Business Model Innovation for DaaS and AaaS Companies

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ABSTRACT: DaaS and AaaS companies struggle to choose for an effective revenue model. Revenue models as a variable of business models have a significant impact on business profitability. Literature has not addressed the gap of revenue models in the DaaS and AaaS industry, yet. This design study describes an artifact for choosing an effective revenue model. The artifact is a formula that measures business model variables in two projects at Infotopics. Various revenue models dominate specific industry clusters. Therefore, cluster evaluation allows determining potential revenue models. The research proves the results from two sides. On the one hand, there is an artifact which measures benchmark scores for the deviation between company and cluster. The formula evaluates on a business model variable and attribute level. On the other hand, there are the managers´ direct evaluations of the company´s cluster. On basis of the findings, the paper suggests subscription or usage fee model. For a competitive strategy of market growth, the paper suggests usage fee model. For the goal of high profitability, the article suggests subscription model.

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1. INTRODUCTION

Just some years ago, companies started to gather data over channels such as social media, smartphones, sensors and other technologies to leverage the value of data (Hartmann et al., 2016). In consequence, the potential for data analysis increased. The growing popularity in Data as a Service (DaaS) and Analytics as a Service (AaaS) have led to the emergence of a whole range of new business models (Chen, Kreulen, Campbell, & Abrams, 2011). According to the evolution of business models for AaaS and DaaS companies, different kinds and stages of business models emerged. The range of business models for DaaS and AaaS companies causes difficulties in selecting the best business model. Companies lose orientation over what business models are up to date and which is most efficient. Researchers have investigated business models as a whole for the DaaS and AaaS industry, e.g., Hartmann et al. (2016). Moreover, literature has researched pricing for the DaaS and AaaS industry, e.g. Niyato, Alsheikh, Wang, Kim, and Han (2016). This paper fills the gap between business models and pricing, thus the evaluation of the revenue model. For this study, the revenue model describes how a company yields profits. This definition of revenue model explains who pays in which structure for a service or product (Krumeich, Werth, & Loos, 2015). A revenue model is different from a pricing model because it does not provide a price but a structure.

This paper finds a technique to choose the best revenue model per company specialized in data or analytics. Infotopics is settled in the industry of DaaS and AaaS and searches for a more efficient revenue model. Infotopics´ customers usually require the company to give meaning to their datasets, thus allow an interpretation of data to make more sophisticated decisions. In projects, Infotopics typically supervises a customer company concerning their data for a limited time. The time can range from some days to several months. The tasks inside projects include e.g. acquisition of customer data as a basis to start the project, processing and aggregating the data through the program of Alteryx, and workbook building for visualization. A workbook serves as a kind of manual and guides the customer company to visualize data on its own. The offered results of a project are data, information, and knowledge. Data is the output of the Alteryx processing and aggregation. The information or knowledge are generic workbooks and workflows that allow the customer company to handle its data set on its own. A workflow is a generic solution which allows the client company to process specific data types on its own. In the end, Infotopics shares the results on a company server.

DaaS and AaaS are known as service subdomains of Business Intelligence (BI) (Stipić & Bronzin, 2012). DaaS provides an efficient data collection, data storage and providing information on demand (Marini & Bianchini, 2016). DaaS gathers data from different locations and provides infrastructure to share and access these data (Terzo, Ruiu, Bucci, & Xhafa, 2013). Literature shows no full separation between DaaS and software services. Thus there is an interdependence between DaaS and software services (Terzo et al., 2013). Governmental and non-governmental organizations execute DaaS to provide data to users via a centralized

web portal (Zhuang & Lee, 2015). DaaS enables organizations to integrate information, configure distributed enterprise systems and heterogeneous data sources (Cai, Xie, Jiang, Fang, & Huang, 2016). Decisions makers can use analytic tools with AaaS (Delen & Demirkan, 2013). Analytics is a tool to extract value out of data. Analytic tools are typically located in a cloud. The inbound of analytic tools in a cloud can be offered as a service as well. Analytics-as-a-service is less established than DaaS and is considered to be an emerging concept in the business world (Imhoff & White, 2011) Examples of AaaS are data optimization, simulation or automated decision making (Demirkan & Delen, 2013)

"Business models help firms to set a right path to create, grow and retain their business value" (Guo, Wei, Sharma, & Rong, 2017). The most cited definition states that business models present structure, content, and governance of transactions between focal companies and its stakeholders (Amit & Zott, 2001). According to Linder (2000) and Osterwalder, Pigneur, and Tucci (2005), the concept of the business model describes constituent variables. This study refers to the following business model variables (1) key resources (2) key activities (3) offering/value proposition (4) customer segment, and (5) revenue model. The next section explains business model variables further. Teece (2010) describes the relevant variables of a business model as value creation, value proposition and value capture. The revenue model or value capture variable is a focal point in this study. For comparison with other studies, literature uses many synonyms for business model variables such as elements, dimensions, factors, building blocks, partial models, sub-models and parts (Krumeich et al., 2015). The Results chapter shows a business model component map in e3 service style (figure 2). Business model variables have a modular character. The modular nature means that business model variables can be rearranged. Teece (2010) describes the rearrangement of business model variables as business model innovation. Therefore, business models are constellations of business model variables.

This research reveals an artifact for choosing the most efficient revenue model for a business model. Infotopics BV is a company in the DaaS and AaaS industry. Managers think that the enterprise underperforms in its revenue model variable. The current revenue model is hour based payment per employee and customer. For instance, client companies approach Infotopics with a problem. Infotopics provides one or more employees to the project. After that, Infotopics notices costs as accumulated number of working hours per employee. In the case of Infotopics hour based payment causes high administration costs and managers feel potential for a revenue model that captures value from customers better. For this research, managers fill in information about their business model per business model component for the benchmark scores.

The academic value of this paper is manifold. The study presents successful business models for the DaaS and AaaS industry. The study codifies and classifies business models and business model variables on two levels. On the one level, the study categorizes five business model variables and 14 attributes for the DaaS and AaaS industry. Consequently, the classification gives a micro perspective for each company on its own.

The second level of analysis reflects how larger parts of the industry behave. The literature review describes the clusters. The clusters are the macro-perspective in this paper.

The focal research question in this thesis asks: how to innovate revenue models within the context of business models for AaaS and DaaS industry?

1.) What are business model clusters in the DaaS and AaaS industry?
2.) How to classify business model variables for the DaaS and AaaS industry?
3.) How to benchmark the revenue models as a part of the overall business model compared to clusters in the DaaS and AaaS industry?

The paper systematically breaks down business models from broad to narrow to answer these questions. Therefore, in broad it asks for the various clusters in the AaaS and DaaS industry. Next, the research deepens by identifying the composition and critical service variables of AaaS and DaaS. The paper investigates the variables taxonomically. Afterward, the study inquires the consequential business models of DaaS and AaaS clusters and the business model variables. Consequently, the third subquestion builds on the previous two. The e3 service tool illustrates the benchmark analysis (Razo-Zapata, de Leenheer, & Wieringa, 2015). Moreover, the developed formula measures business model variables and suggests a revenue model which is common in the evaluated industry cluster.

Subsequently, the paper is structured like chapter two; the literature review reflects past research about the evolution of business models for DaaS and AaaS. Naturally, the literature review provides basic definitions of business model variables, especially the revenue model, attributes and background knowledge. Chapter three, the methodology shows how the knowledge is gathered and introduces the central artifact of this research, a formula. Chapter four, the Results section shows a general map of possible business model component constellations. Furthermore, the Results indicate two tables about difference measurements between two Infotopics´ projects and the population represented through clusters. Chapter five, the Discussion reflects on differences between project measurements. The fifth chapter discusses the impact of the results for the Infotopics and further research. The conclusion summarizes the results.

2. LITERATURE REVIEW

This chapter illuminates the reasons why a revenue model is successful in a given context. First, the section describes the clusters, then the business model variables that make up the clusters. In the end, this chapter addresses revenue models. This chapter discusses the revenue models in more detail. This chapter informs the reader about revenue models in the DaaS and AaaS industry. The literature search is executed by a snowballing system. The researchers investigated different combinations of key terms in “Scopus” and the “Web of Science.” The examined keywords are Data as a Service (DaaS), Analytics as a Service (AaaS), BI, BI&A, Big Data, data-driven, revenue model, pricing model, business model, capture value. The scarcity

of previous research in the field created a need to vary in search terms. However, the articles were reduced to management, business, economic and computer science papers and significance to the topic. For deeper research associated literature from reference lists were investigated more precisely. This research also gives feedback on the study of Hartmann et al. (2016) as constructive criticism and feeds forward in the sense that it develops a formula for revenue model choice. The methodology explains the details of the formula.

In recent years researchers have studied the field of business models, business model variables and the contextual clusters for the DaaS and AaaS industry. The clusters that are a topic in the first step are retrieved from Hartmann et al. (2016). The reason to choose the clusters from Hartmann et al. is that they have pioneered clustering for DaaS and AaaS, but at the same time the study appeared just one year ago. Therefore, the cluster is young and probably has not changed fundamentally. Furthermore, Hartmann et al. (2016) provide clear taxonomy about data-driven business models. Moreover, the authors use data driven as a synonym to DaaS and AaaS which becomes evident in the taxonomy. The business model component map (figure 2) shows the most important elements of the Hartmann taxonomy in a transformed way. The map shows relationships between business model variables which the taxonomy does not.

Knowledge about clusters is essential in this research because the clusters describe conventional compositions of business model variables in a population. The study is interested in showing these clusters to enable an industry-wide comparison of revenue model application. The study discusses five types of business model variables subsequently in this chapter. However, the revenue models as part of business model clusters are the central subject of the study. On the one hand, the revenue model investigation fills the named gap in the literature, on the contrary, revenue model research supports the choice of an appropriate revenue model. In the end, this chapter discusses revenue models due to its centrality in this research. The chapter illuminates the reasons why a revenue model is successful in a given context.

Business Model Clusters

Table 1 shows a compressed version of the clusters on the business model scale. Originally, the table displays percentages of representation of attributes per cluster. Table 1 is adapted to this research by the Ranked Order Centroid (ROC) method (Barron & Barrett, 1996). The Methodology introduces the ROC method as part of the formula in more detail. The table shows the attributes per cluster. The first column lists the business model variables. The second column shows the business model attributes. The cells demonstrate the rank of each attribute per cluster. A zero means that the attribute has no relevance for the cluster; a ten means that the attribute appears in each company that is part of the cluster. For example, the meaning of the cell target customer/B2B row for cluster (a) with a rank of 7 means that B2B cluster makes an important target group for most companies in the cluster a. The clusters themselves are named as (a)“free data collector and aggregator”, (b) “Analytics as a Service”, (c) “data generation and analysis”, (d) “free

data knowledge discovery", (e) "data aggregation as a service", (f) "Multi-source data mash-up and analysis". Logically, each of these clusters has its own characteristics.

Difference/Cluster		**a**	**b**	**c**	**d**	**e**	**f**
Target customer	B2B	7	10	6	9	8	9
	B2C	5	2	5	2	3	2
Key activity	data generation	5	0	10	5	2	7
	data acquisition	2	2	1	2	2	3
	Processing	10	2	0	0	10	9
	Aggregation	1	8	7	9	0	9
	Analytics	2	10	6	4	3	6
	Visualization	10	4	2	3	8	5
	Distribution	4	0	1	5	0	4
Offered result	data	1	0	0	0	0	1
	Information/knowledge	9	10	9	10	8	10
	non-data product/service	0	0	1	1	0	0
Key resource	external data	10	10	5	10	10	10
	internal data	4	4	10	2	2	4
Revenue model	Asset sale	0	0	2	0	0	0
	Lending/renting/leasing	**1**	0	0	0	0	0
	Licensing	0	0	0	0	0	0
	Usage fee	**1**	**1**	**1**	**2**	0	0
	Subscription fee	**5**	**5**	**4**	**6**	**3**	**4**
	Advertising	**1**	0	**1**	**1**	0	**1**

Table 1: Cluster characteristics (Hartmann et al., 2016)

The data-driven business model framework by Hartmann et al. (2016) primarily builds on the investigations of Chesbrough and Rosenbloom (2002), Hedman and Kalling (2003), Osterwalder (2004), Morris, Schindehutte, and Allen (2005), Johnson, Christensen, and Kagermann (2008) and finally Al-Debei and Avison (2010).

Business Model variables

The five business model variables are (1) key resources (2) key activities (3) offering/value proposition (4) customer segment, and (5) revenue model. Each of these variables has two to six attributes. The following paragraph gives an understanding of these business model variables. Business model variables are printed bold attributes are underlined for a better differentiation.

(1) **Key resources**: Resources are the foundation of companies to create value (Wernerfelt, 1984). Earlier, company resources were defined as "all assets, capabilities, organizational processes, firm attributes, information, knowledge controlled by a firm" (Barney, 1991). Data is one but not inevitably the only key resource in DDBM frameworks. Data is focal and types of data need to be understood. Negash (2004) differentiates between internal data and external data sources. Internal data means data are drawn from IT-systems (e.g. ERP data), self-generated data for a specific purpose, through tracking (e.g. the web-navigation or sensor data), or crowdsourced data generated by a broad group of contributors over the internet or social collaboration techniques (Gartner, 2013 http://www.gartner.com/it-glossary/). External data includes acquired data from data providers, data provided from customers or business partners and freely available data at no fee. Free available data can be further categorized into open downloadable data, machine readable and structured without processing in advance (Lakomaa & Kallberg, 2013). Social media data means e.g. networks such as Facebook. Web-crawled may be openly available but needs to be further electronically refined (e.g. blog entries).

(2) **Key activities**: This paper uses the classifications of key activities data generation, data acquisition, processing, aggregation, analytics, visualization, and distribution. Data generation examples are crawling internal sources, tracking sensors or crowdsourcing (Hartmann et al., 2016). Other authors refer to data generation or acquisition as retrieving data (Otto & Aier, 2013) or gathering and organizing (J. Rayport & Sviokla, 1996). Processing refers to data mining, (Fayyad, Piatetsky-Shapiro, & Smyth, 1996; Otto & Aier, 2013), selection of data set for the following analysis, data cleaning, data reduction or transformation to reduce the number of variables (Fayyad et al., 1996). Visualization and distribution remain as commonly used terms in literature.

(3) **Offering/value proposition**: The value proposition is "the starting point of any business model" (Harry Bouwman & MacInnes, 2006). Barnes, Blake, and Pinder (2009) describe value proposition as the "expression of the experience that a customer will receive from a supplier". In the context of data, the offering involves raw data, information/knowledge, thus data with a meaning, or non-data products/services that do not fit the first two groups (Fayyad et al., 1996).

(4) **Customer segment**: customers were classified as B2B and B2C customers (Morris et al., 2005; Osterwalder, 2004). This segmentation is used in this paper because it is simple and demonstrates two basic and important customer groups at the same time.

(5) **Revenue Model**: There are seven common differentiations in revenue streams: asset sale means the exchange of ownership rights of goods and services. Lending/renting/leasing is selling of usage rights of an asset. Licensing is the sale of intellectual property (IP) for a limited time. Usage fees charge per use of product/service. Subscription fees charge for a certain period. Brokerage fees charge for an intermediate service or advertising (H Bouwman, Faber, Haaker, Kijl, & De Reuver, 2008; Osterwalder, 2004; Osterwalder & Pigneur, 2010).

Revenue models

In general, asset sale is the process of selling ownership rights to a physical product (Osterwalder & Pigneur, 2010). The "physical product" element in this definition makes this revenue model atypical for service supplies such as AaaS or DaaS. However, some authors refer to asset sale as usage fees, with the difference of single buy action in the asset sale model (Zhang & Seidmann, 2010b). The revenue model of asset sale becomes successful if a company can sell a product once, then the company can increase the quality of a product to such a degree that the customer is willing to buy the improved version a second time for a higher price (Zhang & Seidmann, 2010b). Transfer of ownership rights can cause a quality increase, in contrast to revenue models like licensing or subscription (Zhang & Seidmann, 2010b). One can argue that the persistent transaction of ownership rights for a product weakens the negotiation position of a supplier after the first sale.

Software renting and licensing are revenue models which have been explored a lot in the software industry but little in the AaaS and DaaS industry. Lending/renting/leasing means to grant a customer to use an asset for a limited time (Osterwalder & Pigneur, 2010). Licensing gives customers the right to access intellectual property in exchange for a licensing fee (Osterwalder & Pigneur, 2010). The difference between licensing and leasing is that licensing means the exclusive usage of the property. The following lines use literature about the software industry and bridge over to the AaaS and DaaS industry. In the related software industry, the revenue models have certain characteristics concerning competitive forces, competitive advantages, and factors that impact on the selection of the revenue model. Porter´s five forces analysis can facilitate the choice between renting and licensing. Ojala (2016) states that if the competitive forces of potential entrants, rivalry, substitutes, and suppliers are vigorous, the renting model is dominant. If the buyer is a strong force, then the licensing model is chosen. Furthermore, the marketing perspective can be expanded to a strategy view (Porter, 1980). From a competitive strategy perspective, software renting is a revenue model that fits the strategies of cost leadership or differentiation (Ojala, 2016). Whereas software licensing matches the strategy of focusing. Factors that affect the choice of revenue model beyond Porter's competition forces and strategy are named as well. Literature summarizes factors that point to a renting model as low development costs, flexible pricing and diversification of the customer base. In a particular case of software companies, a study states that the rental model helped to decrease costs related to the installation, delivery,

implementation, maintenance and after-sales support of software (Ojala, 2016). The same study states that rental models give flexibility in pricing to target different customer segments. On the other side, licensing satisfies a psychological customer need; the control of sensitive data through ownership (Ojala, 2016). Some companies demand to keep data in-house for security concerns. These companies have or are willing to create an infrastructure to process data internally. The reasoning, when to use which revenue model can count for both industries. The renting model allows more flexible pricing, which applies for the DaaS and AaaS industry as for software pricing. However, in the DaaS and AaaS industry security concerns about data security can rise as for software. The consequence is that companies asking for data and analytics solutions like to insource services and create an infrastructure to secure its data.

The usage fee revenue model describes a billing process whereby users pay only for the offer they use (Dong-liang & Xue-qiang, 2006). Similar and related billing methods are access fee and a variable fee. If a user has decided to book a service the customer has to pay the access fees regardless of the real usage (Li, Yang, & Zheng, 2012). Variable fees allow dynamic billing without limitation of usage per user (Li et al., 2012). However, usage fees are calculated in dependence on the resources the user occupies, the time the user holds the resources (Park, Park, Han, & Park, 2010). Furthermore, literature explains a segmentation option of usage fees for `basic´ and `premium´ customers (Mazzucco & Dumas, 2011). In the basic-premium usage fee model basic customers have to pay a per-hour fee, premium customers have to pay an upfront fee plus a per-hour fee whereby the per-hour fee is lower than the fee for the basic users. For the extra upfront payment, the premium customers get particular advantages in contrast to basic customers. The distinctive characteristic about usage fee is that the more the customer uses a service or product, the more the customer has to pay (Osterwalder & Pigneur, 2010). A typical application field of the usage fee model is telecommunication (Fruchter, Rao, & Shi, 2006) or cloud services (Dong-liang & Xue-qiang, 2006). An advantage of usage fees is the option of discriminatory pricing through upfront payment (e.g. membership payments) (Fruchter et al., 2006). In the question of choice whether to apply usage fee or subscription model literature suggests a choice in dependence on the situation. If the supply company accepts a smaller market share but aims for higher profit, then a subscription model is advised (Zhang & Seidmann, 2010a). Furthermore, consumer surplus and social welfare are greater or equal if the supplier chooses a usage fee model (Zhang & Seidmann, 2010a). From a user perspective, if the user demands latest software updates, thus state of the art information technology, a subscription model with higher fees on average is advised by literature (Zhang & Seidmann, 2010a). Continuous usage fees would lead to lower total revenues. Prestigious companies such as Microsoft, Oracle or SAS applied subscription model (Zhang & Seidmann, 2010a). For consideration in the AaaS and DaaS context, it is imaginable to implement standardized solutions into software.

In the advertising revenue model fees result from an advertisement for a product, service or brand (Osterwalder & Pigneur, 2010). Content providers such as newspaper dominantly finance their business over advertisement (Bodenbenner, Hedwig, & Neumann, 2011). Consumers pay for goods with money, personal information or time, in consequence of the advertisement revenue model the customers pay with time for advertisements instead of money (Lambrecht et al., 2014). The advertisement displaying company finances its activities (partly) through revenues from advertisers. The literature discusses different opinions about advertisement as a revenue model. Lambrecht et al. (2014) say that consumers prefer free (advertisement sponsored) apps over paying. In contrast, Gupta (2013) states that users not always welcome ads within apps. The discussion is about the mobile app industry. However, there may be interesting parallels to the AaaS and DaaS industry because both industries sell digital goods. Nonetheless, advertisement revenue models seem primarily useful in the B2C industry. J. F. Rayport (2013) names privacy concerns as a critical point in an advertisement which count for businesses even more than for consumers.

3. METHODOLOGY

The aim of this research is to reason for a revenue model inside a business model for the DaaS and AaaS industry. From a methodological perspective this target is reached in several steps (see figure 1). The research is constructed as a design science and builds on two research sites: benchmark scores and managers´ evaluation scores. For the benchmark scores, a mathematical formula tests two projects of a single company with various clusters of DaaS and AaaS industry. Consequently, the results of the test will show deviations from a single company compared with the industry cluster. For a "further evaluation of a new artifact" (in this study the artifact is the formula). Hevner, March, Park, and Ram (2004) advise qualitative assessment of the artifact. This study seeks to confirm the benchmark scores by qualitative research with interviews and observation. In the interviews, the managers stated which cluster they see their company. Beyond confirmation of the artifact, the interviews give additional material for discussion. Additional material for discussion means comments on the completeness of business model map. Especially, about variables or attributes that are missing.

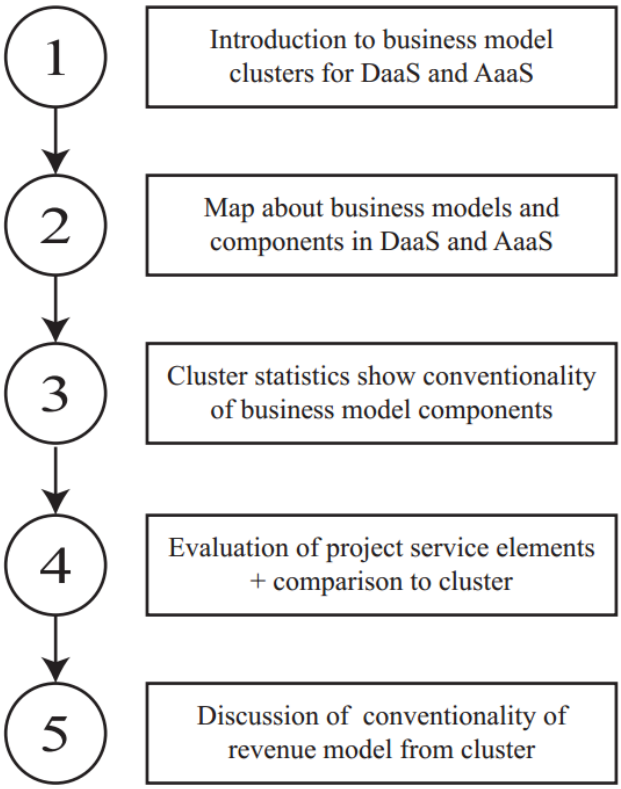

Figure 1: Methodological Design Approach

An additional qualitative research method applied in this research is observation. Observation aims to confirm the validity of the artifact as well. Interviewing has the advantage that the investigation gets an expert insight from the perspective of the supplier company. The expert from Infotopics has profound insight about the company and focal project. However, observation aims to get a neutral view. Observations bridge the perspective of Infotopics and perspective of research. Observation is necessary to have a further justice about the reliability of the artifact and interview value. In comparison to interviewing, observation has not the profound insight into details of the project but a standard view on the company as a whole. Observation delivers additional value to the study because the observing researcher owns profound knowledge about relevant terms and definitions. Therefore, first, the observer can check if, during interviews terms are understood well and second, the observer can validate if the managers´ evaluations are correct because of his bridging position between science and company.

Design approach to identify the appropriate revenue model

The paper introduces clusters of business models in the DaaS and AaaS industry. Thereby, basic definitions are given, thus the meaning of business models in the industry, the meaning of business model variables and the relationship of business model variables that make the clusters. Through preparation in the previous step, the study can map business model variables in the greater framework of typical DaaS and AaaS business models. The map visualizes a business model for DaaS and AaaS by variables, the attributes of the

variables and brings the variables into the context customer-supplier exchange process. Additionally, the map illustrates business models for DaaS and AaaS generically. Consequently, the reader gets an insight into all the single business model variables and how these can be composed. The cluster statistics allow a view of the population of business models. In other words, clusters describe which business model component combinations appear regularly in a population. The business model composition cluster says how business model variables usually make up a typical business model in the DaaS and AaaS industry. Each cluster has one or more revenue models. The characteristic to reflect the revenue model per business model cluster allows in the next step to give an appropriate revenue model per service bundle. For clarification: business model clusters show a typical pattern how business model variables compose of many companies. In contrast, a service bundle shows how business model variables composed of a single company. One focal company evaluates the business model variables of two projects. The central company estimates (a) if the service component attribute appears in the business model and (b) if the attribute appears, what is the importance of each of the attributes of the business model. Moreover, in step four the result of the business model evaluation is compared to the clusters. The exact process of step 4 is further explained later in this chapter. In the final step of this analysis, the study discusses the meaning of the result. The result gives one or more revenue models that are typical in the given cluster of business models. The discussion explains the revenue models with its pro´s and cons for the DaaS and AaaS industry. For an illustration of this process, the study takes the example of Infotopics to play through this process. The example shows how the whole framework needs to be used.

Applied methods

After the introduction of the overall methodological idea, this paragraph argues for the chosen methods and data. From a methodological view, the business model map uses the e3 service method as developed by De Kinderen, Gordijn, and Akkermans (2009). According to the authors, e3 service method is a useful tool to describe services and e-service supplies. Gordijn, Razo-Zapata, De Leenheer, and Wieringa (2012) state that the “e3 service approach takes two perspectives on service composition, namely a customer- and a supplier perspective, and tries to generate a multi-supplier service bundle and the corresponding [service value networks] to satisfy a complex customer need”. In this paper, the e3 service structure is applied in the map (figure 2). The characteristics of the e3 service method to display complex services make the e3 service method valuable for this research about Data as a Service and Analytics as a Service. The focus of e3 service lies on the composition of services (Gordijn et al., 2012). The composition characteristic allows e3 service the application in the field of business models and business model variables. Furthermore, the e3 service method is elementary in this study because it makes the service bundling, thus the bundle of various business model variables visible and understandable. The visibility of the business model variables bundles is crucial for the comparison between cluster and project evaluation (step 4). The map helps to see the business model

cluster and the individual project service bundle. Both business model cluster and project service bundle base on the same business model variables.

The developed artifact to measure the best fit between a company´s business model and the business model clusters consists of two elements. First, the Euclidean distance measure which is well known from cluster evaluation calculations. The Euclidean distance measure is validated by several authors for clustering (Han, Pei, & Kamber, 2011; Mooi & Sarstedt, 2010; Pham, Dimov, & Nguyen, 2005). Next, to the Euclidean distance measure, the formula includes the Rank-Order Centroid method (ROC) (Barron & Barrett, 1996). The ROC method evaluates the importance of an attribute from the perspective of a company. This paper determines the importance from the perspective of the supplier company because interviews have shown that DaaS and AaaS companies are more conscious about what the customer wants. For example, a DaaS and AaaS customer seeks a visualization of a data set and is not aware of the need for data validation in advance. The supply company is aware of this need because it is the expert in the field.

$$SB = \sum_{j=1}^{n} \left| \frac{wj}{10} vj - \frac{Wj}{10} Vj \right|$$

In this formula, the Euclidean distance is measured between the clusters which represent the population of DaaS and AaaS companies and a single DaaS and AaaS supplier company. The ROC method is represented in the formula for the cluster and the company/project perspective through the variables *wj;vj* and *Wj; Vj*. The numerical code of *vj* is limited to a binary code consisting of zeros and ones. One means an attribute is present in a bundle; zero means an attribute is not present in a bundle.

The sum of all *project or company service variables* adds up to the *project or company service bundle*. The adapted formula directly calculates the deviation between *cluster statistics* and the *project or company service component*. The calculation of the difference between business model component clusters and project or company service bundle evaluation is the core of this study. The smallest difference between one cluster and the project or company evaluation means that the revenue model fits the service bundle offer of the focal company the best.

Data gathering and data usage

The analyzed data consists of two different data sets. (A) The data set describes the business component clusters. (B) The other data set is the evaluation of two projects´ business model variables by Infotopics employees. This study investigates two company projects because different projects have different customers. Each client has a differing want. In consequence, supplied services and business models can vary. For instance, some projects require data acquisition while other projects do not. Consequently, these differences between projects lead to different suggestions for revenue models.

(A) The data set describes the population of business models from 100 companies in the DaaS and AaaS industry (table 1). This paper uses data from the Hartmann et al. clustering because the procedure of data

gathering is scientific due to the applied methods for data collection and data coding. Furthermore, the structure of the data perfectly fits this research. The business model classification as implemented in this paper consists of 5 business model variables: customer, key activity, offering, data source and revenue model. Figure 2 provides further information about the attributes of the business model variables. The vertical elements on the map show these attributes. This data set is relevant for the first term of the formula to describe the cluster statistics service bundle. In the formula, the data will replace the variables *wj* and *vj*.

(B) The second data set illustrates the importance of business model variables. The data set B can be split into two further data sets, for each project one. Project participants have generated the data sets. A project participant is anybody who participates in the project, thus a supplier employee, a customer employee, a supplier company or a client company. The project participants who generate the data have to be able to evaluate the importance of an attribute inside the business model. The second data set (B) allows a comparison of the first data set (A) through the formula described above. The second data set allows showing a focal company deviations of itself towards the typical cluster.

Unit of analysis: Infotopics

Infotopics B.V. is a company for Business Intelligence (BI) and data visualization. It is founded in 2003 and settled in Oldenzaal, the Netherlands. Now, Infotopics employs 35 members. The company performs in three branches: 1.) by selling licenses for data visualization and analytics software (Tableau and Alteryx), 2.) training for the supplied software programs and 3.) consultancy service provision of total problem solution through data and analytics services. The two projects investigated in this study originate from consultancy service branch. The focal projects have a revenue model of hour based payment. Therefore, the customer companies pay Infotopics for the hours the single employees have spent. Managers assume this hour based payment system as inefficient. For example, a client has a question related to data and analytics. The customer calls Infotopics and gets a fast and precise answer at the phone. Employees can quickly solve the problem due to experience, knowledge, and skills developed inside Infotopics over the past years. However, Infotopics does not charge the customer for the provided knowledge but for the short time of the phone call due to the hour-based revenue model. In consequence, Infotopics is a good example of a DaaS and AaaS company that needs another revenue model to improve value capture. The chosen projects inside Infotopics are exactly such instances that capture value on an hour based revenue model basis. The involved managers know well about the project details, and they are competent to answer questions about business model variables in this project. One of the interviewees is responsible for the strategic outlay of several projects. Therefore, the interviewee is inbounded in various projects directly from the beginning till the end and owns in-depths knowledge about those projects. Other respondents work as business intelligence consultants. These employees have close contact with customers and understand their needs best. They have daily contact with customers.

Qualitative research execution: Interviewing and Observation

For this study expert employees were interviewed for two projects of Infotopics. The workers were conscious of the project details, the business model variables, and business model attributes. The interviewed employees were the same as the ones who offered necessary data for the benchmark scores. The employees did not know the results of the benchmark scores. The interviews served the purpose to confirm or reject benchmark score evaluation. The benchmark scores and managers´ evaluation investigated the fit between clusters and company projects with the difference that benchmark scores studied each attribute in detail while managers´ evaluation investigated cluster differences in total. In this investigation, the interviewees got a description of the clusters as a whole and determined the one cluster the employee sees the company in (Appendix A shows the cluster description). Therefore, the focal question was what cluster shows the best fit with Infotopics. Next, to interviewing, observation is another qualitative research method in this research paper. The observation was applied to guarantee the reliability of interview answers. Insufficient understanding of keywords can be a weakness in research. Observation eliminated this study gap. Observation through the researcher aims to proof the reliability of interviewees´ answers and understanding. Therefore, the observation was executed for four months. During this time the researcher was present at Infotopics and able to understand the business model and revenue model of Infotopics. The researcher observed the supply of project services and communication between customer and supplier company. Therefore, the researcher was introduced into mechanisms inside the enterprise.

Limitations of data, methods, and methodology

This research has limitations through its methodology, data set and data classification. Regarding the data set from Hartmann et al. (2016), there is a static view on business models. The authors suggest adding a more dynamic view of business models. The sample has a limited number of clusters, and the sample size is about 100 companies. Future research can approach business model innovation in a more dynamic way. Krumeich et al. (2015) investigated e.g. in interaction effects between business model variables. The sample size in this study can be increased in a further study, also in the direction of established companies. The e3 service business model map (see figure 2) illustrates that there is a limited number of attributes. These attributes may be extended in future research. Business model clusters in the DaaS and AaaS industry may change over time. Therefore the more time lapses, the greater the need to update the data set from Hartmann et al. (2016). Moreover, the e3 service method is not able to show cost causes or price causes (Razo-Zapata et al., 2015). Furthermore, the e3 service method is not able to improve the business models beyond the given business model variables and attributes. Future research may question if the classification of business model variables and attributes are still up to date. This research innovates business models through a new arrangement of business model variables, thus business model innovation on an architectural level (Bieger & Reinhold, 2011). Nonetheless, this research does not innovate the business model variables themselves.

4. RESULTS

Map about business model variables

The map (figure 2) about the business model variables in the DaaS and AaaS industry is the first result presented in this section. The map gives the reader insight about how business models compose in the DaaS and AaaS industries. The map is created in a style of e3 service as suggested by De Kinderen et al. (2009) for service and especially information service models. The content to fill the map is retrieved from Hartmann et al. (2016). The figure adds nothing new to literature by content but visualizes theoretical background. The visualization helps the reader to understand business model compositions. The map illustrates attributes per business model variable. On the left side of the map processes executed by the customer are displayed. The right side shows the supplier´s component processes. The larger rectangle boxes with elements inside represent the business model variables. The horizontal box inside a business model component box states the variable. The vertical box inside a business model component box indicates the attribute per component as described in the legend. For example, the map can show a business model cluster, thus a composition of attributes; per business model variable at least one. For instance, a DaaS and AaaS company provides Information/knowledge through processing and analytics of data from an external source, the customer. The client is a B2B company and pays the supplier with a year contract subscription model. This example takes from each variable at least one component. In total, this makes the business model.

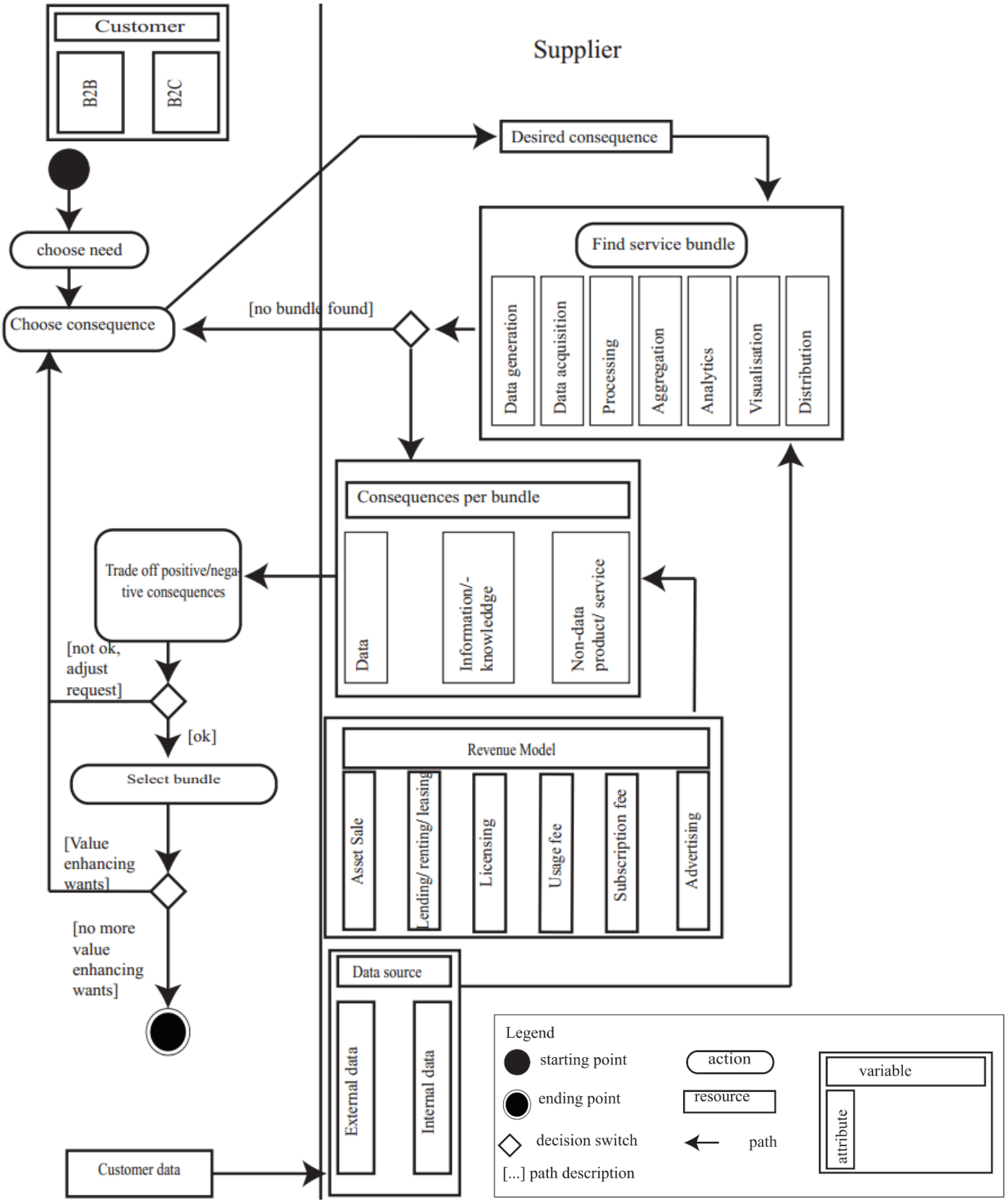

Figure 2: business model component map in e3 service style

Deviations per Cluster by unit of analysis

The central result is table 2 and table 3 as the outcome of the artifact calculation. In this study table, 2 shows that Infotopics differs at least from cluster e. The idea is the measurement of the difference between the cluster and unit of analysis. Table 2 demonstrates the difference between clusters from DaaS and AaaS and the unit of analysis per cluster and per attribute. The columns show the results per cluster from a to f. The rows show the attributes per business model component variable. There are 14 attributes at all. The first column displays the business model component variable. The second column lists the attributes per variable. Each cell shows the calculated result of the formula above. The last row indicates the sum of the business model component deviations per cluster (SB). Therefore, the last line shows the overall result of the whole formula. The cells above the last row show the results per attribute before these values are summed up. The cells above the bottom line state which attributes deviate from the cluster and which results vary not or less. Therefore, these results are displayed in table 2. Logically, the greater the result the greater is the difference between cluster and unit of analysis (Infotopics). The results can range between 0 and 10 per cell. In the

Difference/Cluster		**a**	**b**	**c**	**d**	**e**	**f**
Target customer	B2B	3	0	4	1	2	1
	B2C	5	2	5	2	3	2
Key activity	data generation	5	0	10	5	2	7
	data acquisition	5	5	6	5	5	4
	Processing	5	3	5	5	5	4
	Aggregation	1	8	7	9	0	9
	Analytics	2	10	6	4	3	6
	Visualization	1	5	7	6	1	4
	Distribution	7	10	9	5	10	6
Offered result	data	1	0	0	0	0	1
	Information/knowledge	1	0	1	0	2	1
	non-data product/service	0	0	1	1	0	0
Key resource	external data	0	0	6	0	0	0
	internal data	4	4	10	2	2	4
Difference in sum (SB)		**40**	**47**	**77**	**45**	**35**	**49**

Table 2: Difference between Clusters to Infotopics per variable and attribute for Project 1

bottom row, the result can range between 0 and 140. In this particular experiment, the accumulated sum ranges between 35 as lower boundary and 77 as the upper boundary. In the cells, the whole range between 0 and 10 is represented. Table 2 shows for cluster 2 the smallest deviationTable 3 for project 2 is constructed in the same manner as table 2. In table 3 cluster b shows the smallest deviation between project and cluster, followed by cluster e. The SB results show the same range between 35 and 77.

Difference/Cluster		**a**	**b**	**c**	**d**	**e**	**f**
Target customer	B2B	3	0	4	1	2	1
	B2C	5	2	5	2	3	2
Key activity	data generation	5	0	10	5	2	7
	data acquisition	5	5	6	5	5	4
	Processing	0	8	10	10	0	1
	Aggregation	9	2	3	1	10	1
	Analytics	8	0	4	7	7	4
	Visualization	2	4	6	5	0	3
	Distribution	4	0	1	5	0	4
Offered result	data	9	10	10	10	10	9
	Information/knowledge	1	0	1	0	2	1
	non-data product/service	0	0	1	1	0	0
Key resource	external data	0	0	6	0	0	0
	internal data	4	4	10	2	2	4
Difference in sum (SB)		**55**	**35**	**77**	**54**	**43**	**41**

Table 3: Difference between Clusters to Infotopics per variable and attribute for Project 2

5. DISCUSSION

Benchmark score interpretation

Table 2 and 3 show different cluster deviations for each project. Table 2 shows the smallest difference between business model clusters and Infotopics for cluster e. The small deviation from cluster e means that the sum of overall deviations per attribute is the smallest. Indeed the benchmark scores deviate significantly from managers´ evaluation through interviews. One interviewee stated that Infotopics and the project case matches best with cluster b. The measurement of the benchmark scores does not have the same outcome as

cluster evaluation through managers. However, project 2 (table 3) shows the smallest deviation from cluster b. Consequently, interviews and observation confirm this business model. Nonetheless, both projects have in common, that cluster e shows little deviation.

The following lines discuss the emergence of differences in between the tables. The two projects differed in the offered services namely data acquisition, processing, aggregation, analytics, and distribution and delivered results namely data. Obviously, Infotopics has a broad variance in business models depending on the project and therefore customers. Infotopics supplies services beyond the services listed under the key activity variable. Consequently, Infotopics has a broad supply domain of services which goes beyond what Daas and AaaS suppliers according to literature provide.

In table 2 cluster b shows one of the largest deviations between cluster and Infotopics. Hence, other attributes than the low values make such a great deviation that cluster b has higher overall deviation than other clusters. A new question arises: What are the causes for the difference between managers´ evaluation and benchmark scores? There are several preliminary answers to this question. There is a different perception between business model cluster as a whole and perception of business model component attributes. Therefore, if managers see the full description of a cluster, the manager gets another impression than if the manager sees descriptions of business model attributes that belong to a cluster. Recent studies have shown that perception changes if clusters are reduced (Etemadpour, Murray, & Forbes, 2014).

Qualitative result incorporation

The interviews have shown that the business model map (figure 2) misses a key activity namely data validation. One interviewee stated that data validation is an important factor for data analytics. Furthermore, this interviewee told about the still increasing importance of data validation. Under the variable of key activities, data validation is not listed as an activity on its own. Consequently, the business model map clearly lacks an attribute that has a significant meaning for at least the company under study. Gao, Xie, and Tao (2016) emphasize the importance of data validation and data quality for DaaS and AaaS industry. According to IDC forecasting, the industry of data validation and data assurance will grow in this year 2017 at 27%[1]. High data quality is important because “poor data quality could affect business revenue, waste enterprise resources, lose productivity, and even lead to wrong business decisions” (Gao et al., 2016). To generalize the results from this instance to the industry, we advise controlling the business model variables and attributes used by Hartmann et al. (2016). Articles like Gao et al. (2016) show a rising trend for data validation.

The other significant finding through interviewing is the deviation from benchmark scores. The interviewees have claimed that Infotopics fits best in cluster b. Appendix A shows an overview of all the cluster

[1] Editor of Hosting Journalist, December 18, 2013.

descriptions that the interviewees were confronted. Observation of the company through the researcher confirms this claim that contradicts the benchmark scores from table 2. Triangulation through feedback on the results from other employees from Infotopics confirm the statement of the interviewed managers. Meanwhile, table 3 shows conformity with manager´s cluster evaluation.

Implications for the revenue model of Infotopics

The DaaS and AaaS industry is dominated by the subscription model. Each business model cluster as described by Hartmann et al. (2016) is predominantly occupied subscription model. For example, managers determined cluster b as a best fitting cluster for Infotopics. Subscription revenue model dominates the cluster since half of the companies apply this revenue model. Benchmark scores have revealed clusters b and e depending on the project. In cluster b there is a "1" rank of companies that apply usage fee revenue model and cluster b and e-subscription model (table 1). In consideration of the properties of the two revenue models, the company can choose depending on its strategy. As described in the literature review, subscription revenue model promises a higher profit. On the other hand, usage fee allows greater market penetration. Consequently, sales volume increases. Since Infotopics is a company that grows it can choose the subscription revenue model. Nonetheless, the choice between subscription model and usage fee pricing has not to be an exclusive option. Porter (1980) says that a company can run two revenue models in parallel. Consequently, Infotopics can choose for different customers different models.

This research intends to bridge between business models and pricing for DaaS and AaaS. Therefore, at this point, the paper connects to the pricing models. Sarkar (2015) classifies pricing models into four types for DaaS: request based, volume based, data type based and subscription based pricing. Currently, Infotopics applies hour based revenue model while the primarily advised model is a subscription model. A subscription based revenue model has the advantage of lower administration costs because the company has not to count the hours anymore and can request regular monthly amounts of money. For Infotopics´ customers, predictable budgeting appears as an advantage. However, Ojala (2016) states that customer´s inertia to switch the revenue model can be a problem. The author says that changing revenue model can be problematic even if there are financial advantages for both sides.

Hour based pricing is a cost-oriented pricing scheme. Xuemei Tian, Baur, Bühler, and Bick (2015) suggest a value based pricing for a subscription model. The proposed revenue model switch, therefore, would impact a pricing model switch. For further reading Niyato et al. (2016) suggest a pricing scheme on the basis of the value of information for DaaS. The researchers suggest an optimal subscription fee and optimal data price for service providers.

In general, if the formula would identify a project or company in another cluster, table 1 shows the revenue model. For a more precise look, the Literature Review assesses the trade-offs in between the revenue models which allows alignment of the revenue model to the company´s strategy. For instance, a project is evaluated

as cluster d. Therefore, the relevant revenue models are a subscription fee, a usage fee, and advertising. If a company´s customers and strategy fit to the advertisement, then the company can choose the advertisement model to lower or eliminate costs for the customers. As described in the literature review, the client has to be accessible for advertisement to make the advertisement model effective.

Limitations and further research

The result in this study is not unambiguous but varies per project. Qualitative research of interviewing and observation has not confirmed benchmark score results for both projects. The developed artifact, the formula, is only partly proven. Further research suggests testing a weighting system that pays more attention to business model dynamics. Additionally, the study shows that a key activity attribute is missing. The missing attribute can distort the results. Respondents to the attribute evaluation may have matched data validation with another attribute.

This study serves as a fundament for further research. There is tiny literature in the field of DaaS and AaaS. Majchrzak (2014) warns to generalize a single case study about a design artifact to different environments. Therefore, case studies and field studies have to follow. The DaaS and AaaS industry is an emerging market which means that competition is continuously increasing. Infotopics is an incumbent company, founded in 2003. Infotopics is one of the oldest partners for Tableau and Alteryx (computer software systems for DaaS and AaaS) which questions if Infotopics has a unique position in an industry environment. Suggestion for further research would be a field study about the relationship of business model innovation with revenue models and clusters in the DaaS and AaaS industry to test and develop the artifact further. Finally, the reader has to keep in mind that the generated artifact compares industry clusters to single companies. For a single company imitating competition has not to mean an advantage at all but a benchmark.

6. CONCLUSION

In conclusion, the research has designed an artifact to innovate the revenue model variable of the business model for DaaS and AaaS companies. The managers´ cluster evaluation does not match benchmark results from both projects. In conclusion, single company projects do not represent the business model of the whole company. On the other hand, a revenue model choice on the basis of the enterprise business model as a whole may ignore idiosyncrasy of single projects. Nevertheless, the paper prepared the way for further research. To answer the first sub-question, the paper has ranked six business model clusters according to five business model variables and 14 attributes. Qualitative research suggests a 15^{th} attribute data validation for key activities for future studies. To answer the second sub-question: the study investigated business model variables with a precise look on DaaS and AaaS industry. Furthermore, the study has described trade-offs between revenue models. The last research question looks for an industry benchmark tool. In theory, the paper delivers this tool. Further research has to develop the artifact further for adapted variables and attributes. The central research question: “how to innovate revenue models within the context of business

models for AaaS and DaaS industries?" The answer to this question leads the reader to an artifact which is a combination of Euclidean distance measure and the ROC method. This artifact works by architectural business model innovation. It does not include business model dynamics. Qualitative research suggests an addition to the attribute data validation. Data validation is an advancement of qualitative data acquisition. Therefore, the qualitative analysis part supports incremental business model component innovation. In the end, the developed artifact is a tool to determine revenue models of projects. The study has enabled revenue model choice for companies that know which cluster they fit in.

7. APPENDIX A

Type A: "*Free data collector and aggregator*." Type A companies create value by collecting and aggregating data from a vast number of different, mostly free, data sources, and then distributing it, for example, through an API. Other key activities performed by such companies are data crawling (35 per cent) and visualization (24 per cent). While companies of this type are characterized by the use of free available data (100 percent) – mostly social media data (65 percent) – other data sources such as proprietary acquired data (12 percent) or crowdsourced data (12 percent) are also aggregated by some of the companies. A relatively high share of companies targeting consumers with this kind of offering is observable. For example, companies like AVUXI and CO Everywhere aggregate data from numerous sources on local businesses, such as restaurants and bars, providing it to consumers. An example of such a B2B company is Gnip, which aggregates data from a wide range of different social media sources, normalizes the formats, offers possibilities to filter the data and provides access to the raw data via an API. Besides providing free available social media sources, Gnip is also a premium reseller of Twitter data. Gnip's key value proposition is easy, reliable access to a large number of different data sources through a single API.

Type B: "*Analytics-as-a-service*." Type B companies conduct analytics (100 per cent) on data provided by their customers (100 percent). Further noteworthy activities include data distribution (36 percent), mainly through providing access to the analytics results via an API, and visualization of the analytics results (36 percent). In addition to the customer-provided data, some companies also include other data sources, mainly to improve the analytics. Sendify, a company providing real-time inbound caller-scoring, joins external demographic data with inbound call data to improve the analysis. The scope of the different analytic services varies from fraud detection (Sift Science), improving marketing activities (7signal), improving customer service and relationships (Sendify) and increasing sales (Granify), to generic data analysis (Augify). Companies of this type primarily target business customers with their solution.

Type C: "*Data generation and analysis*." Type C companies generate data rather than relying on existing data. Moreover, many also perform analytics on this data. Firms can be roughly subdivided into three groups: companies that generate data through crowdsourcing; web analytics companies; and companies that generate data through smartphones or other physical sensors. For example, Swarmly provides a smartphone

application whereby users can share their current location and provide details of their sentiments about the venue. Swarmly aggregates this data to provide a real-time map of popular venues such as bars, restaurants or clubs. The second group comprises companies such as GoSquared, Mixpanel or Spinnakr, which provide web analytics services. They collect data through a tracking code embedded in their customers' websites and analyze it. Reports or raw data are provided through a web-based dashboard or other interfaces. The third group is companies that collect data through any physical device, including smartphone sensors. For example, Automatic sells a device that can be plugged into a car's data port and submits data via Bluetooth to the driver's smartphone. Automatic collects and analyses this data to provide feedback on driving styles. Both B2C and B2B business models can be found in this cluster.

Type D: "*Free data knowledge discovery*." Type D companies create value by performing analytics on free available data. Furthermore, as not all free data is available in a machine-readable format, some companies crawl data from the web (data generation 50 per cent). An example of this type is Gild, which provides a service for companies facilitating developer recruitment. Gild automatically evaluates the published code on open source sites such as GitHub, as well as coders' contributions on Q&A websites like Stack Overflow. A scoring mechanism allows them to identify hidden talents. Although the companies in this cluster are homogeneous regarding key data sources and activities, their offerings vary significantly: automated monitoring of review sites for hotels (Olery); recommendation of hotel deals based on analyzing different booking websites (DealAngel); and identifying relevant social media influencers (Traackr, PeerIndex). Both B2B and B2C business models can be found in this cluster. The type of analytics performed by these companies ranges from descriptive analytics (the majority) to more advanced analytics techniques. TrendSpottr, for example, applies predictive analytics to identify emerging trends on real-time data streams such as Twitter or Facebook before they reach mainstream awareness.

Type E: "*Data-aggregation-as-a-service*." Companies in this cluster create value neither by analyzing nor creating data but by aggregating data from multiple internal sources for their customers. This cluster can be labeled "aggregation-as-a-service." After aggregating the data, the companies provide it through various interfaces (distribution: 83 percent) and/or visualize it (33 percent). The areas of application focus mostly on aggregating customer data from different sources (Bluenose) or individuals (Who@) within an organization. Other companies focus on specific segments or problems (AlwaysPrepped helps teachers to monitor students' performance by aggregating data from multiple education programs and websites).

Type F: "*Multi-source data mash-up and analysis*." Type F companies aggregate data provided by their customers with other external, mostly free, available data sources, and perform analytics on this data. The offering of these companies is characterized by using other external data sources to enrich or benchmark customer data. For example, Next Big Sound provides music analytics by combining proprietary data with

external data sources such as view counts on YouTube or Facebook Likes. These business models mostly target business customers.

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