Volker Liermann, Partner at ifb group, worked in the banking industry for over two decades, primarily focusing on financial risk management. Throughout his career, he has focused on developing integrated and comprehensive frameworks to help organizations correctly project risk at a strategic and tactical line of business and departmental level. He has also focused on developing frameworks to integrate stress testing and regulatory stress tests. In recent years, his focus has shifted to digitalization, machine learning and digital processes including improvements to classical financial and non-financial risk management. He has a background in economics and a degree in mathematics from the University of Bonn.

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THE DIGITAL JOURNEY OF BANKING AND INSURANCE, VOLUME II

DIGITALIZATION AND MACHINE LEARNING

Edited by
Volker Liermann
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THE DIGITAL JOURNEY OF BANKING AND INSURANCE

VOLUME II

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This book, the second one of three volumes, gives practical examples by a number of use cases showing how to take first steps in the digital journey of banks and insurance companies. The angle shifts over the volumes from a business-driven approach in "Disruption and DNA" to a strong technical focus in "Data Storage, Processing and Analysis", leaving "Digitalization and Machine Learning Applications" with the business and technical aspects in-between. This second volume mainly emphasizes use cases as well as the methods and technologies applied to drive digital transformation (such as processes, leveraging computational power and machine learning models).

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We would first like to thank all contributors (clients, partners and colleagues), whose expertise was invaluable in exploring and formulating such a comprehensive work with a wide overview and deep insights. Their insightful feedback helped us to sharpen this work to this amazing level.

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Volker Liermann
Claus Stegmann

Introduction to Volume II—Digitalization and Machine Learning

Looking at the whole book series *The Digital Journey of Banking and Insurance, Volume II*, this second volume might be the most important one in the context of digital transformation. Practical experience in digital transformation shows that the combination of in-depth knowledge of the business processes and the ability to leverage the new technology are the keys to a successful digital transformation.

The starting point of digital transformation is a key decision to be made. Some institutions start with the technology and build up teams for machine learning, cloud computing and data lakes. Once the infrastructure is ready, they look for cases to leverage the technology. Other organizations start with a focus on the more pressing business challenges and look for tools in the lucky bag of digital transformation. The second approach tends to deliver a more efficient digital strategy. One of the reasons for this is the dilemma of vision and value (see Stegmann and Ludwig 2021): after a few years with mixed success in digital transformation, the stakeholders demand a long-term value (and profit) strategy, which is challenging due to narrowed margins, new competitors and technology and infrastructure investments to be made.

The challenge posed by the second approach (driven by the business unit needs, internal/external business units) is to anchor the technology knowledge and enable the business units to leverage the technology. Studying and discussing successful use cases will enable the business units to discover certain promising patterns. The business units will then be able to project these patterns onto their own business needs.

The deep dive into practical use cases offers an understanding of the ingredients of digital transformations. When looking at the many use cases, certain structures come to light: e.g. pattern identification to group and cluster transactions and use these clusters for processing similar transactions in a standardized way (for fraud detection see [Enzinger and Li 2021], or for optimization of regression tests see [Liermann, Li and Wünnemann], Use Case—Optimization of Regression Tests—Reduction of the Test Portfolio Through Representative Identification 2021) and for projection of terminations see (Schmüser et al. 2021). Another important design is to continuously learn from humans and improve automation through automated decision-making using machine learning (see [Liermann et al. "Hyperautomation (Automated Decision-Making as Part of RPA)" 2021] and [Gabriel 2021]).

In-depth business knowledge is inevitable. Only the business units can identify the application of the new technologies with the best leverage. The implementation of most of the technologies is to some extent complex or needs at least some good IT fundamentals. The tasks can only be solved by a team working closely together. The close collaboration of business units and IT is not a new approach. However, not only do the boundaries need to be overcome, but the two parties need to merge their knowledge to understand the other side in a deeper fashion than before.

Lloyd Blankfein (Goldman Sachs CEO) stated "We are a technology firm," emphasizing that IT is the major tool to transform data into information and knowledge. Dave McKay took the different viewpoint "If a bank thinks it is a tech company, then it is wrong. We are still business-to-consumer and business-to-business companies, trying to meet customer needs. Banks are using technology to anticipate those needs and meet them in a creative way, but we don't derive our income from technology." It is correct that no income is generated by technology and the customer needs are at the center of attention. Dave McKay's view is supported by the creative use of technology to analyze and anticipate customer behavior (outside digitalization). Inside digitalization helps the institute to optimize the tasks and reduce costs or provide more insights with the same costs.

Figure 1 illustrates inside and outside digitalization and their impact on cost reduction and revenue increase.

Most of the use cases presented in this book are in the lower areas of analytics and predictive analytics as well as process and process automation and contribute to the cost reduction of internal tasks.

Another important aspect of digital transformation originates from the processes or, to be more precise, the functions documented in the functional architecture linked by processes to get the required tasks done. To improve

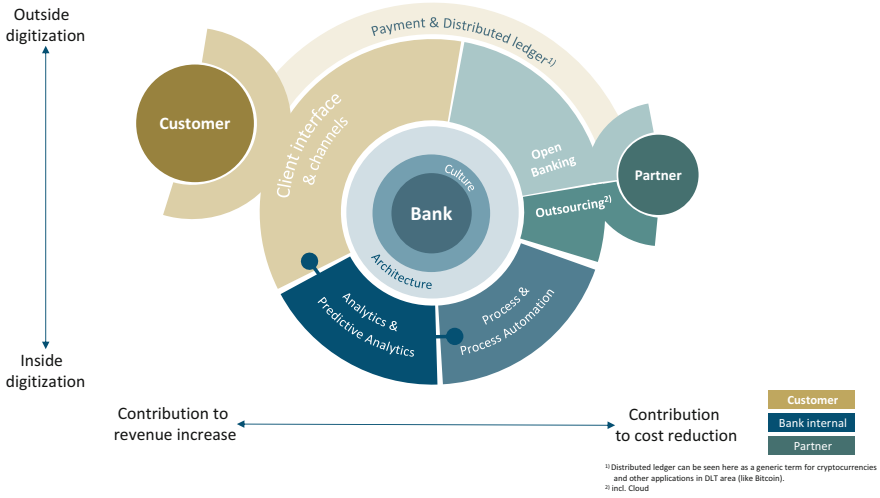

Fig. 1 Overview digital transformation © ifb SE

the processes, two roads could be taken: (A) improve the processes with the functions already existing and (B) improve the functions and the ways the tasks are handled.

Process improvement—up to a certain level—could be achieved by RPA and other techniques to adjust automation within the processes. Process mining can help to identify the slow and weak parts of a process. RPA can provide the organization with incremental process improvements, which could subsequently lead to significant cost reductions.

More potential lies in the deeper, functionally oriented analysis of the underlying tasks and a recomposition of the functions in the existing processes. This is still far from a disruptive process improvement (or at least a rare outcome). On the one hand, these functionally driven process improvements generally have a greater potential for optimization. On the other, the potential for failure is higher in the implementation, as with all significant changes. The focus on incremental process improvements or functional process improvements is accompanied by a risk/return assessment, calculation and evaluation.

Cyber risk is omnipresent for all institutions and is continuously rising due to the growing portion of data available electronically. While the IoT[1] and the risk of attacks on remotely managed physical machines are significant in the industry, the principal[2] cyber risk arises from the threat of disclosure of client

[1] Internet of Things.

[2] In terms of the impact on reputational risk.

or position data. Cyber risk will not go away, but the management could be improved continuously.

Quantum computing is a groundbreaking technology. Practical implementation is not at hand for every institution, but it is within sight and expected to become a standard practice in the coming decade. The way algorithms are structured is significantly different from the classical (binary) programming paradigm. The differing programming paradigm is a challenge for all nontheoretical physicists and some aspects might demand different thinking even for mathematicians. The hurdle is even higher for all others, but a basic knowledge about the idea behind quantum computers is again the key to identifying the relevant use cases, helping to improve the business. Quantum computing will contribute to scenario generation and analysis, making it a powerful tool for all risk managers and controllers.

Overview of Book Series

This book is the second volume of the three-volume book series *The Digital Journey of Banking and Insurance, Volume II*. The first volume *Disruption and DNA* focuses on change and the things staying stable in the banking and insurance market (outside view) as well as the effect on accounting, risk management and regulatory departments (inside view). The inside view is completed by an analysis of cultural alterations. This volume "Digitalization and Machine Learning Applications" mainly emphasizes use cases as well as the methods and technologies applied (such as processes, leveraging computational power and machine learning models). In the last volume of the series, "Data Storage, Processing and Analysis," the view of the way we deal with data shifts. The angle shifts over the volumes from a business-driven approach in the *Disruption and DNA* volume to a strong technical focus in the *Data Storage, Processing and Analysis* volume, leaving the *Digitalization and Machine Learning Applications* volume with the business and technical aspects in-between.

Overview of the Parts of This Book

This volume indicates the technological requirements and builds a bridge between the business-inspired first volume and the technology-driven third volume.

The first part offers insights into use cases in the context of inside digitalization. All use cases show the importance of models to identify patterns and demonstrate how to work with the results. The use cases discussed are applied in accounting and risk management.

The second part illustrates how the improved availability of computational power and innovation can encourage new applications in the context of risk management and planning. One example is the visualization of scenario results via a dynamic dashboard.

Quantum computing is the topic of the third part of the volume. Reports from practical applications in a lab setting and beyond are combined with a compact and focused deep dive into the setup of programming: quantum computing and quantum annealing.

Processes and process optimization (including process automation) are major areas in a digital transformation. The fourth part is dedicated to processes and process optimization and presents the tools to improve the processes tactically and sustainably.

The last part visits the space of open source and explores the origins of this omnipresent paradigm. It investigates the success of open source and defines the areas in which open source is most successful. A summary of all parts closes this volume.

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Marie Kristin Czwalina Senior Consultant, has been working at ifb group in the Core Banking Team since 2020. She deals with further development in the area of innovation management and digitalization topics around the areas of sales and processing in banks and specializes in process automation, customer-oriented advice and the implementation of GDPR requirements in IT applications. She studied business informatics with a focus on IT management in her master's degree at the FOM University of Applied Sciences.

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Jens Gabriel Director at ifb SE, has been working as a consultant in the banking industry in Europe for more than fifteen years. He has in-depth experience both in advising business departments and in implementing standard software. In addition to this, he possesses in-depth knowledge of accounting and reporting standards (IFRS and local GAAP), especially of financial instruments. He is also an expert in IT as well as functional architecture and has focused on SAP Bank Analyzer and SAP S/4HANA FPSL implementation regarding IFRS 9 and project management. He has also co-authored books and professional articles on IFRS and Basel III. He graduated in economics from Technical University of Cologne.

Sebastian Geisel works at ifb as a Senior Consultant in the Finance Process Excellence Team. Before joining ifb, he gained significant experience in optimization and digitalization of financial and operational processes with a special focus on real estate. Now, he also works on the development and implementation of target operating models for insurance companies and engages in the development of digitalization and process automation topics. He did his master's degree in business administration at the LSE (London School of Economics and Political Science) and the University of Trier.

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Matthias Jacoby Director at ifb, is head of the Finance Process Excellence Team. During his studies in business administration with a major in finance and accounting, he gained international work experience in Germany, Switzerland and Spain. Before joining ifb International AG (Zurich, Switzerland), he spent five years working for Ernst & Young in Assurance & Advisory Services and successfully completed his Swiss CPA qualification in 2011. During the last nine years working for ifb, he has mainly been involved in large finance transformation projects at financial service providers. Based on his expertise in financial processes and benchmark know-how, he has led several process optimization projects, including Fast Close or Outsourcing within Europe.

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Alexander Liebl joined ifb group as a Senior Consultant in April 2019 after gathering several years of experience in consulting projects in the financial services industry. He is part of the Insurance unit at ifb group and the leading process mining expert. The business information scientist advises and supports insurance companies in their digitalization programs. His focus lies on agile project management, business process management and operational excellence. He also has a profound academic background in technology and innovation management and holds a master's degree (Master of Science).

Volker Liermann Partner at ifb group, worked in the banking industry for over two decades, primarily focusing on financial risk management. Throughout his career, he has focused on developing integrated and comprehensive frameworks to help organizations correctly project risk at a strategic and tactical line of business and departmental level. He has also focused on developing frameworks to integrate stress testing and regulatory stress tests. In recent years, his focus has shifted to digitalization, machine learning and digital processes including improvements to classical financial and nonfinancial risk management. He has a background in economics and a degree in mathematics from the University of Bonn.

Dr. Peter Nonnenmann Senior Scientist at Quant-X Security & Coding GmbH, is a highly experienced Computer Scientist and Quantum Theory Expert who prefers to work on solutions for problems with a clear industrial focus. The most recent projects at Quant-X Security & Coding involved work on quantum algorithm solutions for chosen industrial problems and quantum security analyses of globally used symmetric crypto algorithms. Before that, he co-authored a contribution in DIGITALE WELT magazine on a novel approach to AI and 3D computer vision by defining a preliminary but mathematically rigorous concept for "holistic, global information," incorporating category and sheaf theory into neural networks. He holds a degree in informatics with a strong focus on mathematics from the University of Frankfurt.

Lars Rautenburger Director and Head of Operational Excellence. He is responsible for the digital transformation of insurance companies, including topics like process mining, robotic process automation, data science, change management and agile project management. Before joining ifb, he acquired extensive know-how in the insurance industry for more than 20 years. At Sopra Steria SE, he led the insurance consulting workforce in ASG. At MSG Systems AG, he was responsible for business consulting insurance. He started his career in consulting with Accenture, where he worked for nearly ten years. He has an economics background with a degree in business administration from the University of Siegen.

Christopher Schmidt joined the ifb group in April of 2019. The Senior Consultant has a strong record of managing complex projects in international environments as well as a proven skillset in developing automated processes with RPA technology. The certified RPA Advanced Developer focuses on the development of software robots as well as the design of target operating models and overall RPA strategy. Before joining ifb, he already gathered experience as a consultant in projects within the financial sector, at both insurance companies and banks.

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Claus Stegmann has as Co-CEO of ifb group—an international consulting firm—acquired extensive know-how over the last three decades in the financial industry regarding finance transformation, risk management and regulatory compliance. He is intensively engaged with the current challenges of the financial industry, which result from strong changes to customer behavior, a changing competitive environment and new technologies due to digitalization. He has also co-authored books on *Stress Tests in Banks, Basel III* as well as *Digitalization in the Finance Industry*, and graduated from Business School at the University of Passau, Germany.

Marian Tieben holds an M.Sc. degree in economics from the University of Cologne with a focus on finance and started his career at ifb group in 2019. He has mainly worked on technical implementations of several data science tasks with R or Python. Marian is an active member of the internal Research & Development working groups in the context of digitalization and has already gained practical project experience in this field.

Dr. Johannes Waizner began his career at ifb in 2018 in a group dedicated to credit risk and is now a Senior Consultant. His focus lies on the technical side, where his work ranges from implementations using Access databases, to novel use cases in the field of robotic process automation, to, most recently, work in Hadoop systems. He also specializes in Python integration due to the great potential of machine learning in the realm of credit risk models. Before ifb, he obtained his Ph.D. in theoretical physics at the University of Cologne modeling resonances in helical magnetic solid-state systems.

Christoph Wünnemann has worked at ifb group since 2006. He has supported numerous customers in the field of regulatory reporting, in particular with the widely used reporting software ABACUS360. As a team leader and topic manager in the competence center Regulatory Reporting, he promotes innovative ideas in this context. Christoph holds an M.Sc. degree in information systems from the University of Muenster.

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