

The Successful Adoption of Generative AI for Self-Service Business Intelligence: A Strategic Evaluation Combining the TOE Framework and IS Success Model

Masterarbeit

zur Erlangung des akademischen Grades „Master of Science (M.Sc.)“ im Studiengang
Wirtschaftsingenieur der Fakultät für Elektrotechnik und Informatik, Fakultät für
Maschinenbau und der Wirtschaftswissenschaftlichen Fakultät der Leibniz Universität
Hannover

Prüfer: Prof. Dr. Michael H. Breitner
Betreuer: M. Sc. Lukas R. Grützner

vorgelegt von

Kledion Sinanaj

A large black rectangular redaction box covering the signature area of the student.

Hannover, 15.10.2024

Contents

List of Figures	III
List of Tables	V
List of Abbreviations	VI
Abstract	VII
Research Summary	VIII
1 Introduction	1
1.1 Motivation and relevance	1
1.2 Research Questions and Objectivities	3
1.3 Research Procedure	4
2 Theoretical Background	5
2.1 Business Intelligence	5
2.2 Self-Service Business Intelligence (SSBI)	6
2.3 Artificial Intelligence	8
2.4 Generative Artificial Intelligence (GenAI)	11
2.5 Theoretical Framework: TOE Framework and IS Success Model	13
2.5.1 TOE Framework	13
2.5.2 Information Systems Success Model	14
2.5.3 Integrating the TOE Framework and IS Success Model	17
3 Research Design and Methodology	18
3.1 Research Design	18
3.2 Research Methods	19
3.2.1 Literature Review Methodology	19
3.2.2 Case Study Approach	21
3.2.3 Online Survey	22
3.2.4 Data Analysis	23
3.2.5 Focus Group Discussion	27
4 Research Process	28
4.1 Literature Review	28
4.2 Interview-Based Case Studies	32
4.2.1 Interview Design and Execution	32
4.2.2 Data Analysis of Interviews	33
4.3 Model Conceptualization and Implementation	34
4.3.1 Conceptual Model Design	34
4.3.2 Hypotheses Development and Specification	35
4.4 Internet Survey	45
4.5 Empirical Analysis and Model Testing	47
4.5.1 Practical Implementation in Python	47

4.5.2	First Iteration Data Analysis	52
4.5.3	Second Iteration: Model Refinement and Enhanced Analysis	64
5	Results and Findings	74
5.1	Qualitative Findings from Interview-Based Case Studies	74
5.2	Quantitative Findings from the Internet Survey	78
5.3	Empirical Analysis and Model Testing	79
5.3.1	First Iteration Findings	79
5.3.2	Second Iteration and Model Refinement	79
5.4	Synthesis of Findings	81
5.5	Practical Validation: A Use Case of Company B	82
6	Discussion and Recommendations	85
6.1	Answering the Research Questions	85
6.2	Implications for Research	89
6.3	Implications for Practice	90
7	Limitations and Future Research	92
8	Conclusion	94
	References	95
A	Literature Review	107
B	Interview Transcripts	110
B.1	Interview Transcript – Interviewee 1 (Company A)	110
B.2	Interview Transcript – Interviewee 2 (Company A)	114
B.3	Interview Transcript – Interviewee 3 (Company B)	117
C	Survey Instrument	120
C.1	Survey Questionnaire	120
C.2	Measurement Items	126
D	Python Scripts	128
D.1	data_preprocessing.py	128
D.2	mapping.py	128
D.3	model_definitions.py	129
D.4	data_analysis.py	130
D.5	vizualization.py	131
D.6	main.py	132
E	Data Analysis Output	134
E.1	Descriptive Statistics	134
E.2	PLS-PM Model Results	137

Research Summary

Introduction

Motivation and Relevance

"Generative AI has the potential to change the world in ways that we can't even imagine. It has the power to create new ideas, products, and services that will make our lives easier, more productive, and more creative."

—Bill Gates (2023)

At a time when data is being generated at an unprecedented rate, the competitive advantage of companies depends on how effectively they use these data. Self-Service Business Intelligence (SSBI) plays an essential role in this process. SSBI makes data analysis more accessible, enabling non-experts to draw meaningful insights from data without having to heavily rely on IT departments (Schlesinger and Rahman, 2016). Integrating Artificial Intelligence (AI) into SSBI has further enhanced its capabilities, allowing deeper data analysis, pattern recognition, problem detection, and predictive modeling. This integration helps bridge the gap between the needs of businesses and data science capabilities (Kakatkar et al., 2020). AI tools within SSBI can also automatically choose the best methods and visuals to present data, making it easier for users to understand and identify patterns. This helps users move from simply viewing data to actively exploring it, leading to quicker and more informed decision-making (Alpar and Schulz, 2016). Generative AI, a subset of AI, is particularly transformative for business intelligence. Large language models, such as ChatGPT, are capable of processing large amounts of text, extracting insights, and generating detailed reports. This capability makes data easier to access and enables non-technical users to find insights on their own (Rane, 2023; Feuerriegel et al., 2024). This evolution raises important questions about the current state of SSBI tools and the extent to which they have adopted generative AI. Understanding which SSBI platforms have integrated generative AI and how they leverage it provides valuable insights into the ongoing transformation of business intelligence. An overview of the current state of the integration of generative AI technology for SSBI tools is given in Table 1. The table provides an overview of various Self-Service Business Intelligence (SSBI) tools, detailing whether they have implemented Generative AI. It also specifies the models and types of Generative AI employed. Tools such as Tableau and Power BI rely on custom AI solutions customized to their specific needs (Einstein Copilot and Microsoft Copilot, respectively), while others like QlikView and ThoughtSpot have integrated OpenAI's ChatGPT to enhance their functionalities. Examining these tools provides a clearer picture of how generative AI is currently being used to enhance SSBI functionality.

Tool	Generative AI used	Model/Type
Tableau	Yes	Einstein Copilot (Tableau)
Power BI	Yes	Microsoft Copilot (Microsoft)
QlikView	Yes	OpenAI (Qlik)
ThoughtSpot	Yes	OpenAI (ThoughtSpot)
SAP Business Objects	Yes	Joule AI (SAP)
Domo	Yes	Domo.AI (Domo)
Looker	Yes	Gemini (Looker)
MicroStrategy	Yes	MicroStrategy AI (MicroStrategy)
TIBCO Spotfire	Yes	Spotfire Copilot (TIBCO)
Sisense	Yes	Custom AI Solutions (Sisense)

Table 1: SSBI Tools and their use of Generative AI

However, integrating generative AI into SSBI tools in company environments introduces challenges such as complex system integration, data privacy concerns, and inherent biases in AI models (Feuerriegel et al., 2024; Rane, 2023). Addressing these challenges requires a strategic approach that considers organizational readiness, technological infrastructure, and external environmental factors. The Technology-Organization-Environment (TOE) framework (Tornatzky et al., 1990) and the Information Systems (IS) Success Model (DeLone and McLean, 2003) provide robust models to understand these dynamics, highlighting the importance of both adoption factors and subsequent success metrics. This research seeks to bridge the gap between the technological advancements in SSBI tools and their successful adoption and implementation in organizations. By integrating the TOE framework and the IS Success Model, this study aims to offer a comprehensive strategic evaluation of the adoption of generative AI in SSBI systems.

Research Questions and Objectives

This research aims to explore the integration of GenAI in SSBI systems. It focuses on the strategies and organizational conditions critical for successful adoption. Additionally, it examines the subsequent impact on decision-making and innovation within organizations. The study addresses the following primary research questions:

RQ1: *What strategies and organizational conditions are critical for the successful adoption of generative AI in Self-Service Business Intelligence systems?*

RQ2: *How does the adoption of generative AI in Self-Service Business Intelligence specifically enhance decision-making and innovation within organizations?*

To address these questions, the study sets the following objectives:

1. Identify and analyze the critical success factors for adopting generative AI in SSBI tools using the TOE framework.
2. Evaluate the impact of generative AI on decision-making and innovation within organizations through the IS Success Model.

3. Develop a strategic framework integrating the TOE framework and the IS Success Model to guide organizations in the effective adoption and implementation of generative AI in SSBI tools.
4. Provide practical recommendations for organizations to overcome challenges and maximize the benefits of generative AI in their SSBI systems.

This research seeks to bridge the gap between technological advancements in SSBI and their successful adoption and implementation, offering both theoretical insights and practical guidelines to enhance business intelligence capabilities through generative AI.

Research Design and Methodology

Literature Review Methodology: A systematic literature review forms the foundation of this study. It provides a thorough understanding of the current state of knowledge on Business Intelligence (BI), Self-Service Business Intelligence (SSBI), Artificial Intelligence (AI), and Generative AI. Following the structured approach, the literature review process involves several key steps, as illustrated in Figure 1. The process includes a structured search of academic databases with relevant keywords and Boolean operators, as well as forward and backward search techniques to ensure complete coverage (Hart, 2018; Booth et al., 2021). Following the identification of relevant literature, each study is critically evaluated for its methodology, findings and theoretical contributions using a concept matrix as suggested by Webster and Watson (2002). The synthesis of these studies highlights existing gaps and informs the development of the theoretical framework for this research.

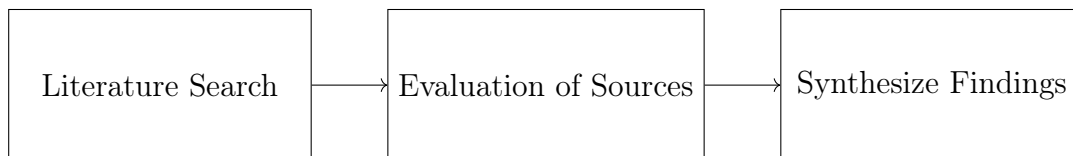


Figure 1: The literature review process (adapted from Hart, 2018)

Case Study Approach: The case study approach is a flexible research method used to explore complex issues in real world contexts, particularly useful for answering the "how" and "why" questions. Yin (2018) defines case studies as in-depth investigations of contemporary phenomena. Case studies can be intrinsic, instrumental, or collective (Stake, 1995), and serve exploratory, descriptive, or explanatory purposes (Yin, 2018). They offer a comprehensive understanding of issues by examining interactions between factors. This makes them valuable for theory building in areas that lack sufficient frameworks. (Eisenhardt, 1989). To ensure accuracy and reliability, Runeson and Höst (2009) provides a structured approach with five phases: (1) case study design, (2) preparation for data collection, (3) collection of evidence, (4) analysis of data and (5) reporting. Researchers should define objectives, use multiple data sources, maintain a chain of evidence, and provide clear reporting. Thorough documentation throughout the process increases reliability and contributes to methodological knowledge.

8 Conclusion

This thesis investigated the critical factors influencing the adoption of Generative AI (GenAI) in Self-Service Business Intelligence (SSBI) systems. By integrating the Technology-Organization-Environment (TOE) framework with the Information Systems (IS) Success Model, the study offers a comprehensive understanding of what drives the successful integration of GenAI tools in business intelligence environments.

The research highlights that technological readiness, which includes scalable and adaptable infrastructure, is fundamental to ensure that GenAI tools are both easy to use and valuable. Additionally, organizational support, demonstrated by strong leadership and a culture that fosters innovation, plays a crucial role in the adoption process. External factors, such as regulatory compliance and competitive pressures, significantly influence how organizations perceive the usefulness of GenAI tools. These factors motivate their adoption to ensure that organizations remain competitive and comply with data privacy laws. The case study of Company B serves as practical validation of the research findings. Company B's implementation of GenAI tools like ChatGPT and Microsoft Copilot underscores the importance of having a flexible infrastructure and the necessity for scalability as more users adopt these tools. Furthermore, the company's efforts to address initial employee skepticism by demonstrating the practical advantages of GenAI reinforce the importance of organizational support in successful adoption. This study contributes to the limited body of literature on GenAI adoption in SSBI systems by providing theoretical and practical insights. The findings offer valuable guidance for organizations aiming to implement GenAI technologies, enabling them to understand the essential conditions for successful adoption and the positive effects on decision-making and innovation. Building on these findings, future research should focus on expanding the scope by incorporating a larger and more diverse sample of organizations, allowing for a broader understanding of how GenAI adoption plays out across different contexts. Additionally, examining long-term adoption trends and employing qualitative methods like focus groups could provide deeper insights into the collective experiences and challenges associated with GenAI adoption, offering a more nuanced view of its impact on organizations.

In conclusion, this thesis demonstrates that the successful adoption of GenAI in SSBI systems relies on a combination of robust technological infrastructure, strong organizational support, and the ability to manage external pressures effectively. By addressing these factors, organizations can successfully integrate GenAI tools, leading to enhanced decision-making processes and fostering a culture of continuous innovation.