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TEACHING CASE

Understanding the value and organizational implications of big data analytics: the case of AUDI AG

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Abstract "Understanding the value and organizational implications of big data analytics: the case of AUDI AG" presents the case of AUDI AG and its attempts to implement big data analytics in its organization. The case highlights the situation of an original equipment manufacturer (OEM) in the automotive industry and the potentials and challenges the emerging technology big data analytics may entail for such organizations. The case tries to help students to grasp the technical characteristics, the value, and organizational implications of big data analytics as well as the distinct types of analytics services. The case is presented through the eyes of Hortensie, an aspiring manager at AUDI, who gained strong interest in the phenomenon of big data analytics and received the task to position it within AUDI. To ramp up the topic big data analytics, AUDI is engaging with industry and design experts as well as an external consultancy ITConsult.

Keywords Big data analytics · Organizational adoption · Organizational change · Organizational transformation · Organizational benefits · Predictive analytics · Descriptive analytics · Analytics services · Teaching case

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Introduction

On a rainy day in autumn 2014 Hortensie woke up with only one thought on her mind.[1] Today, was her big day. She had to present the use cases and value potential of big data analytics in front of the chief of sales and marketing (CMO), which she had elaborated with her team over the last work-intensive months. Nicolas Moreau—the new CMO at AUDI—not only was known for his positive attitude toward innovativeness but also for his ability to find any weakness of potential ideas. He was one of the persons she did not want to disappoint.

She remembered how everything had started: Soon after she had become manager at AUDI's sales and marketing department, Nicolas joined the company. Coming from one of the haute écoles of Paris, he had gained experiences as CMO at Renault and at PSA Peugeot Citroën. He had the mission to put AUDI ahead in regard to profit, earnings, and, first and foremost, innovativeness. When one of the first tasks of Nicolas was the elaboration of the value and the organizational implications of the emerging technology big data analytics for AUDI's sales and marketing department, Hortensie had willingly accepted the position as lead of the task force.

[1] This illustrative case is developed on the basis of a longitudinal case study with AUDI AG (see Dremel et al. 2017). However, due to reasons of confidentiality, descriptions of the organization's inner processes, organizational hierarchies, names, and roles are anonymized. Any views and statements expressed within this teaching case do not necessarily reflect the views or policies of any individual or the organization represented by this case.

She first had heard of the potential of big data analytics in the article "Data Scientists: The Sexiest Job of the 21st Century" in the October Issue of Harvard Business Review in 2012. Since then, she learned about anecdotal evidences of companies profiting from big data analytics such as Netflix through their challenge for improving the prediction accuracy of future movie ratings depending of a customer's movie preferences priced with 1,000,000 USD, the Oakland Athletics as described in the book Moneyball by Michael Lewis and in the same named movie, or LinkedIn with the People You May Know feature, which had suggested to her an old friend from her studies at the London School of Economics just last month.

However, AUDI was a company known for its precision and quality in building cars for the premium segment as well as their innovative engineering progress, but not for their data scientists on-site. So, she never thought of the possibilities of big data analytics at AUDI. But now, with the assignment of Nicolas, her thinking changed fundamentally. An assignment of the CMO not only meant a huge responsibility but also a huge commitment of one of the board members and thus power of persuasion. Hence, she thought it will be easy to get some data, to try some analytical scenarios in the context of AUDI, and to put together a nice slide deck proving the value of big data analytics. After all, she knew that at least one business unit at the sales and marketing department was successfully using analytics, in particular data mining, to improve the product feature combinations in the car configurator.

AUDI's slogan is "Truth in Engineering," which is well established in the corporate culture and brand image. Consistent with this slogan, the company aims at further extending its market leadership by leveraging digital technology to provide superior products and services to its customers. Being among the top in its market segment, AUDI aims not only to differentiate products by innovation from competitors but also to stay competitive investing in new technologies (see Dremel et al. 2017). To do so, AUDI AG heavily invests in emerging technologies to improve its core product, the car, for the profit of the company. In 2015, AUDI shipped more than 2 million luxury cars to the customers worldwide. Originally established in 1909 by August Horch, the company was acquired by Volkswagen in 1966. Headquartered in Ingolstadt, Germany, it has been operating under the AUDI name since 1985.

However, the traditional business of AUDI was attacked by traditional car manufactures such as Daimler, BMW, Volvo, by innovative market entrants such as Tesla, Faraday Future, and by tech-giants like Google or Apple, as well as Uber and other companies providing innovative mobility services.

Unraveling big data analytics

The first day of the project, Hortensie had a meeting with the team members: Matthias, a newly hired employee with a background in statistics and math and an affinity to data manipulation, Tobias, an employee with 10 years AUDI background mainly active in a multitude of projects to improve AUDI's retail, and Nadine who worked for 8 years in the marketing strategy department at AUDI.

Before the meeting started, Hortensie remembered one last explanation of Nicolas, when she was assigned with the new task (see Exhibit 1): "I briefly discussed with the other board members whether they would be willing to invest in a unified data organization, which could leverage big data analytics along all departments. You know, though everyone is thinking of this topic as an interesting one, they want to minimize the risk to invest budget without any additional profits or cost reductions. We, as the most innovative department, will at first elaborate use cases for sales and marketing alone." She had read the article "How Smart, Connected Products are Transforming Companies" of Porter and Heppelmann (2015) last Monday and reflected since then about a unified data organization. She really liked the idea to leverage data throughout the whole company. However, if Nicolas had already made up his mind and discussed this point with the other board members, she could invest her efforts elsewhere.

She abounded her thoughts and started the meeting by asking one simple question: "As you all know, Nicolas gave us the task to elaborate scenarios for big data analytics at AUDI. But what does big data analytics mean conceptually? Is it just the visualization of data? Can we distinguish distinct types, supposed there are any?" Suddenly, the whole room was filled with silence. No one in this room had asked themselves this question before this meeting. After a brief period of time, however, Matthias started: "In my opinion, big data analytics is not just the visualization of data—if you provide services, which are just visualizing data, they are reporting services. For analytics, you need at least an analytical model, which derives causalities within data, may it be a model examining the present, the past, or the future." Tobias looked rattled and said: "And what about all the tasks I had to coordinate to get a visualization of our customers configuring their cars in our car configurator as well as the technology stack we have to pay every month to our external provider?" Matthias briefly thought about Tobias' comment and drew a short image illustrating the distinct types of analytics on the backboard (see Fig. 1).

Referring to Delen and Demirkan (2013) he explained: "If you simplify big data analytics services, you can distinguish descriptive and predictive analytics. Both require a technological infrastructure, integrated data sources, and of

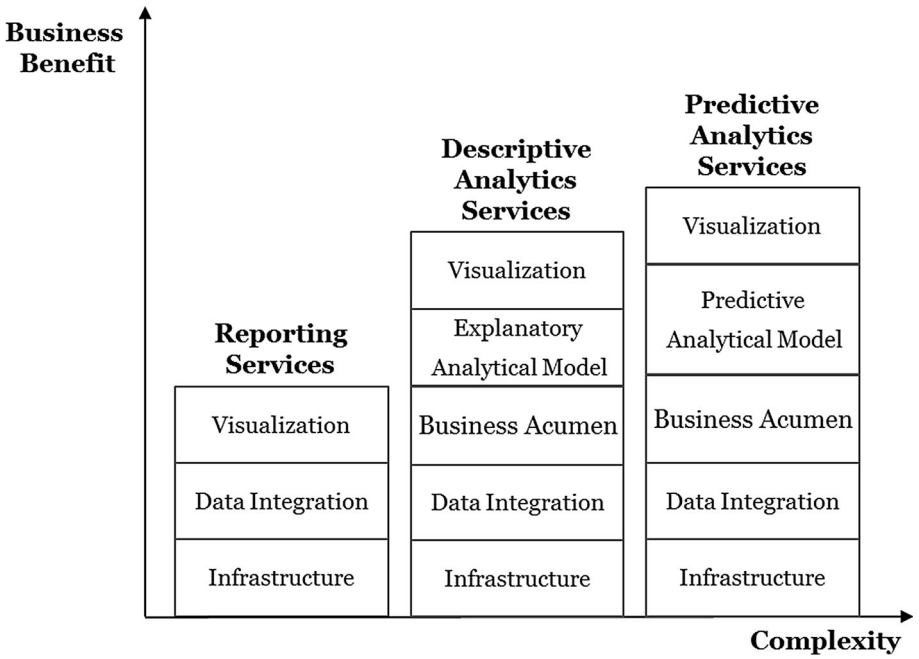


Fig. 1 The distinct types of analytics services at AUDI AG

course the visualization of data. This holds also true for reporting services. However, a descriptive analytics service possibly explains the past or the presence (i.e., what happened or what is currently happening and why is it most probably happening) with the help of an explanatory analytical model. A predictive analytics service on the other hand looks into the future using an additional predictive analytical model. Based on historical data and with the input of current data it explains or extrapolates what will happen and why it will happen. However, both require a certain business acumen since, without any business questions, no answers can be given through any model. Of course, reporting services require business acumen as well, but for the sake of simplicity I neglect it here."

Moreover, Tobias added, that you have to consider the technological characteristics of big data itself as well because they will pose a challenge regarding the technological infrastructure (see Table 1).

In particular, initial projects had shown that a car possibly sends 500 signals per second. Thus, car data will result in immense high *volumes* of data requiring appropriate big data analytics technologies to enable the appropriate analysis. In this context, not every technical system within every car used the same formats and names for the same data points resulting in a *variety* of formats. Moreover, AUDI as recognized brand and through their expensive advertisement videos, for instance, the commercials in super bowls, generated quite a buzz of data in social media, which not always had the desired amount of *veracity*.

Following this meeting, Hortensie looked up the article "Data, information and analytics as services" of Delen and Demirkan (2013), which Tobias had given her. Soon she realized, that Tobias had not mentioned a last distinct type of big data analytics "prescriptive analytics." Whereas "predictive analytics" used data, text, and media mining as well as forecasting, "prescriptive analytics" uses either optimization or simulation or decision modeling to suggest which action a decision maker should perform based on the analyzed data. She wondered why Tobias had missed out this type but realized soon that developing prescriptive analytics services would be something they could consider in the long run, but right now the technological infrastructure constituting of the technology stack and integrated data sources did not allow prescriptive analytics. Moreover, Hortensie realized that the future organizational unit will have to deliver analytics-as-a-service. Thus, the insights of analytics services will have to be accessible through a standardized interface such as an analytics platform.

Bringing big data analytics to AUDI

Soon after, Tobias and Matthias had identified an external service provider who was one of the leading IT consultancies. After their successful pitch at a meeting with Hortensie and the other team members, this consultancy had the mandate not only to help identify potential use cases for AUDI's sales and marketing department but also to identify potential future work models as well as organizational implications to implement those use cases in the future in collaboration with the task force. After 2

Table 1 Technological characteristics of big data

Characteristic	Description	Exemplary source at AUDI
Volume	High volumes of unstructured, volatile and heterogeneous data enable a company to broadly generate insights, for instance on customer sentiments. The sheer amount of data exceeds the ability of traditional business intelligence systems to process this data	With over 100 sensors, a car produces up to 25 GB of data per hour
Variety	Variety stands for the various formats of data resulting from the many data sources that are often unstructured and inconsistent in their nature. The usage of further data sources increases the variety of data and thus the complexity to analyze these data points. Big data characterizes the shift away from predefined categorizations and data schemas	A connected car needs to communicate with multiple external data sources (such as traffic lights or other cars) as well as with the driver (for instance via speech recognition)
Velocity	Velocity states that big data is produced in high speed requiring real-time analysis to achieve decisive insights	A connected car needs to respond to external conditions in real-time (e.g. critical traffic situations)
Veracity	Data sources like social media produce data that carries no single truth and thus requires big data technologies to assess data accuracy	AUDI needs to interpret social media buzz, to filter out deceptive data, and to interpret ambiguous statements

months and several interviews, Stefan, the senior consultant of *ITConsult*, called Hortensie late on a Thursday afternoon. After some small talk, he started: "Currently, AUDI is contacting the customer through a multitude of contact points such as the website, the car configurator, their dealers, and their car. The interactions of AUDI with its customer produces data that allows to identify customer desires, to elaborate their preferences, and behavior. However, you currently miss on leveraging the potentials of data-driven marketing because of either no integration of relevant data sources or a lack in the competence to do so. Please have a look at Fig. 2, you can see how, on a very generic level, a potential unit could address possible customers, such as AUDI's business units, dealers, and importers in collaboration with an analytics partner, who is capable of conducting the entire process of data connection, exploration, analysis, and visualization."

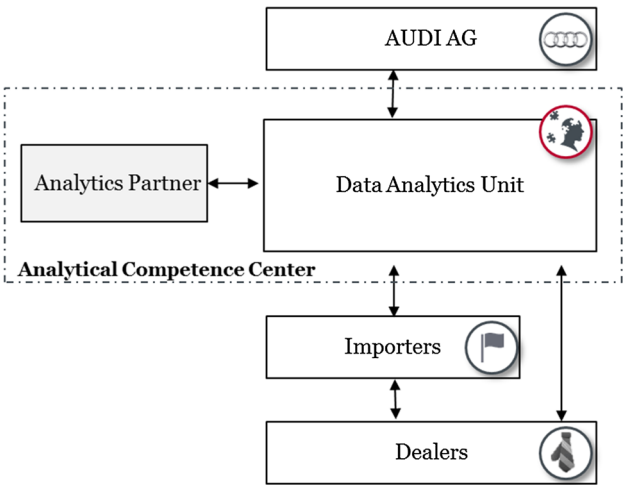


Fig. 2 Conceptual work model of an analytical competence center

He, further noted that, first, an analytics team or a loosely coupled analytical competence center must be implemented to provide analytics-as-a-service. How the implementation takes place is highly depending on how strategically and centralized the sales and marketing department wants to pursue big data analytics. Moreover, it will most probably demand quite some investment for the sales and marketing department. In this context, he handed her Exhibits 2, 3, and 4. The following Monday Hortensie had a meeting with Nicolas. Hortensie showed him the exhibits: "Exhibits 2 and 3 illustrate approaches for an organizational embedding of big data analytics, or, more precisely, of the competencies and capacity we need to succeed in big data analytics through a new subsidiary. This subsidiary, as the strategy department informed me, could not only support big data analytics use cases but also new digital business models and services. Exhibit 4 on the other hand represents the embedding in our existing subsidiary *InnovativeCar*.[2] That way we would minimize our investment, however, this means also that *InnovativeCar* as supporter of our engineering departments is taken over tasks, which were traditionally in the hand of the sales and marketing. Exhibit 3 assigns the data analytics unit to the strategy department and thus ensures cross-departmental responsibility. Exhibit 2, however, clearly prioritizes sales and marketing related big data analytics topics."

[2] *InnovativeCar* was specifically created to support new innovative technologies and concepts for cars (e.g., autonomous driving and electric mobility).

After a while Nicolas explained, that his strategy team had already planned to create a new, more agile company that would be able to develop, design, and operate digital services and their business models. In his opinion, that might be one solution where synergies could help not only the development of digital services through big data analytics but also vice versa. He said: "I think one point is crucial. Every future digital service will not only require data, may it be data from the customer, the car, marketing agency, weather agency, and so on, but also produce data on its own. The more we can use big data analytics to our advantage, the better will our services be and thus our value proposition. That is why I want to implement analytics not only in a new company but also in my sales and marketing department, and of course we should not miss out our colleagues at the IT department. However, I still would like to start step-by-step. This is such a new topic. I am not only talking about a re-organization but also about required skill sets. We are at the very beginning of implementing a data-oriented mindset at AUDI. This holds true for digitization but also for big data analytics." Hortensie, replied: "Alright, in this case it would make most sense to go with Exhibit 2 and assign it to the connected retail unit. Here, we are already trying to improve our retail through data analysis, for instance a targeted marketing approach for new models, the optimization of car feature combinations, and feature usage analyses." Nicolas said: "Sounds great to me. Maybe, you could already start with a pilot project to support our introduction of the upcoming e-tron model of the A3 in Germany." Hortensie left partially happy and partially confused. Was she the one who would be the manager of this analytics unit? Nicolas had not said it explicitly but implicitly. The next day, she received the official mail making her the manager of the data intelligence subunit in the connected retail unit. The start of a long journey.

The next day, Nadine came to Hortensie's office after Hortensie had explained the decision to her team in a previous 2-h meeting: "Looks like we will have to build up some new competencies and skills in analytics. However, I am not sure whether I like it to engage with external agencies. This would mean that right from the start we become dependent on external agencies." Tobias replied: "Though I think you are absolutely right, we have no choice but to work with consultancies till we have our subsidiary *Analytics GmbH* which will ensure the technological and analytical competencies through their data scientists, big data architects, and visualization experts." Hortensie had already thought about bringing in external expertise. However, she knew that this will be a challenging task as it meant to implicitly state that right now the IT department and her team cannot provide the technological and analytical expertise required to succeed. However, the creation of the subsidiary was not planned before 2015. After one discussion with Tobias and having reflected on Fig. 1, Hortensie was sure that enough business acumen was already available at the sales and marketing department. In regard to analytical skills as well as some technological tasks, however, they fell short in capacity, skills, and, most of all, experience. Hence, she and her team had to collaborate with external agencies with the goal to substitute the agencies with the innovative subsidiary in the medium term. So, at first Hortensie's team and the agencies developed pilot uses cases with Tableau as well as SPSS Modeler as first tools. Soon, they found pilot customers with whom they carried out first projects in the sales and marketing department.

Finally, when the subsidiary was created, Hortensie tried to sketch how the data analytics unit at sales and marketing, the IT department, and most importantly the subsidiary *Analytics GmbH* would collaborate and work together: "Internally, it's a cross-functional team consisting of our unit, the *Analytics GmbH*, and the IT department to ensure the required capabilities. The data scientists and big data architects need to work with database engineers, the business owner, and people from the sales and marketing department who are advocating for the end user. It will take a lot of collaboration."

Achieving commitment for big data analytics

The respective parties had to adopt an attitude that values data along with a data-specific technical infrastructure. AUDI needed to institutionalize a practice of sharing data in a standardized way across teams, whether it will be sales or manufacturing, and integrate it in a central database. These standards, along with technical systems for warehousing and organizing data, had to be established as soon as possible and facilitated through a defined change management plan.

To elaborate use cases, industry experts, designers, and AUDI representatives collaboratively conducted an innovation workshop. Hortensie and her team was excited about the atmosphere of innovation during these days. However, most of the potential use cases that were identified would only be possible in the future when some homework such as setting up a technology stack and integrating all required data sources would have been done. Nevertheless, the data analytics unit started to think about the key steps to derive insights (see Fig. 3).

In between the discussion rounds, a guest speaker from General Electric mentioned: "GE makes large machines like jet engines and locomotives. GE realized that these big machines are just commodities and the value to their customers lies in telling them more about the machine: What's

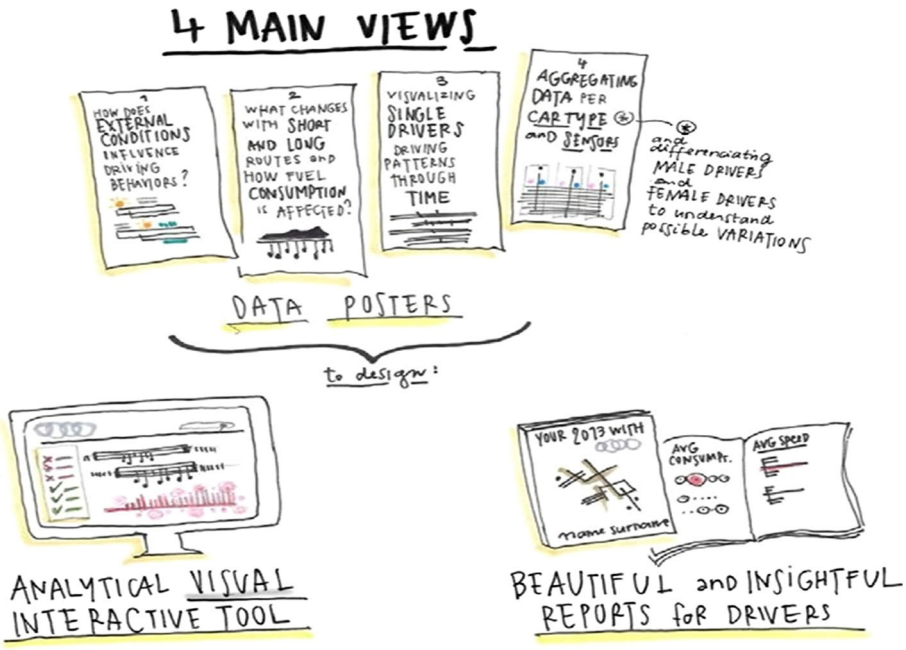


Fig. 3 Deriving value from AUDI's data

wrong with the machine so they can maintain it more efficiently. How the machine is performing so its performance can be increased. When the machine will need maintenance so they can schedule the downtime. What they do is put sensors on the machine and what I do is look at all this data coming in, look at the people who are going to use that data, find out what metrics are useful for them, and present it in a way that makes sense for them." Hortensie reflected on this interesting comment—of course AUDI was as well producing some kind of machine that the customers are using to get from point A to point B. Thus, the similarities to this comment were obvious to her. Another participant mentioned: "Oftentimes data means uncertainty. That's the biggest source of hesitancy in larger companies. People ask: Is this is a science experiment? That is a blanket term, with a little bit more understanding and empathy, companies could actually differentiate between a moon shot and what actually makes very clear sense."

Hortensie summarized the workshop: "Both the creative teams and industry experts emphasized the importance of first defining and understanding the end user. Data should be thought of as adding value for the customer: as something that might be given back to customers as a meaningful service. In order to engage with users, especially as concerns over data privacy and ownership grow, human-centered design methods and a focus on user experience should drive the development of new products and services. Your shared advice included activating emotion, drawing on both convention and novelty, and empowering users as active participants."

This workshop resulted in a multitude of ideas for new use cases, for instance the optimization of marketing approaches based on sociodemographic information and customer sales data or the optimal planning of sales numbers based on historic information. Moreover, the teams had created a quick proof-of-concept for a reporting service that describes the usage of AUDI connect (see Table 2).

As a starting point, the business analytics unit developed a pilot use case for the service MicroTargeting (see Table 3). To do so, the respective data were gathered in the form of a data snapshot, because the technological infrastructure had not yet been set up. The data included internal data from AUDI AG and importers (e.g., purchase history and car specifications of the analyzed car) and were enriched with external data (e.g., sociodemographics, sociogeographics, behavioral variables, innovation affinity, and price sensitivity). Afterward, the data were visualized with the help of a visualization software to elaborate the data richness and quality. Next, an analytical model was developed and, in a second step, an analysis of the data screenshot took place using clustering analysis to group similar customers. At last, the results were visualized a second time in a customer-specific dashboard.

Although the first pilot projects led to an initial commitment for big data analytics, the unit did not manage to create solutions that could be leveraged in a standardized way across all countries. One major reason was the data-centered development of services. Based on available data, use cases were identified with one pilot customer. The interest of all potential customers was not required. However, the first pilot cases needed data from the sales and marketing business units. Although, of course, big data

Table 2 The analytics service "AUDI connect usage" (proof-of-concept)

Illustration

Description
This service reports the usage of AUDI connect on a country level. It helps to analyze and plan the coverage of AUDI connect services.

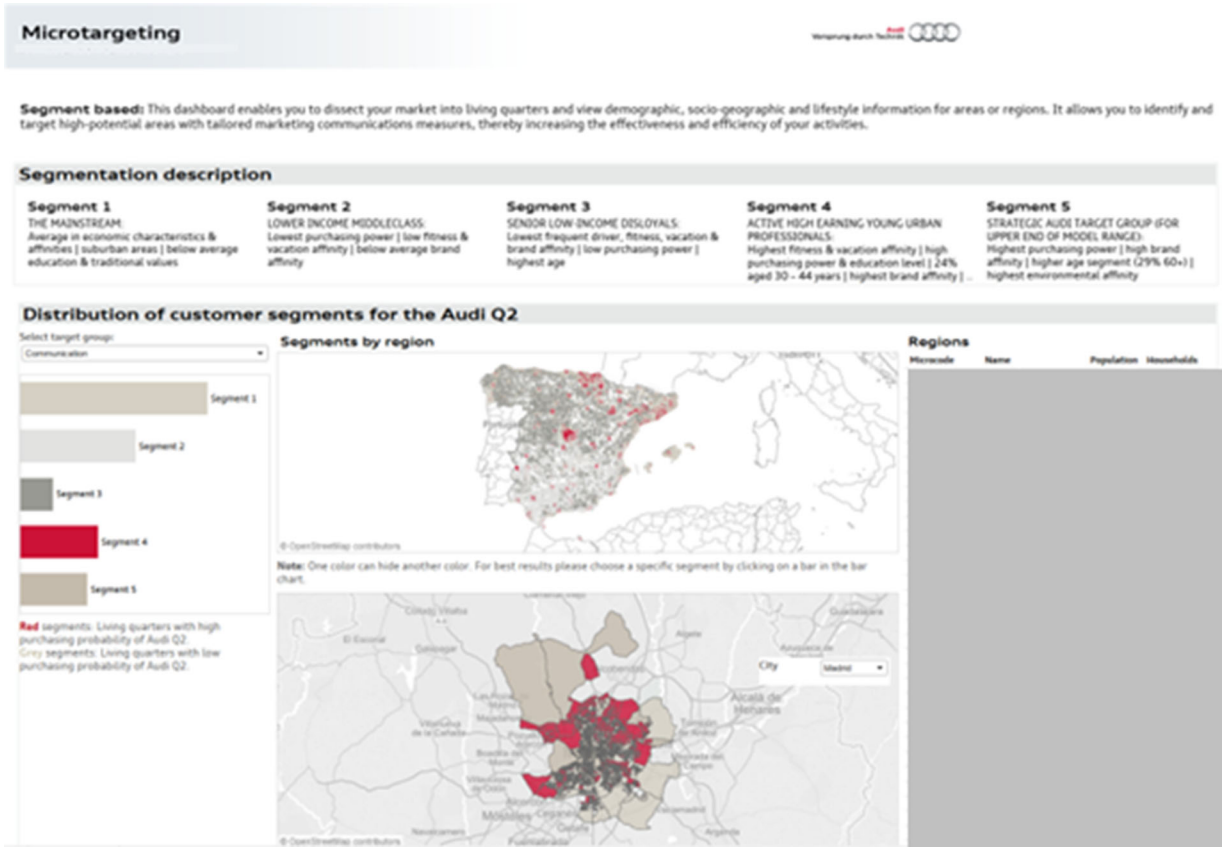
analytics would be used for the benefit of the whole company, Hortensie and her team struggled to get access to relevant data sources due to a lack of understanding of the benefit of big data analytics, power issues as well as departmental boundaries. For instance, Nadine had to collect the data of A3 customers to develop in collaboration with *ITConsult* the service MicroTargeting. In a meeting, she received the answer: "Sure, we have the data of previous AUDI A3 customers, but not only we do not have any statement of our management to share the data but also I do not get the point how your service should help our customer targeting at all."

Equipped with statistics of the pilot use cases, she replied: "We improved our targeting by 10% in Spain and our project in France shows comparable results. Contacting customers based on big data analytics instead of just sending any customer advertisement is what Premium car manufacturing is about. Or do you want to lose any customer just because we are not able to collaborate and share data?" This was not the first time she had to talk straight to get access to data, and she knew it would not be the last. That moment she remembered how Stefan had explained to her: "AUDI is currently too much characterized by parties that try to improve the business of their single unit instead of improving the whole company. Big data analytics, however, as technology innovation requires a mindset of data-sharing."

Hortensie received quite good feedback for this proof of concept: "Microtargeting is like a good sales man in my dealership…if we have a look at the fluctuation it's of real high value to have data-based evidence standardized and storable." The positive response to MicroTargeting led to further awareness for data analytics at the sales and marketing department on executive, managerial, and operative levels. That way business units at the sales and marketing were more willingly cooperating with Hortensie's team and sharing their data and ideas. This resulted in further follow-up projects requiring both Hortensie's team and the *Analytics GmbH* to hire more employees.

Table 3 The analytics service MicroTargeting (proof-of-concept)

Illustration



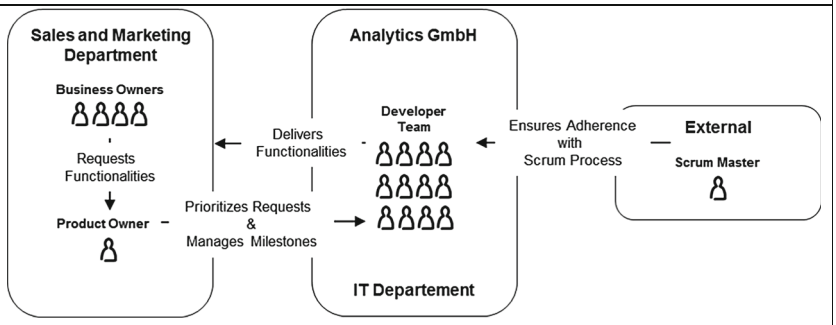
Description

The analytics service MicroTargeting is engineered as a combination of a descriptive analytics service and the visualization of additional data. Its goal is the description of the demographic distribution of customers for a specific car model (e.g., A3 e-tron) to sharpen the marketing approach by better addressing the target group. The service was, specifically, developed to gain knowledge of the customer base and their need for certain products. The Microtargeting dashboard allowed for in-depth analysis of potential at both area and customer level. Initially, this service was created because of a decision on executive board level to improve the targeting of potential A3 e-tron customers in Spain.

Challenge

Depending on each market new market specific data had to be gathered and were not always available in the right quality and richness. Consequently, having built the analytical model the biggest and continuous challenge when developing and delivering the MicroTargeting service was the acquisition of market specific data. Therefore, the effort for delivering the service to a new customer did not decrease but stayed instead on the same level. Moreover, the variety of data sources in the different countries of AUDI importers resulted in country-specific solutions, which is against the paradigm of analytics-as-a-service.

Table 4 Developing analytics services using scrum

Definition	The basic notion of scrum is to deliver incremental value for the product in an iterative way. It is reflected by the basic unit of development: the sprint. Each sprint has a length of two weeks and starts with a sprint planning, which defines the scope of work in the form of user-stories that has to be done in the iteration. All team members update each other daily about their progress in a 15min daily scrum call and once per sprint the backlog refinement and retrospective are performed. Each sprint ends with a sprint review in which the development team presents the work results to the stakeholders. Due to its cross-functional nature the scrum team incrementally builds the full analytics service by ensuring the integration of the data into the data warehouse, the design and implementation of the necessary analytics to the handover of the analytics service to the regular IT operations. The scrum process helps as well to solve the challenge of evolving requirements for analytics services as those new requirements can be implemented incrementally in a new iteration.
Roles and Relations	 • Product owner: Staffed by the AUDI sales and marketing department, the product owner bundles the requests and needs of the stakeholders (Business Owners) and formulates them in the form of user stories. He prioritizes those user stories in the product backlog and ensures that features and milestones for the individual projects are met. In parallel the product owner acts as link between the program steering board, the external business owners and the development team. • Development team: The cross-functional development team consists of members of the AUDI IT and *Analytics GmbH* and spans competences from operations, data handling/integration, analytics to UX and visualization skills. • Scrum master: Externally staffed, the scrum master ensures that the regular scrum process is followed and helps the development team to successfully remove impediments to delivering the product goals. He puts a focus on continuous internal improvements of the team.

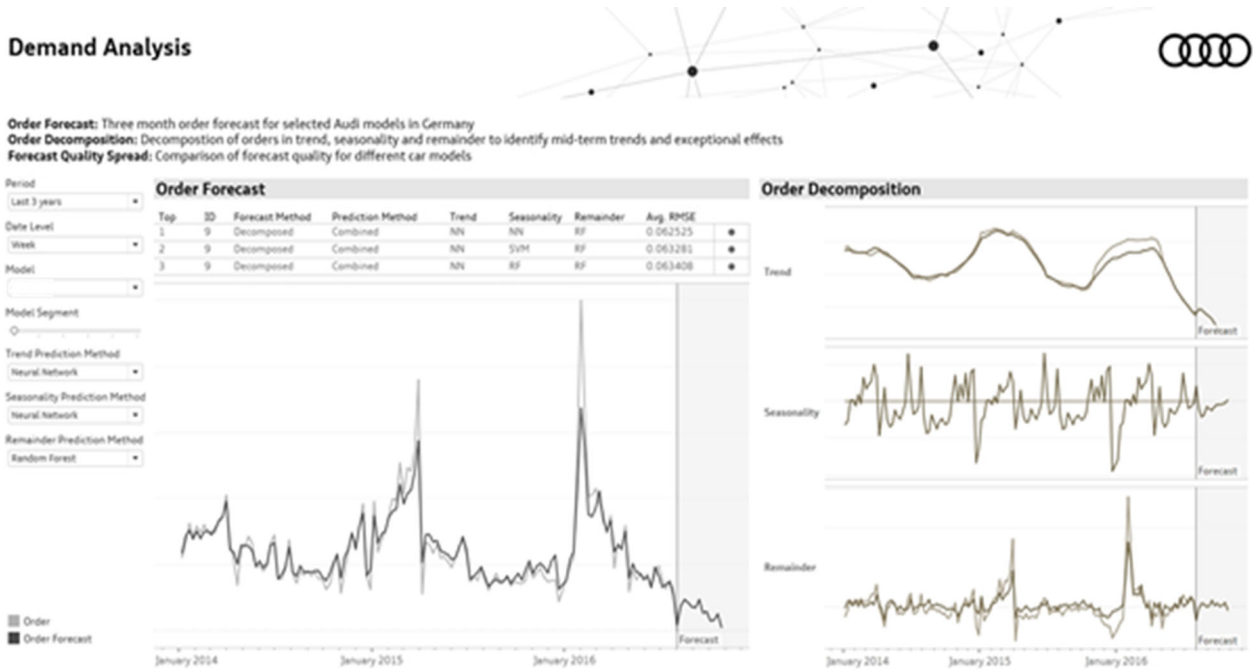
Achieving the value of big data analytics through scrum

With the growing importance of Hortensie's unit and big data analytics at AUDI, the number of projects rose and the fulfillment of each project in time was near to impossible. Matthias, who was planned to act as program manager for the analytics initiative, proposed to try out the agile software development method scrum to use the resources available in the best way and to prioritize the resources according to the strategic relevance for the success of each project. He made a one pager explaining scrum in general and the roles needed to develop analytics services (see Table 4). After his explanations, Hortensie realized working with big data necessitates a variety of design methodologies and approaches including design thinking and agile software development. She deemed agile software development and, in particular, scrum as appropriate because it ensures that requirements and solutions evolve through collaboration between self-organizing, cross-functional teams, and it promotes evolutionary development, prompt delivery, and continuous improvement. Moreover, it encourages rapid and flexible response to change.

Having the subsidary with analytical and visualization expertise in place, Hortensie let her team implement the scrum process to follow up on additional valuable pilot cases such as stock time reduction of used cars, a detailed analysis of AUDI connect, prediction of repurchases, and identification of factors influencing the selling of cars. Besides others, the service Demand Analysis was developed with the help of the newly implemented scrum process (see Table 5).

With the success of MicroTargeting and Demand Analysis, Hortensie and her team were increasingly

Table 5 The analytics service demand analysis (proof-of-concept)

Illustration

Description
From its early roots, the analytics service Demand Analysis was designed as predictive analytics service. Its goal was to anticipate order entries for 3 months in advance. This helped to optimize the spending of media budgets as well as sales commissions based on data-driven analysis instead of experience and gut-feeling. The service used sophisticated analysis methods (e.g., machine learning and neural networks).
Challenge
Developing an analytical model to predict the future order entry posed two major challenges. First, data that could be used from AUDI systems was not always complete. Second, the effects that elevated previous order entries were not always known and were thus not correctly interpreted by the analytical model.

confronted with how to manage all the data sources available at AUDI. Tobias had the task to illustrate the most important data sources depending on their hidden business value, capturing the eventual case that an analysis with this data would become possible. He reasoned, that the more the data are related to the core product of AUDI—the car—the more the value rises as AUDI as company is the only organization that can actually access this kind of data if they act within privacy and legal guidelines. Consequently, he sent Table 6 to Hortensie.

Presenting Table 6 Tobias explained: "Car data is by far the most valuable data source we have right now. However, it is not only the most valuable but also the most difficult one to transfer to our big data landscape as our cars are always moving and the data itself is highly critical to privacy. Customer and web data on the other hand is mostly available

Table 6 Data sources and their value

Data source	Data	Value
Car data	Car model-code	Very high
	Car identification number	
	Purchasing date	
	Registration date	
	Car model description	
	Model year	
	Engine displacement	
	Engine power	
Customer/web data	Customer ID	High
	Salutation	
	Birth-date	
	Type of customer (business; private, small commercial)	
	Full address	
	Number of car the customer owns	
	Car configurator data	
	Traffic data from website	
Third party data	Sociodemographic data	Medium
	Social media data	

right now and from a privacy standpoint we have already performed all measures necessary to stay within legal and privacy guidelines. As additional data sources 3rd party data is easily purchasable and from a privacy standpoint already anonymized enabling us an easy handling."

Looking at this table, Hortensie reflected whether Tobias did not miss something. Sure, the car was the most important and valuable data source, but she could not abandon the thought of a missing data source. However, these data sources were the most important ones for the sales and marketing department right now. Looking back, Hortensie was surprised what had happened during the recent months. Nicolas had enjoyed the use cases she had presented with her team, she was now responsible for big data analytics at the sales and marketing department, and the first pilot projects to enable the transfer of data from every car model had been started. Yet she knew there was still a long way ahead to turn AUDI into a digital car company.

Assignment questions and teaching note

The students are supposed to take the role of the task force in order to decide which organizational implementation of big data analytics is probably the best solution for AUDI. The project team has to identify the advantages and disadvantages of the diverse potential of implementing big data analytics as well as to identify the most valuable use case for an OEM in the automotive sector.

For the preparation of the class discussion, the students are recommended to prepare the following assignments:

1. Please describe, which technological characteristics are commonly used to describe big data. Which distinct types of analytics services exist? Please, provide one example for each type how AUDI used this type of analytics services within this case.
2. Following Davenport and Harris (2007, p. 118), Porter and Heppelmann (2015), and Ross et al. (2013), should AUDI follow up on a strategic path to implement big data analytics or use a step-by-step approach championed by one business department (e.g., sales and marketing) to prove and implement big data analytics?
3. Please elaborate which of the provided Exhibits (1, 2, 3, and 4) would have been the best solution for AUDI? Why?
4. Which data sources of AUDI have been identified? Which are the most valuable ones and why? Please, provide at least one example for each data source of how AUDI uses or could use this data source.
5. Is big data analytics, a buzzword or an emerging and sustainable technology? Which trends in our daily life as customers might affect the importance of big data analytics?
6. How is the company going to progress through the analytics ladder? Which obstacles does the company encounter and how have those challenges been resolved?

If you are a bona fide instructor, please contact the first author of this teaching case to receive a copy of the supplementary teaching note.

Appendix

See Exhibits 1, 2, 3 and 4.

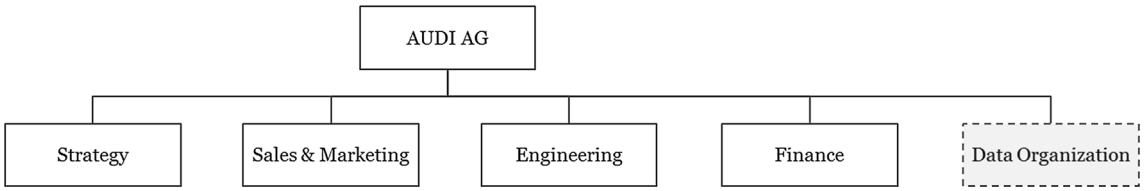


Exhibit 1 Organization chart for a unified data organization

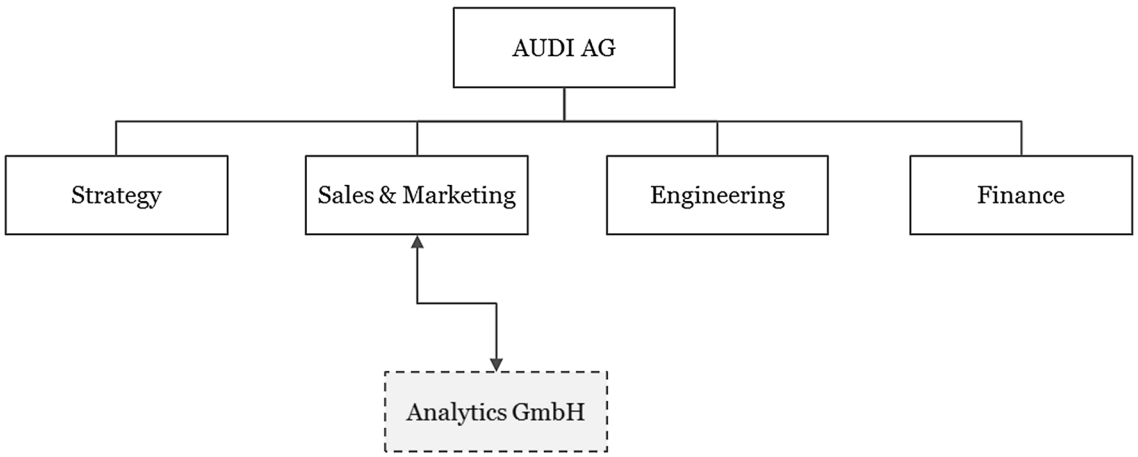


Exhibit 2 Organization chart analytics GmbH in collaboration with sales and marketing

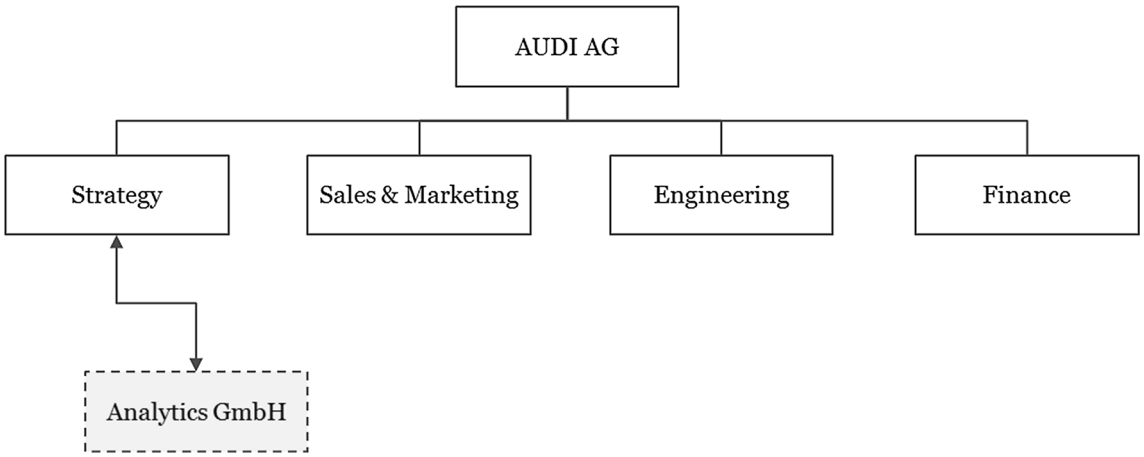


Exhibit 3 Organization chart analytics GmbH in collaboration with strategy department

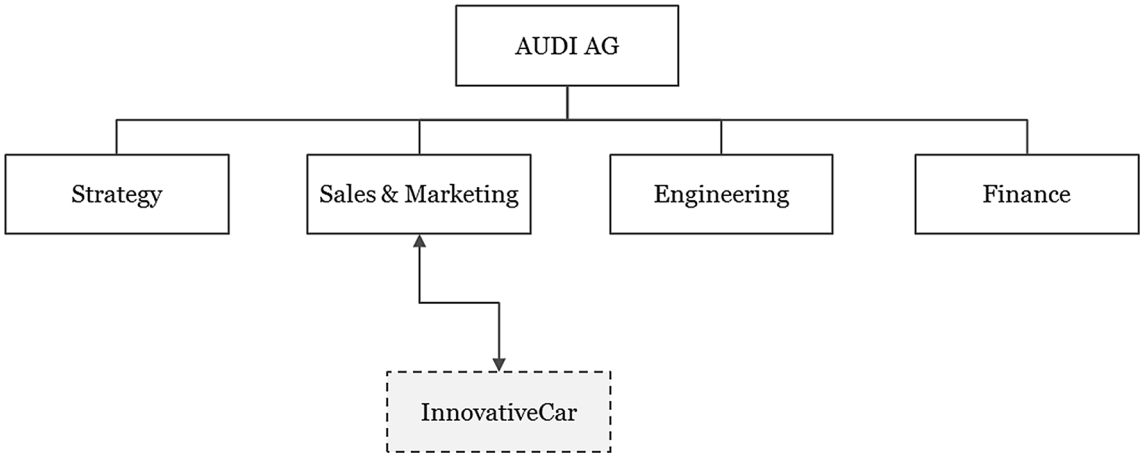


Exhibit 4 Organization chart existing subsidiary *InnovativeCar* in collaboration with strategy department

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Jochen Wulf is lecturer and fellow of the International Postdoctoral Fellowship program at the University of St.Gallen. Prior to this, he was assistant professor at the Institute of Information Management at University of St.Gallen (IWI-HSG), Switzerland. His research focuses on socio-technical systems and large-scale data processing systems, consumer-centricity, and IT service management. Jochen authored more than 50 scientific publications. His research has been published in journals such as Business & Information Systems Engineering (BISE) and Electronic Markets (EM), and presented at conferences such as International Conference on Information Systems (ICIS) and European Conference on Information Systems (ECIS).

Annegret Maier is responsible within AUDI AG for the field of Data Strategy and Analytics. Along with her team, she pushes for the usage of data analytics to support business decisions and how data can be used to enable personalized digital experiences for the users and customers throughout all online touchpoints worldwide. The strategic direction of data usage within Audi, with a special focus on the connected vehicle and car sensor information, falls into her responsibility.

Walter Brenner is professor joined St.Gallen University in 2001 after having held chairs at the University of Essen (Germany) and Freiberg University of Mining and Technology (Germany). He received a graduate degree in business administration and a doctorate from the University of St.Gallen. His research focuses on information management, consumer data, innovation and digital industrial services. He has authored and edited 30 books and more than 300 publications. Brenner also practices as a consultant and is an entrepreneur. Prior to joining academia, he was Head of Application Development at Alusuisse-Lonza AG (Switzerland).