

# The Impact of Digital Transformation and FinTech on the Finance Professional

Edited by

Volker Liermann  
Claus Stegmann



```
12010111010101001
00101010101000101
110101011100101011
1101010020011011
111110110110101110110
101101010101101
1111111000101011111011010
10110101111
101011101011010110101
011001111110101
1111101010101010101
```



# The Impact of Digital Transformation and FinTech on the Finance Professional

Volker Liermann · Claus Stegmann  
Editors

# The Impact of Digital Transformation and FinTech on the Finance Professional

palgrave  
macmillan

*Editors*

Volker Liermann  
ifb AG  
Grünwald, Germany

Claus Stegmann  
ifb Americas, Inc.  
Charlotte, NC, USA

ISBN 978-3-030-23718-9      ISBN 978-3-030-23719-6 (eBook)  
<https://doi.org/10.1007/978-3-030-23719-6>

© The Editor(s) (if applicable) and The Author(s), under exclusive license to Springer Nature Switzerland AG, part of Springer Nature 2019

This work is subject to copyright. All rights are solely and exclusively licensed by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, expressed or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Cover illustration: Sergey Nivens, Shutterstock  
Cover design by eStudio Calamar

This Palgrave Macmillan imprint is published by the registered company Springer Nature Switzerland AG  
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

# Preface

Digitalization has gained substantial recognition in a broad range of very different areas. Drastically reduced prices for both on-premise and cloud storage combined with an extreme increase in IT performance have served to make artificial intelligence (AI) including machine learning and deep learning more and more part of our daily lives. Younger kids will not remember a time without personal assistants like Alexa and Siri, or commands like “Hey Google” or “Hey Mercedes”. The technology sector led by Google, Apple, Facebook, Amazon (GAFA) is investing heavily in these technologies as well as blockchain for their software, services, analytics and devices. The automotive, logistics and health-care sectors as well as many others are currently undergoing massive change processes and will be entirely different 10 years from now.

This book takes an in-depth look at how digitalization is affecting players in the financial sector including banks and insurance companies. Moreover, within the finance sector, this work is explicitly focused on analytical topics including finance, accounting, regulatory reporting and client-related aspects. In the wake of the financial crisis, the finance industry had to invest heavily in data integration, processing and data lineage to comply with a long list of new regulatory requirements. Basel III was internationally agreed in 2017 and new regulations are on the way. The coming regulations will likely be less extensive and less costly than what banks have had to deal with in the past few years. On the other hand, banks and insurance companies must use the data generated for regulatory purposes to optimize analytical processes, accelerate reporting for decision-making and, most importantly,

improve prediction of client behavior. The demand for the abovementioned advanced analytical methods will increase sharply in the risk and finance departments of financial institutions.

This will change the financial professionals' perspectives and require their ability to understand AI, deep learning, machine learning or blockchain technology. In addition to this, the architectures and infrastructures will have to mirror these method-driven improvements. Of course, the financial professionals will not be required to invent these methods themselves. They already exist and, combined with cloud services, are being offered by the big technology players or flexible fintech companies on the market. Financial professionals will be required to evaluate, tailor and implement these methods whenever they can leverage the available processes. They can even present entirely new opportunities in holistic financial planning or simulation.

Regulators also have to take these technologies into account. On the one hand, they have to evaluate whether neuronal networks, for example, can amend common risk methods. Another example described in this book consists of using blockchain technology for syndicated loans. Regulators will have to approve applications and processes like this in the future.

This book is intended to provide a full spectrum of information, from the fundamental principles of digitalization to concrete examples of how new methods and infrastructures can be applied and implemented in the existing bank and insurance IT architectures. A central focus here is on the area of bank management, in which risk management, planning, data integration and data lineage will be improved dramatically in coming years.

The authors have created a comprehensive work of broad yet in-depth content, which will benefit risk managers, finance managers, managers for regulatory and internal reporting and IT managers alike.

I hope this book helps and encourages all readers to embark on a successful, albeit demanding, digital journey.

Frankfurt, Germany

Dr. Andreas Dombret  
Former Board Member of Deutsche  
Bundesbank (2010–2018)

# Disclaimer

The information contained in this book is provided for information purposes only. The information is of a general nature and is not intended to address the circumstances of any particular individual or entity. Ifb International AG assumes no responsibility for errors or omissions in this document and shall not be responsible for any damages arising out of the use of, or otherwise related to, this book. Nothing contained in this book is intended to, nor shall have the effect of, creating any warranties or representations from ifb International AG or any affiliate of ifb group. Furthermore, the information on this document is not a commitment, promise or legal obligation to deliver any material, code or functionality. No one should act on such information without appropriate professional advice after a thorough examination of the particular situation.

The information contained herein is being furnished solely for information purposes and may not be reproduced, redistributed, passed on or published, in whole or in part, to any other person for any other purpose.

The names and/or logos of actual companies and products mentioned herein may be trademarks of their respective owners.

# Contents

<b>1</b>	<b>Introduction</b>	<b>1</b>
	<i>Volker Liermann and Claus Stegmann</i>	
<b>Part I Automation, Distributed Ledgers and Client Related Aspects</b>		
<b>2</b>	<b>Batch Processing—Pattern Recognition</b>	<b>13</b>
	<i>Volker Liermann, Sangmeng Li and Norbert Schaudinnus</i>	
<b>3</b>	<b>Hyperledger Fabric as a Blockchain Framework in the Financial Industry</b>	<b>29</b>
	<i>Martina Bettio, Fabian Bruse, Achim Franke, Thorsten Jakoby and Daniel Schärf</i>	
<b>4</b>	<b>Hyperledger Composer—Syndicated Loans</b>	<b>45</b>
	<i>Gereon Dahmen and Volker Liermann</i>	
<b>5</b>	<b>The Concept of the Next Best Action/Offer in the Age of Customer Experience</b>	<b>71</b>
	<i>Uwe May</i>	
<b>6</b>	<b>Using Prospect Theory to Determine Investor Risk Aversion</b>	<b>79</b>
	<i>Constantin Lisson</i>	

## Part II Bank Management Aspects

- 7 Leveraging Predictive Analytics Within a Value Driver-based Planning Framework** 99  
*Simon Valjanow, Philipp Enzinger and Florian Dinges*
- 8 Predictive Risk Management** 117  
*Volker Liermann and Nikolas Viets*
- 9 Intraday Liquidity: Forecast Using Pattern Recognition** 139  
*Volker Liermann, Sangmeng Li and Victoria Dobryashkina*
- 10 Internal Credit Risk Models with Machine Learning** 163  
*Markus Thiele and Harro Dittmar*
- 11 Real Estate Risk: Appraisal Capture** 177  
*Volker Liermann and Norbert Schaudinnus*
- 12 Managing Internal and External Network Complexity: How Digitalization and New Technology Influence the Modeling Approach** 193  
*Stefan Grossmann and Philipp Enzinger*
- 13 Big Data and the CRO of the Future** 225  
*Richard L. Harmon*

## Part III Regulatory Aspects

- 14 How Technology (or Distributed Ledger Technology and Algorithms Like Deep Learning and Machine Learning) Can Help to Comply with Regulatory Requirements** 241  
*Moritz Plenk, Iosif Levant and Noah Bellon*
- 15 New Office of the Comptroller of the Currency Fintech Regulation: Ensuring a Successful Special Purpose National Bank Charter Application** 259  
*Alexa Philo*

**Part IV Methods, Technology and Architecture**

<b>16</b>	<b>Mathematical Background of Machine Learning</b>	271
	<i>Volker Liermann, Sangmeng Li and Victoria Dobryashkina</i>	
<b>17</b>	<b>Deep Learning: An Introduction</b>	305
	<i>Volker Liermann, Sangmeng Li and Norbert Schaudinnus</i>	
<b>18</b>	<b>Hadoop: A Standard Framework for Computer Cluster</b>	341
	<i>Eljar Akhgarnush, Lars Broeckers and Thorsten Jakoby</i>	
<b>19</b>	<b>In-Memory Databases and Their Impact on Our (Future) Organizations</b>	357
	<i>Eva Kopic, Bezu Teschome, Thomas Schneider, Ralph Steurer and Sascha Florin</i>	
<b>20</b>	<b>MongoDB: The Journey from a Relational to a Document-Based Database for FIS Balance Sheet Management</b>	371
	<i>Boris Bialek</i>	
<b>21</b>	<b>Summary and Outlook</b>	381
	<i>Volker Liermann and Claus Stegmann</i>	
	<b>Notes on Contributors</b>	385
	<b>Index</b>	399

# List of Figures

## Chapter 1

Fig. 1	What can competitors do better?	3
Fig. 2	The path of benefit	4
Fig. 3	Impact of digitalization on earnings and costs	5

## Chapter 2

Fig. 1	Pattern recognition process	14
Fig. 2	System architecture—schematic representation	16
Fig. 3	A simple batch process	17
Fig. 4	Structure of a trained Bayesian network	22
Fig. 5	Test data set	22
Fig. 6	Reconstruction error	24

## Chapter 3

Fig. 1	Distinction between virtual machines and containers	32
Fig. 2	Schematic workflow of an endorsed transaction	39
Fig. 3	Private channels in Hyperledger Fabric. Every peer participates in the main chain (gray), but can also have several side-channels with different participants (white, black)	40
Fig. 4	Private data hidden from an unauthorized peer	41
Fig. 5	blockToLive setting in the configuration	42
Fig. 6	Zero-knowledge proof identity mixer	42

## Chapter 4

Fig. 1	Involved parties	49
Fig. 2	Business process domains	50
Fig. 3	Components of the Hyperledger Composer modeling language	56
Fig. 4	Hyperledger Composer Playground online login	59
Fig. 5	Modeling language example (participants)	61
Fig. 6	Modeling language example (loan types)	62
Fig. 7	Modeling language example (loan substructures)	62
Fig. 8	Sample data (transaction)	63
Fig. 9	Sample JavaScript code (generate loan)	64
Fig. 10	Sample data (participants)	65
Fig. 11	Sample data (transaction)	65
Fig. 12	Sample data (collateral)	66
Fig. 13	Generated loans for syndicate members	67
Fig. 14	Example query (all loans)	67
Fig. 15	The primary decision—on or off the blockchain	68
Fig. 16	A typical Hyperledger Composer solution architecture	68

## Chapter 6

Fig. 1	An empirically valid value function exhibiting concavity (risk aversion) over positive values and convexity (risk-seeking behavior) over negative values	86
Fig. 2	Choice between a risky asset and a fixed deposit with the same expected return, in which the worst possible scenario is a negative return, so that uncertainty aversion over losses influences the outcome	89
Fig. 3	Choice between a risky asset and a fixed deposit with a zero expected return, where the worst possible scenario is a zero return, so that only uncertainty aversion over gains influences the outcome	90
Fig. 4	Choice between a risky asset and a fixed deposit with a positive return less than the expected value of the risky asset's return; The fixed deposit's return has been increased relative to the previous question, so as to determine whether the investor still prefers the fixed deposit	91
Fig. 5	Investor decision following a downturn; This question is used to evaluate investor temperament	92

## Chapter 7

Fig. 1	Example of overall planning framework	101
Fig. 2	Value driver trees embedded within the planning framework	102

Fig. 3	Value driver tree design principle	103
Fig. 4	Process-oriented illustration of the inclusion of external value drivers	106
Fig. 5	Example of a linear model	108
Fig. 6	Available living spaces in The City	110
Fig. 7	Total building costs in The City	110
Fig. 8	Regression results	112
Fig. 9	Mortgage market development	113
Fig. 10	Market share prediction	113

## Chapter 8

Fig. 1	Overview of the risk management pyramid—goals of risk management	119
Fig. 2	Scenario-based planning including value driver modeling by ABM	121
Fig. 3	Transversal risks	122
Fig. 4	General mechanics of transversal risks	123
Fig. 5	Process of transversal risk calculation	124
Fig. 6	Simulation of the impact of climate legislation on a company's risk profile	125
Fig. 7	The effect of the reduced demand for office space	126
Fig. 8	The effect of increasing e-commerce market share	126
Fig. 9	Projection of the risk situation—motivation for change	130
Fig. 10	High-level example—is risk developing in line with the strategy?	131
Fig. 11	Projection of the risk situation in the future—general	132
Fig. 12	Credit risk example (simplified)	133
Fig. 13	Projection of the risk situation vs. scenario-oriented risk planning	134
Fig. 14	Financial risk management—evolution in three steps	136

## Chapter 9

Fig. 1	Analysis framework	143
Fig. 2	Intraday liquidity—regulatory stress test (example)	143
Fig. 3	Stress test requirements overview	146
Fig. 4	Example of cumulative cash flows	147
Fig. 5	Evaluation of clustering result	148
Fig. 6	Clustering result based on global alignment kernel distance and 13 clusters	149
Fig. 7	Z-normalized vs. original time series of cluster No. 3	149
Fig. 8	Subclustering: grouping cluster members according to mean and variance	150
Fig. 9	Subclustering of cluster No. 3	150

Fig. 10	Forecasting the target time series	151
Fig. 11	Clustering result	152
Fig. 12	(1) Nearest cluster based on nearest neighbors; (2) Nearest cluster based on cluster center	152
Fig. 13	R Shiny—loading data	153
Fig. 14	R Shiny—preprocessing data	154
Fig. 15	R Shiny—extraction clusters	154
Fig. 16	R Shiny—clustering member filtering with FX=EUR and Client = Deutsche Bundesbank	155
Fig. 17	R Shiny—brush the cluster members	155
Fig. 18	R Shiny—load actual time series and search for the nearest cluster	156
Fig. 19	R Shiny—select additional time series of “Deutsche Bundesbank” by “Expert”	157
Fig. 20	R Shiny—add the selected time series into the group of forecasting candidates	157
Fig. 21	R Shiny—forecasting the actual time series using the forecasting candidates	158
Fig. 22	R Shiny—load actual time series and search for the nearest cluster	158
Fig. 23	R Shiny—add additional time series of the same currency “EUR” by “Expert”	159
Fig. 24	R Shiny—forecasting the actual time series using the forecasting candidates	159
Fig. 25	R Shiny—blockwise aggregation	160
Fig. 26	R Shiny—aggregate the forecast time series with 3 blocks	160
Fig. 27	R Shiny—aggregate the forecast time series with 6 blocks	161

## **Chapter 10**

Fig. 1	Differences between the traditional mode and a machine learning based mode of modeling	166
Fig. 2	The impact of splitting data into a training set and a test set on the performance of the resulting artificial neural network. The AUC after 1500 training steps for the test set of the DNN_10.20.10 model (boxes), the LogReg model (circles) and for the training set of the DNN_10.20.10 model (triangles)	173
Fig. 3	Comparison of the performance of three different artificial neural networks: the AUCs for the test set (circles = predictive power) and for the training set (triangles = fit effectiveness) of the DNN_2.2 (inner lines), DNN_10.10 (outer lines), and DNN_10.20.10 (blue). The benchmark result of the logistic regression is shown as a gray line. The inner and outer curves simply serve as visual guides	174

**Chapter 11**

Fig. 1	Modularized approach	180
Fig. 2	Substance and dynamic data	181
Fig. 3	Example scheme for an application built to extract information from appraisal documents	187
Fig. 4	Example German real estate appraisal	189
Fig. 5	Structure of extracted data	190

**Chapter 12**

Fig. 1	Recent models of systemic risk	194
Fig. 2	Taxonomy of network complexity	196
Fig. 3	Setting up trait matrices	202
Fig. 4	Self-organizing map	202
Fig. 5	Multi-layered network representation of interbank financial links	205
Fig. 6	Overview of process mining	207
Fig. 7	Process mining use case—handling event stream data	212
Fig. 8	Process mining use case—cloud resource allocation for business processes	213
Fig. 9	Process mining use case—distributed application architectures	213
Fig. 10	Overview of agent-based modeling	215
Fig. 11	Agent-based modeling use case—financial services industry	218
Fig. 12	Agent-based modeling use case—new product launch	219
Fig. 13	Agent-based modeling use case—bond market participation	219
Fig. 14	Meta-process coping with network complexity	222

**Chapter 13**

Fig. 1	Traditional data warehouse	227
Fig. 2	Modern data warehouse	228
Fig. 3	Agent-based model—Example	235

**Chapter 16**

Fig. 1	Domains of machine learning	272
Fig. 2	Components of a machine learning system	273
Fig. 3	Classification graph	275
Fig. 4	Linear classification	275
Fig. 5	Nonlinear classification	276
Fig. 6	Clustering	277
Fig. 7	Steps in centroid-based models	282
Fig. 8	Normalization	284
Fig. 9	Example of three time series $X$ , $Y$ and $Z$	285

Fig. 10	Dynamic time wrapping	286
Fig. 11	Alignment path	287
Fig. 12	Example of cross-correlation	289
Fig. 13	Example Bayesian network	290
Fig. 14	Example Bayesian network	290
Fig. 15	Examples of conditional independence	291
Fig. 16	Example Bayesian network—creditworthiness	292
Fig. 17	Markov blanket	293
Fig. 18	Bayesian network parameter learning	293
Fig. 19	Decision tree	294
Fig. 20	Random forest	296
Fig. 21	K-fold cross-validation procedure	298

## **Chapter 17**

Fig. 1	Deep learning in the artificial intelligence context	306
Fig. 2	Perceptron and feedforward network	307
Fig. 3	Perceptron—weights and activation functions	308
Fig. 4	Simple feedforward neural network (FF or FFNN)	308
Fig. 5	Feedforward neural network (FF or FFNN)—architecture	310
Fig. 6	Overview—activation functions	312
Fig. 7	Gradient descent algorithms	313
Fig. 8	Back propagation	314
Fig. 9	Deep feedforward network (DFF)	315
Fig. 10	Recurrent neural network (RNN)	316
Fig. 11	Translation of a recurrent cell	316
Fig. 12	Simple recurring cell	317
Fig. 13	Memory cell in detail	317
Fig. 14	Structure of long-/short-term memory (LSTM) and gated recurrent unit (GRU)	317
Fig. 15	Gated recurrent unit—memory cell	318
Fig. 16	Autoencoder (AE)	319
Fig. 17	Sparse autoencoder (SAE)	319
Fig. 18	Variational autoencoder	319
Fig. 19	Denoising autoencoder	320
Fig. 20	Boltzmann machines	321
Fig. 21	Restricted Boltzmann machines	321
Fig. 22	Deep belief networks (DBN)	322
Fig. 23	Deep convolutional network (DCN)	322
Fig. 24	Deconvolutional network (DN)	323
Fig. 25	Deep convolutional inverse graphics network (DCIGN)	323
Fig. 26	Generative adversarial network (GAN)	324
Fig. 27	Extreme learning machine (ELM)	324

Fig. 28	Liquid state machine (LSM)	325
Fig. 29	Echo state machine (ESM)	325
Fig. 30	Deep residual network (DRN)	326
Fig. 31	Kohonen machine (KM)	326
Fig. 32	Support-vector machine (SVM)	327
Fig. 33	Neural turing machine (NTM)	327
Fig. 34	Autoencoder	329
Fig. 35	Distributed representations	332
Fig. 36	Word analogies	332
Fig. 37	A simple CBOW model with one word in the context	333
Fig. 38	CBOW model with multiple words for one context	334
Fig. 39	Skip-gram (SG) model	335

## Chapter 18

Fig. 1	FsImage	345
Fig. 2	MapReduce	346
Fig. 3	SparkContext within the Apache Spark Framework	350
Fig. 4	DAG Visualization	350
Fig. 5	Overview of built-in libraries in Apache Spark	351
Fig. 6	Relationship and processing in and between the Apache Spark libraries (Das, 2015)	352
Fig. 7	Overview over graph analytics pipeline in GraphX	352

## Chapter 19

Fig. 1	Big data or computationally intensive operations relocated to in-memory computing	359
Fig. 2	Adapted system environment	360
Fig. 3	Traditionally separated online transaction processing (OLTP) and online analytical processing (OLAP)	361
Fig. 4	SAP HANA time line	363
Fig. 5	SAP HANA platform overview	364
Fig. 6	Cash Flow Generator (CFG) and Query Creator (QC)	367

## Chapter 20

Fig. 1	MongoDB web interface	376
Fig. 2	OS server entity	378
Fig. 3	Server overview	378

# List of Tables

## Chapter 2

Table 1	Data set examples	18
Table 2	Data categorization	21
Table 3	Conditional probability per feature	22
Table 4	Reconstruction error per feature	24
Table 5	Cross validation results of random forests	26
Table 6	Cross validation results of Bayesian network	26
Table 7	Cross validation results of autoencoder	26

## Chapter 10

Table 1	Overview of different models that were used	171
---------	---	-----

## Chapter 18

Table 1	Price development of hard disk storage	342
---------	--	-----

## Chapter 20

Table 1	Example of a MongoDB representation of a financial position	375
---------	---	-----



# 1

## Introduction

Volker Liermann and Claus Stegmann

### 1 Introduction

#### 1.1 Why This Book?

The financial sector and in particular the banks are in a state of upheaval. Haven't they been continuously for the past twenty or thirty years? Digitalization as a megatrend with all its sub-aspects is hitting all industries and many of the templates for better business generation<sup>1</sup> and cost optimization look quite similar across these industries.

What are the fundamental differences between the financial services sector and other industries? The business environment surrounding banks has the additional load of excessive regulation requirements and technology-driven competitors (fintech companies or GAFA<sup>2</sup>). Depending on the region,

---

<sup>1</sup>Generating better business based on better contact with clients and a better understanding of clients' needs.

<sup>2</sup>GAFA—technology companies—Google Amazon Facebook Apple.

---

V. Liermann (✉)  
ifb AG, Grünwald, Germany  
e-mail: [volker.liermann@ifb-group.com](mailto:volker.liermann@ifb-group.com)

C. Stegmann  
ifb Americas, Inc., Charlotte, NC, USA  
e-mail: [claus.stegmann@ifb-group.com](mailto:claus.stegmann@ifb-group.com)

other challenges like geopolitical uncertainties, increasing credit risk driven by the end of a long economic cycle or a low-interest rate phase must be added to the business environment.

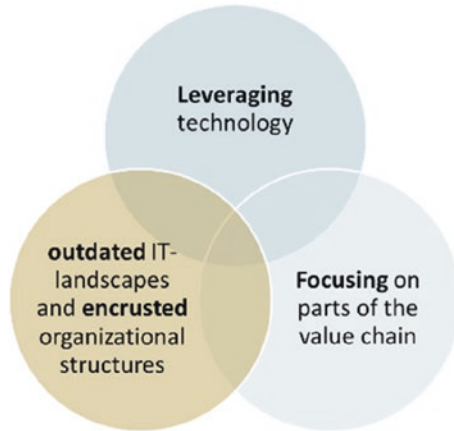
Before delving further into the details of the banking business environment, we would like to introduce you to the focus of this book, namely the impact on financial professionals. Does the storm taking place in the financial industry effect the financial or risk management department? Will the cacophony of “blockchain, fintech, AI, Zettabyte Era, RPA, ...” spouted out by consultants, tech evangelists and other prophets affect the accountant and risk manager? The answer is yes, but to a different extent than other parts of a financial institution are affected.

In this introduction and the first part, we will be looking at aspects of digitalization and fintech companies in more detail to explain the impact on the financial industry. The second and main part of the book will illuminate those aspects from the perspective of a financial department and cover the bank management matters involved. Given the importance of regulation to the industry, we address the regtech dimension in part three. The final part summarizes new and different methods being applied within the environment of financial professionals as well as the technology and architecture considerations. The book ends with summary and outlook in the final chapter.

## 1.2 Setting the Scene

So again, why is digitalization affecting and frightening stakeholders in the financial industry differently than those in other industries? First of all, the competitors (fintech or technology companies) are by nature better in leveraging technology to decrease costs and satisfy customers. Secondly, most competitors focus only on parts of the value chain. Thirdly, the outdated IT landscapes and encrusted organizational structures in traditional banks prevent quick changes. And lastly, the scaling effect of digital business models poses an overwhelming threat.

When it comes to digitalizing business models, there is no guaranteed success if gone alone. Application programming interfaces (APIs) enable traditional banks to compete with new competitors along the entire value chain. The idea behind this consists of establishing a digital financial platform/ecosystem. This is referred to as platform banking, API-based banking or open banking. Platform banking is to some extent driven by the European Payment Services (PSD 2) Directive (EU) 2015/2366

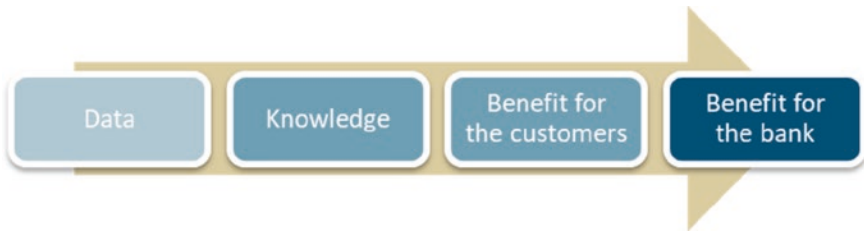


**Fig. 1** What can competitors do better?

(see The European Parliament and the Council of Union, 2015), which forces European banks to provide access to client's payment data (naturally only with the client's consent). Figo is a well-known example of such an API provider (see Figo GmbH, 2019). PSD 2 opens up business opportunities for new market participants, as it makes it much easier to switch banking service providers (Fig. 1).

Many of the traditional banks, however, have accepted this challenge and are doing well in adopting the strengths of their competitors. The gap in organizational flexibility is being closed using agile methods, albeit only to a minor extent. Technological advance is being absorbed to some extent by way of co-innovation, investment or copying the best parts. The competition is driving banks to rethink their core bands and competencies to focus and reshape their business model. However, outdated IT landscapes and legacy systems are slowing innovation and transformation.

Talk of leveraging technology leads to the question: What will drive the business models of banks in the future? In 2015, Lloyd C. Blankfein, CEO Goldman Sachs, called the company a "technology company" based on the fact that Goldman Sachs has 9000 programmers. David McKay CEO Royal Bank of Canada responded by saying, "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" (RBC CEO Dave McKay looks to stay ahead of technology, 2017) (Fig. 2).



**Fig. 2** The path of benefit

With regard to technology, the cloud and various cloud strategies<sup>3</sup> require mention. The primary benefits of the cloud include scaling based on changing requirements (timing and changing resources) as well as the associated cost advantage and efficiency. The financial sector still has certain reservations regarding the cloud due to the sensitive data involved and the reputational impact a data leak would cause. Cloudera has an interesting approach to accompany clients from an on-premise environment to a private or public cloud in development over time.

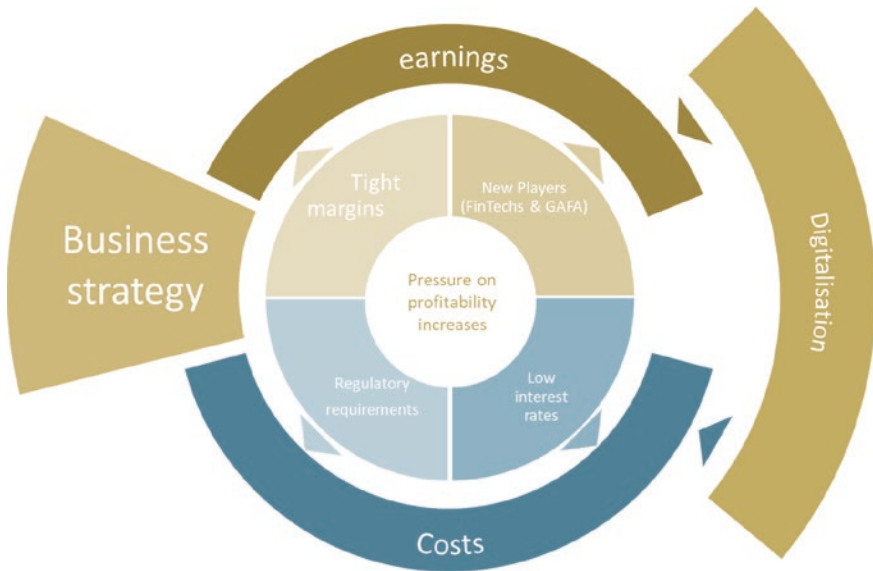
Robert Solow stated in 1987, “You can see the computer age everywhere but in the productivity statistics” (Solow, 1987, July 12). A deeper look at digitalization’s impact on financial institutions could lead to a similar assessment today. The main question is: Do we serve the customer better by using this technology?

To a certain extent, Dan Ariely already summed up big data in 2013 in a way that could now be applied to AI, machine learning, deep learning and blockchain: “Big data is like teenage sex: everyone talks about it, nobody really knows how to do it, everyone thinks everyone else is doing it, so everyone claims they are doing it” (Ariely, 2013, January 6). Banks have to decide if their business model is technology or customer-centric. The latter will be the future!

Design thinking (Brown, 2008, June) puts the client first from the initial stages of the product development process. Concepts like Customer Journey (CJ) and Context Driven Banking (CDB) focus on being there for the customer at the right time.

Fintech companies and technology companies (GAFA) are by far more dynamic (in terms of organizational structure and innovation speed) than traditional financial institutions. Fintech companies are most successful in picking well-chosen parts of the value chain and providing better

<sup>3</sup>Private cloud, public cloud, ... .



**Fig. 3** Impact of digitalization on earnings and costs

(i.e., cheaper or more convenient) services. However, these companies are restricted due to their limited capital. A bigger threat is posed by the GAFA companies due to their deep pockets and the ability to change the playing field of a whole industry, like Apple did with the music industry or Google with maps. The impact is already being felt in the payment context in the form of Apple Pay, Google Pay and Alipay.

### 1.3 Impact on Financial Professionals

Financial and risk management professionals can only contribute to the client-centric business models on a small scale. But they could be less restrictive on business than is currently the case. Financial and risk management have to become more dynamic, adoptable or, to use the digitalization buzzword, “agile.”

The cost saving aspect driven by optimization and automation up to automated decision-making, can significantly improve banks’ stability and agility. The templates for this do not differ much from those applicable to other industries.

The twofold impact of digitalization is illustrated in Fig. 3. Banks in Europe are suffering from an enormous pressure to increase profitability.

Digitalization can impact the business strategy on both ends of the spectrum (earnings and costs).

The model's and architectures developed for understanding the customer better, can be applied to risk management and, to a lesser extent, financial management. Model improvements offer significant enhancements in predicting the future and providing a foundation for better management decisions. All of this requires data, which has to be transformed into information and then knowledge.

New technological foundations are adopted by the technology companies (GAFA). Examples of this include Hadoop and Hana. While Hadoop allows for scaling, SAP Hana can accelerate aggregation at the database level to drive data analysis on another level. Hadoop incurs reasonable implementation cost even at scale. SAP Hana offers new business applications resulting from the speed improvements provided by new technology.

The predominate business model in the financial sector centers around risk, which implies an excellent knowledge of the risks taken and an outstanding ability to manage these risks. Data ["Data is the fuel of the digital economy" (HM Treasury, 2018)] turned into information has always been the main ingredient for the financial sector's risk-based business models. Incorporating new previously unavailable data or more detailed (i.e., more granular and interconnected) data provides the potential to improve risk analysis.

The distributed ledger technology opens up a wide space for optimizing internal processes as well as improving customer satisfaction by speeding up communication and by increasing commitment. The syndicated loan use case is a good example for both (internal and client-oriented) potential improvements.

## Literature

Ariely, D. (2013, January 6). *Big data is like teenage sex ...* [Twitter].

Brown, T. (2008, June). Design thinking. *Harvard Business Review*.

Figio GmbH. (2019, January 29). figio homepage. *figio.io* [online]. <https://www.figio.io/>.

HM Treasury. (2018). *The economic value of data*. London: HM Treasury.

*RBC CEO Dave McKay looks to stay ahead of technology*. Macknight, J. (2017). s.l.: The Banker.

Solow, R. (1987, July 12). We'd better watch out. *New York Times Book Review*, p. 36.

The European Parliament and the Council of Union. (2015). *Payment services in the internal market—Directive (EU) 2015/2366*. Strasbourg; s.n. Directive (EU) 2015/2366.

# Part I

## Automation, Distributed Ledgers and Client Related Aspects

The world is changing and so is the financial services industry. Bill Gates said, “banking is necessary, banks are not”—a disruptive statement to say the least. That was all the way back in 1994. But will it become true in our age? Although most American banks are quite profitable,<sup>1</sup> fear of disruptive change has been significant in recent years. In 2014 banks started fearing the fintech companies and their ability to disrupt the banks’ business models. In 2015 and 2016, it became clear that they are “only” ripping out certain parts of the bank’s value chains. Due to their focused approach, many fintech companies were quite successful in doing so to a certain extent. Robo-advisors are a good example of this.

Other fintech companies have proven that they understand the customer needs better than the traditional financial institutions. N26<sup>2</sup> is an example of a start-up that at first simply sought to provide a digital wallet for young people. The company then realized that parents showed interest in a more digitalized bank. Based on this, they developed a purely smartphone-based bank by decomposing the classical services in a user-friendly way. The higher grade of digitalization produces a significant amount of data, which can be used to understand what customers need in new depth. Examples of this approach are NBO,<sup>3</sup>CJ<sup>4</sup> and context driven banking.

---

<sup>1</sup>Especially in contrast to the German banks.

<sup>2</sup>N26 (formerly known as Number 26 until July 2016) is a German direct bank, headquartered in Berlin, Germany [see (N26 Inc., 2019)].

<sup>3</sup>NBO—Next Best Offer

<sup>4</sup>CJ—Customer Journey.

Bitcoin is a well-known application of the distributed ledger technology. While it first targeted sanctions-free transfer of value, bitcoin has now developed into a currency-like payment alternative [see (Nakamoto, 2008)]. Driven by the architecture, the intermediators (normally financial institutions) are cut out of the process, thus restricting traditional financial institutions' customer contact to a minimum.

Even some central banks like the Monetary Authority of Singapore (MAS) [Project "Ubin" see (Singapore Exchange, 2018)], the Bank of Canada [Project "Jasper" see (Chapman, Garratt, Hendry, McCormack, & McMahon, 2017)] and the German Bundesbank ["Forschungsprojekt Blockchain" in (Bundesbank, 2017)] are experimenting with distributed ledger technology. In a research project conducted by the German Bundesbank in 2017, they mirrored bonds into a distributed ledger using Hyperledger. This same pattern can be found with regard to so-called security tokens. In addition to the distributed ledger implementation, security tokens promise to exchange the token with things in the real world (goods or money). This type of asset-backed or Bretton-Woods-style<sup>5</sup> cyber-currency could push this kind of distributed ledger to a new level.

While the world of tokens and public blockchain is continuously transforming, the distributed ledger technology with private blockchains is opening up interesting new applications. This includes we.trade in the area of trade finance and digital replicated bonds using blockchain technology (LBBW and Daimler Benz) as well as Everledger in the diamond certification domain.

A core aspect of digitalization that covers almost all areas is robotic process automation (RPA)<sup>6</sup> and workforce automation. Over the long term, RPA aims to replace manual decisions using robots that can identify decision patterns. This transformation is rarely done with a big bang, especially in traditional financial institutions, but rather performed incrementally. The different levels of process automation are shown in Fig. 1. The six levels indicated here span from manual decisions to autonomous decision-making.<sup>7</sup>

Robotic Process Automation (RPA) is intended to relieve people of performing dull repetitive tasks in front of their computer screens all day long. RPA replaces human labor but also minimizes the risk of human error. RPA

---

<sup>5</sup>The Bretton Woods system of monetary management established among the United States, Canada, Western Europe countries, Australia and Japan in 1944. One key element was that the exchange rate between the dollar and an ounce of gold was fixed.

<sup>6</sup>RPA—Robotic Process Automation.

<sup>7</sup>The 5-step decision automation model is dealt with in detail in (Bitcom, 2017).

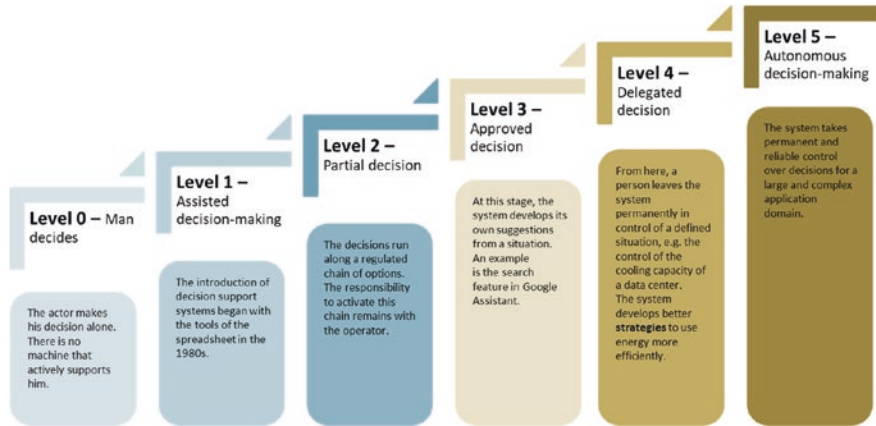


Fig. 1 5-step decision automation model

helps rethink and redefine financial services processes. A decision has to be made, as to which parts of the process can be fully or partially automated and when. Simply put, RPA is software that uses artificial intelligence (AI) and has machine learning capabilities to handle repetitive high-volume tasks.

Workforce virtualization using robotics has the potential to fundamentally change the way financial institutions tackle multiple areas of process execution while providing significant business benefits. While its rapid introduction is almost inevitable, leading companies will use it as a way to not only reduce costs, but also to improve controls and improve employee effectiveness, make them more productive and evaluate them within the organization. The coverage of digitalizing processes differs significantly between traditional non-digital banks and challenger banks.

While Fig. 2 shows the primary steps of process automation (on the left), it is important to understand that the early steps only contribute minor growth in efficiency. The real boost happens when decision-making is automated.

Aspects like standardized processes and process industrialization are necessary milestones on the road to full digital transformation. In recent years, companies in the US and Europe have sought to reduce their operating costs and increase their overall efficiency by standardizing, centralizing and sometimes outsourcing a wide range of processes. These processes were initially of high volume but with little added value, e.g., Accounts Payable, Accounts Receivable, General and Subledger bookings, expense reports and other activities once performed at the company's headquarters. Over time,

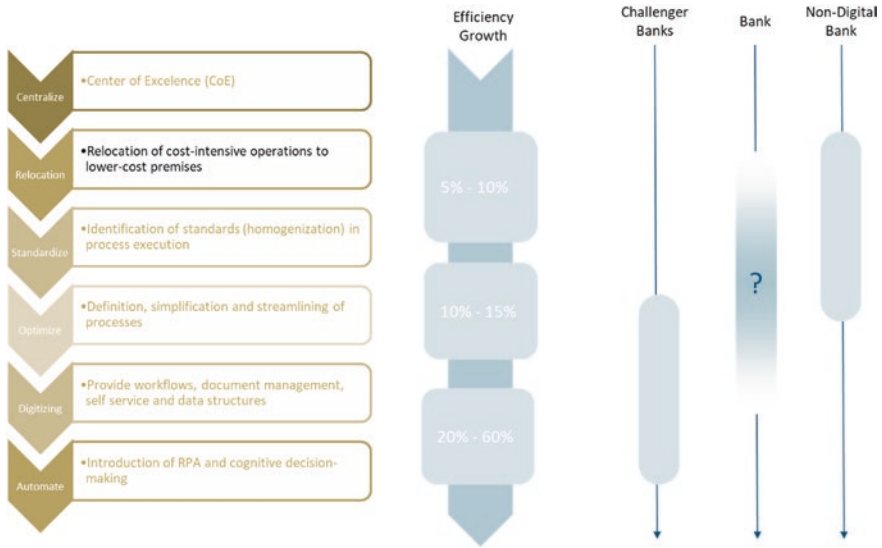


Fig. 2 Automation of Location Determination

more complex and sensitive “industrialization” processes have been introduced through standardization and the use of third-party platforms. These include compliance, compensation reviews and policies, contract management, and a variety of other corporate functions, many of which relate to risk management.

Examples of this transformation include risk reports and batch processes. Extensive, time-consuming risk reports are perfect candidates for automation that allows for timely, accurate and comprehensive data quality reviews and remedial actions as indicated. Batch processes can be separated into two tasks: (A) monitoring and validation of already automated processes (e.g., data transfer) and (B) automated decisions on whether processes should be restarted or whether manual steps are necessary.

Chapter 2 “Batch Processing—Pattern Recognition” (Liermann, Li, & Schaudinnus, 2019) describes a practical application of monitoring and data-pattern recognition. The chapter introduces the necessary framework for such tasks, including data lakes and methods like Bayesian networks, random forest and autoencoders.

The next subsection focuses on private blockchains and introduces the Hyperledger framework that is part of the Linux project. The two chapters focus on different aspects of the Hyperledger framework. As stated earlier, the blockchain applications can generally be split into two kinds of domains: the public blockchains (e.g., bitcoin and Ethereum) and the private

blockchains (e.g., Hyperledger and Corda). This book focuses on private blockchains, because we see more potential and applications here for financial services companies.

Chapter 3 “Hyperledger Fabric as a Blockchain Framework in the Financial Industry” (Bettio, Bruse, Franke, Jakoby, & Schärf, 2019) introduces the main components and concepts of Hyperledger Fabric. The chapter provides an in-depth description and can be seen as a summary of the documentation for the Hyperledger project. Concepts like nodes of a blockchain, permissions and blockchain channels are explained as well as the consensus mechanism and design possibilities Hyperledger Fabric offers on this side. Chapter 4 “Hyperledger Composer—Syndicated Loans” (Dahmen & Liermann, 2019) describes the Hyperledger Composer tool and a practical application for syndicated loans. Hyperledger Composer is a tool used to develop rapid prototypes based on the Composer modeling language.

The last two chapters of this part address client-related aspects like NBO, context-driven banking [see “The concept of the next best action/offer in the age of customer experience” (May, 2019)] and prospect theory within the context of wealth management documenting the client-oriented approach of a Robo advisor [see “Using prospect theory to determine investor risk aversion in digital wealth management” (Lisson, 2019)].

## Literature

- Bettio, M., Bruse, F., Franke, A., Jakoby, T., & Schärf, D. (2019). Hyperledger fabric as a blockchain framework in the financial industry. In V. Liermann & C. Stegmann (Eds.), *The impact of digital transformation and fintech on the finance professional*. New York: Palgrave Macmillan.
- Bitcom. (2017). *Künstliche Intelligenz verstehen als Automation des Entscheidens Leitfadens*. Berlin: Bitcom Bundesverband Informationswirtschaft, Telekommunikation und neue Medien e.V.
- Bundesbank, D. (2017). *Monatsbericht September 2017*. Frankfurt: Deutsche Bundesbank.
- Chapman, J., Garratt, R., Hendry, S., McCormack, A., & McMahon, W. (2017). *Project Jasper: Are distributed wholesale payment systems feasible yet?* Ottawa: Bank of Canada—Financial System Review.
- Dahmen, G., & Liermann, V. (2019). Hyperledger composer—Syndicated loans. In V. Liermann & C. Stegmann (Eds.), *The impact of digital transformation and fintech on the finance professional*. New York: Palgrave Macmillan.
- Liermann, V., Li, S., & Schaudinnus, N. (2019). Batch processing—Pattern recognition. In V. Liermann & C. Stegmann (Eds.), *The impact of*

- digital transformation and fintech on the finance professional*. New York: Palgrave Macmillan.
- Lisson, C. (2019). Using prospect theory to determine investor risk aversion in digital wealth management. In V. Liermann & C. Stegmann (Eds.), *The impact of digital transformation and fintech on the finance professional*. New York: Palgrave Macmillan.
- May, U. (2019). The concept of the next best action/offer in the age of customer experience. In V. Liermann & C. Stegmann (Eds.), *The impact of digital transformation and fintech on the finance professional*. New York: Palgrave Macmillan.
- N26 Inc. (2019). N26. Retrieved February 15, 2019, from N26: <https://n26.com/en-us/>.
- Nakamoto, S. (2008). *Bitcoin—A peer-to-peer electronic cash system*.
- Singapore Exchange, M. A. (2018). *Delivery versus payment on distributed ledger technologies—Project Ubin*. Singapore: Singapore Exchange, Monetary Authority of Singapore.