application in section 4.2 and the evaluation in subsection 4.3.

4.1 BI-CSN

The CSN was extended by the mentioned BI specifics to be able to describe BI Cloud service offerings. The new BI specifics were arranged in the BI-CSN shown in Fig. 7. The root of the feature hierarchy is placed at the center of the BI-CSN. The child features are then concentric placed in surrounding rings. Features on the same level of hierarchy are placed on the same ring as siblings, while sub features are placed in the outer sections that their ancestors cut from the pie. Present service descriptions are colored and absent features would be transparent.
The green colored features in Fig. 7 are the new BI specifics, which are added based on factors of BI Cloud service offerings as result of the survey and the consolidation. By using the BI-CSN to describe existing BI Cloud service the coloring represents the service properties. Present features will be colored and absent feature will be transparent. The application of the taxonomy by using the BI-CSN is following in the next section.

4.2 Application

In total, the BI-CSN was applied to eight BI Cloud service offerings. Here, to not over extend this paper, are shown two cases the BI Cloud service *Power BI* from Microsoft and the BI Cloud service *SAP HANA Cloud* from SAP. In the BI-CSN (Power BI in Fig. 8 and SAP HANA Cloud in Fig. 9) the blue colored features means that these features are present and the transparent (white) features are absent. Figure 8 shows the specified BI-CSN for the BI Cloud offer Microsoft Power BI. Microsoft *Office 365* with *Microsoft Excel* and supplemented with Microsoft *Sharepoint Online* represents the main components of Power BI. Power BI follows the SaaS approach and offers the possibilities to visualize, to model and to analyze data for example by using OLAP functions and Data Mining. Furthermore, the analyzed data can be visualized through different types of diagrams. Thereby, Power BI follows the MaaS and VaaS approach. Power BI is based on the Microsoft Platform *Windows Azure* which is hosted in a Virtual-Private Cloud in Microsofts own data centers. The scale of the demand can be performed in self management and the accounting is based on the resources used. Microsoft offers detailed SLA with assurances e.g. in security, maintenance, response times. Support has to be aditionally orded and payed.

Figure 8. BI-CSN for Microsoft Power BI

An other BI Cloud service offering that was used for the evaluation was the *SAP HANA Cloud Platform*, see Fig. 9. SAP HANA Cloud is offered as a Platform as a Service in the sense of a Data Warehouse System as platform service (DWSaaS). On this plattform the VaaS and MaaS offerings *SAP BI OnDemand* and *Lumira Cloud* are deployed. Further considered here, is the platform offering. The SAP HANA Cloud is hosted by Amazon, so that a third party is involved. Just as Microsoft, SAP offers detailed SLA aspects.

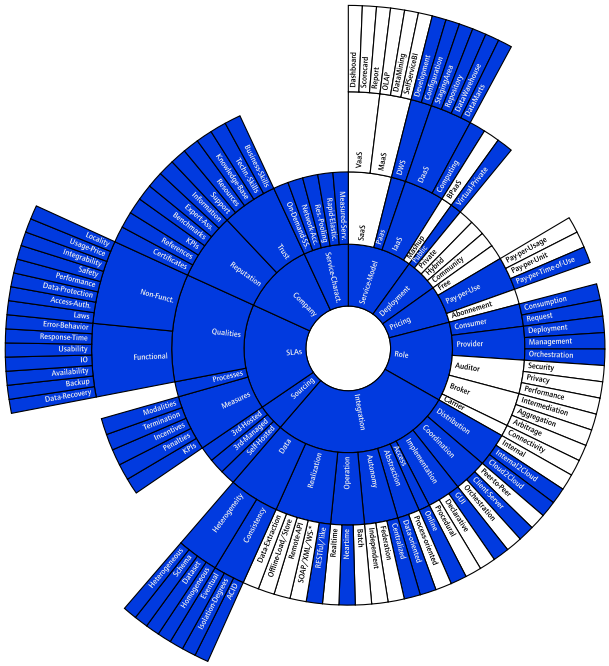

Figure 9. BI-CSN for SAP HANA Cloud

4.3 Evaluation

As part of a comprehensive literature review (see section 2), many approaches in the area of BI Cloud have been discovered. We identified and removed dublicates, unrelevant references and reviews and editorials. We identifies approaches of different groups - that's why our approach is based on a certain wide opinion. On the base of the survey and their analysis, the conceptualization of the taxonomy was performed as part of an interative design science process with repetetive incremental steps. The individual factors of the references were successively compared, considered and consolidated. This ensures that our architecture is on the current state of the status of scientific, industry and governmental and other associations.

The application is importance to demonstrate the feseability. So we took eight BI Cloud offerings and used our taxonomy to describe them (due to the brevity, the application is displayed on two BI Cloud services, see section 4.2). In the application it was found out, that our architecture is completely inasmuch as all features of the observed offerings were covered.

Within expert dialogues on this subject, we presented the taxonomy and the application to several offerings and discussed it. The completeness and feasibility has been confirmed there. By visualizing the consideration deals with the BI-CSN, the comparability showed the visually simple as possible. A comparison of existing factors of a BI Cloud services is easily possible by visually obervation of the specific BI-CSN. Also, with the BI-CSN the requirements of customers can be described and these can simply be compared with existing BI Cloud services to find the most appropriate service.

5 CONCLUSION

In this article, a taxonomy for the description and comparison of BI Cloud services was introduced. This is a tool for orientation and understanding of the subject area BI in the cloud. The taxonomy can also be used to identify and evaluate business needs and to support the selection of suitable offerings.

To help overcome the prevalent skepticism of enterprises regarding BI Cloud services, we surveyed different frameworks for BI Cloud service description. Based on this survey, we proposed a consolidated taxonomy in the form of a feature model to uniformly describe, compare and evaluate BI Cloud services, regardless of whether an organizations own offers or the offers of external providers are evaluated.

In addition, we present the BI-CSN as a suitable visualization technique to describe visually and compare BI Cloud service offerings and requests. Based on the application of the BI-CSN on existing services we evaluated and demonstrated the feasibility and completeness. However, there are several open issues that we consider as future work: The proposed framework should be continuously adapted to the developments in order not to lose validity and soundness by the appearance of new BI cloud service facets. An automatic selection of BI Cloud offerings can be realized by using the taxonomy for describing business requirements and to compare these with service descriptions to find a suitable service for the

considered scenario. Here in particular, existing approaches from the service-oriented field (e. g. service oriented architecture (SOA), unified service description language (USDL) etc.) could be used.
For the future development of BI Cloud systems and services this new domain should be standardized. A standardized architecture could provide transparency, reduce uncertainty and help to raise the potentials. Some questions of enterprise, system and software architecture are not still clear and transparent clarified. Therefore many offerings are in an early maturity and heterogeneous.
With this contribution is a first step in the direction of standardization is done. Regarding the overall goal of the contribution, we consider our work as an important step towards reducing the skepticism in BI Cloud services, since it provides a consolidated view on their features. We delivered a taxonomy that can be used for the description, comparison, selection of BI Cloud services.

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Table 1. Results of Literature Analysis

Reference	***Level of Abstraction***			***Formality***		
	meta model	*aspect*	*instance*	*informal*	*in part formal*	*formal*
BITKOM [9, 10, 11]	X			X		
Gartner [12]	X			X		
BARC [13, 14]	X			X		
SAP [15, 16, 17]			X	X		
Microsoft [18, 19]			X	X		
QlikTech [20]			X	X		
Oracle [21]			X	X		
IBM [23, 24]			X	X		
MicroStrategy [25]			X		X	
TATA [26]			X	X		
Adabi [27]		X		X		
Ouf and Nasr [28]		X		X		
Chadha and Iyer [29]	X			X		
Tamer et al. [30]		X		X		
Grivas et al. [31]		X			X	
Demirkan and Delen [32]	X				X	
Baars and Kemper [2]	X				X	
Gurhar and Rathore [33]		X			X	
Gash et al. [34]		X		X		
Thompson and van der Walt [35]	X				X	
Haselmann and Vossen [36]		X		X		
Seufert and Bernhardt [37]		X			X	
Bernhardt and Balluch [38]			X	X		
Weinhardt et al. [39]	X				X	
Torkashvan and Haghighi [40, 41]		X				X
Leinmeister et al. [42]		X			X	
Schirm et al. [43]		X			X	
Chang [44]		X			X	
Ereth and Dahl [45]		X			X	