Business Analytics

The Road to Data-Driven Corporate Performance Management

Dream Car from the Dream Factory of the ICV 2016
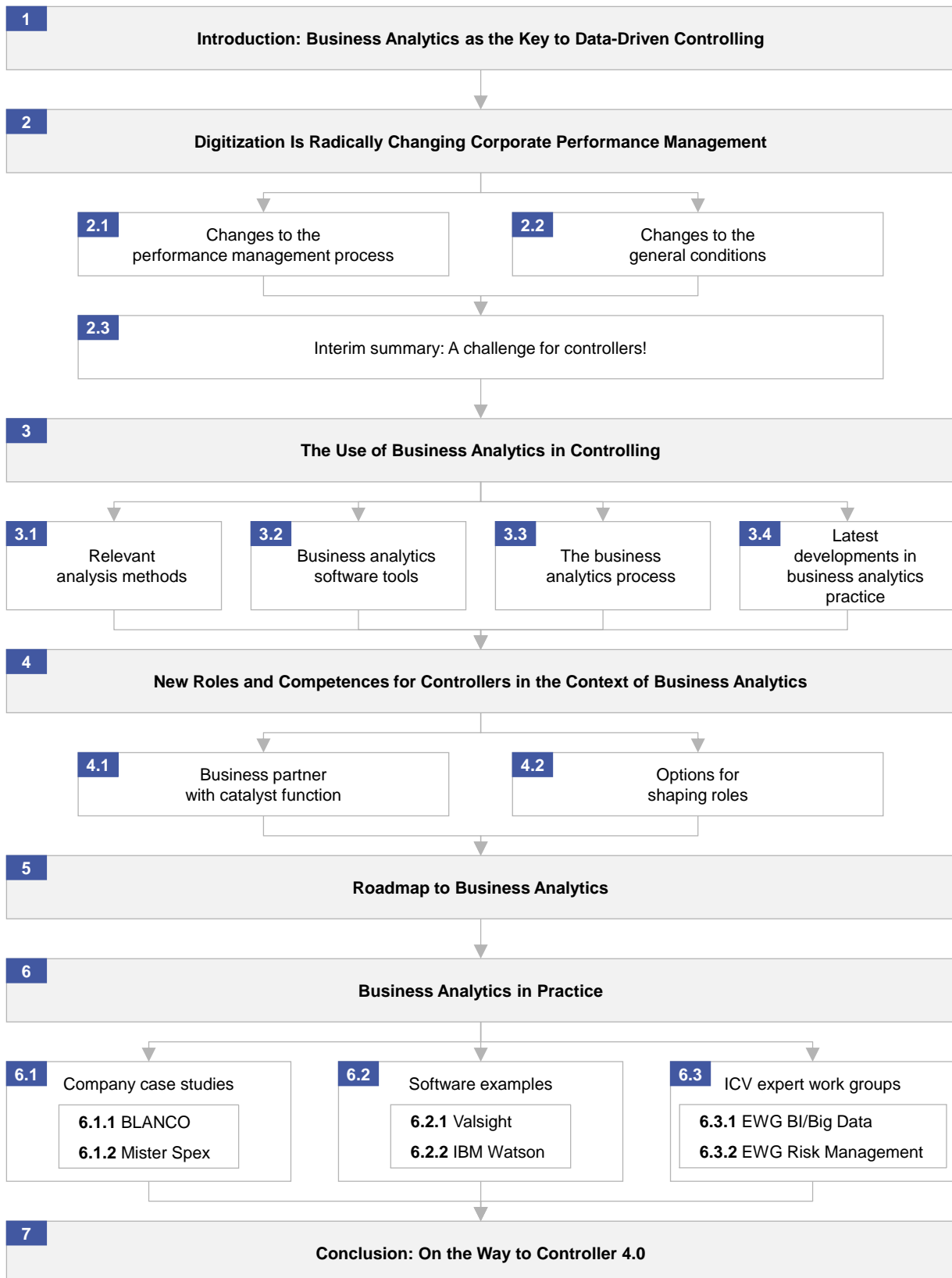
In cooperation with

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With experiences and examples from

BLANCO   TRUMPF   IBM   VALSIGHT   MISTER SPEX

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Management Summary

Digitization is changing the work of controllers fundamentally. They are bombarded with a flood of unstructured data (Big Data) and have to structure and analyze it in order to create information with a beneficial impact on corporate performance management. This is the job of "Business Analytics". Business analytics is the processing of digital data with the help of **statistical methods and quantitative models** to create useful findings. Business analytics can be broken down into **descriptive analytics** (What happened?), **diagnostic analytics** (Why did it happen?), **predictive analytics** (What will happen?) and **prescriptive analytics** (What must be done to reach a specific target?). This Dream Car Report tackles the following highly topical issue:

> **What must a controller know about business analytics and can they use business analytics to design an effective controlling process?**

We have summarized our **findings** in the form of theses:

- **Digitization** is changing corporate performance management fundamentally: It is highly automated, integrated and driven by analysis (cf. Chapter 2).

- **Controllers** must be familiar with business analytics. They do not need to become mathematicians but they must know which methods of analysis there are and what they can achieve (cf. Chapter 3.1). This also applies to the business analytics software tools they can use (cf. Chapter 3.2).

- In their role as coordinator, controllers must design and coordinate the joint **business analytics process** and act as the liaison between management, data scientists and IT (cf. Chapter 3.3).

- Latest developments in **business analytics practice** show that the use of business analytics is on the rise. Controllers should ensure they are familiar with the latest best practices (cf. Chapter 3.4).

- Business analytics enables controllers to fulfil their role even more actively and gives them the chance to act as a business partner with **catalyst function** (cf. Chapter 4.1).

- Controllers must think about their **role in shaping** the design and use of business analytics (cf. Chapter 4.2).

- The use of business analytics should be seen as an evolutionary process in the company. Controllers should act as co-developers of the **business analytics roadmap** (cf. Chapter 5).

- Business analytics is already used in some areas of **controlling practice**. Experience shows that it creates an improved basis for decision-making (cf. Chapter 6).

- The controller is and must remain the **single source of truth** for management information that is completely irreplaceable and completely indispensable (cf. Chapter 7).

> „Analytics is the foundation for the CFO to get greater transparency and insight, and to steer the business."
>
> Helen Arnold,
> until May 2016 CIO at SAP

Preface

The aim of the **Dream Factory of the International Controller Association ICV** (*"Ideenwerkstatt" im ICV*) is to systematically observe the field of controlling and recognize major trends. From this, the Dream Factory develops the "Dream Cars" of the ICV, thereby making a major contribution to ensuring **the ICV is seen as the leading voice in the financial and controller community**. Ideas and findings are transformed into concrete, working products in ICV expert work groups or other project groups.

The Dream Factory always strives to tackle the most relevant and innovative topics that provide new food for thought for the controlling community. In recent years we have investigated the topics of Green Controlling, Behavioral Orientation, Volatility, Big Data and Industrie 4.0. We intend to carry on making controllers aware of new developments and thus provide new stimuli for the ongoing development of controlling.

This year we have spent a lot of time scrutinizing the topic of "Business Analytics". **Business analytics** is the use of statistical-mathematical analyses and models based on those analyses to derive useful findings from a wide range of different data pools. The use of business analytics is the main enabler for data-driven corporate performance management and an important competitive factor in the context of increasing digitization.

The heads of the Dream Factory are:

- Prof. Dr. Dr. h.c. mult. *Péter Horváth* (*Horváth AG*, Stuttgart, Vice-Chairman of the Supervisory Board; *International Performance Research Institute gGmbH*, Stuttgart, Vice-Chairman of the Supervisory Board)

- Dr. *Uwe Michel* (*Horváth AG*, Stuttgart, Member of the Board)

Contributors to the core team of the Dream Factory are:

- *Siegfried Gänßlen* (*Internationaler Controller Verein e.V.*, Wörthsee, Chairman of the Board)

- Prof. Dr. *Heimo Losbichler* (*FH Oberösterreich*, Steyr; *Internationaler Controller Verein e.V.*, Wörthsee, Vice-Chairman of the Board; *International Controlling Group ICG*, Chairman of the Board)

- *Manfred Blachfellner* (*Change the Game Initiative*, Innsbruck)

- Dr. *Lars Grünert* (*TRUMPF GmbH + Co. KG*, Ditzingen, Member of the Management Board)

- *Karl-Heinz Steinke* (*Internationaler Controller Verein e.V.,* Wörthsee, Member of the Board*)*

- Prof. Dr. Dr. h.c. *Jürgen Weber* (*Institute for Management and Controlling IMC at the WHU – Otto Beisheim School of Management*, Vallendar, Director)

- *Goran Sejdić* (*International Performance Research Institute gGmbH*, Stuttgart, Research Fellow)

This year we have also complemented the work of the core team with experiences of different partners from inside and outside of the ICV. The following business analytics experts provided valuable insights:

- *Tobias Flath* (*PricewaterhouseCoopers AG*, Frankfurt am Main, Head of Risk Analytics; Head of the ICV Expert Work Group "Controlling and Risk Management")

- *Jannis Friedag* (*Mister Spex GmbH*, Berlin, Head of Controlling and Analytics)

- *Stephan Müller* (*Valsight GmbH*, Potsdam, CEO)

- *Erich Nickel* (*IBM Deutschland GmbH*, Ehningen, Director of Automotive Solutions CoC DACH)

- *Thomas Rachel* (*BLANCO GmbH + Co KG*, Oberderdingen, Head of Sales Controlling)

- Prof. Dr. *Andreas Seufert* (*Hochschule Ludwigshafen; Institute for Business Intelligence at the SHB – Steinbeis-Hochschule Berlin*, Berlin, Director; Head of the ICV Expert Work Group "BI/Big Data and Controlling")

- Dr. *Werner Sinzig* (*SAP SE*; *Valsight GmbH*, Potsdam, Member of the Advisory Board)

- *Matthias von Daacke* (*BLANCO GmbH + Co KG*, Oberderdingen, Head of Sales and Subsidiary Controlling; Member of the ICV Board)

We would like to take this opportunity to give our sincere thanks for their willingness to support the work of the Dream Factory of the ICV and for their contributions to this Dream Car report.

Our special thanks go to *Goran Sejdić* for his editorial efforts for this report and for his coordination of the core team of the Dream Factory.

We hope you enjoy reading this report and that you gain new impetus for your daily work in controlling.

Best regards,

Siegfried Gänßlen   Prof. Dr. Heimo Losbichler

representing the Board of the International Controller Association

Prof. Dr. Dr. h.c. mult. Péter Horváth   Dr. Uwe Michel

representing the Dream Factory of the International Controller Association

1 Introduction: Business Analytics as the Key to Data-Driven Controlling

Digitization is one of the most important **developments of the 21st century**.

> **Digitization is the transformation of all data, such as texts, videos or sensor data, into a binary code.**

Thus, with the use of information and communication technologies we can collect, record, save and exchange relevant information via the Internet.

Comprehensive digitization leads to the availability of an enormous **variety of data** and an unprecedented **volume of data**. The challenge is to derive useful findings from this data. Hence, data is becoming one of the most important resources for a company and the target-based analysis of data a crucial competitive factor. Within digitization, the term **business analytics** is currently on everyone's lips and it stands for the use of data for management decision-making.

> **"Analytics" means the comprehensive use of data, statistical and quantitative analyses, and explanatory and predictive models (cf. Davenport/Harris 2007).**
>
> **The term "business" in this context underlines the fact that these analyses and models are used for business purposes to provide support for and improve data-driven managerial decision-making.**

Data-driven decisions through business analytics

Business analytics has **four development stages** (cf. BITKOM 2014):

- The focus of the first stage is to collect and describe data in order to identify relevant patterns. Here, the main question is, "What has happened?" (**Descriptive analytics**)

- In the second stage, we define the causes for the correlations we identified in the first stage. Here, the main question is, "Why did this happen?" (**Diagnostic analytics**)

The development stages of business analytics

- In the third stage, we use these findings to develop a model which can be used to predict future events. Here, the main question is, "What will happen in the future?" (**Predictive analytics**)

- Finally, in the fourth stage we derive recommended measures based on the data patterns and the predictions. Here, the main question is, "What is the best course of action to achieve a specific goal?" (**Prescriptive analytics**)

These four business analytics categories have a major influence on the work of the controller, as can be seen in the examples in Figure 1.

Controlling and business analytics

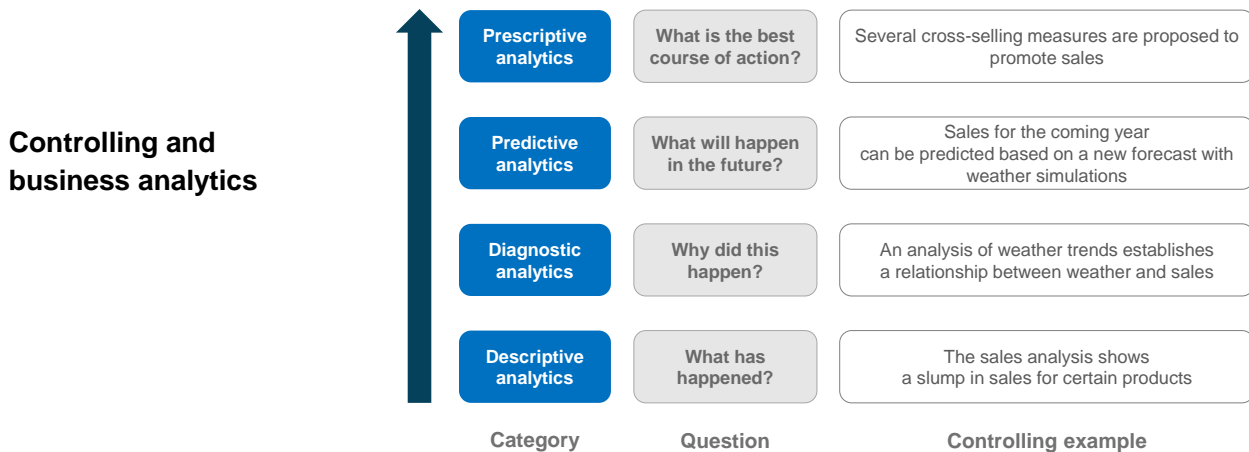| Category	Question	Controlling example
Prescriptive analytics	What is the best course of action?	Several cross-selling measures are proposed to promote sales
Predictive analytics	What will happen in the future?	Sales for the coming year can be predicted based on a new forecast with weather simulations
Diagnostic analytics	Why did this happen?	An analysis of weather trends establishes a relationship between weather and sales
Descriptive analytics	What has happened?	The sales analysis shows a slump in sales for certain products

Figure 1: Business analytics categories with examples from controlling

Since its very beginnings, data-based planning and performance management has been a core element of controlling. In recent years, leaps and bounds have been made in the degree of detail of the data analyses used and the knowledge and insights of the findings of those analyses. In the process, both mathematical and statistical analyses and explanatory and predictive models have become increasingly important. Thomas Davenport breaks this development down into **three fundamental phases** (cf. Figure 2). Davenport is the co-founder and Research Director of the International Institute for Analytics and is regarded as a leading expert in the field of business analytics.
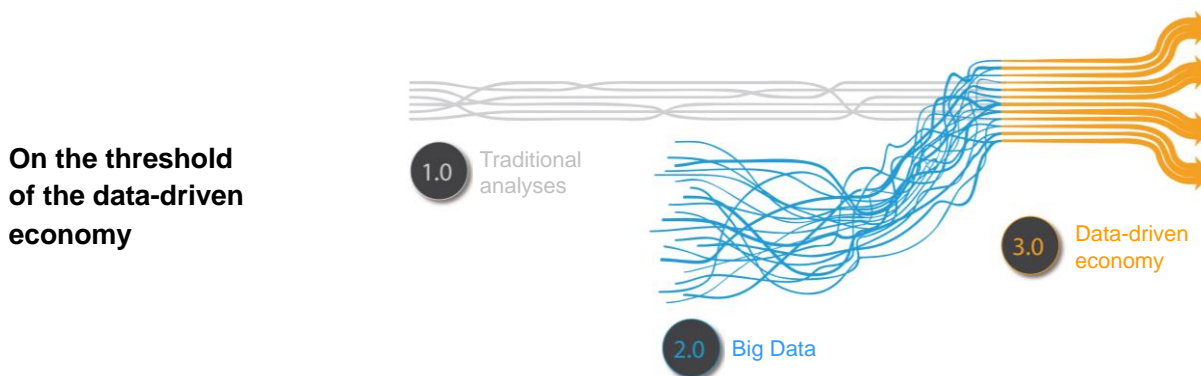
On the threshold of the data-driven economy

Figure 2: The development of data analysis (taken from Davenport 2013, p. 8)

The first development phase **"Traditional analyses"** (mid-1950s to 2000) was characterized by mainly descriptive analyses and what we tend to call "classical" reporting. The objective was to use internal and structured data to describe transactions and activities which lay in the past. Predictive or prescriptive analyses were rarely used at all. It often took several days or indeed weeks to carry out more comprehensive statistical analyses.

The second development phase **"Big Data"** (2000 to today) started with the utilization of data from the Internet. Online companies such as Google or eBay were able to implement their data-driven business models within a very short period. While the focus of this phase still lies on descriptive analyses, unstructured data is also analyzed here. Additionally, external corporate data has become increasingly important.

Today, we find ourselves on the threshold of a third development phase: **a data-driven economy**. The overriding characteristic of this phase is that most operative decisions are driven by data. This creates considerable competitive advantages not only for online companies but also for companies from traditional industries. These competitive advantages can be traced back in particular to the use of predictive and prescriptive analyses. Additionally, both structured/unstructured and internal/external data can be combined as needed depending on the specific goal.

Business analytics is one of the most important enablers of the data-driven economy. As it focuses heavily on the use of target-based data analyses and the subsequent derivation of useful findings, **controllers must familiarize themselves with the topic of business analytics**. In this Dream Car Report we wish to pay heed to this necessity and shed light on the topic of business analytics for the benefit of the controller community.

Using Big Data with business analytics

It's time for the controller to step up to the plate!

- First, we look at the impacts of digitization on corporate performance management and, as a result, the extent to which business is becoming more important for controllers (**Chapter 2**).

- Then, we explain the basic principles of business analytics in controlling: analysis methods, software tools and the current state of practice in business today (**Chapter 3**).

- Subsequently, we show which roles controllers can take on in the context of business analytics and which skills and requirements they need to fulfil (**Chapter 4**).

- Additionally, we present a business analytics roadmap showing how companies can systematically approach the topic of business analytics (**Chapter 5**).

- Based on this, we use concrete implementation cases and software solutions to describe the use of business analytics in business today. Moreover, two ICV expert work groups present their work (**Chapter 6**).

- Finally, the report finishes with a summary (**Chapter 7**) and recommended reading on business analytics.

Our Dream Car itinerary

2 Digitization Is Radically Changing Corporate Performance Management

Digitization produces the flood of data that is Big Data. IT-supported business analytics provides the opportunity to **transform Big Data into information with performance management relevance**. Here, thanks to new developments in hardware and software, IT technology enables the storage and integrated processing of data into performance management information. This transformation has the potential to change the entire system of corporate performance management, with a fundamental impact both on the controlling process itself and on its underlying conditions. These changes can be summarized in **ten theses** (cf. Figure 3).

We can expect extensive changes to the performance management process and its general conditions
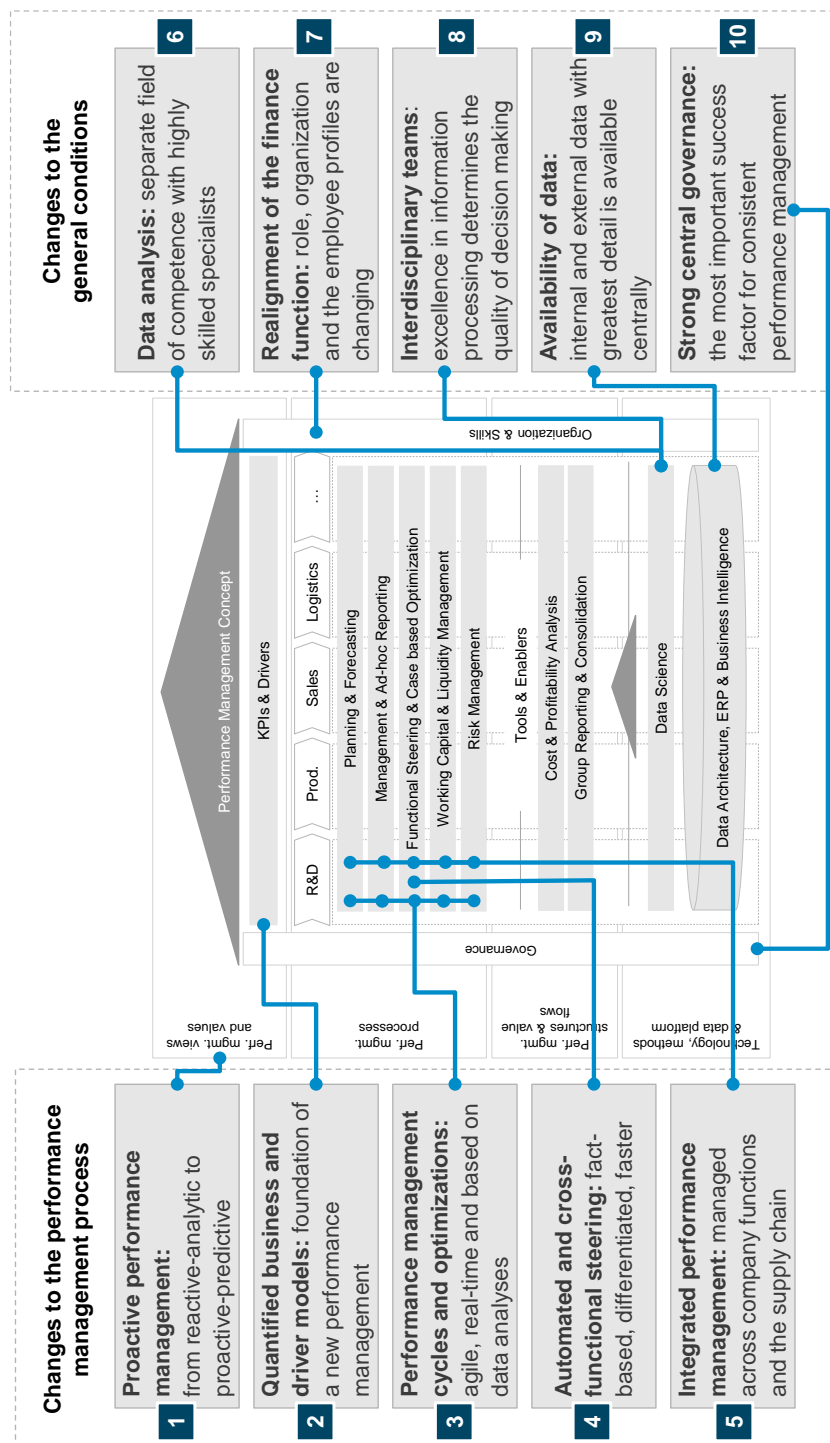

Figure 3: The influence of digitization on corporate performance management (based on Kieninger et al. 2015, p. 10)

2.1   Changes to the performance management process

From reactive-analytical to proactive-predictive

As there is a huge amount and variety of available data, quantitative models can be used to create forecasts in the sense of predictive analytics, and this process can, in part, be automated. The forward-looking focus means historically-based evaluations are becoming less and less important. Based on those model-based forecasts, suitable measures are derived which enable companies to actively influence the predicted development.

Proactive performance management

The foundation of new performance management

Increasingly, data-based and statistical interdependencies are replacing previously assumed qualitative cause-and-effect chains. For this to work, these data-based and statistical correlations must be validated regularly and, if necessary adjusted. Thus, driver models are becoming an essential element in corporate performance management.

Quantified business and driver models

Agile, real-time and based on data analyses

Automated analyses can reduce reaction times, thereby enabling "high-frequency decisions" which, in turn, can lead to the ad-hoc implementation of optimization measures. In all, the ex-post and deviation-oriented performance management approach can be supplemented with an explorative, real-time optimization system.

Performance management cycles and optimizations

Fact-based, differentiated, faster

Predictive analytics and machine learning approaches are increasingly establishing themselves as standard instruments in corporate performance management. Overall, decisions which must fall between defined value and risk parameters are being automated using the results of probability-based predictions.

Automated and cross-functional steering

Managed across company functions and the supply chain

Digitization leads to even stronger corporate networking as different types of information are disseminated across company borders. This development is not limited to B2B but also includes customers and other external partners. In this context, controlling must increasingly take charge of internal and external company processes and in doing so identify and evaluate new and relevant data sources.

Integrated performance management

2.2   Changes to the general conditions

Data analysis

Separate field of competence with highly skilled specialists
The use of business analytics requires an extended skills profile. This includes proficiency in modelling, statistical analysis skills, and man-machine communication capabilities. Currently, this competence profile is often discussed as part of the role model for the "data scientist" (cf. Grönke/Heimel 2015).

Realignment of the finance function

Role, organization and employee profiles are changing
The CFO is developing more strongly towards being a chief performance officer. Controllers can use the results of the data analyses first to optimize operative processes and second to continuously expand their role as business partner. The finance function is organized strictly along the lines of transactional and analytical processes.

Inter-disciplinary teams of controllers, data scientists and IT specialists

Excellence in information processing determines the quality of decision making
Business analytics does not develop its full potential until we combine expert and industry knowledge with the methodological skills and the entrepreneurial spirit of the interdisciplinary experts and managers involved. While data scientists analyze all the data to find correlations relevant to performance management, the interpretation and processing of the findings is the responsibility of controlling and top management. The results from the models and analyses reveal probabilities which the functions can use in decision-making and performance management.

Availability of data

Internal and external data with greatest detail is available centrally for performance management
Companies who wish to fully tap the potentials of business analytics need access to a wide variety of data. One critical success factor is also the rapid availability of data. This encompasses both internal/external data sources and structured/unstructured ones.

Strong central governance

The most important success factor for consistent performance management
It is essential to have governance which is extensive and which works in order to ensure the data, the analysis models, the results and the proposed decisions are both compatible and consistent. The CFO must involve controlling more heavily in order to organize this governance, make it more transparent and, ideally, to take full control of it.

2.3   Interim summary: A challenge for controllers!

In the light of the developments shown here, we need to ask how they will impact on the focus of controllers' activities. Business analytics creates both **new chances and new challenges**. On the one hand, the use of business analytics enables proactive management support while, on the other hand, we have the challenge of learning how to use business analytics.

First, the use of statistical methods and models can **reveal previously unknown causal effects** or generate **more precise predictions**. This leads to considerable increases in the quality of planning and performance management. However, the use of such methods and models requires controllers to **learn new skills and competences** and **cooperate more closely across functional borders** with data scientists and IT experts. Second, new – and above all external – data sources must be evaluated for relevance and integrated into corporate performance management. Only by mastering these challenges can the chances inherent in business analytics be fully utilized.

Chances and challenges for controllers

The controller should act as the "architect" of the further development of the performance management process. Thus, our interim summary is:

> **Through the use of business analytics, controllers can perform their role in the controlling process more proactively. They should be co-designers of the further development of the digitized controlling system.**

3 The Use of Business Analytics in Controlling

As shown in the previous section, business analytics is the key to digitization. For this, four topics are important for controllers:

- They must know the **calculation methods** of business analytics.

- They must know which **software tools** are available for business analytics.

- They must be able to coordinate the **process** of using business analytics.

- They should know the latest developments in business analytics **practice**.

We wish to take a closer look at these four topics in this section.

3.1   Relevant analysis methods

An important success factor in the implementation of business analytics is the analysis and use of suitable analysis methods.

Check or discover correlations

Before actually carrying out any analysis, we have to collect and prepare the data required (data acquisition and data mining). Here it is important to know that texts and data from social media also play a big role. Then we can differentiate the analysis methods used between analysis methods which **test structures** and those which **discover structures** (cf. Backhaus et al. 2016).

The focus of the **structure-testing** analysis methods is on the causal relationships between one relevant variable and one or more independent variables. Prior to this analysis it is thought there might be some correlation between these variables. By using these methods we can test these dependencies (e.g. correlation between purchasing behavior and customer satisfaction).

There are no such prior considerations for **structure-discovering analysis** methods. As a result, their goal is to discover whether there actually are any dependencies at all between different variables and objects (e.g. to test which factors influence product quality).

Figure 4 shows the most important structure-testing and structure-discovering analysis methods. The following then describes each of these methods briefly and illustrates them with a business use case.

Structure-testing analysis methods	Structure-discovering analysis methods
Regression analysis	Factor analysis
Nonlinear regression	Cluster analysis
Time series analysis	Neural networks
Analysis of variance	Multidimensional scaling
Discriminant function analysis	Correspondence analysis
Logistic regression	
Contingency analysis	
Structural equation analysis	
Conjoint analysis	

Figure 4: Overview of the analysis methods (cf. Backhaus et al. 2016)

The **regression analysis** can be used both to explain connections and to create predictions. In particular, it is used to investigate causal relationships between one dependent variable and one or more independent variables. By using a regression analysis, such relationships can be quantified and described extremely precisely.

Explanation and prediction

> **Example:** Dependency of the sales quantity of a product on price, advertising expenditure and income.

While conventional regression analyses are based on linear connections, the **nonlinear regression** shows random relationships between dependent and independent variables. This makes the scope for potential use of the regression analysis much greater. However, this increased scope goes hand-in-hand with several challenges, e.g. computing time increases as iterative calculation algorithms are used.

Non-linear correlations can also be shown

> **Example:** Investigation of the growth of new products, the diffusion of innovations or the spread of epidemics.

With the help of a **time series analysis** we can, on the one hand, describe or explain the development of a variable over time and, on the other hand, predict how it will change in the future. The time series analysis produces estimates on the values of this variable in future phases, meaning it can be used in different decision-making situations.

Over longer time frames

> **Example:** Analysis and prediction of the development over time of the
> sales volume for a product or market.

Analyzing experiments

An **analysis of variance** is used when the independent variables are shown on a nominal scale (classifications of qualitative characteristics) and the dependent variables are shown on a metric scale (interval or ratio scale). Analyses of variance are used in particular when analyzing experiments.

> **Example:** Impact of different packaging formats on the sales volume of a
> product.

Classification as typical application

In the reverse case, we use the **discriminant function analysis**. This is used when the dependent variables are nominally scaled and the independent variables are shown on a metric scale. A typical use for this is classification.

> **Example:** Classification of customer groups based on socio-demographic
> and psychographic characteristics.

Allocation based on probability

Logistic regressions are used in similar situations to the discriminant function analysis. Here we investigate the probability of objects belonging to a specific group depending on one or more independent variables. The independent variables can be shown on both a nominal and a metric scale.

> **Example:** Calculating the risk of non-delivery of a supplier based on the
> size of the company and the size of the vehicle fleet.

Contingency table with frequencies

We use a **contingency analysis** when both the independent and the dependent variables are shown on a nominal scale. A contingency table with the frequencies of the characteristics of both variables forms the basis for the contingency analysis.

> **Example:** Analysis of whether products trialed on a test market are more
> successful than untested products.

The analysis methods named so far always investigate variables which can actually be observed in the real world and as such can be measured directly. However, there are also questions which require variables to be investigated which cannot be observed directly (so-called latent variables). Often these are psychological constructs such as attitude or motivation. In such cases, we use **structural equation models**.

Focus on latent variables

> **Example:** Dependence of customer loyalty on the subjective product
>   quality and service quality of a provider.

If dependent variables are measured on an ordinal scale, we can use the **conjoint analysis**. Here we often analyze preferences or selection decisions which are measured ordinally. The aim is, for example, to calculate the contribution to overall benefit made by the individual characteristics of products.

Calculating the contribution of individual characteristics

> **Example:** Derivation of the contribution of materials, shapes and colors of
>   products to overall preference.

With the help of a **factor analysis** we can reduce or bundle a large number of potential variables to the "core factors". We often need to answer the question of whether many characteristics pertaining to one particular situation can be traced back to a few central ones.

Reduction to core influences

> **Example:** Consolidation of a large number of assessments of
>   characteristics for a purchase decision to a few core influences.

While the factor analysis bundles variables together, a **cluster analysis** focuses on bundling individual objects together. The objective of the cluster analysis is to **break a given set of objects down into subsets** (called clusters). Objects in the same cluster should be as similar as possible in terms of their characteristics, while objects from different clusters should be as different as possible.

Summarizing objects

> **Example:** Formation of customer groups according to customer
>   satisfaction based on all available documents and
>   correspondence (cluster analysis through text mining).

Mirroring how the brain processes information

The analysis system behind **neural networks** is based on the biological processing of information by the brain. Artificial neural networks are set up which learn independently through experience. Within these neural networks, artificial neurons (nerve cells) are the main component of information processing and are organized in layers. Each neuron is linked to the next downstream layer. This network allows us to model complex (nonlinear) dependencies which can be used to deal with badly structured problems and issues.

> **Example:** Investigation of share prices and possible influences in order to predict share price developments.

Positioning analysis

The typical use for **multidimensional scaling** is a positioning analysis. The goal of multidimensional scaling is to position the objects being investigated in a multidimensional space so that the position of the objects and the space between them corresponds as closely as possible with the actual distances between the objects (in the sense of the way in which they differ from one another).

> **Example:** Positioning of competing product brands in the perception of consumers.

Use of two-dimensional contingency tables

Similar to factor analysis and multidimensional scaling, a **correspondence analysis** is used to visualize complex data. The correspondence analysis enables us to graphically portray the rows and columns of a two-dimensional contingency table in a shared space.

> **Example:** Portrayal of product brands and product characteristics in a shared space.

Our conclusion:

> **Controllers do not have to be mathematicians. However, they must know which methods of structure-testing and structure-discovering analysis there are and what they can achieve.**

3.2   Business analytics software tools

Meanwhile there are numerous software tools which make it possible to use business analytics. The **Business Application Research Center (BARC)** differentiates between four software groups (cf. Iffert/Bange 2015):

- Application-specific solutions
- Business Intelligence solutions with integrated analytics functions
- Data mining software
- Programmer environments for in-house developments

In this context, BARC – an independent research and consulting institute for application software and IT solutions – has compiled a market overview with relevant software tools (cf. BARC 2016a). It compares the functionality of over 300 software products. The following table lists those tools which focus on the implementation of business analytics (especially data mining and predictive analytics).

Vendor	Product name	Brief description
ANGOSS SOFTWARE CORPORATION	Knowledge READER	Application for visual text analysis
	Knowledge SEEKER	Data mining and predictive analytics tool for data exploration and the development of models such as decision trees
	Knowledge STUDIO	Tool for data mining and predictive analytics with tree algorithms
ANKHOR	FlowSheet	Visual development environment and server-based execution platform for in-memory evaluations and advanced statistical visualization of data from different sources
Blue Yonder	Predictive Analytics Suite	Forecasting software for the predictive analysis of large data quantities and automated decisions
Cassantec	Prognostics	Solution configured to customer requirements for condition-based availability predictions in machine and plant management (predictive maintenance)
Comma Soft AG	INFONEA®	In-memory-based BI solution for data science analyses, ad-hoc analytics and reporting with a focus on specialist users and quantity-based and visual navigation in networked data spaces
Dell StatSoft	Statistica	Tools for statistics and data mining
Dymatrix Consulting Group	Customer Insight Suite	Tool suite to support customer-centric processes consisting of campaign management, media analysis and real-time decision-making
	DynaMine	Data mining tool
Hitachi Data Systems	Pentaho Business Analytics	Commercial open source suite with products for reporting, dashboarding and advanced analyses/ data mining

Business analytics is impossible without software tools

There are a large number of business analytics software tools on the market

Vendor	Product name	Brief description
IBM (cf. also Chapter 6.2.2)	SPSS Modeler	Graphics tool for data mining, text analytics and predictive analytics
	SPSS Statistics	Modular software environment for the statistical analysis of data with its own programming language
	Watson Analytics	Cloud-based artificial intelligence engine and GUI for data analyses, data mining, text analytics and predictive analytics
ID Business Solutions	InforSense für E-WorkBook	Tool for constructing analytical applications for data analyses and visualizations for life sciences, healthcare and finance companies
Kisters	Belvis Pro	Software solution for energy data management
KNIME	KNIME	Open source tool for data mining
Mathworks	Matlab	Development environment for the programmer-driven numerical solution of problems with analysis, visualization and data mining functions
MAX-CON	Forecaster	Forecasting software for data selection and data analysis, as well as training for the forecast models through self-learning algorithms
Microsoft	Azure HDInsight	Cloud-based tool which uses the open source programmer environment R for statistics and data mining
	SQL Server Data Mining	Data mining tool supplied with the SQL server incl. result visualization and modeling in Excel
	Revolution R Enterprise	Programmer tool for creating scripts and programs based on R, incl. R extensions
MindLab	NetMind	Web analytics solution for the collection and analysis of web session logs incl. segmentation and personalization with prepackaged, customizable reports
OpenText	Actuate Big Data Analytics	In-memory tool for advanced analysis and data discovery with a focus on users from functions
Oracle	Data Miner	Data mining extension for Oracle SQL developer
Pitney Bowes	Portrait Miner	Data mining and predictive analytics environment with a focus on the evaluation of customer information
RapidMiner	RapidMiner Server	Predictive analytics server for data analyses and predictions based on RapidMiner data mining engine with additional reporting and administration functions
	RapidMiner Studio	Tool for predictive analytics and data and text mining with well-developed visualization options and a report generator
SAP	Predictive Analytics	Tool for advanced analysis and data mining consisting of two modules and SAP HANA
SAS	Enterprise Miner	Tool for data mining and text mining
	Visual Analytics/ Statistics	Platform for analyzing and visualizing data

Vendor	Product name	Brief description
SpagoBI Competency Center of Engineering Group	SpagoBI suite	Open source tool which combines numerous open source solutions
Synop Systems	Synop Analyzer	Analysis tool with interactive statistical analyses and functions for data mining, forecasting and pattern recognition which uses integrated in-memory data storage
Systat Software	SigmaPlot	Software solution for creating scientific graphics and data visualization incl. own statistical and mathematical analyses, which is used in particular in research
	Systat	Software solution for statistical analyses and data mining with a large number of pre-defined statistical procedures
System Design Consulting Prospero AG	Suite	Different standard solutions for financial services providers and life science companies to acquire knowledge from data
Teradata	Teradata Warehouse Miner	Data mining environment with a focus on implementing the calculations and analyses in the (Teradata) database
TIBCO	Spotfire	Tool for interactive visual analysis (Big Data, predictive analytics, location analytics, event analytics and content analytics) and dashboarding with extensive statistical functions
Urban Science	GainSmarts	SAS-based tools for data mining with a focus on analytical CRM for automotive dealers
Valsight (cf. also Chapter 6.2.1)	Valsight	Tool for implementing driver-based corporate performance management
Zementis	ADAPA	Tool for the integration and use of predictive analytics procedures

Figure 5: Business analytics software tools (cf. BARC 2016a)

Our conclusion:

Controllers need IT experts to select and implement the "right" software tools.

3.3   The business analytics process

The use of business analytics requires different skills profiles and must be seen as a shared work process. Ideally, managers, controllers, data scientists and IT experts are involved in order to foster better decision-making. It is very unlikely that small and mid-sized enterprises will have mathematicians as data scientists, so controllers and IT experts will have to develop flexibly implementable solutions (cf. Becker et al. 2016).

During the course of implementing business analytics, controllers will be required to put their skills to use in all implementation stages. Only in this way can they act as the "link" between management, the data scientists and the IT experts and ensure the successful use of business analytics. In this context, implementation consists of four phases from problem identification through exploration and optimization to monitoring (cf. Figure 6).

Substantiating the scope of the task

The starting point is often when the manager feels that something is not quite right, leading him to ask, "What can we do better?". During **problem identification** it is the controller's responsibility to define the specific goal the business analytics project should aim for, to delineate the concrete scope of the project and finally to formulate the actual task. Here, it is particularly important to define what the use of business analytics is supposed to achieve or what is supposed to be optimized. Examples here could be that the company wants to understand its customers better or that it wishes to create more precise forecasts. In this phase the data scientist acts as a discussion partner as they will also need to understand the problem at a later stage in order to be able to carry out focused analyses.

Selecting and preparing data

During **exploration**, the data scientist first cooperates with the controller to select suitable data sources needed for the analysis. At this stage, the controller uses their business expertise to act as an equal partner in discussions and analyses. After that, during data cleansing, the data scientist is responsible for ensuring that incorrect data is removed and any data gaps are filled. Ideally, in the process the data set is reduced. A further goal here is to use statistical methods to derive useful findings from the different data sources (data mining). Additionally, IT experts become involved during this phase in order to evaluate the software products on offer and to select an appropriate software solution for the project.
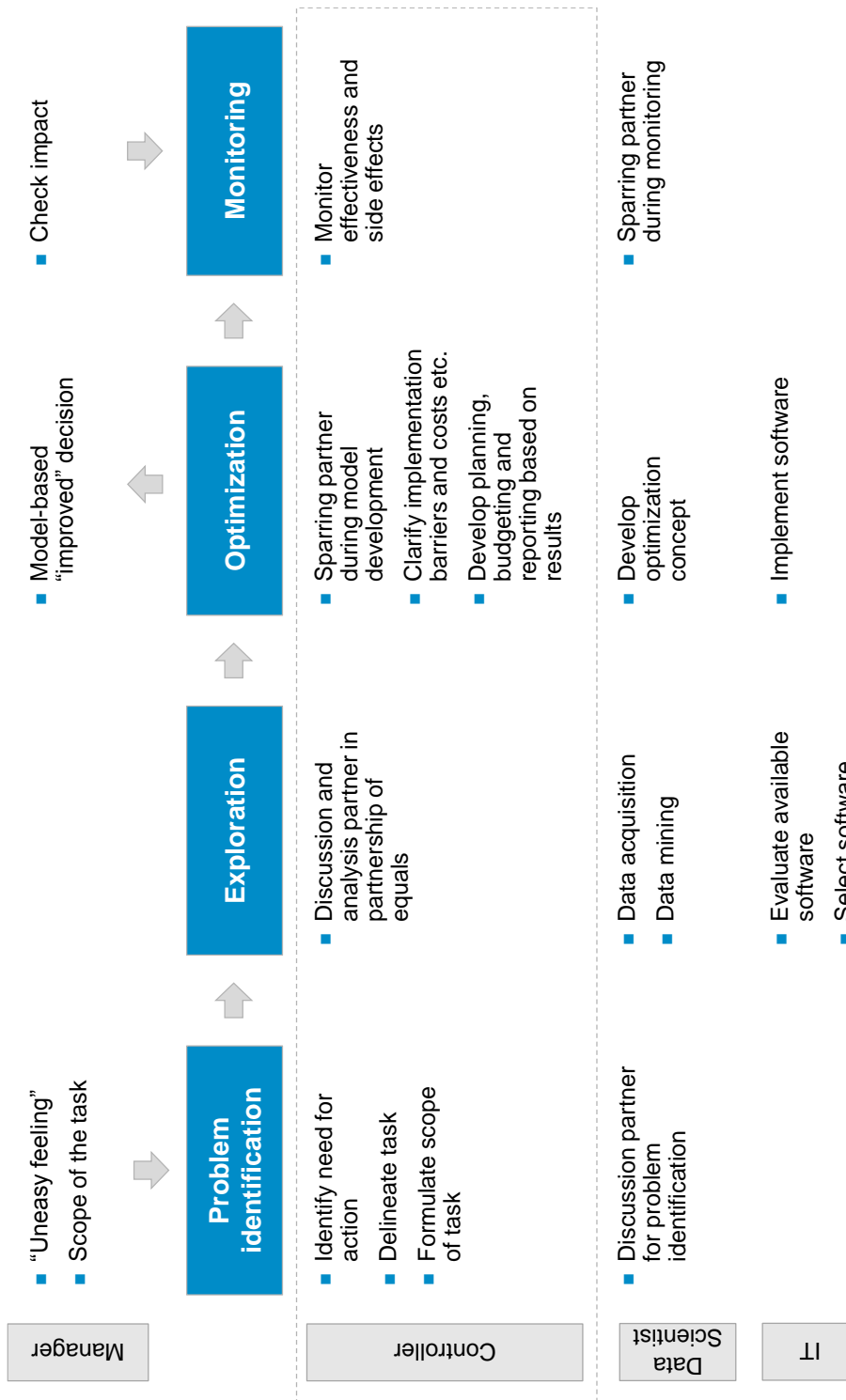
	Problem identification	Exploration	Optimization	Monitoring
Manager	• "Uneasy feeling" • Scope of the task		• Model-based "improved" decision	• Check impact
Controller	• Identify need for action • Delineate task • Formulate scope of task	• Discussion and analysis partner in partnership of equals	• Sparring partner during model development • Clarify implementation barriers and costs etc. • Develop planning, budgeting and reporting based on results	• Monitor effectiveness and side effects
Data Scientist	• Discussion partner for problem identification	• Data acquisition • Data mining	• Develop optimization concept	• Sparring partner during monitoring
IT		• Evaluate available software • Select software	• Implement software	

Figure 6: The implementation of business analytics as a shared process

Creating the optimization model

During **optimization** the data scientist develops the optimization model needed for the project. At this stage the controller acts as a sparring partner, identifying possible barriers to implementation and calculating the implementation costs. Additionally, the controller develops a reporting system tailored to the results of the optimization model, while the IT expert implements the software tool which allows the optimization model to be applied. The acid test for the proposed optimization is its use for concrete decisions by the manager.

Validating the results

Finally, implementation of the optimization model and its effectiveness, together with any side effects, are observed during the **monitoring** phase. The controller is responsible for most of this stage, and particular attention is paid to checking the plausibility of the results with the data scientist acting as a sparring partner.

The age old principle of "garbage in, garbage out" applies throughout the business analytics process. The controller must ensure that there is sound and systematic management of data quality in place, especially for master data, which is used frequently (cf. Otto/Österle 2016).

While the IT expert is responsible for selecting and implementing the business analytics software tool in this example of an implementation process, the controller should still have enough knowledge of the individual analysis tools to be able to be an equal partner in shaping how they are used.

Our conclusion:

> **It is essential for controllers to act as designers and coordinators of the business analytics process. To do so they must be able to act as the "link" between management, data scientists and IT experts.**
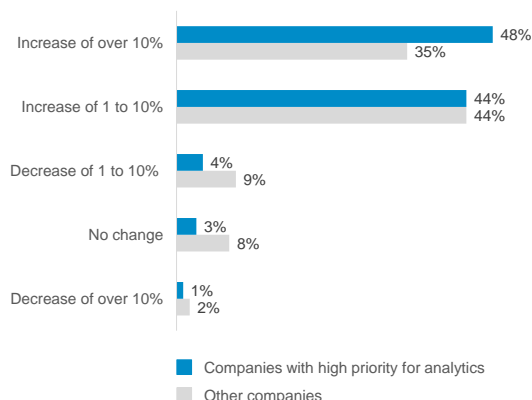
3.4   Latest developments in business analytics practice

Business analytics is still in its infancy and there is much to be done! This can be seen in different empirical studies. We would like to take a quick look at three studies which, however, indicate that nevertheless some considerable progress has indeed been made:

- The study by **Ernst & Young (2015)** shows, among other things, the positive influence of business analytics on corporate success.

- The study by **KPMG (2015)** investigates which industries are pioneers in business analytics.

- The survey by **BARC (2016)** looks at the frequency of certain business analytics methods.

In a current study by **Ernst & Young (2015)** over 650 CFOs from different countries were asked among other things about the impact of business analytics on earnings (cf. Figure 7). The development of EBITDA, which stands for "earnings before interest, taxes, depreciation and amortization", was used as the performance indicator to calculate the impact on earnings.

How has the EBITDA of your company changed in the last three years?

	Companies with high priority for analytics	Other companies
Increase of over 10%	48%	35%
Increase of 1 to 10%	44%	44%
Decrease of 1 to 10%	4%	9%
No change	3%	8%
Decrease of over 10%	1%	2%

■ Companies with high priority for analytics
▢ Other companies

> "Analytics is the foundation for the CFO to get greater transparency and insight, and to steer the business."
>
> Helen Arnold,
> until May 2016 CIO at SAP

Companies with a higher priority on analytics are more successful

Figure 7: Influence of analytics priority on EBITDA
(cf. Ernst & Young 2015)

The study revealed that 48% of the companies with a high priority on analytics were able to increase EBITDA by over 10%. Only 35% of those companies which did not prioritize analytics were able to match this increase.

While the Ernst & Young study investigated the impact on earnings in general, a current study by **KPMG (2015)** looks at individual industries to discover which ones are leading the way in terms of the use of business analytics (cf. KPMG 2015). Among other things, participants were asked about the extent to which decisions were based on data analyses and whether the findings of data analyses had a beneficial impact (Figure 8).
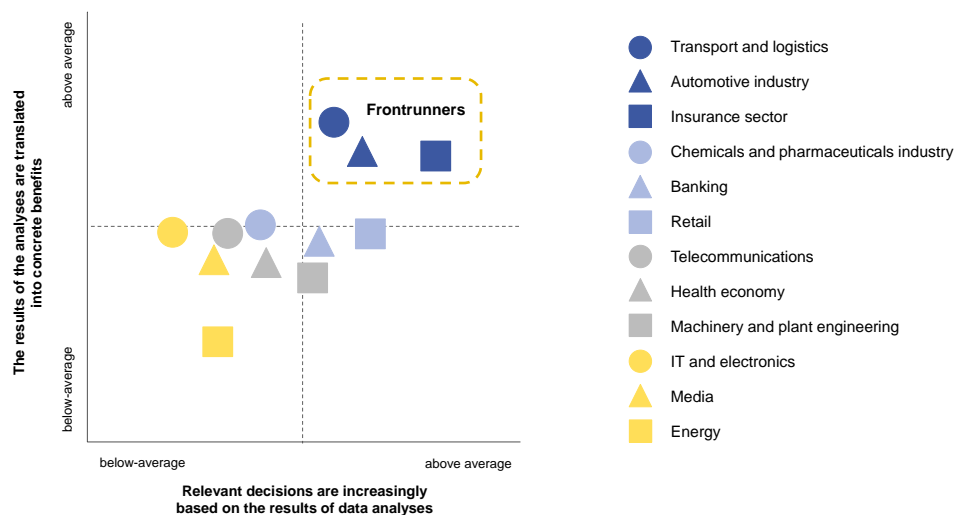
Focus on three trailblazing industries

Figure 8: Use of business analytics by industry
(based on KPMG 2015, p. 19)

According to the study, there are three main pioneer industries: transport & logistics, automotive, and insurance. Here, controllers already have the chance to strengthen their role through the use of business analytics. After this group of frontrunners, the other industries are relatively close to one another.

Companies from the **transport & logistics industry** number among the trailblazers although they use comparatively simple analyses. Indeed, when it comes to the use of more complex analysis methods, transport and logistics companies are among the stragglers.

More than two thirds of the companies surveyed from the **automotive industry** already generate considerable added value through the use of business analytics. One typical use case is data-driven optimization of the supply chain. At the same time, the automotive industry is also a leader in the use of more complex analysis methods.

The **insurance sector** is also heavily data-driven. Mathematical and statistical methods play an important role, especially in risk assessment and the allocation of risks to risk classes. This is used, for example, to optimize customer segmentation.

Among other things, the study by the **Business Application Research Centers (BARC) 2016** investigated which business analytics methods companies from German-speaking countries are currently using or testing (cf. Figure 9).
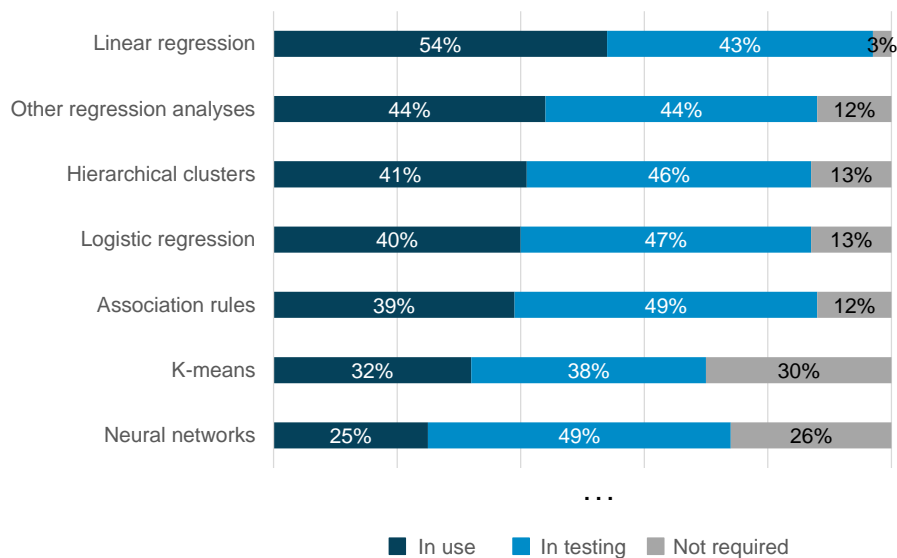
Method	In use	In testing	Not required
Linear regression	54%	43%	3%
Other regression analyses	44%	44%	12%
Hierarchical clusters	41%	46%	13%
Logistic regression	40%	47%	13%
Association rules	39%	49%	12%
K-means	32%	38%	30%
Neural networks	25%	49%	26%

. . .

■ In use   ■ In testing   ■ Not required

Figure 9: Frequency of use of different business analytics methods
(cf. BARC 2016b, p. 31)

One finding was that linear regressions and other regression types are the most frequently used methods. Nearly half of the companies use hierarchical cluster analyses, with one third using the k-means algorithm (a special type of cluster analysis in which a previously known number of k-groups is created out of a large number of similar objects).

Overall, we can say that companies use – or are testing – **mainly classical business analytics methods**, while more complex methods are less commonly used. One reason for this could be the lack the knowledge about how to use more complex business analytics methods.

Complex methods are not yet in widespread use

Our conclusion:

Business analytics is on the rise! Controllers must face up to this development especially as it is proven that the use of business analytics has a positive impact on corporate success. They must keep up with best practices!

4 New Roles and Competences for Controllers in the Context of Business Analytics

The main skillsets of controllers are still in demand

Alongside topics such as "business partner" or "change agent", business analytics is another field where controllers have to take on new roles and expand their skillsets accordingly – or at least reappraise them. The role of business partner requires in particular business expertise and the ability to interact with management as an equal partner, as well as empathy and psychological and sociological know-how – all requirements which fall outside the qualification package of the traditional tools- and numbers-based controller. Indeed, for business analytics primarily controllers must once again prove themselves in their old domain as **methods specialist and analyst** and further develop those strengths. Even if many controllers are still unfamiliar with a lot of the methods used there and are not yet really in a position to assess the chances and risks of business analytics, many of them will find it easier to come to grips with new instruments than to be successful when dealing with pure management topics.

We believe this topic has two fundamental aspects which are linked with one another:

- **General aspect:** Business analytics enables controllers to perform more intensively and more proactively. Additionally, they have the opportunity to act as a catalyst.

- **Personal aspect:** Every controller should think about which special role they themselves think they want to play in the context of business analytics.

4.1 Business partner with catalyst function

Big Data is useless if we are unable to use business analytics to make it "talk". By using appropriate business analytics methods, controllers can portray previously hidden connections in numbers and thus provide new information to support decision-making. In this context they can also take advantage of new data sources (e.g. information from social networks), thereby making new correlations and performance drivers visible.

Expansion of the controller toolset

Using business analytics enables controllers to **strengthen their role as "business partner" and at the same time to become a catalyst** in the company. If applied to people, a catalyst is someone who triggers or accelerates a particular development. In the context of business analytics, the use of business analytics methods also enables controllers to identify specific developments and to communicate them proactively to management for decision-making. Thus, the catalyst function can be seen

as the ability to make management aware of new developments. Here, analysis methods are used which previously were not part of the standard controller toolset.

The following simplified example highlights the catalyst function of controllers.

Example: Sales optimization with the help of a regression analysis

The controller of a kitchen appliance manufacturer used ERP data to determine that sales volumes varied between different sales regions. He hypothesized there was a connection between sales volume and the number of visits carried out by sales representatives in each sales region. Using the company's ERP system, the controller took a random sample from ten sales regions of approximately the same size. In order to derive the connection in numbers, the controller carried out a simple **regression analysis**.

As many controllers already know, the regression analysis is one of the most flexible analysis methods available and focuses on the relationship between **one dependent variable** (sales quantity per representative per period) and **one or more independent variables** (number of visits by sales representatives per period). The goal is to define the relationship between the dependent and the independent variables.

Figure 10 lists the ERP data in the columns A (sales region), B (sales quantity) and C (visits by sales representatives).

	A	B	C	D	E
1	Sales region	Sales quantity	Number of visits by sales representatives	Auxiliary calculation	Auxiliary calculation
2	k	y	x	$x*y$	x^2
3	1	2.585	109	281.765	11.881
4	2	1.819	107	194.633	11.449
5	3	1.647	99	163.053	9.801
6	4	1.496	70	104.720	4.900
7	5	921	81	74.601	6.561
8	6	2.278	102	232.356	10.404
9	7	1.810	110	199.100	12.100
10	8	1.987	92	182.804	8.464
11	9	1.612	87	140.244	7.569
12	10	1.913	79	151.127	6.241
13	Total Σ	18.068	936	1.724.403	89.370

Figure 10: ERP data
(based on Backhaus et al. 2016, p. 68)

During the regression analysis, the controller calculates the **regression coefficient *R*.**[1] *R* expresses the additional sales volume which can be expected from one additional visit by a sales representative.

To calculate *R* we need the calculations from column D and column E, together with the corresponding totals from row 13.

Example:

Increased sales through additional sales rep visits

$$R = \frac{10 * 1.724.403 - 936 * 18.068}{10 * 89.370 - (936)^2} = 18{,}881$$

In this instance, the value of *R* = 18.9. This means we can expect an increase in sales volume of 18.9 units if one additional visit from a sales representative takes place (this information cannot be generated in accounting!)

Now, the controller speaks to the sales manager, thereby triggering an adjustment to visits by sales representatives.

In summary, the controller can proactively provide the sales manager with the information he has calculated, together with suggestions for optimizing decision-making.

Do not confuse correlation and causality!

However, when evaluating such statistical correlations, controllers must always take a long and **critical look at the causality and thus the actual cause-effect relationship**, as implied causal effects could in some cases prove to be spurious. A famous example of this is the assumption that fewer storks means falling birth rates.

The example highlights three main aspects:

- Mathematical calculation instruments (such as the regression analysis) **expand the information potential** of the controller.

- The controller can proactively provide the manager with a selection of **decision options** and in this way provide valuable decision-making support.

- However, the controller must be familiar with the possible **mathematical methods**.

---

[1] For those who do not have the formula to hand:

$$R = \frac{k(\sum x * y) - (\sum x)(\sum y)}{k(\sum x^2) - (\sum x)^2}$$

For further details, please see Backhaus et al. 2016, p. 73.

4.2   Options for shaping roles

In business practice, controllers face the question of how to meet the challenge of business analytics. In the following, we take a look at how (differently) controllers can position themselves in the field of business analytics. The spectrum of activities is broad and goes **far beyond simply making use of statistical tools**. We can see that the broader controllers' current experience is, the easier they find it to perform these extended activities. To distinguish between the possible roles, we use a structure from Davenport & Kirby (2015) which was originally applied to workers in general in a company but which is also very suitable for the special case of controllers.

The authors differentiate the possible reasonable reactions of individuals in five different basic behaviors or individual adaptation strategies as shown in Figure 11 based on the example of marketing.

We have transposed these – strikingly named – five behaviors to the controller, which leads to the following manifestations or roles:

Step up: Controllers who choose this role think **strategically about the potential** of business analytics for the company and then anticipate ways in which to tap into this potential. In the first step, they resist the temptation to see the new instrumental solutions as a fundamental change in management processes which leaves most of the real thinking to the algorithms of the IT systems. It is wrong to believe the instruments are omnipotent, but their findings should also not be underestimated. The controller in the step up-role needs to learn from experience and design the implementation model step-by-step. As things stand at the moment, there is no organizational silver bullet for introducing business analytics. In the final analysis, we have to **strategically reconsider** how the **current business models** of the company could or will develop under the influence of business analytics. This, in turn, also leads to the development of, or at least impetus for, **new business models**, from new products through processes to employees and technologies.

Focus on strategic aspects

Step aside: This role can be classified as a complement to the manager and/ or the business analytics specialist. Controllers often act in a complementary role, and a classic example is their interaction with managers, by supporting, challenging and confirming the intuition of the manager with analytics. (cf. Gänßlen et al. 2013). However, in the case of step aside, on the one hand it is not so much the analytical side of the controller which is called for but rather their intuition when it comes to **interpreting the identified correlations** and recognizing the **causalities** behind the correlations. On the other hand, **hypotheses** developed by the managers can be validated by controllers through the use of business analytics, which can lead to significant improvements in planning quality.

Interpretation of the results of business analytics

Finally, the tools of business analytics can also be used to evaluate considerations and hypotheses put forward by the controllers themselves.

	How you add value	Marketing example	Transfer to the controller
Step up	You may be senior management material – you're better at considering the big picture than any computer is.	A brand manager orchestrates all the activities required to position a brand successfully.	A controller who assesses the strategic potential of business analytics and anticipates ways of tapping into that potential.
Step aside	You bring strengths to the table that aren't about purely rational, codifiable cognition.	A creative can intuit which concept will resonate with sophisticated customers.	A controller who acts as a complement to the manager and/or the business analytics specialist.
Step in	You understand how software makes routine decisions, so you monitor and modify its function and outputs.	A pricing expert relies on computers to optimize pricing on a daily basis and intervenes as necessary for special cases or experiments.	A controller who uses business analytics and acquires the necessary skills and competences.
Step narrowly	You specialize in something for which no computer program has yet been developed (although theoretically it could be).	A "wrap advertising" specialist has deep expertise in using vehicles as mobile billboards.	A controller who helps develop the topic of business analytics in their own company.
Step forward	You build the next generation or application of smart machines – perhaps for a vendor of them.	A digital innovator seizes on a new way to use data to optimize some key decision, such as cable video ad buys.	A controller who plays a major role in shaping the topic of business analytics and is involved in the development of new methods.

Figure 11: Five roles in the context of man-machine collaboration
(based on Davenport/Kirby 2015, p. 62)

Use and further development of business analytics applications

Step in: Here, the controller joins the ranks of business analytics users. Controllers who choose this role must acquire deeply-rooted knowledge in **how to use business analytics** and both master and be able to critically appraise the relevant toolsets. The tasks here start with checking the effectiveness of current business analytics applications and extend through involvement in changing algorithms to benchmarking experiences with business analytics solutions in other companies.

Driving force and active further development

Step narrowly: In this role, the controller becomes a **driver of business** analytics, helping to develop the topic **in the company**. To this end, for example, they collect experience in design and applications in controlling, perhaps in forecasting or in the field of performance analysis, which can be linked with the experiences in business analytics applications in other functions. Additionally, they raise questions with controlling relevance in ongoing business analytics projects in other functions, which de facto means the implementation of the traditional controller question, "(How) Does this make financial sense?" in the new context of business analytics.

Step forward: By taking on this role, the controller places themselves at the **cutting edge of the design and development** of business analytics. This begins with a comprehensive analysis of the basic deployment possibilities of business analytics in the company, continues with an evaluation of the controller's toolset in terms of integrating business analytics, and finishes with the formulation and realization of demands upon new algorithms.

The five possible roles of controllers in the context of business analytics we have shown here make considerable demands upon all the fields of competence laid out in the ICG Controller Competence Model (personal competence, activity and implementation competence, social-communicative competence, and professional and methods competence), and they differ greatly from role to role.

Step up: The first of the five roles requires a **great deal of experience with a wide range of different topics**. This starts with strategic questions, continues with an overview of the entire company and the business models it uses, and extends to the different systems of regulation and governance. Personal, social-communicative and activity and implementation competences are required to accompany the necessary change projects. On the other hand, what is not needed is detailed knowledge of the algorithms being used or in the use of the corresponding tools. Here, it is enough to have a broad and categorizing knowledge instead of instrumental specialist expertise. Controllers who are particularly suitable for the role of step up are those who have **a lot of experience** and who are already positioned as a real business partner.

Step aside: This role can be characterized as the **interface** between technological application and interpretation of the results. In order to fulfil the role, controllers need extensive knowledge of the business together with a very good understanding of the business analytics tools. This results in similar requirements as those for the step up-role, but they do not need to be (anywhere near) as in-depth. Thus, a step aside can also be an option for controllers with a **business partner orientation but with less experience**.

Step in: As shown above, in this role controllers act as **methods specialists** who work in a team comprised of specialists from other corporate functions, e.g. marketing, sales, or supply chain. Hence, the focus of the new skills they need to acquire lies on professional and methods competence. Here, controllers compete with the **new profession of data scientist**, i.e. with people who are already highly skilled in these aspects but who need to familiarize themselves with controlling topics. Currently, it remains to be seen who will close their respective gaps faster and more easily.

Highest level of business analytics expertise

Business analytics and the IGC Controller Competence Model

Practical knowledge is the basis

Interface between application and result

Using methods competence to compete with the data scientist

This calls for expertise in using the instruments

Step narrowly: In addition to the requirements for the role of step in, **concept design skills** concerning the **new set of instruments** are also needed here. However, this is a skillset that should be all too familiar for controllers. Their function as specialist for business management instruments always also included – at least according to the textbooks – knowing the conditions of use, risks and side effects of instruments, as well as how to combine individual instruments properly with one another. Now, the same is required for the business analytics toolset. While there is indeed a lot to be learned concerning the new instruments for the role of step in, the potential competitor to the controller, the data scientist, has exponentially more to learn as they are completely unfamiliar with the controlling toolset. As a result, controllers have a really good chance of making the running.

All the controller competences are needed

Step forward: The requirements for the role of step forward are similar to those of step narrowly, but now they have an even **stronger forward-looking component**. Here, controllers need to be able to play a leading role in the company, to promote the instrument, and to anchor and develop it in the company. This requires the corresponding personal competence, activity and implementation competence, and social-communicative competence. However, as the requirements bar is set even higher for this role, thanks to their overview of the whole company, in comparison to data scientists controllers again have a (very) good platform to build on. If the data scientists are given responsibility for integrating the business analytics toolset, there is a risk that they only promote the instrument but do not know or do not recognize what is really necessary to position such an instrument in the performance management landscape of a company.

5 Roadmap to Business Analytics

There is already a history of business analytics in many companies. Back in the **1980s and 1990s**, companies often used statistically based customer and market analyses. Before that, in the **1960s and 1970s**, operations research was all the rage, with production and logistics processes in particular being optimized with linear optimization models.

As we have seen, digitization and Big Data have given rise to lots of **new applications** in all areas. What individual companies must do is build upon the experiences they have already made to draw up an individual roadmap with clear milestones. Our thesis is:

> **The controller should be involved in drawing up and implementing the business analytics roadmap.**

We want to use the example of the company **TRUMPF** to illustrate how to design a business analytics roadmap and what points should be observed in the process.

> **About TRUMPF**
>
> TRUMPF is a worldwide leading hi-tech company which produces machine tools, lasers and electronics for industrial applications. In 2015 TRUMPF had nearly 11,000 employees and generated annual turnover of over 2.7 billion Euro. It is active all over the world, whether through its own production and sales subsidiaries or via a far-reaching network of distributors.

Analyzing, preparing and presenting corporate data to management in order to support decision-making is also nothing new at **TRUMPF**. They began professionalizing data analysis in the 1990s based on a classical management information system and developed that first into web-based and Excel-based reporting and then into user-specific self-service analyses (cf. Figure 12).

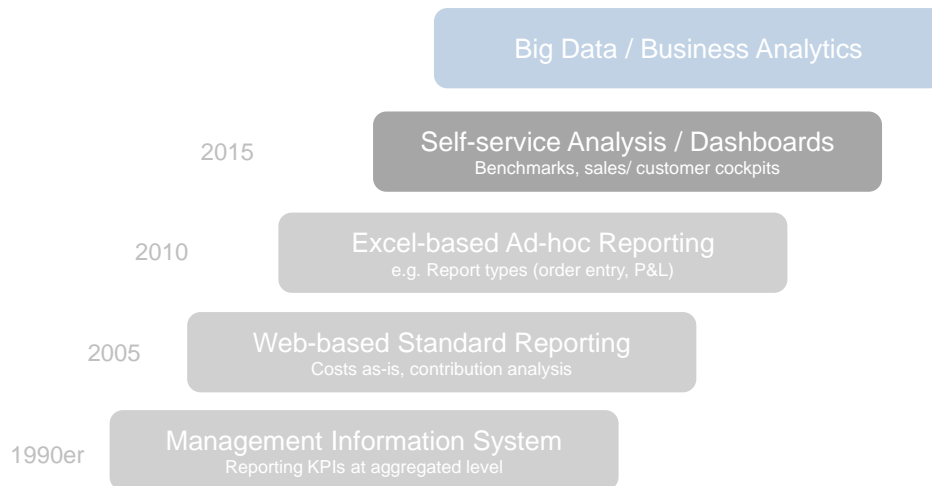**There is a history of business analytics**

Figure 12: The evolution of business analytics at TRUMPF

Integrating a wide range of different data sources, such as **ERP and CRM systems**, as well as **external market and competition data**, opens the door for new analysis options. Relevant topics here are recognizing patterns and trends, making predictions and carrying out optimizations.

At TRUMPF they have chosen a step-by-step approach to establishing business analytics in the company (cf. Figure 13).
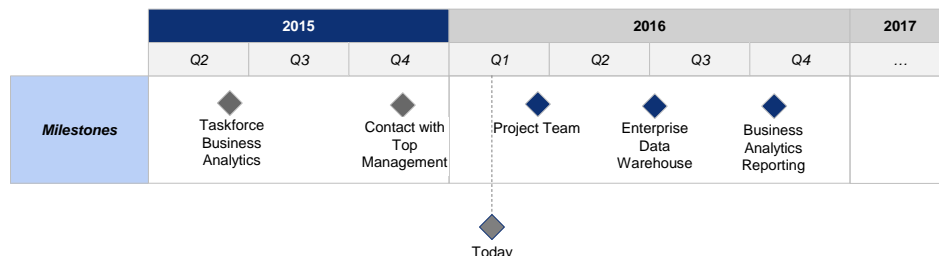
Business analytics roadmap at TRUMPF

Figure 13: Business analytics roadmap

Their approach contains five milestones, which are described in more detail below:

1. **Initiation of a taskforce:** A business analytics task force with a controller on board determined the current state of business analytics in the organization. The task force carried out numerous coordination meetings in the department which focused on

   ▪ Identifying (groups of) people who are already working on business analytics, and
   ▪ Identifying first use cases.

2. **Attention of top management:** Presentation of the intended project to top management in order to focus their attention on the topic. During the presentation the potentials of business analytics were shown and discussed, and specific needs were localized.

The following points provided a framework for the meetings:

- Presentation of status quo by showing current projects and discussion of "blank spots",
- Presentation of reporting goals in line with business goals,
- Analysis of business areas and definition of which areas should be focused on first.

3. **Composition of the project team**: The use of business analytics requires close cooperation between employees beyond the borders of their functions. The topic has a strong inherent technology component, but it also requires deeply-rooted commercial know-how. Consequently, controllers must also be included in the composition of the cross-function project team.

Special attention was paid to the following questions when TRUMPF put the project team together:

- **Is there enough IT know-how in the team?**
  Business analytics projects make high demands on the skills profiles of employees. Experience in using query and report analysis tools is as essential as data modeling expertise. Additionally, employees should have a healthy portion of curiosity and enjoy analyzing new solutions.

- **Is there also enough know-how on the business side?**
  Being technically brilliant is not enough for excellent business analytics projects. On the one hand, we need input on the management level in order to ensure the analyses are in line with strategy. On the other hand, we also need employees from the business side who know the status quo, i.e. the state of the current processes and reports.

4. **Creation of a data pool:** The foundation of a successful business analytics application is to have a data pool which is as comprehensive and up-to-date as possible. Data quality is the key to reliable data analysis. Alongside internal company sources, external sources are also available. The main aspect concerning internal data sources is to consolidate the different data repositories (such as in an enterprise data warehouse system, cf. Figure 14). This ensures company-wide data integration and increases the speed of the analyses.
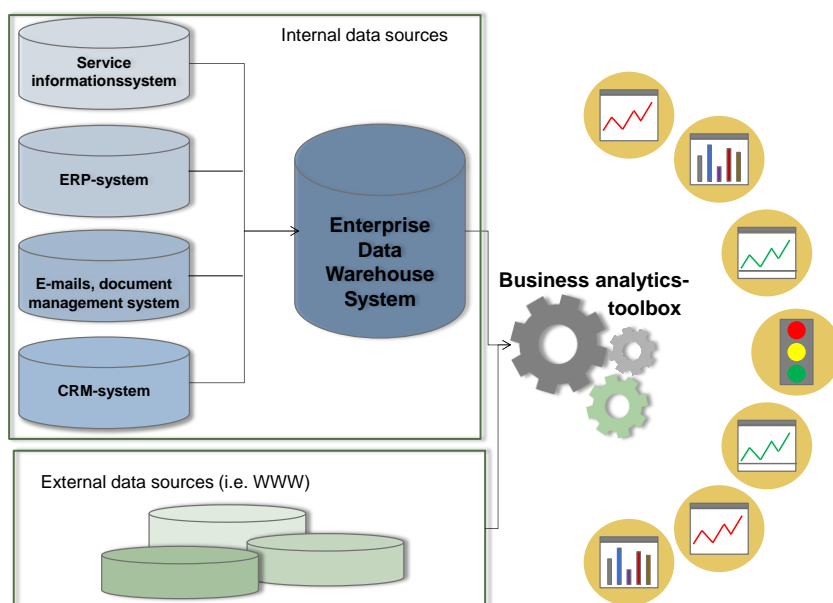
Figure 14: Connecting internal and external data sources

5. **Business analytics reporting**: The first business analytics reports should be available in Q4 2016. Based on the newly created data pool, there will be interesting new possibilities as, for example, sales analyses can be expanded to include market data in real time (e.g. stock exchange information, economic situation). Optimizations in customer relationship management will now also be possible: It will be possible to combine CRM data with information from customer correspondence (e-mails and telephone notes) and content from social media (Twitter and Co.) to create an objectivized picture of the overall mood of the customers.

We believe there is a great deal of potential in the execution of business analytics projects. The roadmap outlined provides the necessary foundation in order to establish these projects in the company and generate real benefit.

6 Business Analytics in Practice

The theory of business analytics is built on the theories underlying mathematical-statistical methods which, in part, have been around for some time. IT and Big Data are big levers concerning the practical application of business analytics.

In business practice there are three sources which provide insights into the practical application of the theory of business analytics:

- **Use cases** with benchmark character

- **Software solutions** which enable the use of business analytics in company activities

- **Exchange of experiences** with practitioners, especially in the ICV

A look at controlling practices in business

In this chapter we want to use two examples to shine a spotlight on each of these three sources of knowledge. In a sense, they represent the state-of-the-art of business analytics in practice:

- In the two example companies, business analytics is used in **specific cases**. Controllers are involved in each case.

- Both software solutions demonstrate **two types of business analytics software**: focused solutions (Valsight) and universally applicable software (IBM Watson).[2]

- Two pertinent expert work groups in the ICV present **their current work on business analytics**.

Together, the examples are proof that business analytics is a learning process in the world of business: Any long journey starts with initial concrete steps. This also applies to the ICV.

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[2] Both case studies were provided by the software companies themselves.

6.1   Company case studies

6.1.1 Sales planning with business analytics at BLANCO

*Authors: Matthias von Daacke (Head of Sales and Subsidiary Controlling)
and Thomas Rachel (Head of Sales Controlling)*

About BLANCO

The **BLANCO Group** (www.blanco-germany.com) is one of the world's leading providers of high quality sinks and mixer taps for domestic kitchens. The company is Germany's biggest sink manufacturer, and produces sinks in the main materials stainless steel, Silgranit and ceramic. In 2015 the company turned over 350 million Euro, around 65 % of it on international markets. BLANCO has over 1,400 employees worldwide. The family company was founded in 1925, and since then has stood for German quality and reliability.

The challenge

Focus on three problems

In the past, the planning process of the international sales units was not defined uniformly. There were three different process approaches in use:

1.) Planning for sales revenues, sales and net margins took place on the **SBA level** (strategic business area). Expected developments for the prices, quantities and costs of the product families and the customer/ customer groups were entered into the planning as flat rate modifications. Excel was used to support the planning process and the data was stored locally.

2.) Sales planning took place on the **product family level**. SAP/APO-DP served as the planning platform. To calculate the value categories, quantity plans were executed in Excel and evaluated on the product family level using average prices and costs. Expected developments for the prices and quantities of product groups were entered into planning as flat rates and the data was stored locally.

3.) In this variant, the **sales planning for each product family was transferred to SAP/BW**. Here, the value categories were calculated with the support of a BI system. Expected developments for customers were entered into the planning as flat rates and the data was stored centrally.

What all variants have in common is that the resulting budgets are insufficient for the purposes of sales performance management. Subsequently, the budgets are broken down to sub-levels (e.g. month, country, sales representative) using Excel.

For BLANCO there are two particularly important developments:

1.) Increasing **concentration in the retail sector** (impact on customer mix and conditions)

2.) Consumer trend towards **„good enough" products** (trading down, impact on product mix)

Market challenges

Under the conditions described above, it was only possible in part to consider these mix effects appropriately in the planning process. At group level, consolidation had reached its limits, while the downstream detailing of sales planning was very time-consuming.
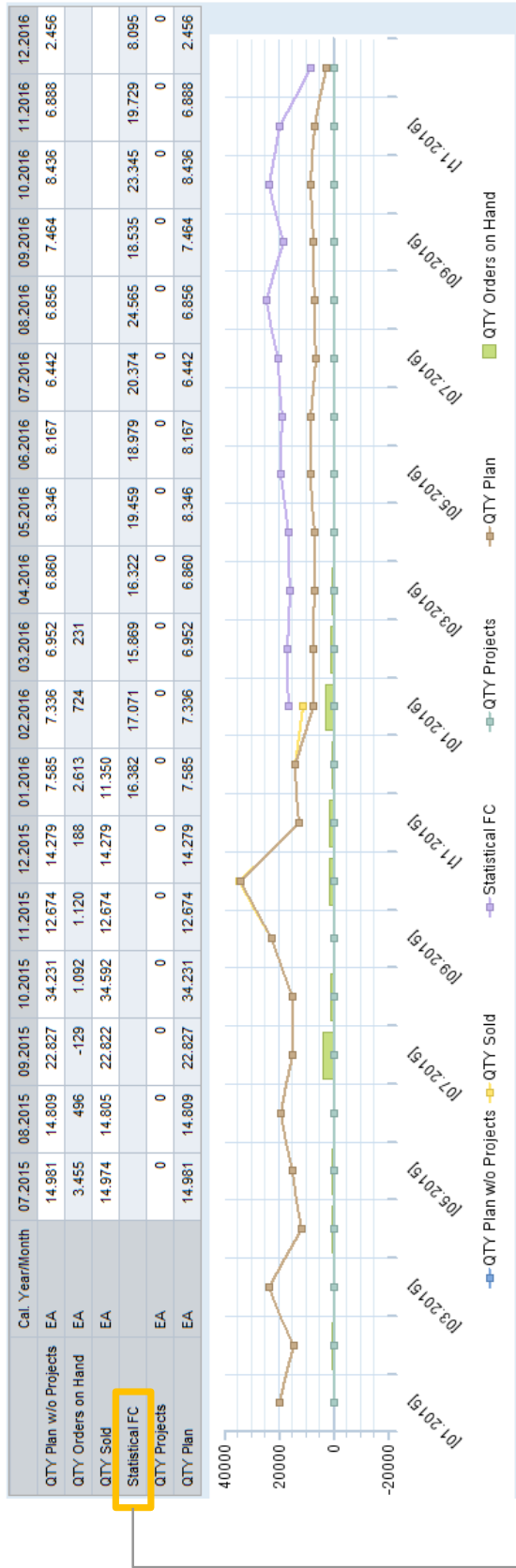
The solution

The solution BLANCO uses for sales planning (cf. Figure 15) is based on the SAP/BW-IP technology.

The granularity of the data is defined by the customer/ material combination. In order to ensure appropriate system performance during the planning sessions despite the immense volume of data, the solution is connected to SAP HANA. The solution has been rolled out globally. All sales units plan sales quantities according to uniform standards. Depending on the situation, it is possible to enter the planning process at different levels of aggregation. Aggregation and disaggregation functions based on historical information ensure the **consolidation and distribution of planned values** at higher and lower levels (based on customer, article and time). There is no need for subsequent budget processing. The "new" customer view enables mix effects to be addressed with pinpoint accuracy. By integrating prices, manufacturing costs and cost estimation functions, the impacts on sales revenues and net margins can be calculated immediately. The data is stored centrally and with live access for SAP/BW. Those responsible for the budgets receive analytical support during the planning sessions in the form of analyses of the impact on sales and margins (price, quantity, mix effects). Sales revenue consolidation is extensively automated at the BLANCO Group. Now, business analytics enters the game: Forecasting quality for planning should be improved using a special statistical method.

Mix effects under control

**SAP/BW-IP
in operation**

Cal. Year/Month		07.2015	08.2015	09.2015	10.2015	11.2015	12.2015	01.2016	02.2016	03.2016	04.2016	05.2016	06.2016	07.2016	08.2016	09.2016	10.2016	11.2016	12.2016
QTY Plan w/o Projects	EA	14.981	14.809	22.827	34.231	12.674	14.279	7.585	7.336	6.952	6.860	8.346	8.167	6.442	6.856	7.464	8.436	6.888	2.456
QTY Orders on Hand	EA	3.455	496	-129	1.092	1.120	188	2.613	724	231									
QTY Sold	EA	14.974	14.805	22.822	34.592	12.674	14.279	11.350											
Statistical FC								16.382	17.071	15.869	16.322	19.459	18.979	20.374	24.565	18.535	23.345	19.729	8.095
QTY Projects	EA	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0
QTY Plan	EA	14.981	14.809	22.827	34.231	12.674	14.279	7.585	7.336	6.952	6.860	8.346	8.167	6.442	6.856	7.464	8.436	6.888	2.456

Legend: QTY Plan w/o Projects · QTY Sold · QTY Orders on Hand · QTY Plan · QTY Projects · Statistical FC

Statistical proposal (Ø from 6 months) Default plan proposals
→ Default plan proposals are only corrected

Figure 15: Planning table

The next step is to integrate a benchmark into the planning table which is derived using the Holt-Winters method. This is a specific type of time series analysis. The Holt-Winters method (aka exponential smoothing) is based on the assumption that future developments will resemble the recent past. The recursive progression of the underlying function ensures that the weighting of the smoothing parameter is reduced along the time series towards the past. Thus, a trend observed at the beginning of a time series has less importance for the prediction as the trend at the end of the time series.

Business analytics to improve predictions

Involvement of controllers

Business analytics provides controlling with a new data basis and enables previously impossible analysis perspectives. Two aspects should be emphasized in particular:

Better analyses by controlling

- With a powerful IT solution it is possible to perform evaluations **"at the touch of a button"**, while the degree of detail of those evaluations can be adjusted as and when needed.

- The use of statistical methods increases the prevalence of **data-driven predictions**. Increasingly, these are replacing subjective forecasts based on experience.

6.1.2 Marketing budgeting with business analytics at Mister Spex

Author: Jannis Friedag (Head of Controlling and Analytics)

About Mister Spex

Founded in 2007, **Mister Spex** (www.misterspex.de) has over 1.5 million customers and is Europe's leading online optician. The company has established a contemporary way of buying glasses by combining the advantages of e-commerce with the consultation and services provided by a local optician. In 2014, the company generated approximately 65 million Euro and currently has 350 employees.

The challenge

Due to its digital business model and the associated measurability of customer interactions, the company has an immense pool of data, despite having to adhere to the strictest of data protection regulations. The technical basis for this is provided by a data warehouse system that integrates and intelligently links raw data from the **shop, ERP and web tracking system** and makes it analyzable.

More transparency along the customer journey

The main driver of corporate performance is the efficient use of marketing measures to acquire new customers and to generate follow-on sales from existing customers. Hence, the objective is to make the so-called **customer journey** (in the context of web mining) transparent for the department, i.e. all the touchpoints a customer has with the brand Mister Spex or the products on offer, to supply the department with target-based KPIs and reports and to provide impetus for target-based marketing measures.

The solution

At Mister Spex the aim of using business analytics is to replace explorative tasks. In this context, the company has two approaches to defining budgets for the marketing channels:

Better budgets for marketing channels

1.) The **cost per order** (CPO) in relation to the contribution margin per order is used as a relatively simple target KPI. Here, the goal is to generate a positive contribution margin for each order. However, this approach has weaknesses as existing customer orders and new customer orders are weighted equally and follow-on sales are left out of the calculation.

2.) An extended approach is to apply the same target of a positive contribution margin to **customer acquisition costs** and **customer lifetime value**. Here, new customer acquisition is given a higher budget as it is cheaper to generate sales from existing customers. The marginal costs for new customer acquisition must be considered for both target values.

In general, the more simple CPO model is used to manage daily operations in marketing. It is calculated in two different so-called **attribution models**. In the *last touch model*, an order is assigned to the channel which was the final touchpoint before the purchase. However, as the typical customer undergoes a relatively long decision-making process when ordering glasses and thus has many touchpoints in the selection process, this model discriminates against marketing channels which play a big role in the early phases of the customer journey. An example of this is banner advertising, which contributes to brand awareness and first information of the customer but rarely triggers the actual purchase itself. As a result, a weighting model (*bathtub model*) is also included in the cost per order calculation which allocates different weightings (first and last touchpoint 40%, all others in between spread across a total of 20%) to all the touchpoints (customer contact with marketing measures such as seeing banners or searching for "Mister Spex").

Optimizing the marketing channels

When we compare both models we can see that individual marketing channels show **very large differences in the values calculated** (cf. Figure 16). In the last touch model, for example, the marketing channel "Affiliates" generates considerably more orders than would be the case if the entire customer journey were viewed using the bathtub model. This indicates that this channel only plays a small role at the beginning of the customer journey but is very important in the final step of the purchasing process (the customer still tries to get discounts just before purchasing the item).

When viewing the fictitious CPOs for the marketing channel Affiliates, a marketing manager would see a considerably better CPO if only the last touch model were used than if the whole customer journey were taken into consideration. Thus, the marketing manager would tend to pay over the odds in commission to the affiliate partners.

It is a completely different scenario for the channel SEM Brand (search engine marketing with a focus on the brand "Mister Spex"), which generates significantly more orders in the customer journey model. Thus, based on this approach the marketing manager can pay nearly 10% more for advertising space before the last touch CPO is reached.

Using both models at the same time enables Mister Spex GmbH to fine tune and manage its marketing activities with considerable efficiency.

Mathematical example

Last touch		Journey 40 – 20 – 40		CPO factor
Channels	**Orders**	**Channels**	**Orders**	
Direct + SEO	17.777	Direct + SEO	18.110	0,98
SEM brand	3.360	SEM brand	3.689	0,91
SEM-non brand	1.844	SEM-non brand	2.260	0,82
Affiliate	2.237	Affiliate	1.512	1,48
Pricing	944	Pricing	862	1,10
Retargeting	66	Retargeting	61	1,08
Partners	1.864	Partners	1.660	1,12
CRM	5.513	CRM	5.452	1,01
Total	**33.605**	**Total**	**33.605**	**1,00**

Abbreviations

SEO = Search Engine Optimization   CPO = Cost per Order

SEM = Search Engine Marketing   CRM = Customer Relationship Management

Figure 16: Fictitious mathematical example from
the budgeting for marketing at Mister Spex

Involvement of controllers

Demands upon the controller are growing

Business Intelligence/ business analytics will have a fundamental impact on controlling and create completely new possibilities and challenges for Mister Spex:

- The sheer volume of data is **exploding the possibilities for evaluations** and this can trigger a tendency in the company to provide a surfeit of information.

- The job profile for controllers is also changing. Alongside **analytical and mathematical skills**, detailed IT know-how is becoming increasingly important.

- However, the greatest emphasis is shifting to the **communication skills** of the controller as reports and analyses become more and more detailed. The increasing complexity means that controllers will spend more time interpreting the data and thus will transform their role into that of an internal consultant for the management.

6.2   Software examples

6.2.1 Business analytics with Valsight

Authors: Dr. Werner Sinzig (Member of the Advisory Board) and Stephan Müller (CEO)

About Valsight

Valsight (www.valsight.com) is a Berlin startup (founded in January 2015) which has developed a software solution for driver-based corporate performance management in order to enable data-driven decision-making. As alumni from the renowned Hasso Plattner Institute, the founders have many years of research experience in the field of in-memory database technology and innovative enterprise software. Valsight combines Big Data technologies and predictive analytics with classical performance management processes.

Driver models as a methodology for performance management

Driver models have been used in business management for a long time and are well-developed (cf. Figure 17). They are a component in the toolset of corporate performance management and form the basis of concepts such as flexible standard costing, activity-based costing, process costing and target costing. Even the recently proposed approach to external reporting, integrated reporting, uses this methodology. However, until now there has always been a lack of suitable methods of mapping and depicting driver models in software. This was also confirmed by a current BARC study which found that 66% of the companies surveyed regard inadequate software, or the complete lack thereof, as the main hurdle in introducing driver models.

Reports and performance indicators which are based exclusively on multi-dimensionally classified data are only suitable for documenting business transactions, for actual-actual comparisons, and for comparing fixed budgets with actuals. To have an effective control mechanism in the form of plan-actual comparisons and for decision-making support in the form of simulations, we need a model-based description of the functional **correlation between drivers and related variables**.

The definition of the model, i.e. the selection of the relevant dependencies in the form of drivers and KPIs, the dimensionality of the data, the time frame etc. **are derived from the business context**. For software solutions aimed at supporting driver-based methodologies this means that:

- the driver models must be flexible in their definition,
- statistical methods for model validation must be available,

Lack of user-friendly software tools

- numerical mathematical methods, e.g. to solve large equation systems, must be available, and

- the models must be connected to the data without being limited by any technological restrictions.

Implementing the requirements

Recently, significant progress has been made in the implementation of all these requirements. On the one hand, the increasing digitization of business operations processes and of consumer activities means more extensive data is available (Big Data), allowing us to define realistic models. On the other hand, **in-memory database technology** can be used to process even huge quantities of data at vastly increased speeds. Today, we can say that all data can be linked together in the ways required by the business situations. Restrictive constructs, like mirrored data, special access paths or consolidated data, which were needed in the past to be able to receive sufficiently fast answers, are no longer necessary.
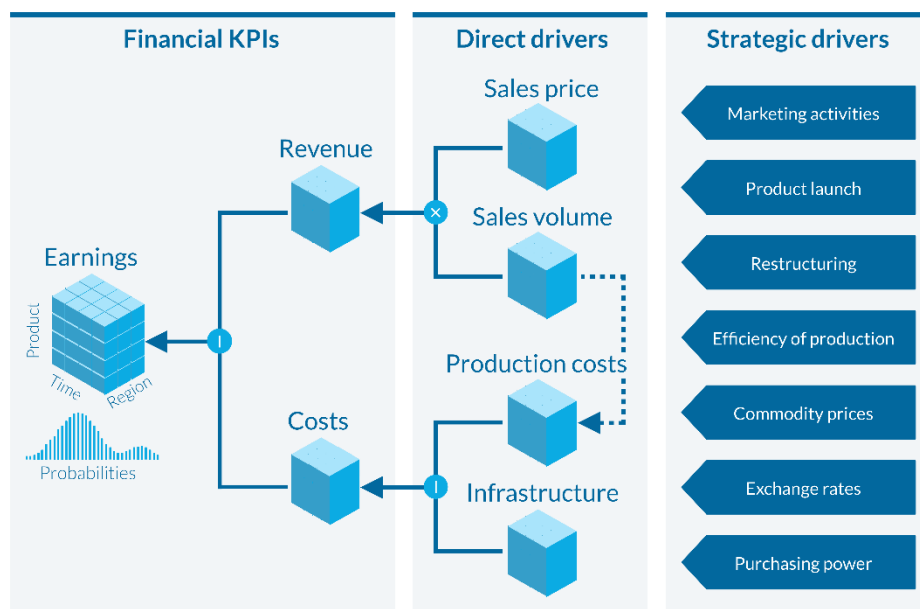
Figure 17: Simplified driver model consisting of financial KPIs,
direct and strategic drivers

Figure 17 shows a simplified driver model. In this model, the company's profit depends on the financial indicators "revenue" and "costs". These indicators are influenced by different drivers. Thus, for example, revenues are dependent on the "sales price" and "sales volume" of the product being evaluated. In turn, the sales quantity is influenced by the strategic driver "marketing activities", and so on.

The software solution from Valsight

Against this background, the **product Valsight** was developed, a platform for **driver-based corporate performance management**. The goal of Valsight is to create a bridge between the software-based support of performance management processes, such as planning, forecasting, reporting and analysis, and newer approaches from the fields of Big Data, simulation and predictive analytics. These methods are emerging from the niche worlds of experts and can now be made accessible to a broader group of users, especially in controlling and corporate performance management ("Big Data for controllers").

The lynchpin of Valsight is the definition of **value driver models** which enable users to develop plan scenarios, carry out simulations and analyze specific matters and circumstances more precisely. One main focus is the user-friendliness of the software – starting with the flexible creation of the driver models, through the testing of simulation scenarios, to collaboration between people and departments. This results in a wide range of possible uses in controlling in companies of different sizes and from different industries.

Two examples:

The software can be used interactively in board meetings, for example, to use ad-hoc simulations to calculate the **impacts of portfolio decisions**, modified **targets for individual subsidiaries** or the **latest assumptions** about expected market conditions on relevant top KPIs The software outlines the development of the upcoming three business years based on the current plan. In this context, Valsight offers the possibility to **create new scenarios** or to modify existing ones flexibly and quickly.

Driver-based scenario creation

The driver-based planning approach can be used across the entire company. In this example, the most important driver for planning relevant KPIs is the **number of employees in sales** (and marketing). For simplicity's sake, in the first step the correlations between an **increase in employees in sales** and the **development of costs and revenues** are entered into the driver model using subjective experience-based values and used for simulation. In the next step, the experience-based values are replaced with historical data from the model.

Driver-based simulation

Other use cases that can be portrayed using driver models are also conceivable. This includes product-based profitability calculations with sub-models for revenues, price reductions, production costs and resources deployed. Simulations based on the infrastructure of the company with sub-models for employees and fixed assets, as well as liquidity and working capital management, can also be shown. Potential drivers for such simulations could be, for example, **machine run times**, **raw materials**

prices, **staff turnover**, **production quantities**, **receivables** or **disposable income**.

Visualized dashboard

Figure 18: Driver-based modeling and simulation

A further feature of Valsight is the integration of **probabilities** and **statistical methods** into corporate performance management. At the heart of this is scenario-based thinking and the end-to-end description of risks and uncertainties through error measurements and probability distributions. Thus, simulation techniques, such as Monte Carlo simulation, can be used in connection with driver-based KPI models to create a probability-based view. This incorporates risk variables into planning and forecasting, giving decision-makers the possibility to present forward-looking figures with greater certainty and, in the final analysis, to manage key risks more efficiently.

Figure 18 shows the visualized dashboard with four quadrants. The first quadrant (top left) lists the comments of different employees about the results of an analysis. The second quadrant (bottom left) shows the actual driver model. The development of EBIT and its simulation-based prediction can be seen in the third quadrant (top right). Sales revenues are broken down into specific regions in the fourth quadrant (bottom right).

Benefit for controlling

Value driver models can be the lynchpin of financial plans and simulations, linking performance indicators with their operative and strategic drivers and thus defining the cause-effect relationships. They provide significant support for planning and **scenario-based simulations with probabilities**, thus making it possible, for example to quantify in advance the influence of external market risks and internal strategic measures.

Driver models as support for controllers

6.2.2 Business Analytics with IBM Watson

Author: Erich Nickel (Director of Automotive Solutions CoC DACH)

> **About IBM**
>
> **In 2015, IBM** (www.ibm.com) turned over 81.7 billion dollars, making it one of the world's biggest operators in the field of information technology and B2B solutions. Currently, the company has over 380,000 employees. With subsidiaries in more than 170 countries, IBM is the technology and transformation partner which works together with companies, governments and non-profit organizations to develop IT solutions for the challenges they face.

Watson

Cognitive systems can change the way in which companies will think, act and work in the future. Such systems **learn through interaction** and provide **fact-based answers** which ensure better results.

Learning through interaction

Watson represents a first step towards cognitive systems. The system is based on current data processing but it differs in a number of important aspects. A combination of **three characteristics** makes Watson special: the processing of natural language, the creation and evaluation of hypotheses, and fact-based learning. The Watson solution portfolio consists of four business areas: Cognitive Computing Technologies, Watson Advanced Analytics Products, Business Applications and Watson Platform Services.

Cognitive Computing Technologies:
Watson Engagement Advisor
Watson Discovery Advisor
Watson Policy Advisor

Watson Advanced Analytics Products:
Watson Explorer
Watson Analytics

Business Applications:
Watson for Wealth Management
Watson for Oncology
Chef Watson

Watson Platform Services:
Watson APIs on IBM Bluemix
Watson Developer Cloud

Figure 19: The Watson solution portfolio

The following section takes a brief look at Watson Analytics.

IBM Watson Analytics

IBM Watson Analytics offers powerful analysis functions which can be used by virtually anybody. Automated functions for data preparation, predictive analytics and clear and uncluttered reports and dashboards give users control over their own analyses, making it possible to define solutions for known and unknown problems.

- **Receive better data**

  With Watson Analytics users can automatically receive relevant business information through an integrated management service. This provides the basis for conclusions with decision-making relevance. Data preparation and processing, the creation of predictions and the visualization of the results all take place automatically in the system.

- **Understand business processes**

  Watson Analytics works with an intelligent data service which compares data or also highlights data which will probably lead to negative results. The tool points out anomalies and conspicuous data which the user might find interesting and also offers a collaboration application for exchanging information within the company.

- **Answer business questions**

  The software enables users to pose questions in natural language and gives answers based on statistical analyses and correlations. Examples of areas where the software can be used include marketing, sales, HR, finance or operations.

- **Tell a compelling story**

  With the help of automatic data visualizations, users can create powerful and clear infographics. These graphics can be tailored individually and show complex correlations in a clear and uncomplicated way.

Concept

Watson Analytics works with questions posed by the users, who frame the questions in natural, **familiar language** and receive predictions and answers. Alongside speech recognition, the tools are uncomplicated and easy to use, both of which occur as a self-service smart data discovery service available on the cloud, which enables 24-7 access via any device.

Man-machine interaction made possible

Advantages over "conventional" analysis tools

Today, an average of **60 percent of the time** available for an analysis project is needed for **data preparation, processing and uploading**. Watson Analytics automates these steps, thereby reducing the expertise and technical know-how required for its use. Contrary to conventional analysis tools, Watson Analytics can process data cognitively. This means that data can be evaluated and sorted independently based on the user's wishes.

Further, the tool offers the possibility of carrying out advanced analytics which are normally the domain of highly qualified analysts. Additionally, the software can be used in all departments and functions of a company.

One-stop shop for business analytics	Predictive analytics for the unpredictable	Dialogue in natural language
Preparation of data Creation of predictions Visualization of results	Pattern recognition	Speaks and understands the language of business
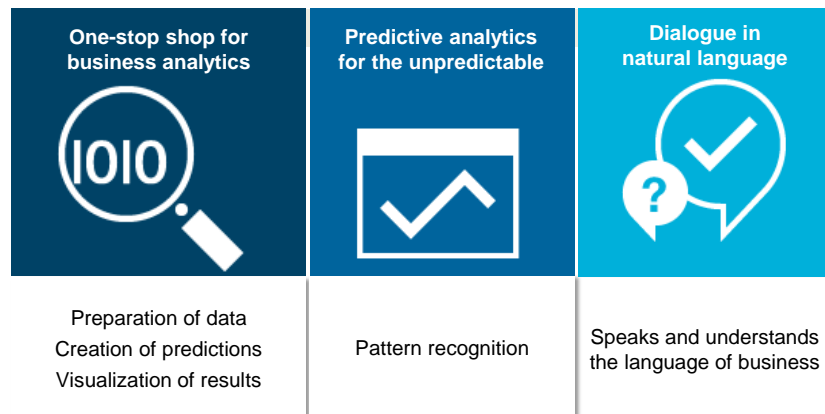
Figure 20: Watson Analytics approaches

Use of Watson Analytics in controlling

Suitability of Watson Analytics for use in different controlling processes

In the fields of planning and corporate performance, forecasting and reporting, today controllers need quick answers to complex questions. Intelligent data analysis tools can provide **more precise, more reliable and also faster answers** to these questions. However, in many cases we still come across hurdles when it comes to using analysis tools, and they often require specialist expertise. Gradually, there are now ways in which we can overcome these hurdles and get around the requirements.

With Watson Analytics IBM has taken an important step forwards. As soon as questions arise, the user can formulate a specific question in natural language using the analysis tool. Then, suitable data is collected, summarized and presented in an easily understood way.

Watson Analytics can be individually customized to enable its use in the main processes of controlling. Figure 21 shows the processes in which Watson Analytics can generate significant added value, thereby making data analysis much simpler.

As it is particularly simple to use, Watson Analytics provides valuable support for **management reporting** through clear and vivid visualizations and the portrayal of correlations.

Watson Analytics also implements functions for **risk management**, such as the 360° review of customers or firms. In the fields of production and controlling for pre- and after-sales, it has many application possibilities for visualization, for collecting relevant data, and for creating predictions.
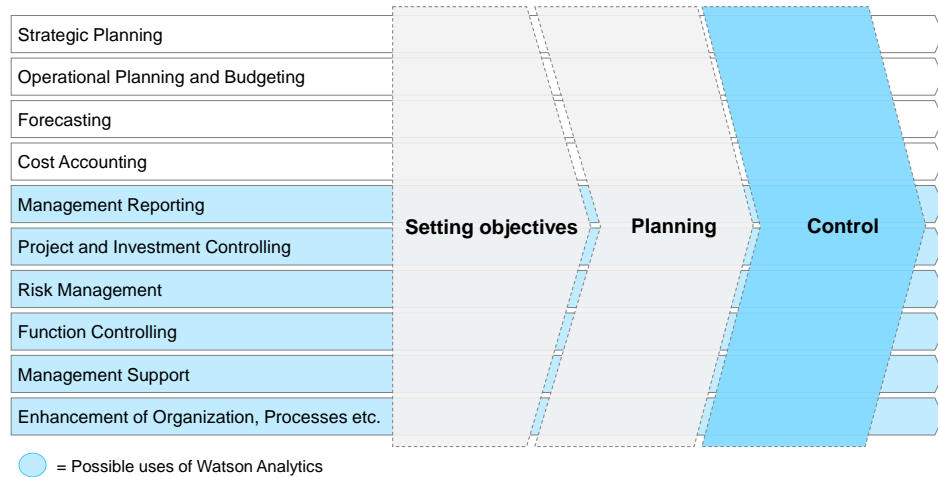
Controlling – Main processes

Strategic Planning			
Operational Planning and Budgeting			
Forecasting	Setting objectives	Planning	Control
Cost Accounting			
Management Reporting			
Project and Investment Controlling			
Risk Management			
Function Controlling			
Management Support			
Enhancement of Organization, Processes etc.			

◯ = Possible uses of Watson Analytics

Figure 21: Possible uses of Watson Analytics

Cognitive uses of Watson

The intelligent evaluation of large text bodies enables modern controllers to analyze difficult topics faster and in a more graphically appealing manner. Based on NLP, machine learning and other mathematical methods, these smart analysis tools help controllers to both gain and provide more detailed views and perspectives of business. Previously, this was **only possible for highly specialized data scientists**.

6.3   ICV Expert Work Groups (EWG)

6.3.1   ICV-EWG "BI/Big Data and Controlling": Digital Transformation – Implications for business analytics

Author: Prof. Dr. Andreas Seufert (Head of ICV Expert Work Group "BI/Big Data and Controlling")

> *This section provides a short overview of the discussion in the EWG.*

Digital transformation as challenge for methods expertise

Challenge

Digitization creates fundamentally new challenges for companies concerning the procurement, analysis and provision of information. The ability of companies to develop (new) data sources quickly, to network information and to utilize it in decisions has always been seen as a critical success factor (cf. Brynjolfsson et al. 2011 and Seufert/Sexl 2011).

These developments create completely new challenges for controlling, affecting it twofold: On the one hand, digitization has a huge impact on business models, business processes, structures and products, and thus by definition on the skillsets required for the role of business partner ("changes in business aspects"). On the other hand, the possibilities for handling information are also changing due to increasing digitization. There are completely new technologies, new data pools and new analysis methods ("changes in data/ business analytics aspects"). At this point, we would like to outline the implied changes and the new possibilities in data and business analytics brought about by digitization.

Digitization as enabler in the field of data and business analytics

We see three major changes:

New underlying data sources: In practice we see that to date many companies rely primarily on internal operative systems, such as SAP, or analytical systems, such as data warehouses. However, the massive digitization of nearly every aspect of life means that completely new data pools are being created. Due to their sheer size (volume of data) and also their structure (partly structured or unstructured), these new sources, for example sensor data or social media data, are creating considerable challenges for companies.

New data storage technologies: As a rule, the new data acquired from the new data sources must be stored as raw information so that it can be harnessed subsequently (e.g. sensor data). What is important here is to retain the right degree of data granularity. While a very high degree of detail can require alternative data storage technologies, it is precisely that very

high granularity which is vital for the meaningful use of modern business analytics methods.

New analysis methods: As a rule, we need analytical methods to be able to exploit and utilize the raw information. While in the meantime the use of multi-dimensional decision models (OLAP) has become firmly established in companies, many companies are only just beginning to use complex business analytics methods.

The business analytics process

Digital transformation creates completely new demands upon business analytics. These stem from the interaction between business management requirements on the one hand and the far-reaching understanding of data bases and modern analysis methods on the other. The following section outlines this interaction based on a generic analytical cycle originally developed for the field of data mining.

Business understanding: First, the starting point is a comprehensive understanding of the goals and objectives. We must clarify which business management questions should be answers or which requirements from the business perspective should be addressed. These questions can, for example, come from the field of digital transformation described at the beginning of this chapter, but they can also stem from classical controlling issues such as forecasting. What is important in this phase is not only to define the business aspects of the problem and the desired objective but also to translate those into an analytical perspective. Here, it is very important to choose the right methods. Should, for example, forecasts be created based on manual input from planners, based on time series analyses, based on correlations (in many cases the basis for so-called predictive analytics) or based on cause-effect analyses?

Business understanding

Data understanding: The objective of this phase is to use the business understanding as the foundation for defining relevant data bases and selecting potential data sources. Due to the considerable expansion of potential data bases already mentioned, there is a whole range of completely new possibilities here, e.g. in the identification of determinants and their impacts on sales quantities. What is also important in this phase is to carry out a first methodical screening of the data and to develop first explorative results, such as information content of the data, structure of the data, frequency distributions, location parameters, statistical connections, etc.

Data understanding

Data preparation	**Data preparation:** Based on this data understanding, the next step is data preparation. This includes the creation of a relevant data set (e.g. selection of tables, data strings, attributes) and the transformation and cleansing of the data (e.g. missing values, outliers, data types/ conversion, transformation of scales if necessary, feature selection, data sampling, etc.) for the subsequent analysis.
Modelling	**Modelling:** The actual analysis itself can be broken down into two stages: modelling and evaluation. The aim of modelling is to choose different modelling approaches based on the business understanding and the characteristics of the data. We can differentiate roughly here between, for example, regression and classification approaches and monitored and unmonitored learning approaches. Within these modelling approaches there are numerous different methods and algorithms which, in turn, can be parameterized.
Evaluation	**Evaluation:** The use of different analysis models supplies two basic types of results. First, the content-based business management results, e.g. forecast values, and, second, quality criteria. The latter serve to define the reliability of the models and to compare different methods with one another so as to be able to choose the most suitable model.
Deployment	**Deployment:** If the model supplies the desired results in a pre-defined acceptable quality, it can be deployed and made available to customers (internal and external), for example through integration in an existing tool or in reporting/ portal environments, but also directly as feedback in transaction systems such as the supply chain.

Conclusion for method expertise in controlling

Digitization influences the role …	The understanding and roles of controlling will change considerably in the coming years. On the one hand, controlling will be seen increasingly as a business partner of management. Due to the digital transformation of the economy this will result in completely new challenges. On the other hand, handling information has traditionally been seen as a focus of controlling, but new developments in this field will also lead to fundamentally new challenges for the methods expertise of controllers.
… and the required method expertise in controlling	These new challenges offer controlling the potential to redefine its own role and to position itself accordingly in the company. To this end, it is essential for controlling to develop and expand comprehensive information and methods competences, especially in the fields of information as a resource, Big Data management, and trend scouting.

6.3.2 ICV-EWG "Controlling and Risk Management": Predictive Analytics in the context of corporate planning and risk management

Author: Tobias Flath (Head of ICV Expert Work Group "Controlling and Risk Management")

> *This section provides a short overview of the discussion in the EWG.*

Starting point: Increasing uncertainty in the business world

In corporate performance management it is becoming increasingly difficult to recognize determinants for predicting plan positions in an **international and volatile environment** and to include them in planning and thus in decision-making. Consequently, the challenges in risk management associated with the identification, interpretation and quantification of risks are also increasing. Primarily, there are two essential drivers of the increasing complexity: globalization and the digitization of the world markets.

Globalization leads to a globally networked value chain with more and more interdependent influencing factors (drivers or indicators), while digitization results in a **massive flood of fast-moving data** (Big Data). The rapid changes in the way determinants influence business and the economy make it difficult to use them for predictions. Consequently, it would appear that it is almost impossible to make valid predictions concerning corporate success (e.g. sales quantity and sales prices) with the aid of the drivers of success (e.g. gross domestic product, consumer climate, raw materials prices). Yet, it is precisely because of these circumstances that flying blind and driving by line of sight are also not the right solution.

Increasing complexity makes it difficult to create valid forecasts

It is especially in volatile times like these that companies should be placing more value in (also short-term) predictions. As a return to times of stable influences is unlikely in the foreseeable future, it is corporate management's responsibility to find more flexible and robust solutions, especially in controlling and risk management.

> These constantly changing masses of information and their patterns should not be perceived as a hindrance but can be used as a real **competitive advantage**.

Solution: Predictive analytics

What is needed to improve planning quality is the use of modern methods and technologies. One solution for the aforementioned challenges is

predictive analytics, which enables companies to create an objective and resilient forecasting model and to process huge amounts of data.

A critical success factor is the identification of leading indicators from a large number of possible drivers which have proven relevant for the planning object through a quantitative analysis.

Then, the bundle of qualified drivers is transferred to, for example, a multiple or simultaneous explanatory model which considers possible correlations between the individual drivers and the respective time lags to the planning object.

In order to enable more realistic planning, it is essential that the predictions for the individual drivers after the time lags (up to this point there is no need for a prediction) are not calculated in point values but in **bandwidths (corridors)** and the predictions for the drivers are aggregated via a **stochastic method** across the explanatory model.

Data Analysis

… which drivers are relevant?

Explanatory Model

… how are these drivers connected and how do they influence the planning object?

Prediction

… how will the planning object and its drivers develop in the future?
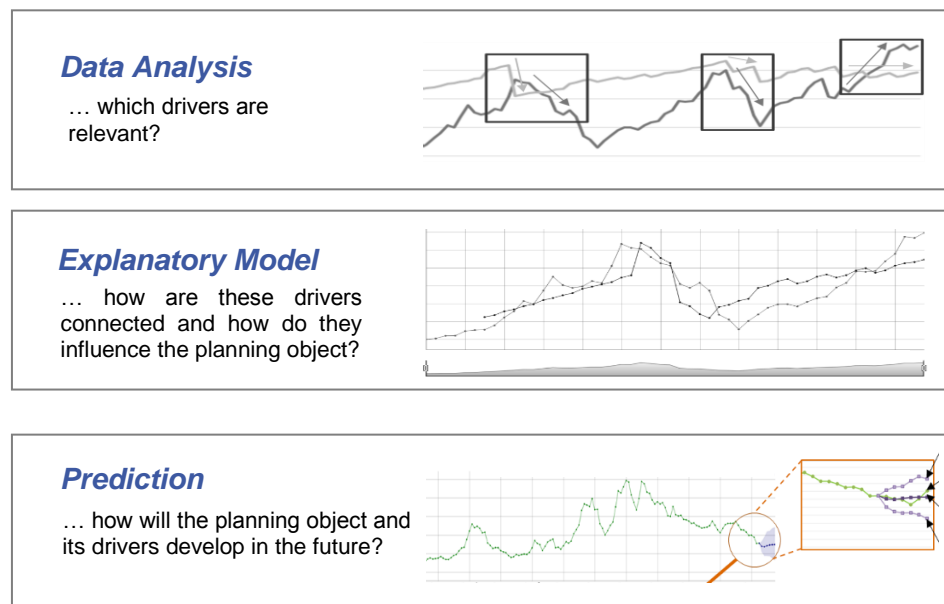
Figure 22: Approaches in predictive analytics

Predictive analytics as the link between corporate planning and risk management

Possible positive and negative deviations from the expected prediction of the planning object can be used as objectively quantified chances and risks in decision-making under uncertainty. In this way, predictive analytics embodies the optimum connecting link between corporate planning and risk management. With the help of this methodology we can **recognize chances and risks early** and **proactively initiate countermeasures**. The relevant leading indicators enable the company to look forward and thus build up an important competitive advantage over their competitors. This objective, efficient and transparent view of the future is the ultimate goal of predictive analytics.

- ✓ Structured collection, preparation, analysis and visualization of mass data for potential drivers
- ✓ Focus on relevant time-based leading drivers and their interdependences, as well as transfer to an optimized clarification model
- ✓ Dynamic predictive analysis solutions can easily and uncomplicatedly adapt to changes in the Big Data of the drivers and thus also to the volatile environment
- ✓ Objective, transparent and rapid predictions with high quality including chances and risks through bandwidths
- ✓ Possibility to react proactively to changes in planned values

Figure 23: The benefits of predictive analytics for risk management

Challenges: Fear of transparency, complexity and workload

Today, companies still base their actions purely on experience and rarely on data or facts, especially when it comes to predictions. There are many reasons for this.

Paradoxically, the transparency gained through predictive analytics can actually be a further barrier as it can mean that unrealistic plan values and expectations are **exposed mercilessly**. The resulting reluctance and resistance can only be broken down through cultural change in the company.

An additional obstacle is the **complexity** of predictive methods. For management, these are often like a black box as the managers do not fully understand the underlying mathematical concepts. For this reason it is important that the users of predictive analytics are able to communicate the benefits, methods and requirements in a clear and understandable fashion.

It is essential for companies to have painstaking data recording and maintenance systems in place, as well as IT-based data processing in order to be able to create meaningful predictions. Processes for collecting and preparing data must be anchored permanently in the corporate culture, the corporate processes and the technical infrastructure to ensure the data can be used to create a real competitive advantage.

Creating a better data basis for risk management with predictive analytics

Outlook: Predictive analytics as the new basis for decision-making

Predictive analytics cannot and will not replace corporate planning. Instead, predictive analytics should be seen as a complementary tool for meeting the aforementioned challenges head on and thus counteracting the weaknesses of conventional planning. Discussions with departmental heads from controlling, purchasing, production, sales, risk management, corporate planning and strategy clearly show there is both a significant need and great willingness to use such methods and procedures jointly in the future.

Predictive analytics can and will provide controllers and risk managers with **extremely important information** and increase their standing in the company. At the same time, their remit and job specifications will change fundamentally. As a result, we will see far more mathematicians and statisticians working in these two fields who can create and understand predictive models and correctly interpret their results. The only question remaining is which companies will recognize this quickly enough and act accordingly.

7 Conclusion: On the way to Controller 4.0

In our opinion, it is absolutely vital that controllers address the topic of "Business Analytics" and in doing so evaluate the potential of new instruments for their field. In the last few years the role model of the controller has changed continuously. Increasing digitization and the associated use of business analytics will add further impetus to this change.

If we look at the analysis methods and instruments used in controlling, we can see that over time, on the one hand, these have delivered increasingly detailed findings and, on the other hand, they have become more and more complex to use. If we compare this development to the Industrial Revolution, we could talk about Controller 4.0:
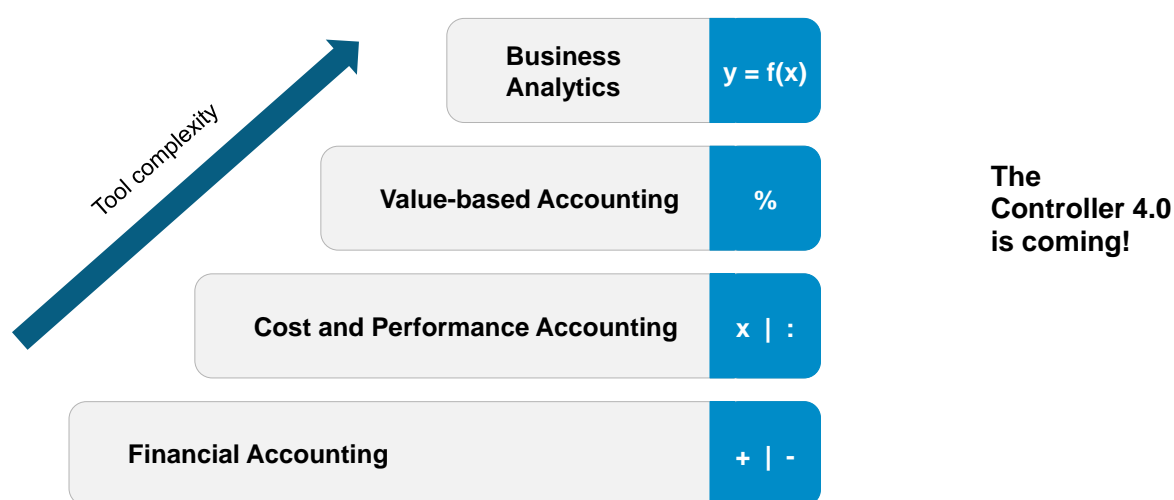
Figure 24: On the way to Controller 4.0

The Controller 4.0 is coming!

During the course of this development, first the method of compound interest ("value orientation") and now mathematics in the form of business analytics have joined the ranks of basic arithmetic operations as "tools".

Our main conclusion is:

> **Controllers must address the topic of business analytics and reposition themselves and their role in the company.**

Business analytics is the main enabler of data-driven corporate performance management in which most of the operational decisions are based on facts. The road to such a form of data-driven corporate performance management can only be travelled successfully if controllers address the topic of business analytics. Although there are many different challenges along this road (complexity of the analysis tools, integration of new data pools, etc.), it will ensure the competitiveness of companies in the digital age.

Controllers must also be aware that most of the operative controlling processes used until now will be automated, which means that their repositioning in the company will also be driven by IT (cf. Figure 25).
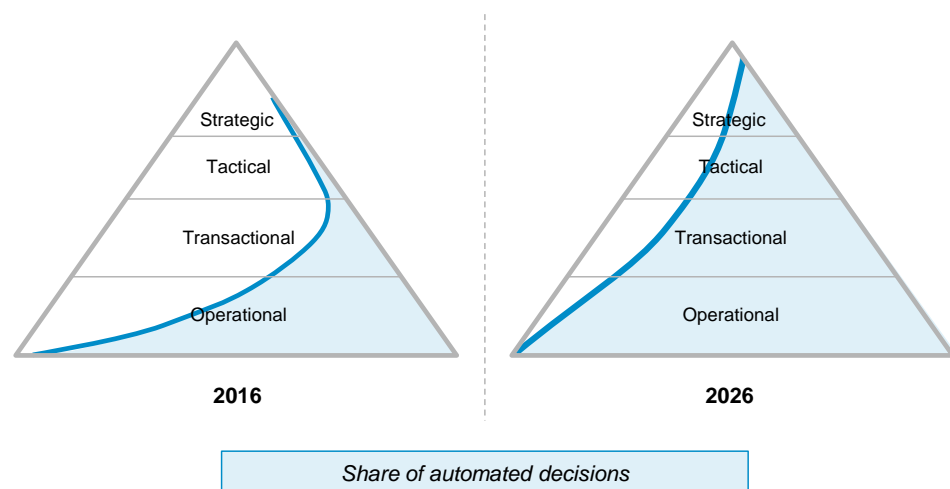
Figure 25: Increase in the degree of automation in decision-making
(based on Vocelka 2016, p. 27)

Digitization must be seen as an evolutionary process

In this sense, the development described in this Dream Car can be characterized as a revolution but in the world of business it must be designed, shaped and implemented as an evolutionary process.

Due to the ever-increasing flood of data, companies will need the controller more than ever to be an objective partner for the manager with far-reaching expertise and deeply-rooted know-how:

The controller is a single source of truth that is completely irreplaceable and completely indispensable!

Recommended Reading

For beginners

Published by Wolfgang Becker, Patrick Ulrich and Tim Botzkowski, **"Data Analytics im Mittelstand"** is based on an empirical study from 2014 which investigated the decision-making behavior of CEOs and managing partners from mid-sized companies against the background of new technologies – especially through the use of business analytics. The book focuses on changes in decision-making.
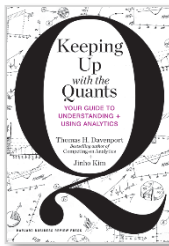
"Keeping Up with the Quants – Your Guide to Understanding and Using Analytics" was written by Thomas Davenport and Jinho Kim and offers a comprehensive overview of the fields and possible applications of business analytics. Among other things, it looks at use cases from different industries. Davenport is the co-founder and Research Director of the International Institute for Analytics and is regarded as a leading expert in the field of business analytics.

For advance readers
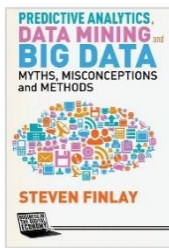
In his book **"Predictive Analytics, Data Mining and Big Data – Myths, Misconception and Methods"** Steven Finlay looks in particular at the use of predictive analytics. Among other things, he describes how predictive analytics models can be designed and implemented. In this context, he also deals with specific fields, such as text mining. Additionally, he focuses on the main technological requirements for implementation.

In their book **"Multivariate Analysemethoden – Eine anwendungsorientierte Einführung"**, Klaus Backhaus, Bernd Erichson, Wulff Plinke and Rolf Weiber explain the methods used in business analytics. With the help of concrete use cases, even readers with comparably little knowledge of statistics can learn about the basics underlying business analytics models. The 14th edition of this book was published at the end of 2015.

Boris Otto and Hubert Österle tackle the topic of quality management in the context of master data in their book "**Corporate Data Quality – Voraussetzung erfolgreicher Geschäftsmodelle**". They use a range of case studies to show how companies use different individual projects to dramatically increase data quality. In doing so, they present tried and tested methods and immediate measures.

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