Abstract

Recent technology innovations, many of which are based on the capture and analysis of big data, are transforming the automotive industry in a pace deemed inconceivable just a short time ago. At the heart of this transformation is the new role of the car itself, and the increasingly sophisticated abilities that "intelligent cars" possess to communicate with individuals, enterprises, and devices around them. Company leaders in the automotive industry clearly recognize that by embracing the concept of big data, they can access a mass of opportunities for differentiation, growth, and innovation that revolutionize the very core of existing business models. In order to unlock this potential, the key challenge is to develop and implement a big data strategy, which is tailored to the capture, analysis, and interpretation of the ever increasing quantities of structured and unstructured data which will be received from drivers, vehicles, and other devices. Only those companies which incorporate a big data strategy in their transformation agendas will be able to reap the rewards offered by the zettabyte revolution.

GAINING TRACTION

Big Data in the Automotive Industry

Intelligent cars are on the rise and will change our perception of automobiles. The authors of this article illustrate the importance of a big data strategy in helping automotive companies to transform and offer consumers a completely new driving experience.

by Michael Voigt, Christopher Bennison, and Maik Hammerschmidt

During recent decades the automotive industry has seldom been out of the spotlight. Global topics such as climate change, globalization, and the increasing scarcity of resources have served to define the automotive trends (Gartner 2011) and have long since set the transformation agenda for the industry. Automotive companies around the world have responded by adjusting their product portfolios, further developing new energy efficient technologies, and shifting their focus to the BRIC countries. However, recent technology innovations, many of which are based upon the capture and analysis of big data, have moved the industry to the brink of a vastly different transformation; one that will challenge the very core of the existing business models and that will revolutionize the way in which we view the role of transportation in the future.

At the heart of this new transformation is the future role of the car itself. The increasingly sophisticated abilities that "intelligent cars" possess to communicate with the individuals, enterprises and devices around them empower the car in a way that seemed inconceivable a few years ago (Mayer-Schönberger and Cukier 2013). These abilities allow service vendors to quickly gather and analyze masses of structured and unstructured data received from vehicles and, in turn, to provide tailor-made offers to the driver. The customer is the clear beneficiary of this new role of the car, and this will both fundamentally and rapidly shift the expectations of consumers in terms of the functions which they expect a vehicle to perform.

The transformation also goes beyond the changing role of the car itself. The enhanced ability of the car to communicate key vehicle data to other parties allows the establishment of new business models that were previously inconceivable. More flexible car rental offers, an expansion of the leasing frameworks available when acquiring vehicles, intelligent car services, and an increase in the number of car-sharing options are all feasible. All of these models provide the Original Equipment Manufacturers (OEM) and drivers with potential new income sources and vastly increase the choice available to customers.

Undoubtedly, key technological innovations will fundamentally influence the way in which automotive companies run their businesses in the future. Enterprises will be forced to transform their business models and restructure their value chain, respond to new process requirements, and mitigate new risks (Chen et al. 2012). Those enterprises which fail to

do so will quickly suffer the consequences as the buying power of the Millennials increases.

Looking Forward into the New World

In the future, the common driving experience will change. However, what will be the extent of these changes? How deep is the gap between fantasy and reality? Let us imagine a future automotive scenario from a customer perspective:

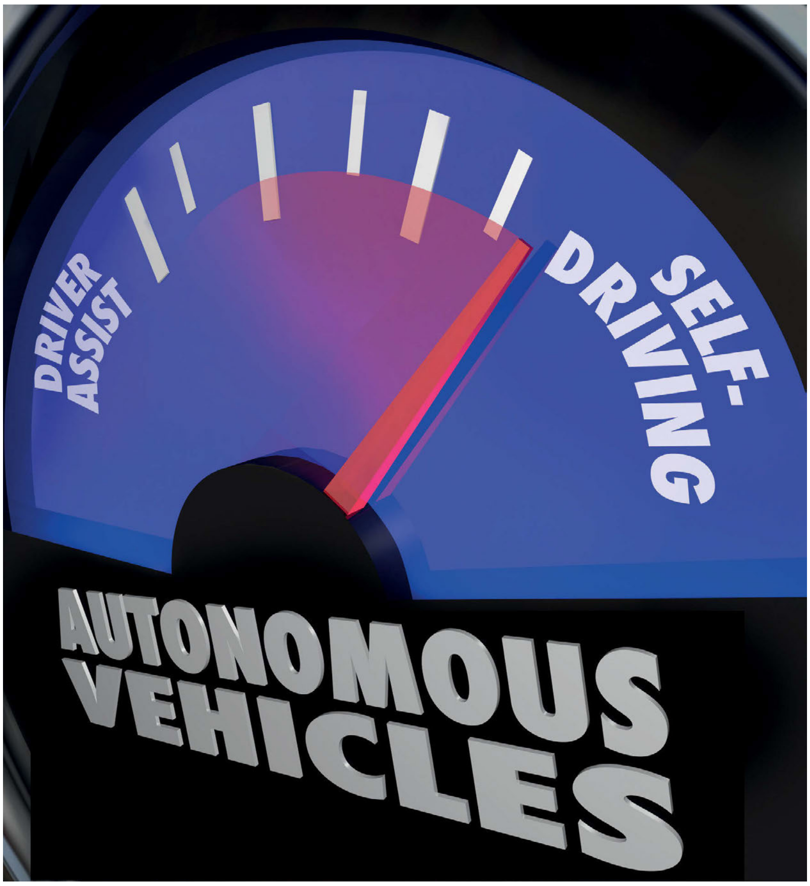
It is an ordinary working day. Stephen Smith is working at home. Before a mid-morning video conference, he goes to the kitchen to fetch a coffee. While doing so, he remembers that he has not yet rented a car for going out with his girlfriend Anna this evening. The problem is quickly solved. While standing in front of the coffee machine he browses all the available vehicle models using the app on his smart phone. The vehicles are displayed in sequence according to the vehicles which he has driven in the past and the stored transmission type preferences. Stephen selects the electric vehicle which he enjoyed driving last week and specifies the time slot for the reservation. Once the vehicle is booked, Stephen confirms that his credit card details are correct before payment is made. The range of available insurance options is subsequently displayed by the app, sorted by price. Stephen selects "insure what you drive". With this option, the insurance price is calculated based on the exact number of kilometers travelled and also considers the current weather conditions for Stephen's location, the vehicle type, the route taken, and Stephen's driving history. An onboard GPS-enabled telematics device continuously transmits trip and vehicle data to the insurance company during the journey which is then used to calculate the final invoice.

Later that day, the reserved vehicle automatically and autonomously makes its way to the service point. Before continuing to its destination, an inspection is necessary. The diagnostic data collected by the vehicle show that the brake pads are worn and need to be replaced. At the same time, additional maintenance work is performed. After the service stop, the vehicle determines the quickest way to Stephen's house. The current traffic situation is determined by gathering real-time information from other vehicles currently on the road via the integrated

sensors of the vehicle, and by previous trip data. From this data, algorithms are derived to model how the traffic situation will develop during the next few hours. The vehicle accesses this information in the cloud and plans the route for the journey accordingly, finally arriving at Stephen's place in time.
Stephen Smith gets into the vehicle and confirms the destination, his girlfriend Anna's place, which has been already transferred via the app. Stephen has had a long day and does not feel like driving, so he activates the auto-pilot. The vehicle uses the road sign recognition logic to regulate its speed according to the traffic conditions. During the journey Stephen talks to Anna. She has made up her mind, she would like to go to the theatre this evening to watch a play which only started a few days ago. Stephen has seen very positive reviews about the performance and knows that it will be difficult to get seats. However, using the intelligent car service within the vehicle, a ticket vendor is found who not only offers tickets for the play, but after a quick price comparison, also offers a discount on all tickets bought this evening. Once Stephen has confirmed the seats, a further service is called to determine which car park would be the closest and cheapest. As it will be busy in the city center this evening, the vehicle knows that it will be necessary to reserve a parking space. Unfortunately, it seems that all the car parks close to the theatre are full. Therefore, the vehicle calls an additional service which checks whether alternative parking spaces at privately owned properties are available this evening. It turns out that Stephen is in luck. A privately owned house is renting out their driveway this evening and the price is cheaper than the car park. Stephen reserves the space and sits back to enjoy the journey. A few minutes later, Stephen receives a request via his mobile device. An online service vendor has identified that Stephen has booked seats at the theatre this evening and asks him whether he would allow the vehicle to be rented to a third party for one hour during the time of the performance this evening. Stephen agrees because he knows that the performance will last for two hours and that he can check the current position of the vehicle on his mobile device at any time to ensure that the car is back at the theatre in time. Besides this, the charge for the short rental will help to pay for the champagne during the interval! Shortly afterwards, Anna is picked up from her place. The vehicle proceeds to the city, pulls into the street where the theatre is and identifies the correct building using the onboard camera. Then it parks in the place that was reserved a few minutes ago. Stephen and Anna leave the vehicle and look forward to a wonderful evening ahead.

Turning Vision into Reality

The described scenario may seem unrealistic; a futuristic vision which will have no impact on the current driving genera-



tion for years to come. This, however, is not the case. The use cases illustrated above, and several related ones, already provide the backbone for many business cases currently pursued by forward-looking OEMs. The necessary IT infrastructure to support these use cases is already available on the market. However, there are a huge number of process and organizational barriers which CIOs must overcome to successfully transform their enterprises and deploy the new possibilities. One key challenge is the development and implementation of a data strategy that is tailored to the capture, analysis, and interpretation of the ever increasing quantities of data which will be received from vehicles, drivers, and other devices (McAfee and Brynjolfsson 2012). Indeed, the ability of OEMs to successfully embrace the possibilities offered by big data analysis and create additional business value in the medium to long term represents a huge opportunity in the eyes of many industry observers. However, this huge opportunity comes along with a big strategic challenge for the major players in the industry (Lopez 2013). During the course of our research for this article, we discussed this hypothesis with the management of leading DAX companies. During our interviews we assessed the way in which the companies are responding to the transformation of the industry and the extent to which they have incorporated big data strategies in their transformation agendas.

A recent study shows that data-driven decision makers have 5% higher productivity, 6% higher profits, and up to 50% higher market value.

The Enabler – A Big Data Strategy

Big data can be defined by the 3 "V"s: volume, velocity, and variety. This means that data is available in very high quantities, transmitted at a high rate, and is varied in structure and quality (Gartner 2011). Recent data growth figures are impressive. According to the International Development Corporation (IDC), the data volume generated worldwide in 2012 amounted to approximately 2.8 zettabyte. In 2020, the yearly data volume generated will have grown to 40 zettabyte, with business transactions on the Internet, both business-to-business and business-to-consumer, exceeding 450 billion per day (Gantz and Reinsel 2012).

In order to be able to support such a dramatic change within the IT landscape, it is essential that enterprises devise a big data strategy. This strategy must, however, go much further than just defining how increased volume, velocity, and variety of data will be supported within the enterprise. Successful big data strategies have to focus on the "economically prudent acquisition and use of data for decision making purposes" (BITKOM 2013). Futhermore, the strategy also describes approaches and techniques for converting the mountains of (often unstructured) data into useful information and subsequently combining these findings with existing business intellectual property to create knowledge that allows companies to gain insight and ensure competitiveness. This knowledge cannot only be used by human beings. It is also increasingly evident that it can provide the foundation for artificial intelligence and self-learning systems (Chen et al. 2012). Consequently, only the link of data characteristics and analytics fully captures the true definition of the term "big data" commonly referred to in academia, and forms the essential dimensions of a big data strategy. In other words, a big data strategy has to be understood as data-driven decision making, i.e., basing business activities on measurement, models, and quantitative analysis instead of subjective opinions only (Brynjolfsson 2011). A recent study shows that data-driven decision makers have 5% higher productivity, 6% higher profits, and up to 50% higher market value (Brynjolfsson et al. 2011).

Pushing the Boundaries

An intelligent car concept is a central element of the big data strategies of many automotive OEMs and is necessary in order to realize the full potential of the use cases described above and to implement them on a large scale. An intelligent car concept not only allows a huge amount of real-time data to be gathered directly from the vehicle, but it also allows the knowledge created by big data analysis to be published directly to the driver. Several cross-industry initiatives are currently underway and have demonstrated that new services and products can be successfully positioned by using this approach, which add value for the service provider, the OEM, and the driver of the vehicle. One example of such an initiative is BMW's ConnectedDrive, which currently offers unique apps for real-time traffic information, concierge services, intelligent emergency call, online entertainment, and BMW specific TeleServices. Even at this comparatively early stage, it is clear that harnessing big data enables mass individualization on an unprecedented level.

Besides data gathered from the vehicle itself, the largely unstructured data from social media is equally valuable. Leading companies apply social media scraping and sentiment analysis to data generated in social media blogs, micro-blogs, and social networks to determine how the different customer segments and stakeholders react to their products and actions (Harris 2013). At Ford, for instance, the product development team was not sure as to which type of lift gate the Ford Escape sport-utility vehicle should be fitted with. There were two options, a standard lift gate which would open manually with a possibility to open the rear window separately, or a power lift gate which would open automatically by tapping under the rear bumper with one's foot, but without the possibility to open the window separately. Although Ford had carried out a series of standard surveys, the question had not been assessed in sufficient detail, so Ford's Research & Innovation team was tasked with answering the question using social media, where users were already actively discussing the topic. Using social media intelligence techniques such as web crawling, Ford successfully managed to "crowdsource" their product development, thus rendering their decision making processes "democratic" (Weiger et al. 2012). The consensus heavily favored the power lift gate which is now a feature of Ford Escape.

Furthermore, the potential offered by big data analysis is not limited to the boundaries of traditional business processes. Sensor and data fusion techniques allow the smart combination of existing data sources with new data, such as telematics data from the vehicles, and can therefore be used to drive innovation and create altogether new business opportunities in real time (Manyika et al. 2011). While in the past it was common to analyze one or two data sources together, it is now possible to expand this data range by adding data sent directly from the vehicle. The Cyber Physical Systems (CPS), upon which the intelligent car technologies are based, are capable of creating a digital representation of the car. They allow information to be sent as real-time data and seamlessly connect the physical vehicle with the IT landscape in the so-called "Internet of things" (Rosemann 2014). The rapid development of CPSs within vehicles is one reason why the automotive industry is a frontrunner in the fourth industrial revolution, commonly known as Industry 4.0.

Big Data Challenges

Although there are several examples of successful initiatives to develop a big data strategy, such as those described above, it is equally clear that many traditional companies are being overtaken by smaller, more agile enterprises that are not hampered by existing business models and IT infrastructures. This is not surprising. The task of building big data facilities within an organization is complex and should not be underestimated. Therefore, separating the task in distinguishable process steps is essential to establish big data projects (see box 2 about the Big Data Chain). Furthermore, as it is frequently repeated by our interview partners, there are five critical factors which determine the success of a big data strategy.

Firstly, it can take a considerable effort to lay the technological foundations for a successful big data strategy. Here it is important not only to consider the choice of technology used for the storage and analysis of the data, but it is also vital to ensure that the existing IT landscape is sufficiently consolidated and harmonized to allow data to be collected from all geographical and organizational areas of the enterprise. In many companies this is not the case and can therefore require considerable investments upfront. The selection of appropriate technologies for the storage and analysis of the data sample is often far from trivial. This decision is generally based on the "mixture" of structured and unstructured data within the data sample. There is currently however a "zoo" of technologies available, all of which claim to be suited for the analysis of big data. These technologies cover various in-memory data bases, different scripting languages, and optimizers. While many enterprises opt for a

Box 1: Apache Hadoop and MapReduce

Apache Hadoop is an open-source software framework for processing data sets on a large scale across clusters of computers. It was developed by the Apache Software Foundation (The Apache Software Foundation 2014). Hadoop includes, among others, the module Hadoop MapReduce, which is derived from Google's MapReduce. Originally, Google's MapReduce was designed for creating web search indexes (Dumbill 2012).

Box 2: The Big Data Chain (BDC)

During our discussions with our interview partners we also talked about the methodological approach the companies have taken. Due to the inherent complexity of big data projects, our interview partners described the need to simplify initiatives by defining the project as a chain of clearly separable and identifiable process steps, the Big Data Chain (BDC). These steps allow better orientation for stakeholders and ensure that the project stays on track. Furthermore, it makes the activities transparent for the senior management and retains their buy in. The following process steps were mentioned on several occasions and can therefore be viewed as best practices for other multinationals.

- **Identify Use Cases**
  The identification of the best use cases is possibly the most challenging aspect of any big data project and requires creativity, business insights, and a deep understanding of the technological possibilities. There are a variety of methodologies which can be used to support this process. The Hasso Plattner Institute (HPI), for example, successfully applies the Design Thinking methodology to support this creative process in multi-disciplinary teams. Traditional process innovation approaches balance the business needs and the technical feasibility of an organization, but they often forget that business process users are humans, with a complex mixture of logic and emotion. In contrast, the Design Thinking approach is an approach for balancing these needs, both on the rational side (business, technology) and also on the emotional side (people) of human intelligence. This approach brings together what is desirable from a human point of view and what is technologically feasible and economically viable. The best ideas and use cases are those that cover all three of these characteristics (Brown 2009).

- **Develop a Portfolio of Initiatives**
  Once key use cases have been defined, a second step within the BDC is to prioritize these and to develop a big data roadmap across the company. Initially it is deemed prudent to perform a lean cost-benefit analysis with the primary aim of identifying the monetary and process benefits of the different use cases for the company. This analysis should answer the questions, what are the value levers addressed by each use case and what are the most promising business areas.

- **Implement by Test and Learn Approach**
  Big data projects require a specific implementation approach because of their nature and complexity. The traditional waterfall approach, suited for traditional software implementation projects where technology is typically introduced using a "big bang" approach, is not recommended. An agile approach has proven helpful for companies to quickly realize first quick successes of big data projects implemented on a limited scope (Manyika et al. 2011). Companies typically experience many small "failures" by developing hypotheses and examining them against the data. This allows enterprises to develop a truly coherent strategic approach grounded in data (Bodkin 2013).

- **Scale to Success**
  Using the process described, it is recommended to launch a series of smaller projects in quick succession, which build on the successes of initial pilots, represent comparably small investments, and can generate a short time to value. It is then possible to increase the efforts spent on big data projects by incrementally broadening the scope of the projects or by adding new technologies (Sensmeier 2013). By learning to walk before starting to run, it is easier to correct early mistakes, ramp up knowledge of the new tools and methodologies, reduce acceptance barriers, and ensure commitment of key stakeholders.

Hadoop-based approach for the analysis of unstructured data (see box 1), the combination of these MapReduce technologies with those more suited to the analysis of structured data can be extremely complex and time-consuming.

The second key challenge is the reduction of the barriers preventing big data adoption within organizations. The shift in mindset and "trust in data", which is necessary for a data driven management approach to be successful in the organization, are often difficult to trigger (McAfee and Brynjolfsson 2012). This is especially true in enterprises that for many years have made decisions based on the opinions of certain individuals, referred to as management by "HiPPOs" (the Highest Paid Person's Opinions). In this regard, a pressing issue is reducing the anxiety of many executives that software engineers instead of marketing professionals will shape the customer experience (Deighton 2012). Thus, the organizational structure itself and the degree to which employees from different departments and functions work together on big data projects in interdisciplinary teams is also a key factor for the success of a big data strategy. Many of our interview partners commented that IT technology was no obstacle, but that they needed to rethink their organizations in order to work in fully integrated processes and avoid any silo structures – to be able to fully leverage the potential of big data for the company as a whole.

The third factor is the availability of skilled people who are capable of supporting a big data strategy. Many of our interview partners commented that they are currently experiencing difficulties in hiring qualified data scientists and architects. It is expected that this trend will contin-

Key Learnings

- Driven by technological innovations like sensors, mobile devices, and data fusion techniques, the automotive industry is a showcase for the "fourth industrial revolution" which will transform existing business models and will change the way in which we view the role of transportation in the future. At the heart of this transformation is the new role of the car itself.
- To ensure being at the forefront of the industry transformation, automotive companies must devise big data strategies that go much further than just defining how the increased volume, velocity, and variety of data will be supported within the enterprise. Successful big data strategies focus far more on the subsequent use of this data for decision making purposes.
- Intelligent car concepts, which gather a huge amount of real-time structured data from the vehicle and publish the results of the data analysis directly to the driver, are a central element of the big data strategies of many automotive OEMs. They enable automotive companies to deploy the full potential of the available use cases and allow their implementation on a large scale.
- The largely unstructured data provided by social media is another valuable source, with leading companies applying social media scraping and sentiment analysis to these data to determine how the different customer segments and stakeholders react to their products and actions.
- The task of building big data capabilities within an organization is complex and can directly affect the success of a big data strategy. There are a number of organizational, technological, and data privacy challenges which must be overcome.

ue and will have two knock-on effects in the short to medium term; firstly, that the role descriptions of typical professions will change dramatically to incorporate big data aspects, and secondly, that the importance of data will soon also be reflected in the courses offered at educational institutions. Already today there is increasing pressure on higher education institutions to offer their students hybrid learning opportunities which combine "traditional" academic disciplines with data modeling and analysis topics. Once enterprises succeed in attracting such talents, the task will be to retain these highly-skilled employees within their organizations, to ensure that they are effectively integrated within the organization and are offered the correct balance of monetary and, more importantly, intrinsic incentives to secure their commitment to the organization over time.

The fourth key challenge for companies is to ensure that the quality of the data used for the analysis is as high as possible. Leaders must be able to trust the data quality because incorrect, inaccurate, or missing data will lead to suboptimal decision making, which will have an immediate impact on the business. Many enterprises are therefore forced to initiate a number of data cleansing projects prior to crafting a big data strategy. This effort is well-invested and, based on the feedback from our interview partners, often provides the foundations for the successful implementation of a big data strategy.

Finally, the topic of data privacy is one of great complexity. The questions "who owns the data?" and "who is permitted to use the data, and for which purposes?" are being posed with increasing frequency. The legal frameworks in the majority of countries offer little assistance in answering these questions. In Germany, for example, the law states that data, which can be uniquely assigned to an individual, can only be used by a third party under the condition that this individual has given his or her permission. As a consequence of this, however, all data that cannot be uniquely assigned to an individual can be used freely by enterprises and individuals alike. It is therefore possible to enable the legal usage of data by anonymizing or depersonalizing the data sets. Anonymization refers to the permanent removal of all information which would allow the identification of the individuals responsible for creating the data. Depersonalization refers to the replacement of all information which would allow the individual to be identified by alternative data or indicators. The laws in Germany are representative of the laws in the majority of European countries, while those in the US tend to be even less strict. Given the lack of support provided by legal frameworks, individuals are increasingly demanding the right to be able to better track and delete their own data. One of the techniques used to enable this is the use of sticky policies. These machine-readable policies can be attached to individual data objects to define their allowed usage and obligations as they travel between multiple parties. By using sticky data, individuals can significantly increase the control they have over their personal information (Pearson and Casassa Mont 2011).

Already today there is increasing pressure on higher education institutions to offer their students hybrid learning opportunities.

Enterprises are currently obliged to continually review the data they are gathering and decide in each and every instance, whether they are legally permitted to store and analyze the data collected. In the future, however, the onus is clearly on the international legal systems to clarify this increasingly nebulous area and to provide a clear and understandable framework that allows big data to be used by enterprises without inflicting on the rights of individuals.

Conclusion

Globally, automotive companies are slowly beginning to hear the call to action and are starting to reassess their business models and to reevaluate the status quo. Many companies have recognized the importance of a successful big data strategy in this transformation and are shifting their investment focus accordingly. Following our interviews with the DAX multinationals, it is too early to judge whether the steps they have taken to embrace the potential offered by big data will be sufficient to guarantee success; furthermore it is unclear whether these investments are being made fast enough. Despite several obvious success stories published by the frontrunners, there are a number of pitfalls and challenges automotive companies must overcome as they embark on their big data journeys. Only those companies which are able to quickly establish and implement a successful big data strategy, learning from the mistakes of others and from the lessons from the "small data" era, will be able to transform their businesses and master the "zettabyte revolution", resulting in a strengthened competitive position and boosted market shares.

Service

AUTHORS

Michael Voigt is a Business Transformation Chief within the SAP Business Transformation Services organization in Germany. With an international track record of more than 16 years in the automotive industry he leads premium partnership programs as a senior executive advisor and program manager for major automotive customers. Prior to SAP he worked for Siemens VDO, Accenture, and BMW. He holds a graduate degree in mechanical engineering from the University of Munich and a graduate degree in general engineering from EPF Graduate School of Engineering in Paris.
m.voigt[at]sap.com

Christopher Bennison is a Business Transformation Senior Consultant within the SAP Business Transformation Services organization in Germany. During his 13 year career at SAP, he has gained broad exposure to the automotive industry, particularly in the retail and wholesale sectors, working on a wide range of business transformation and solution implementation projects across the globe. Prior to joining consulting, he spent 6 years working in product development at SAP. He holds a graduate degree in economics from Loughborough University in the United Kingdom.
chris.bennison[at]sap.com

Prof. Dr. Maik Hammerschmidt is Professor of Marketing and holds the Chair of Innovation Management at the University of Goettingen. His current research focuses on marketing analytics, technology and innovation management, and social media marketing. He has co-authored and co-edited four books on marketing performance and marketing efficiency and has published in renowned journals such as Journal of Marketing, Journal of the Academy of Marketing Science, and Journal of Service Research. He has received numerous awards for his academic achievements, including an Overall Best Paper Award of the American Marketing Association.
maik.hammerschmidt[at]wiwi.uni-goettingen.de

REFERENCES

- BITKOM (2013). Management von Big-Data-Projekten. Report. BITKOM e.V.
- Bodkin, R. (2013). The big data Wild West: The good, the bad and the ugly. September 2013. Available from: http://gigaom.com/2013/09/14/the-big-data-wild-west-the-good-the-bad-and-the-ugly/ [Accessed 30.09.2013].
- Brown, T. (2009). Change by Design: How Design Thinking Can Transform Organizations and Inspire Innovation. New York: HarperCollins.
- Brynjolfsson, E. (2012). How Does Data-Driven Decision Making Affect Firm Performance, MSI Big Data Conference, Conference Summary, December 2012.
- Brynjolfsson, E., Hitt, L., Kim, H. (2011). Strength in Numbers: How Does Data-Driven Decision Making Affect Firm Performance?, MIT Working Paper, April 2011.
- Chen, H., Chiang, R. H., Storey, V. C. (2012). Business Intelligence and Analytics: From Big Data to Big Impact. MIS Quarterly, 36 (4), 1165 – 1188.
- Deighton, J. (2012). What Will Big Data Mean for Marketers? June 2012. Available from: http://www.msi.org/articles/what-will-big-data-mean-for-marketers/ [Accessed 10.02.2013].
- Dumbill, E. (2012). What is Apache Hadoop? Available from: http://strata.oreilly.com/2012/02/what-is-apache-hadoop.html [Accessed 10.03.2014].
- Gantz, J., Reinsel, D. (2012). The Digital Universe in 2020. Report. December 2012. IDC.
- Gartner (2011). Pattern-Based Strategy: Getting Value from Big Data. Special Report. June 2011. Available from http://www.gartner.com/newsroom/id/1731916 [Accessed 10.02.2013].
- Harris, D. (2013). How data is changing the car game for Ford. April 2013. Available from: http://gigaom.com/2013/04/26/how-data-is-changing-the-car-game-for-ford/ [Accessed 10.05.2013].
- Lopez, I. (2013). Big Data Will Represent Billions in Automotive. November 2013. Available from: http://www.datanami.com/datanami/2013-11-21/report:_big_data_will_represent_billions_in_automotive.html [Accessed 02.12.2013].
- Manyika, J., Chui, M., Brown, B., Bughin, J., Dobbs, R., Roxburgh, C., Hung Byers, A. (2011). Big data: The next frontier for innovation, competition, and productivity. Report. May 2011. McKinsey Global Institute.
- Mayer-Schönberger, V., Cukier, K. (2013). Big Data: A Revolution That Will Transform How We Live, Work and Think. New York: Houghton Mifflin Harcourt.
- McAfee, A., Brynjolfsson, E. (2012). Big Data: The Management Revolution. Harvard Business Review, 90 (10), 60 – 68.
- Pearson, S., Casassa Mont, M. (2011). Sticky Policies: An Approach for Managing Privacy across Multiple Parties. Computer, 44 (9), 60 – 68.
- Rosemann, M. (2014). The Internet of Things. 360° – The Business Transformation Journal, No. 9, pp. 6 – 15.
- Sensmeier, L. (2013). Think Big… Right Start Big Data Projects. September 2013. Available from: http://hortonworks.com/blog/think-big-right-start-big-data-projects [Accessed 11.11.2013]
- The Apache Software Foundation (2014). Welcome to Apache™ Hadoop®! Available from: http://hadoop.apache.org/index.html [Accessed 10.03.2014].
- Weiger, W., Hammerschmidt, M., Wetzel, H. (2012). Integration vs. Regulation: What Really Drives User-generated Content in Social Media Channels? AMA Summer Educators Conference Proceedings, Chicago.

PUBLICATION DETAILS OF 360° – THE BUSINESS TRANSFORMATION JOURNAL

PUBLISHER

Business Transformation Academy (BTA)
c/o University of Applied Sciences and Arts Northwestern Switzerland (FHNW)
School of Business (HSW), Institute for Information Systems (IWI)
Peter Merian-Strasse 86
CH - 4002 Basel
info[at]bta-online.com
www.bta-online.com
www.360-bt.com

The Business Transformation Academy (BTA) is a joint research project of the University of Applied Sciences and Arts Northwestern Switzerland (FHNW) and SAP AG. The BTA is a Swiss non-profit association. It is registered with the Commercial Register of the Canton of Basel-Stadt under the name "Business Transformation Academy" and under the number CH-270.6.000.679-0 (legal nature: association).
Authorized representatives: Prof. Dr. Axel Uhl, Lars Alexander Gollenia, Prof. Dr. Rolf Dornberger, Nicolas Steib, Prof. Dr. Jan vom Brocke, Paul Stratil.

Published three to four times a year in electronic format.

EDITORIAL OFFICE

For inquiries about the journal please contact: info[at]360-bt.com.

Subscriptions: If you want to be notified when new issues are published, subscribe on https://www.bta-online.com/newsletter and tick the box labeled "360° Journal News".