In the product aspect, on the other hand, BI is the result of a detailed analysis of comprehensive business data and analytical practices. The processed data as the product is the goal of this approach (Chee et al. 2009).

Like several other business areas, the insurance sector is affected by digital transformation, the threat of new market entrants, and the introduction of technological possibilities (Werth et al. 2020; Eckert et al. 2021). The usage and introduction of new technologic possibilities for insurance companies, e.g., cloud computing or Artificial Intelligence, have been recently reviewed (Eckert and Osterrieder 2020; Eling et al. 2022). Insurance companies need to constantly analyze the needs and requirements of their customers to ensure that these can be met at all times (Rostek 2009). In addition, the business processes within the value chain and the products must be constantly adapted to new needs. Companies collect and centralize information about their customers and use it to gain valuable insights into data, thus supporting the company’s decision-makers. Focusing on BI and BA, several application areas have been discussed. For example, insurance companies can use BI for managing internal documents and integrate them into document management or use it for specific knowledge management (e.g., Negash 2004; Dreyer et al. 2022). Also, BI can automatically handle all incoming customers’ data, e.g., from smart home devices, and examine new marketing possibilities and new insurance product specifications from it (Schulte-Noelle 2001; Eggert and Alberts 2020; Huang et al. 2022). Another application area for BI and BA can be seen in call centers of insurance companies (Kyper et al. 2009). Here, decision trees, derived with BA based on data from call centers, can leverage the overall performance of the call center’s responsiveness. Another application of BI comes from Amini et al. (2021). In this Iranian study, BI is used for better risk prediction in different areas for insurance companies. Also, BI can be used for calculating and monitoring key performance indicators, e.g., managing reserves, calculating large losses or solvency predictions, and against insurance fraud (Ngai et al. 2011; Helfand 2017; Eckert and Osterrieder 2020). Another qualitative approach to the chances and challenges of BI usage comes from Baars et al. (2009). Their study, with a look at the financial services sector, i.e., banks and insurances, reveal challenges such as a

lack of integration into existing IT backends and restricted time and monetary budgets as barriers to the usage of BI. However, their study and examinations are somewhat outdated for such a vital topic as BI.

It can be summarized that researchers from an information systems or business perspective have extensively studied BI. Also, different application areas have been studied so far. However, the German insurance sector has been somewhat neglected, and the literature is fragmented. The efficient usage of BI and its associated chances and challenges in an insurance environment remains somewhat unclear. Therefore, more timely exploratory research on this topic is necessary to accumulate current knowledge for academics and practitioners.

### 3. Research Design and Research Methods

Given the lack of context-specific research findings on the chances and challenges related to implementing and using BI in insurance companies and the explorative nature of the research questions, qualitative case interviews with insurance experts were conducted (Yin 2009). Qualitative research offers the opportunity to generate new insights through a systematic analysis regarding the practice-based experiences of interviewed experts in the area of digital transformation in the financial services sector (Gioia et al. 2013; Schnell et al. 2011). Therefore, potential interview participants in insurance companies were contacted via email after prior research regarding relevant expertise to analyze the research questions. For this purpose, the experts had to have distinctive experience with the use of BI in insurance companies, such as regular use of BI applications or experience with implementing BI in their company. The chosen form of questioning was oral with partially standardized and open guideline interviews. We chose this form of questioning because it is established in the analysis of expert knowledge (Myers and Newman 2007; Schultze and Avital 2011). Seven semi-structured open guideline-based interviews with eight experts could be conducted from May to July 2022. With the seventh interview, no new insights were generated, and theoretical saturation of the results was achieved. The interview duration varied between approximately 45 and 60 minutes. Table 1 shows the expert number and the position within the respective insurance companies.

Table 1  
Interview experts

Interview	Expert	Position
1	E.1	Team Leader Sales Controlling
2	E.2	Team Leader Controlling
3	E.3	Member of the Board
4	E.4	Controller
5	E.5	Team Lead Customer Management
6	E.6	Controller
7	E.7	Team Lead Sales Controlling
	E.8	Team Lead BI and Analytics Competence Center

The interview guideline was developed based on the previous literature review and is divided into four parts, containing six subordinate questions. Initially, general explanations about the research project and the collection of information about the person, professional occupation, and position of the interviewed experts were used at the beginning of the interview. Subsequently, an introduction question on the conceptual understanding of BI is asked in the second part. The third part deals with the potential uses and challenges of BI. Questions on the potential influence of BI on decision-making constitute the last part of the interview. The interviews were held in German, recorded, and fully transcribed afterward. We did not send out the interview guideline in advance but briefly introduced our study as part of the interview invitations.

The evaluation was conducted using the current version of the qualitative data analysis software MAXQDA following the qualitative content analysis, according to Kuckartz (2018), which allows a systematic and rule-based evaluation of the data material. After analyzing the interviews, a deductive-inductive category system with anchor examples was developed (Mayring 2015). Potential categories were identified deductively from the interview guide and inductively from the interview material. The deductive categories were additionally reviewed based on the transcripts, and the inductive development of subcategories followed (Hsieh and Shannon 2005). An overview of the category system is shown in Table 2.

*Table 2*  
**Category system**

Main codes	Subcodes	Definition of the Subcodes	Anchor examples
Definition of BI	/	Text passages indicating the interpretation of the term BI	E.3: "(...) break it down into two different points. On the one hand, you have a business point, i. e., what everyday life involves for us in the company. That always involves numbers, data, and facts, especially the focus on controlling. Intelligence is the area we can feed."
	Reporting system	Indications for possible applications of BI regarding reporting in insurance companies	E.5: "But where you definitely use it is in controlling (...)."
Chances	Sales analysis	Indications for possible applications of BI regarding sales analyses in insurance companies	E.2: "We use it for reporting capabilities, so sending standard reports for the sales part."
	Market forecasts	Indications for possible applications of BI regarding market forecasts in insurance companies	E.3: "I would say to generate past-related insights for the future from the data obtained. That's how I would describe it in one sentence. That means enlightening a bit of a glass ball in order to be able to predict certain things or recognize them at an early stage."
	Usability	Indications for possible applications of BI regarding usability in insurance companies	E.1: "We want to expand this even further in the future and open up additional areas of application, such as operational business for ad hoc information."

Challenges	Data and privacy	Text passages about data used and the handling of data in the respective company	E.4: “That is, of course, Prio 1, that the data we control is reliable and that we can derive the right decisions and measures from them.”
	IT landscape and programming	Text passages about the technical infrastructure and programming in the company	E.2: “When you use software solutions, you naturally have programming in front of your nose. The system we use is very flexible, but also has its own software language, which has presented us as a company with small challenges, wherein the depth of detail the topics were not quite easy to implement and which also cost a lot of time.”
	Employee involvement	Text passages about the involvement of employees in dealing with BI as an innovation in the company	E.4: “Well, the challenge is basically to bring the employees along and to change the perspective.”
Impact on processes	Management process	Text passages about the impact of BI on management processes	E.2: “(...) that the processes or the calculations that lead to the key figures are always followed according to a precise definition and can therefore also be less prone to error. This has increased the confidence of the sales department, and thus it has been possible to tap into the key figures more and more.”
	Decision-making process	Text passages about the impact of BI on decision-making processes	E.5: “So that ultimately we make decisions that are secure for the long term, not just a gut feeling.”

The final category system, based on which the transcripts were coded, contained the four main codes “Definition,” “Chances,” “Challenges,” and “Impact on processes,” and another nine related subcodes, all concerning BI. Based on this, the results of the qualitative content analysis are presented below.



## 4. Results

### 4.1 Definition

According to the experts interviewed, BI is defined as the company's internal data handling in an IT landscape. It should also be mentioned that BI is not defined as the program to be operated but as a kind of idea. In other words, experts believe BI is a type of collective term for various functions and uses that can be realized with the support of a software solution.

E.2: "I think business intelligence can basically be split into two different points. On the one hand, you have the point of business, i.e., what everyday life involves in our company. That always involves numbers, data, and facts, especially the focus on controlling. Intelligence is the area that we can focus on. So from my point of view, the IT machine so that we can put the numbers, data, facts into an intelligent IT machine [...]."

Two of the interview participants (E.4 and E.8) mention the goal is what they call a "single place of truth." This involves the conception and realization of a digital place where all internal company data is bundled and can be evaluated. All visualized data can be viewed by everyone with a high degree of reliability, as there are no other collection, consolidation, and evaluation methods within the company. The BI software solution used within the company also differs between financial service providers. Many programs on the market include BI packages or are described as BI tools. Summarizing the understanding of the term, there is a consensus among experts that BI is defined as an idea and collective term which includes data processing in the company, analysis, and visualization. A software application is required for support and realization, which is company-dependent.

### 4.2 Chances

#### Reporting System

All the experts interviewed mentioned controlling as the most frequently used option. This primarily involves generating standard reports (e.g., to Federal Financial Supervisory Authority (BaFin)) from both the operational and sales areas. The financial services companies consolidate and visualize the information, which can be accessed via the BI tool. The advantage is that this information can be generated automatically and sent to the intended users at the required time. After one-time programming, the information is kept up to date continuously, and the created dashboards and evaluations can be exported and sent independently. The controlling department can also include direct comments

when communicating the results. In addition, only limited programming skills are required for the BI tool to create the reporting to collect and analyze the requested data from the data warehouse.

E.4: “Standard reporting is a main focus of the BI tool, but of course also the possibility to easily browse the data warehouse via a BI tool, to create ad-hoc evaluations without having great SQL knowledge, but to assemble evaluations via drag and drop and then just analyze the data accordingly [...]”

Reporting for executive positions also serves as the basis for financial services companies’ budgeting, revenue, and expense planning. The evaluations and findings determined can ultimately be incorporated into the company’s internal planning processes. Furthermore, financial services companies are subject to many regulatory measures. In this context, BI provides support to present and fulfill the requirements related to the reporting system. In addition, the support of actuaries with BI was highlighted as a usage.

### Sales Analysis

Financial services companies focus particular attention on reporting from sales controlling. Sales is an important core variable in many insurance companies. Therefore, it is important to analyze and optimize the sales channels with the support of BI evaluations. In this way, the sales partner is informed which products offered are in high demand and which are less in demand. In case of doubt, a sales partner can assess this independently, but this provides a clear evaluation, and comparisons can be made with other sales partners and channels. On the one hand, an evaluation of the sales data is important for the success of the individual sales employee since the performance is secured in the long term through sales and continuous customer care. On the other hand, evaluating and comparing product groups and sales channels is important for the insurance company itself, as sales are one of the company’s main sources of income. An analysis of the distribution can protect against damages in the long run, and important distribution channels can be developed.

Another point to be addressed is, according to one of the experts interviewed, the area of sales analyses is also explicitly used for customer management. Evaluations of new as well as existing customers are performed, showing profitability. Whether the remaining respondents perform these evaluations on their customers cannot be explicitly confirmed based on the data material, but it cannot be excluded either.

### Market Forecasts

Most of the experts interviewed stated that BI is used to evaluate and visualize historical data and to show upcoming changes in income and expenses. The data can be analyzed, and the program can be configured to provide warning signals in case of discrepancies. According to the experts (E.1, E.2, E.6, and E.8), discrepancies are defined as deviations between target and actual figures, and BI is therefore used primarily in the company's accounting system. As a result, the company is in a position to react to potential risks at an early stage or to implement measures to improve the key figures in the BI system:

E.2: "[...] where the management can actively go into the figures and see for themselves whether there are points somewhere in the key operating figures that trigger warning signals and must be reacted to."

Concerning the future, any upcoming market and industry developments should be available and readable. This information is used to create an edge over existing and potential competitors. Not only trends for products can be identified, but also potential threats for the company, which may result in a loss of sales. Development opportunities can be observed too:

E.8: "So far, you've only looked at ex-post things with BI, but you can easily enrich that with predictive things or simulations so that you have a good basis for decision-making when you want to weigh two negotiation alternatives against each other for corporate management."

### Usability

It is further noticeable that most financial services companies do not use all the functions and benefits of BI. The experts are aware of more areas that support the use of BI solutions. There is a need for expansion in the frequency of use. Only two of the interview participants said that BI is used in almost all areas of the company (E.2 and E.4)

The interviews showed that the experts' main focus about the application areas of BI is the analysis of operational and sales-related company data. Mainly the controlling department uses its functions to create a standardized reporting system, which can be customized to the target groups. Probably the main advantage, in this case, is the simple operation by drag and drop and the possibility of automated creation of reporting. Sales analyses are performed to assess the profitability of sales partners and channels. Market analyses and forecasts are feasible with BI solutions, enabling an edge over competitors. Furthermore, the experts interviewed are aware that the application areas are diverse, and not all potential functions of the software are exploited.

### 4.3 Challenges

#### Data and Privacy

The quality of the data implemented in the BI software is mentioned by only one interviewee (E.4). According to the interviewee, data quality, in this sense, means reliability. Reliable data contributes to increasing the company's value and constitutes the basis for business decisions. Resource-intensive corrections of previous decisions and sales activities that are not optimally controlled are named as risks for the use of poor data quality.

In addition, the handling of data in the context of data protection was mentioned. Even regardless of the European General Data Protection Regulation (GDPR), the secure handling of customer data in the insurance sector is regulated in the Code of Conduct (CoC) of the German Insurance Association. The CoC defines principles for the quality of data processing and data security. These rules of conduct extend the European regulations and are voluntary. Compared to many other countries, the requirements in this regard are high in Europe, according to the experts (E.2, E.5, E.7, and E.8). Data protection concerning BI is legally highly complex. Which customer data may be collected, who is allowed to access and use this customer data, up to the same assurance that only those persons are granted access who are authorized, are some examples.

E.5: "These are simply legal requirements. The topic of data is very sensitive in Europe and is becoming even more sensitive. I don't want to judge that here, whether it's good or bad. It's just the way it is because we have extremely high legal requirements compared to other countries, such as China or the USA."

#### IT Landscape and Programming

The experts report that the existing IT landscape in the backend can become problematic during an implementation (E.1 and E.5). When attempting to combine reporting and other uses of BI in a software application, it can be seen that in most cases, the IT infrastructure has grown and developed without precise guidelines. The subsequent task is to simplify the highly evolved and complex processes and models to make them more flexible. In addition, the use of data in the company has changed compared to the past. Today, deep insights can be obtained from data through data mining and similar evaluation methods, which can provide an important competitive advantage for the company. This means that the available information was not evaluated to the extent that is possible but was only considered as part of the application and not discussed.

It should also be mentioned that one expert points out the issues encountered when implementing BI solutions about the IT landscape as a subsidiary of a corporate group (E.6). Existing guidelines and requirements of the parent company must be complied with. Once the subsidiary decides to integrate a BI tool into the company on its own, special customized solutions have to be found. Existing security measures of the working group have to be changed to be able to access, read and analyze the data from the data warehouse. Suppose the working group itself does not use a BI software solution. In that case, the subsidiary cannot fall back on expertise in information technology and must ultimately build up its own know-how successively through training and experience:

E.6: “[...] but even with the special solution, we are completely responsible for the tool ourselves. That means we don’t get any support from the group’s IT, and accordingly, some things take a bit longer because we have to get to grips with it ourselves.”

Additionally, the implementation effort of the software solution was mentioned. The programs must be designed to extract data from the desired digital repositories. As BI tools use a proprietary programming language, companies are bound to the support of the software solution providers. There is some scope for action, but companies depend on the appropriate support in the case of complex and specific internal company requests or even general technical problems. Consequently, the implementation of BI is not only time-consuming but also cost-intensive.

### Employee Involvement

The company’s employees are mentioned in a similar context. They must be trained and qualified to be able to use the new programs in the company adequately. Thus, the employees contribute significantly to the company’s success and organizational change. Likewise, employees must understand the purpose and the company-internal goal of the BI application, which requires appropriate communication. This is a process that, similar to the application’s programming, is both time-consuming and cost-intensive. Previous ways of working and the employees’ perspectives are thus changed.

Furthermore, an understanding of the advantages of BI is to be established among employees across departments. Employee resistance to change has been part of innovation management research for many years. These resistances and disruptions occur in the transition period from the current state, i.e., the time without BI, to the future state. The reason for this is a self-perceived inconsistency between the two states. This can occur at all levels of the organization. The resistance can be based on many factors, such as perceived unfairness or a fear of loss. The experts interviewed describe an attempt to communicate a data-driven world to employees:

E.6: “[...] then there is the other view, which would be to trim the employees to really use the data, i. e., to really work with the dashboards and simply admit that this is now our data-driven world.”

It can be seen that companies are aware of the upcoming innovation management when they want to implement BI applications. Costly training programs are launched, and employees are involved in the implementation to familiarize the workforce with the systems from the beginning. The benefits of use seem to outweigh the costs and issues, as these investments are amortized shortly after implementation. Insurance companies are willing to invest time and money to ensure BI education and maximize their benefits.

Overall, financial services companies that have decided to implement BI solutions are facing issues from previous decisions and current problems. The existing IT infrastructure needs to be redesigned and simplified, and the data for the analyses should be high quality. It is also important to involve employees and to comply with legal requirements, such as the GDPR or the voluntary CoC. Employees who evaluate and use the data are crucial to the success of BI in insurance companies. They must be trained accordingly and involved in the development process to generate the best possible benefit for the company. Companies make this resource-intensive investment because the benefits outweigh the costs of the investment.

#### *4.4 Impact on Processes*

##### *Management Processes*

The use of BI is one of the most important application areas in sales. Due to information technology, sales partners can evaluate and compare their own production and their employees’ production. This way, incentives can be set to increase production, and difficulties can be eliminated. Without the need for consultation with the controlling department and the associated reporting, the sales departments have access to the intended evaluations. Since implementing BI solutions in the company, the sales partners have recognized the added value and demanded analyses to control themselves and the employees. Therefore, it can be deduced that the evaluations in the sales department are involved in the management processes and change them. In this respect, management can discuss and interpret the results and production with the sales department. But also the sales units receive an overview of their performance. Additionally, BI uses resources more efficiently, and development potentials can be targeted. Compared to the business organization without BI, searching for potential errors is time-consuming.

In the context of the transformation of the management processes, the inter-departmental possibility of discussion should be mentioned. On the one hand, operational and sales results can be interpreted within management and the board of directors, influencing future processes and communication with employees. In this case, BI positively influences management methods and processes. On the other hand, a department's management can deal with the results without waiting for consultation with the top management. Thus an operational decision-making scope is established within the department. By using resources more efficiently and improving communication within the company, the company gains flexibility. Furthermore, there is the possibility of clear communication of management goals across departments, using the reports of the BI applications for support:

E.2: "You can also discuss and use the key performance indicators through that, and I think that always provides the opportunities for internal and external exchange, also to discuss across departments about the individual topics and therefore provides more flexibility and more opportunities for the whole company."

To conclude, communication within the company is increased because BI can provide precise definitions used consistently across departments. Explanations of terms can be provided in the system with threshold values. In summary, it can be confirmed that the sales department of insurance companies, in particular, can change its management processes by using BI. Thus, the sales partners can evaluate the production of their employed sales partners. Resources can be used efficiently to solve specific problems and are not spent searching for potential sources of errors. A certain scope for decision-making allows the departments to flexibly and responsibly carry out management tasks and communicate these to the employees.

### Decision-Making Processes

The analysis of data is even more important in today's world, as the insights gained have an impact on management decision-making. This link between data and decision-making is also confirmed by the interviewee, a board member of a financial services company. Furthermore, the interviewees agree that quantifying and measuring the impact of BI systems on decision-making is not simple. The implementation in the company is successive, so a direct assessment of the impact is difficult:

E.5: "It's just not that easy to measure, and because you don't implement something like this, I don't know, within a month, but it takes years. It's just such a gradual process."

According to the interview participants, the quality of data evaluations has increased. As data from many sources can converge in the BI application, it is pos-

sible to trace the results in great detail. This allows the exact origin of a problem to be identified more easily and quickly. Subsequently, targeted action measures can be taken and initiated. The reporting system in the BI software is designed interactively to the extent that the core of the problem that occurred can be displayed with a few clicks and drill-down menus. This type of data analysis leads to better decision-making:

E.1: "I can create dashboards that I can navigate relatively interactively, which is obviously great for decision-making. And later, when I've identified a problem issue, I can drill down through what is called drill-downs or drill-throughs into the core information again, so what's really the core cause of the problem, or the identified problem at that moment."

The data quality resulting from BI is also relevant with regard to future-related forecasts. Market forecasts and potential future issues for the insurance company can be better justified and communicated with the available depth of detail. It is also mentioned that decision-making and communication are simplified due to BI. In addition, according to the experts surveyed, there is an improvement in the plausibility of the results and data. In the absence of BI, decisions are often made based on experience and gut feeling. As a consequence of the intelligent system, the decision-makers are in a better position to justify their decisions and assessments and communicate them reasonably. The susceptibility to errors decreases, and the decisions are less regretted in retrospect. This ensures the company's success, especially in the long term.

As a further positive impact, the speed of decision-making in the information material becomes apparent. Based on the fact that data is uploaded to the reporting system at regular times and in an automated manner and that this data is constantly up to date, data analyses and comments can be carried out considerably faster. Decision-making is influenced by the fact the data does not have to be uploaded, compiled, and visualized individually. Due to the automated process, the decision-makers in the company have quick access to the analyses, and internal ad-hoc decisions can be made in a short-term manner. The time saved in decision-making provides resources in the form of time capacities that can be invested otherwise. In addition, spontaneous decisions can be made more quickly by constantly monitoring sales and revenue figures. The changes in the figures are continuously displayed in the BI system so that the necessary decision-making processes can be performed faster. As a result, reacting faster to trends and fluctuations in the insurance market is possible.

According to the experts, the fact that one software solution is now sufficient to perform data analyses and visualizations also contributes to a higher speed of decision-making. There is no longer a need to extract data from different data sources. Since the program aggregates the data, a time saving is created, directly affecting the turnaround time and speed of decision-making. Furthermore, not



only is time capacity created, but it also allows existing resources to be better invested. The surveyed experts stated that BI influences investment decisions. For example, data analyses and market forecasts lead to more informed decisions. By making the right investments, there is the possibility of securing the long-term success of the company. According to the interviewees, investments are not only in capital but also in time, employees, or product groups. A quick and plausible investment decision can help to stay one step ahead of competitors in the insurance sector.

## 5. Discussion and Implications

The qualitative study showed a consensus among the experts that the use of BI in internal and external reporting is the most important function and generates an advantage over previous systems. For insurance companies, the main focus is on analyses of sales partners and channels, as well as market forecasts. In this context, Huang et al. (2022) show that BI can significantly influence financial performance and customer behavior. Curko et al. (2007) also name customer categorization and segmentation as valuable benefits of BI. In our interview study, one expert works as a team leader for customer management, but the job description does not indicate that customer segmentation and targeted selling are performed using BI. In the literature, BI is also highlighted as a possible application for calculating insurance premiums and managing insurance policies (Rostek 2009; Helfand 2017). One expert also highlighted this use. Overall, BI has the potential to improve the calculation and monitoring of key performance indicators as well as the management of internal risks (Helfand 2017; Eckert and Osterrieder 2020). Amini et al. (2021) also use the example of agricultural insurance to show that the use of BI can drastically reduce imprecise estimations caused by uncertainties. In addition, possible predictions for handling financial risks could be made. Overall, the experts surveyed focus more on business than technology in the context of BI. In contrast, Petrini and Pozzeborn (2009) show that in the Brazilian companies surveyed, BI management focuses on technology. As a result, the BI systems were implemented predominantly with a technological focus.

According to Watson (2009), improved decision-making and business process enhancement are among the most important reasons for using BI systems. Also, visualization through the use of BI is highlighted as an advantage (Chung 2009; Toreini et al. 2022). At the same time, they are also one of the most difficult to measure or quantify. The interview participants confirm this aspect. It is expressed that implementation of BI does not take place in the short term but successively over a longer period of time. The interviewed participants confirm that the application potential within the company has not yet been fully exhausted.

Table 3  
Overview of key findings and implications

Main codes	Subcodes	Key findings	Implications
Chances	Reporting system	To use BI for standard reporting, technological know-how is only required to a minor extent.	Standard reporting (e.g., to BaFin) should be supported by establishing dashboards and specific evaluations using BI.
	Sales analysis	BI can be used to analyze and optimize the sales channels clearly. Evaluations of possible new and existing customers provide information on profitability as part of customer management.	To optimize sales analyses, BI should be used for evaluations in this context (e.g., customer evaluations).
	Market forecasts	Competitive advantages can be achieved by analyzing the upcoming market and industry developments (e.g., product trends).	BI should be used to implement market forecasts, and in this context, the definition of key figures is needed in order to be able to use deviations between target and actual in accounting as a warning signal.
	Usability	BI provides a wide range of functions that can be used for sales analysis, market analysis, and for assessing the profitability of sales partners and channels. For e.g., the drag-and-drop operation and the possibility of automating reports are an advantage compared to other tools.	A knowledge transfer between employees on BI-specific know-how should be established to increase the potential for usability.

Challenges	Data and privacy	High-quality data makes a decisive contribution to increasing the value of a company. In contrast, poor-quality data can lead to resource-intensive corrections and inadequately managed sales channels.	It should always be ensured that high-quality data is provided across all business sections to achieve good results with BI.
	IT landscape and program-mining	The use of BI depends on the IT landscape of the parent company and its subsidiaries. Existing guidelines and requirements of the parent company must be complied with.	The IT landscape should be prepared, e.g., through adapting to regulatory requirements, for implementing BI applications.
	Employee involvement	Employees contribute significantly to the success of the company and to organizational change.	For the company's success, employees should be actively involved in the innovation process, i.e., the implementation and use of BI, via adequate training. In this context, employees have to understand the internal goal of BI.
	Management process	The management department has direct access to cross-departmental analyses, which improves communication. BI also leads to more efficient use of resources and the optimization of development potential.	Incentives to increase profitability should be provided through the use of BI, as communication can be optimized. Therefore, these incentives have to be forced top-down.
Impact on processes	Decision-making process	The use of BI leads to the simplification of decision-making and communication. For data analysis and visualization, BI is sufficient as a software solution in this context.	Extracting data from only one source reduces the susceptibility to errors in the decision-making process and increases the speed of decision-making using BI.

Insurance companies are aware that further fields of application, such as the detection of insurance fraud, can be developed. Potential barriers to the further expansion of BI within the company are the difficulties listed regarding data protection, infrastructure, and innovation management between employees. Furthermore, the experts interviewed stated that an investment in the employees and their handling of BI applications is necessary to ensure the best possible use of the systems. Cost and time savings are expected for internal company processes with the use of BI in the literature (Wanda and Stian 2015). It is noticeable that all experts mentioned faster decision-making and, thus, time savings. Grounding and plausibility of decisions were also mentioned as positive outcomes by respondents. However, cost savings were not explicitly named concerning the process change in the company. In summary, Table 3 provides an overview of our interview study's key findings and implications.

## 6. Limitations, Future Research Directions and Conclusions

Due to the unavoidable limited generalizability and limited objectivity, our results can only be considered as a first trend regarding the use of BI in insurance companies. Moreover, the study focuses only on the German insurance market. In order to generate better generalizable results, an increase in the sample size and an extension to international insurance markets is advisable. A comparison with international insurance markets can provide valuable and more holistic insights for various industry sectors. While our research takes a general view of the use of BI in insurance companies in Germany, the interviews suggest that further research can investigate the specific use of BI in individual lines of business, such as property or life insurances. In this context, it is interesting to analyze what influence BI has on individual insurance lines and how BI can support the calculation of insurance premiums and the detection of insurance fraud.

Our paper analyzed established and new applications of BI in insurance companies and identified chances and challenges associated with implementing and using BI. Eight experts from German insurance companies were interviewed. Our results show that the use of BI is generally perceived as advantageous and a further expansion of BI in insurance companies is expected. In particular, employees should be increasingly involved in the use of BI in the future. Overall, application possibilities of BI in insurance companies are not fully exploited. Even in literature, BI in insurance companies is discussed to a limited extent. In the future, the use of BI should be extended to specific lines of business. In an increasingly digital world, insurance companies can profitably use data insights gained through BI for a broader understanding and discussions among practitioners and researchers.

The authors would like to thank the interview partners that participated for this research as well as our colleagues for many fruitful discussions.

(Anonymized) data, the interview guideline, and analysis that support the findings of this study are available on request by the corresponding author.

## References

- Amini, M./Salimi, S./Yousefinejad, F./Tarokh, M. J./Haybatollahi, S. M.* (2021): The Implication of Business Intelligence in Risk Management: A Case Study in Agricultural Insurance. *Journal of Data, Information and Management* 3(2), 155–166.
- Baars, H./Zimmer, M./Kemper, H. G.* (2009): The ICT Convergence Discourse in the Information Systems Literature – A Second-Order Observation. In: *Proceedings of the 17<sup>th</sup> European Conference on Information Systems (ECIS)*, Verona, Italy, June 8–10, 2009.
- Catlin, T./Hartmann, R./Segev, I./Tentis, R.* (2015): The Making of a Digital Insurer: The Path to Enhanced Profitability, Lower Costs and Stronger Customer Loyalty. <http://www.mckinsey.com/industries/financial-services/our-insights/the-making-of-a-digital-insurer>, accessed 11 Dec. 2022.
- Chee, T./Chan, L./Chuah, M./Tan, C./Wong, S./Yeoh, W.* (2009): Business Intelligence Systems: State-of-the-art Review and Contemporary Applications. In: *Proceedings of the 2009 Symposium on Progress in Information and Communication Technology (SPICT'09)*, Kuala Lumpur, Malaysia, December 7–8, 2009.
- Chung, W.* (2009): Enhancing Business Intelligence Quality with Visualization: An Experiment on Stakeholder Network Analysis. *Pacific Asia Journal of the Association for Information Systems* 1(1), 33–54.
- Curko, K./Bach, M. P./Radonic, G.* (2007): Business Intelligence and Business Process Management in Banking Operations. In: *Proceedings of the 29<sup>th</sup> International Conference on Information Technology Interfaces (ITI)*, Cavtat, Croatia, June 25–28, 2007.
- Davenport, T. H.* (2014): How Strategists Use “Big Data” to Support Internal Business Decisions, Discovery and Production. *Strategy & Leadership* 42(4), 45–50.
- Dreyer, S./Werth, O./Olivotti, D./Guhr, N./Breitner, M. H.* (2022): Knowledge Management Systems for Smart Services: A Synthesis of Design Principles. *e-Service Journal* 13(2), 27–67.
- Eckert, C./Eckert, J./Zitzmann, A.* (2021): The Status Quo of Digital Transformation in Insurance Sales: An Empirical Analysis of the German Insurance Industry. *Zeitschrift für die gesamte Versicherungswissenschaft* 110(2), 133–155.
- Eckert, C./Osterrieder, K.* (2020): How Digitalization affects Insurance Companies: Overview and Use Cases of Digital Technologies. *Zeitschrift für die gesamte Versicherungswissenschaft* 109(5), 333–360.
- Eggert, M./Alberts, J.* (2020): Frontiers of Business Intelligence and Analytics 3.0: A Taxonomy-based Literature Review and Research Agenda. *Business Research* 13(2), 685–739.

- Eling, M./Lehmann, M. (2018): The Impact of Digitalization on the Insurance Value Chain and the Insurability of Risks. *The Geneva Papers on Risk and Insurance–Issues and Practice* 43(3), 359–396.
- Eling, M./Nuessle, D./Staubli, J. (2022): The Impact of Artificial Intelligence Along the Insurance Value Chain and on the Insurability of Risks. *The Geneva Papers on Risk and Insurance–Issues and Practice* 47(2), 205–241.
- Gehra, B./Gentsch, P./Hess, T. (2005): Business Intelligence for the Masses. *Controlling & Management Review* 49(3), 236–242.
- Gioia, D. A./Corley, K. G./Hamilton, A. L. (2013): Seeking Qualitative Rigor in Inductive Research: Notes on the Gioia Methodology. *Organizational Research Methods* 16(1), 15–31.
- Gupta, B./Goul, M./Dinter, B. (2015): Business Intelligence and Big Data in Higher Education: Status of a Multi-Year Model Curriculum Development Effort for Business School Undergraduates, MS Graduates, and MBAs. *Communications of the Association for Information Systems* 36(1), 450–476.
- Helfand, R. D. (2017): Big Data and Insurance: What Lawyers Need to Know and Understand. *Journal of Internet Law* 21(3), 2–35.
- Hsieh, H.-F./Shannon, S. E. (2005): Three Approaches to Qualitative Content Analysis. *Qualitative Health Research* 15(9), 1277–1288.
- Huang, Z. X./Savita, K. S./Dan-yi, L./Omar, A. H. (2022): The Impact of Business Intelligence on the Marketing with Emphasis on Cooperative Learning: Case-study on the Insurance Companies. *Information Processing & Management* 59(2), 1–10.
- Keller, B. (2018): Big Data and Insurance: Implications for Innovation, Competition and Privacy. <https://www.genevaassociation.org/research-topics/cyber-and-innovation-digitalization/big-data-and-insurance-implications-innovation>, accessed 10 Dec. 2022.
- Kuckartz, U. (2018): *Qualitative Inhaltsanalyse. Methoden, Praxis, Computerunterstützung*, 3rd Ed. Beltz Juventa, Weinheim/Basel.
- Kyper, E. S./Douglas, M. J./Lievano, R. J. (2009): Operational Business Intelligence: Applying Decision Trees to Call Centers. In: *Proceedings of the 15<sup>th</sup> Americas Conference on Information Systems (AMCIS)*, San Francisco, California, USA, August 6–9, 2009.
- Mayring, P. (2015): *Qualitative Inhaltsanalyse: Grundlagen und Techniken*, 12<sup>th</sup> Ed. Beltz, Weinheim/Basel.
- Myers, M. D./Newman, M. (2007): The Qualitative Interview in IS Research: Examining the Craft. *Information and Organization* 17(1), 2–26.
- Negash, S. (2004): Business Intelligence. *Communications of the Association for Information Systems* 13(2004), 177–195.
- Ngai, E. W./Hu, Y./Wong, Y. H./Chen, Y./Sun, X. (2011): The Application of Data Mining Techniques in Financial Fraud Detection: A Classification Framework and an Academic Review of Literature. *Decision Support Systems* 50(3), 559–569.
- Petrini, M./Pozzeborn, M. (2008): What Role is “Business Intelligence” Playing in Developing Countries? A Picture of Brazilian Companies. In: Rahman, H. (Hrsg.) *Data*

- Mining Applications for Empowering Knowledge Societies, S. 237–257. Information Science Reference, Hershey, New York.
- Phillips-Wren, G./Daly, M./Burstein, F. (2021):* Reconciling Business Intelligence, Analytics and Decision Support Systems: More Data, Deeper Insight. *Decision Support Systems* 146(2021), 1–10.
- Rostek, K. (2009):* Business Intelligence for Insurance Companies. *Foundations of Management* 1(1), 65–82.
- Schmidt, C. (2018):* Insurance in the Digital Age: A View on Key Implications for the Economy and Society. [https://www.genevaassociation.org/sites/default/files/research-topics-document-type/pdf\\_public/insurance\\_in\\_the\\_digital\\_age\\_01.pdf](https://www.genevaassociation.org/sites/default/files/research-topics-document-type/pdf_public/insurance_in_the_digital_age_01.pdf), accessed 11 Dec. 2022.
- Schnell, R./Hill, P. B./Esser, E. (2011):* Methoden der empirischen Sozialforschung, 9<sup>th</sup> Ed. Oldenbourg, München.
- Schulte-Noelle, H. (2001):* Technological Changes in IT and Their Influence on Insurance: The Change Ahead (I). *The Geneva Papers on Risk and Insurance – Issues and Practice* 26(1), 83–88.
- Schultze, U./Avital, M. (2011):* Designing Interviews to Generate Rich Data for Information Systems Research. *Information and Organization* 21(1), 1–16.
- Toreini, P./Langner, M./Maedche, A./Morana, S./Vogel, T. (2022):* Designing Attentive Information Dashboards. *Journal of the Association for Information Systems* 23(2), 521–552.
- Trieu, V. H./Burton-Jones, A./Green, P./Cockcroft, S. (2022):* Applying and Extending the Theory of Effective Use in a Business Intelligence Context. *MIS Quarterly* 46(1), 645–678.
- Wanda, P./Stian, S. (2015):* The Secret of my Success: An Exploratory Study of Business Intelligence Management in the Norwegian Industry. *Procedia Computer Science* 64(2015), 240–247.
- Watson, H. J. (2009):* Business Intelligence – Past, Present, and Future. In: *Proceedings of the 15<sup>th</sup> Americas Conference on Information Systems (AMCIS)*, San Francisco, California, USA, August 6–9, 2009.
- Werth, O./Schwarzbach, C./Rodríguez Cardona, D./Breitner, M. H./Graf von der Schulenburg, J.-M. (2020):* Influencing Factors for the Digital Transformation in the Financial Services Sector. *Zeitschrift für die gesamte Versicherungswissenschaft* 109(2), 155–179.
- Yin, R. K. (2009):* Case Study Research: Design and Methods. 4<sup>th</sup> Ed. SAGE Publications, Thousand Oaks, CA, London/New Delhi.