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Cloud services pricing models

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Abstract. A major condition for commercial success is a well-defined pricing strategy, however, cloud service providers face many challenges around pricing. Clearness and transparency in pricing is beneficial for all the actors in the ecosystem, where the currently existing abundance of different pricing models makes decision making difficult for service providers, partners, customers and competitors. In this paper, the SBIFT pricing model is evaluated and updated to cloud context. As a result, a 7-dimensional cloud pricing framework is proposed that helps clarifying the possible pricing models in order to let companies differentiate themselves from competitors by price. The framework can be used also as a tool for price model development and communication about cloud pricing. The taxonomy is based on a broad literature review and empirical research on currently used pricing models of 54 cloud providers.

Key words: pricing; revenue logic; cloud; SaaS; PaaS; IaaS

1 Introduction

One of the key conditions for commercial success of cloud services is the clearness and transparency of pricing for both customers and providers [1, 2]. Properly applied, a well-defined pricing strategy can change customers' behavior and it can determine the offering's position on the competitive market [3]. Pricing models influence not only the demand, but have an effect also on the way how users use the product or service, and have a long-term influence on customer relationships [4]. Pricing can also differentiate an offering from the competitors [5, 6] and this way increase the company's revenues and position in the market. Therefore pricing is a powerful strategic tool in manager's hands.

However, because of the rapid technology development and increasing competition in the global markets, price modeling for software products became very complex. A number of studies have also suggested that traditional pricing models are not applicable as such for pricing of software products (e.g. [7]) and the way of pricing software products is also changing [8]. Hence, there is a constantly changing labyrinth around software pricing with many different pricing solutions [8]. For this reason, cloud solution providers may face many challenges around pricing [9] and pricing of IT services is often a neglected topic for many IT managers [10].

For the above-mentioned reasons, there is a need for a clear and systematic pricing framework, developed especially for cloud industry, that helps decision makers find

the proper pricing model and evaluate its alternatives, advantages and disadvantages. Hence, the aim of this study is to examine empirically the applicability of an existing pricing model in the context of cloud solutions and, if needed, propose possible modifications to the model. We seek to contribute to the literature of cloud computing by revealing the most popular pricing models used by 54 cloud solution providers. In addition, we propose a model that managers operating in cloud business can use as a tool to evaluate the proper pricing model for their solutions.

2 Related work

2.1 The SBIFT pricing model

A comprehensive taxonomy of pricing models has been proposed by Iveroth et al. [11], that defines pricing models as systems of price-related characteristics of the agreement between buyer and seller. Price models are described along 5 dimensions, that are listed without priority (see figure 1). According to the authors, price models can be described through the specification of the "positions" on each dimension. The taxonomy is called SBIFT model, that stands for the acronyms of the dimensions.

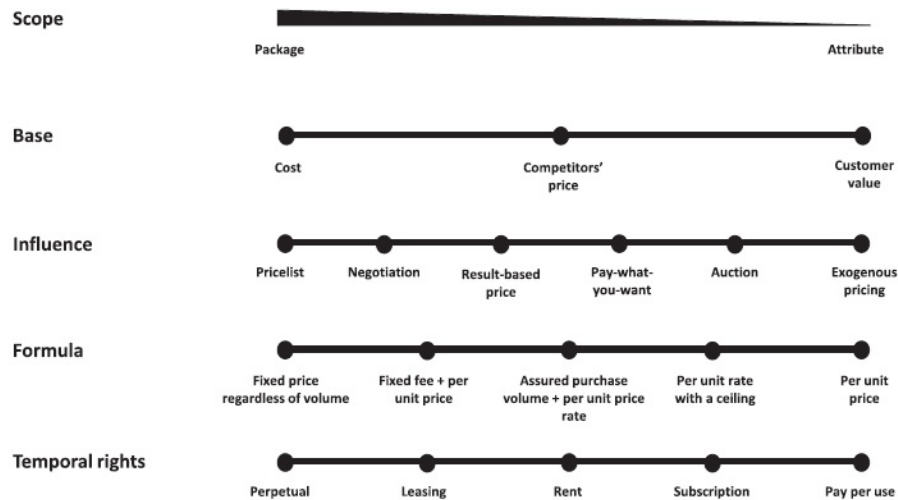


Fig. 1. The SBIFT model [11]

We chose to evaluate this model in cloud context, since it provides the most state-of-the-art and the most integrative work in the current pricing literature. The flexibility of this taxonomy makes it possible to create novel pricing models as a combination of different pricing elements. The model contains pricing elements also from the cloud- and software literature, hence it may be applied to the cloud services easily. The dimensions of the model are presented as follows.

The **Scope** dimension refers to the granularity of the offer. At the left side of the slider, a *Package* of products/services are priced; while the other extreme category is named *Attribute*, referring to the case when each unit of the offer is priced individually and buyers can decide upon buying them or not.

The **Base** dimension refers to the information base that dominates the pricing decisions. *Cost-based pricing* is the most widely used pricing method [12], where the seller determines the price floor based on the cost of developing, producing, distributing and selling the goods. Another pricing formation strategy is setting the price level according to *Competitor's price* of comparable products or services [13]. Using *Value-based* (demand-based) pricing strategies providers define their prices based on the customers' perceived value [10, 14, 15].

The **Influence** dimension reflects the ability of buyers and sellers to influence the price. If the price is decided by the provider alone, this is usually communicated through a *Pricelist*. If the price is set based on a *Negotiation* between the customer and the provider, then the starting point is also a pricelist but the buyer can influence the final price. The next option is *Result-based pricing*, where the price is determined based on some observable result of the product/service [11]. In an *Auction* the price is set based on the customers' willingness to pay and the sellers' influence on the price is limited. *Exogenous pricing* is used if circumstances beyond the sellers' and buyers' influence determine the price.

The **Formula** dimension refers to the connection between price and volume. With a *Fixed price regardless of volume* (flat-pricing, eat-all-what-you-can), customers pay a fixed price, that is independent from the used volume [16]. The *Fixed fee plus per unit rate* formula has two components: a fixed, predetermined, volume-independent part and a volume-dependent part. In case of *Assured purchase volume plus per unit rate*, a fixed amount of volume is priced with a fix price, and an overage price is charged for the extra consumption with the per unit rate. Using the *Per unit rate with a ceiling* formula, the per unit price has to be paid only until a certain consumption-level, and above that the usage is free of charge [11]. In case of *Per unit price*, units (or units per time) are associated with fixed price values and the customer pays this per unit price regardless of the quality or the economies of scale that the seller might encounter.

The **Temporal rights** dimension refers to the length of the time period when the user can use the offering. In case of *Perpetual* offering, the customer can use and own the goods as long as he wants [17, 18, 19]. When *Leasing*, customers buy the right to use the service/product for a fixed period and to buy it after the period on a predefined price. Through *Renting* the right is bought to use the product or service for a "rental" period, during which the customer does not get any updates or changes to the original product/service. On the other hand, in case of *Subscription*, buyers have the right to use the service/product for a period but they also get upgrades, enhancements, new functionalities or new content from the provider during this time. If the buyers pay every time they use the service or product, the seller applies *Pay per use* (pay-as-you-go) mechanism.

2.2 Software pricing

In software business there are three general revenue models, all including several pricing options. In the first revenue model, software licensing refers to the traditional way to buy the software. In software licensing, customers buy a license that gives right to use the software in a certain amount of computers or processors [17, 18]. In many cases, the length or amount of usage is not limited. In the second revenue model, software renting gives right to use the software for a certain time period that is defined in the rent agreement [5]. In the third revenue model, pay-per-use enables software providers to charge customers based on the actual usage of the software [17].

Pricing in these above introduced revenue models may base on different aspects. Lehmann and Buxmann [7] introduced the following pricing parameters:

- (i) *Price formation*: The seller determines the price base (cost-based, value-based or competition oriented) and the degree of interaction between the seller and buyer (unilateral or interactive).
- (ii) *Structure of payment flow*: Payments may be done as single payments, through recurring payments or through a combination of these.
- (iii) *Assessment base*: The number of pricing components, the usage-dependent and usage-independent assessment bases have to be defined.
- (iv) *Price discrimination*: Sellers offer the same good to different buyers at different prices. Price discrimination may be first-degree (prices depend on each user's willingness-to-pay), second-degree (customers may choose one of the offered product-price combinations based on required quantity, software version or time), third-degree (market segmentation by the seller based on personal or regional conditions) or multidimensional (combination of these).
- (v) *Price bundling*: Several items (services, products, rights, etc.) are bound together into an offering with a predetermined price. The offering may be pure bundling (the products are offered exclusively in a bundle), mixed bundling (goods may be bought as a package or separately), unbundling (products may be bought only separately) or customized bundling (customers choose the content of the bundle). In price bundling, software products, maintenance and support services may be packaged together. The degree of integration of the bundle items can be complementary, independent or they can substitute each other. The price level of the bundle can be additive (the price of the bundle is the sum of the prices of the items), superadditive (the price is greater than the sum of individual prices) or subadditive (lower price than the sum of individual prices).
- (vi) *Dynamic pricing strategies*: The seller sets the price dynamically over time. For software products, penetration (setting low prices in the beginning and possibly increasing it later), follow-the-free (the product is free, revenues come from complementary services or extra functionalities) and skimming (high starting prices that may be gradually reduced) pricing strategies are the most important.

Summarizing, the items of SBIFT model [11] and the software pricing parameters [7] overlap each other: some dimensions and parameters refer to the same aspect (Scope-Price bundling, Base-Price determination), some dimensions offer more alternatives than the respective pricing parameter (Influence-Degree of interaction,

Formula-Assessment base), one of the dimensions takes a different point-of-view than the respective parameter (Temporal rights-Structure of payment flow) and some parameters are missing from the SBIFT model (Price discrimination, Dynamic pricing strategies).

3 Methodology and data

In order to evaluate the applicability of the SBIFT model empirically in cloud context and to get an insight into currently used cloud solution pricing models, we studied pricing models of cloud offerings from 54 companies. Our analysis was carried out in September and October 2012 in the following steps: selecting cloud companies for the data sample; search for IaaS-, PaaS- and SaaS-offerings and their pricing information from their webpage; exclusion of those that provide a different type of service or do not provide enough pricing information; evaluation of SBIFT model iteratively. As a result, after searching for pricing data of offerings from more than 160 cloud providers, we could build up 73 pricing models from 54 firms by using the SBIFT model (see Table 1 for more details).

	IaaS	PaaS	SaaS	Total
Number of companies	7	14	33	54
Number of offerings	19	16	33	68
Number of pricing models	20	19	34	73

Table 1. Analyzed pricing models

Data sample selection: To ease the search of the cloud offerings, we identified our sample with the help of an internet portal Cloud Computing Showplace¹, that enlists more than 2050 cloud companies. In this online directory, cloud provider companies can register and categorize themselves into IaaS, PaaS and SaaS providers. SaaS providers can also categorize themselves by industry sector and application category.

We utilized this portal since it contains the most comprehensive collection of cloud providers compared to other portals (e.g. cloudservicemarket.info or www.saasdir.com) and the number of registered companies are growing continuously, fact that suggests that the directory is an up-to-date, maintained and used portal. To increase the reliability of our sample, we added additional validation steps into the process e.g. by excluding the non-cloud offerings.

We identified our data sample by choosing all registered IaaS and PaaS providers and one SaaS company with relevant pricing data from each industry sector. Since the number of registered SaaS companies is too large and growing constantly, we selected SaaS companies from each industry sector randomly until we had detailed pricing data of at least one SaaS offering from each industry sector in order to increase the industry coverage of the sample data.

¹ <http://cloudshowplace.com>

Review of the offerings and disclosure of pricing information: In order to increase the reliability of our data sample method, we reviewed the offerings and excluded the non-IaaS, non-PaaS and non-SaaS services, respectively. Concerning the disclosure of pricing information, our experience is in line with Lehmann et al. [20], who conducted an empirical study on the pricing models of SaaS providers registered on this portal. They found, that especially small and medium size firms provide pricing information on their website. Since not every aspect of the pricing model could be found in most cases, we agreed on excluding data from our sample where the companies did not provide enough information to understand the pricing logic as a whole.

Analysis of the SBIFT model: During our analysis, we matched each pricing model with a SBIFT pricing model pattern that can be defined as a combination of the positions of the pricing model characteristics along the SBIFT dimensions. While defining the positions, we selected the item that described the pricing characteristic in the most accurate way. The evaluation was done in an iterative process with the following evaluation criteria: (i) Each of the characteristics of the pricing model can be matched to a position of a dimension in the SBIFT model. (ii) One pricing pattern in the SBIFT model describes pricing models, that share the same characteristics. If the evaluation criteria was not met, we modified the SBIFT model to address the problems occurred and started a new iteration until the SBIFT model pattern could be defined for each sample data and the evaluation criteria was met.

4 Research findings

4.1 SBIFT model in cloud context

Based on our study, we propose some modifications to the SBIFT model that is specific to the cloud services industry (see Figure 2). The framework consists of 7 dimensions depicted in continuous scale, that describe the details of the offering. Next the proposed modifications are described compared to the SBIFT model.

Scope dimension: Our study revealed that identifying the level of bundling in the Scope dimension is challenging without some kind of categorization between the cases Attribute and Package. Based on the literature, we identify the categories *Package* as *Pure bundling* and *Attribute* as *Unbundling*. The combination of these is referred in the literature to as *Customized bundling*, where customers can choose the components of the bundle while the seller determines the price and scope of the bundle [21]. In IT industry, we see examples of customized bundling when even the price and the scope of the bundle is negotiable. To ease the process of determining the scope level, we propose the categories [Bundling where the amount of some items can be chosen from predefined options] and [Bundling where the amount of some items can be chosen freely].

Tiered pricing: We propose to add a new item to the Formula dimension for offerings with a fixed price and a limitation on the volume or the functionality, where the user has to switch to a less-limited offering with a different price if (s)he requests more volume or functionality. Named as *Tiered-pricing*, the formula attempts

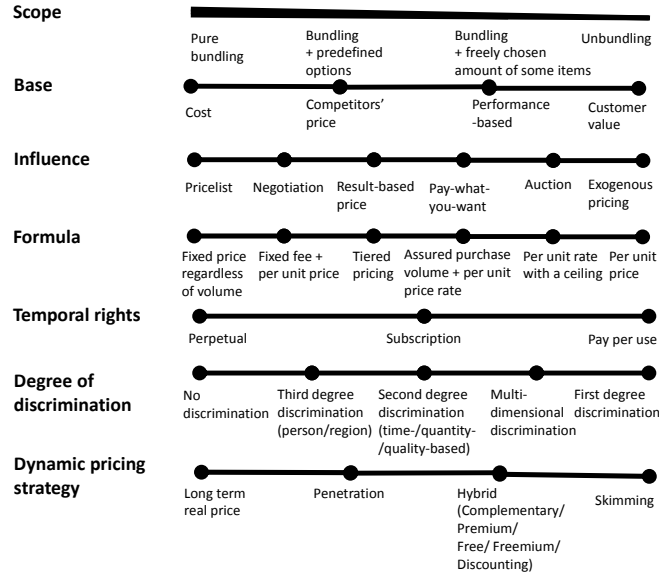


Fig. 2. Cloud Solution Pricing Framework

to package services and products by matching price levels to user’s willingness-to-pay [14]. This formula is popular among IT offerings that apply vertical versioning.

Subscription-based pricing models: In the Temporal rights dimension of SBIFT model the authors distinguish between *Leasing*, *Renting* and *Subscription*. However, these three concepts are faded in cloud literature (see e.g. [17, 5]), therefore we propose to use the term Subscription meaning Renting and Leasing as well and leaving Renting and Leasing out of the framework as separate items.

Usage-based pricing models: In cloud literature, the term Pay per use pricing is used when the customer is charged on the actual usage, that has to be monitored and measured [22]. The customer does not have to make any commitment to use the service or product for a predefined period: there is no obligatory monthly fee, the user pays for the used volume. In digital content pricing literature, units represent a pricing metric that can be either linked to the actual usage or volume of the service/product (usage-dependent metric) or represent only the usage potential (usage-independent metric) [7, 20]. Hence, the term usage-based pricing known from cloud industry refers to a SBIFT price model, where the Formula dimension is Per unit price with a usage-based metric and the Temporal rights is Pay per use.

Performance-based pricing: Being a broadly used pricing strategy in integrated solution pricing, we propose to add the category *Performance-based pricing* to the Base dimension, that takes into consideration both the suppliers’ costs and the customers’ perceived value. In this case, the seller guarantees a certain performance level for a negotiated price and pays a penalty if this is not achieved [15, 23].

Proposed dimension: Degree of discrimination: Based on literature review and the wide use of this pricing aspect of our data sample, we propose to add the dimension Degree of discrimination to the SBIFT model. Price discrimination is used when the same product/service is offered for different buyers for different price. This strategy is extremely important for providers of digital goods, since the low marginal costs allow them to sell the offering also for customers with low willingness to pay [7]. The categories of the dimension are proposed as follows.

The left most item is *No discrimination*, meaning that the product/service is offered for the same price for everybody. In case of *First degree discrimination* the vendor offers the same product/service with different prices for different customers. *Second degree price discrimination* is used when providers sell different units of output for different prices [24]. In this case, customers use self-selection to choose from the offers [25]. Second degree price differentiations can be quantity-, time- and quality-based [7]. In case of *Quantity-based price discrimination* the price depends on the amount of the bought goods [24]. When prices differ in different points of times, *time-based price discrimination* is used. In case of *Quality-based price discrimination* different product/service variants are offered with different price [26]. When applying *Third degree price discrimination*, the vendor identifies different customer groups based on their willingness-to-pay [26]. Third degree price discrimination can be Personal (e.g. student discounts) or Regional (e.g. different prices for developing countries) [7]. *Multi-dimensional price discrimination* occurs when price differentiation is made based on more than one dimension [7].

Proposed dimension: Dynamic Pricing Strategy: Because of its important role in cloud pricing suggested by the literature [7], we propose Dynamic Pricing Strategy to the SBIFT model. Prices set in a dynamic environment can influence the demand behavior of price sensitive customers [27]. Dynamic pricing is the strategy where prices are not fixed for a relatively long period, but the seller dynamically changes the prices over time, based on factors such as time of sale, demand information and supply availability. Next the categories of the dimension are proposed.

The first option is the *Long-term real price* strategy, when prices are kept the same for longer periods and they are adjusted only if necessary, not as a part of a predetermined strategy. The next option is the *Penetration strategy*, when vendors use low prices for faster market-entry and then increase prices over time [28, 12]. In case of *Skimming* the vendor sets high prices in the early stages of market development and then gradually reduces the prices to attract also more price sensitive market segments [12]. *Hybrid pricing strategies* [14] combine elements of penetration and skimming strategies and may contain for example: *Complementary pricing* [14], *Premium pricing* [14], *Free* [8], *Freemium/Follow-the-free* [8, 7] or *Random or periodic discounting* [14].

4.2 Pricing models in cloud industry

Our analysis shows, that indeed, currently used pricing models are very complex, difficult to understand and compare (in line with [8, 29]). Solutions appear as a result of co-operation and competition between the actors of the ecosystem, and the interconnectivity between the actors is visible also in the pricing models (in line with [30]). In Figure 3, currently used pricing model characteristics of different service

sectors are marked, where the values inside the rectangles describe the rounded usage proportions of the respective pricing aspect. In the picture the most popular pricing patterns and the most rarely used categories are also shown. Results related to the dimensions *Base* and *Dynamic pricing strategies* are missing from the figure, since there was not enough data regarding these two aspects. It can be seen from the figure, that firms use similar pricing models for IaaS, PaaS and SaaS offerings.

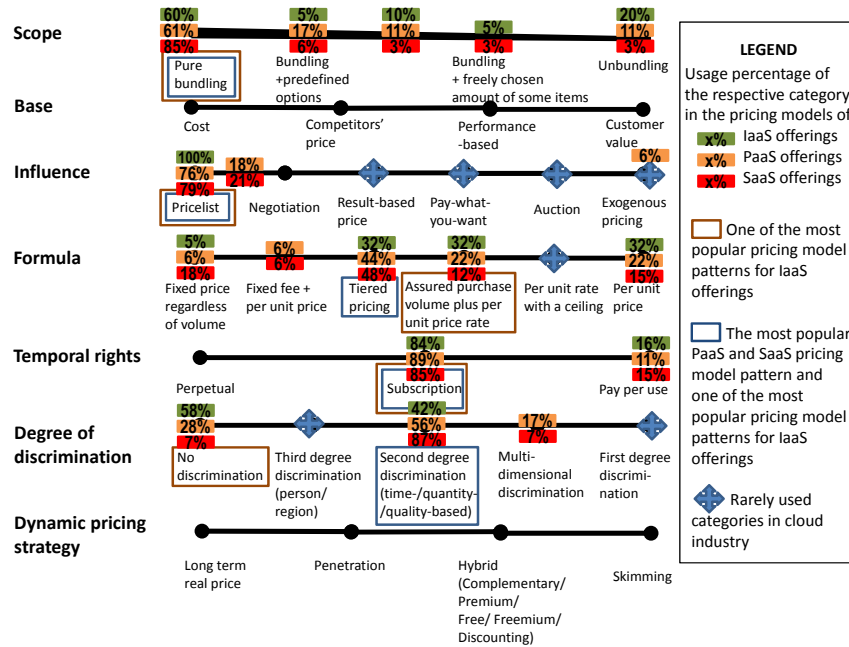


Fig. 3. Currently used pricing models in the cloud industry

Most popular pricing model patterns

Based on our analysis, we can conclude that cloud providers indeed differentiate by price since there is a big diversity in applied pricing models. The most popular pricing model is [Pure bundling, Pricelist, Tiered pricing, Subscription and Second degree discrimination] for all IaaS, PaaS and SaaS offerings, being applied in more than 20% of the cases. Price bundling is an effective pricing strategy if variable costs are near zero, or at least relatively low compared to the customers’ willingness to pay. On the other hand, using different price bundling and unbundling solutions result in a nontransparent market because of the difficulties in price comparisons, and that effects negatively both the providers and the customers [29]. Pricelists are broadly used in cloud industry, especially when there is a large customer base with similar needs. In case of IaaS offerings, another popular pricing model is revealed since IaaS offerings are priced in 20% of the cases with the pricing model [Pure

bundling, Pricelist, Assured purchase volume plus per unit price, Subscription and No discrimination]. As a difference to the price model above, customers get the same product for the same price without any discrimination, and they have the option to buy additional resources with a predefined unit price.

Our study revealed also, that *Free trial version* is offered to the users in 10%, 90%, and 56% of IaaS, PaaS and SaaS offerings, respectively. Besides this hybrid strategy, we met examples of *Tiered marginal discounting*, which assures that usage increase is not so painful while usage decrease still brings economic benefits for the customer.

Rarely used categories

Despite of the big diversity in cloud pricing, there are still rarely used categories that may provide differentiation for firms. Based on our findings, one of the rarely used categories is *Result-based pricing*. However, this category may be often used among business partners, where the actors of the value chain split the generated revenue. Examples of rarely used *Pay-what-you-want* pricing are the popular games downloadable from Humble Bundle website² [31]. *Auction pricing* is also rarely used, however, a good example from IaaS industry could be Amazon’s pricing model regarding the EC2 Spot Instances. On the other hand, Shapiro and Varian [32] state that auctions is usually not a viable option for digital goods where the incremental cost of production is zero. Examples of *Exogenous pricing* are found -however rarely- in SaaS pricing: solutions are priced partly based on the pricing model of IaaS provider - in this case, neither the SaaS provider nor the customer have an influence on this price component. No examples have been found by the authors for the use of *Per unit rate with a ceiling* in cloud industry. Our study reveals, that *Third degree discrimination* is not used alone, but it is preferred to be applied together with *Second degree discrimination*. In addition, *First degree discrimination* is rarely used in cloud context, probably because providers have difficulties in acquiring knowledge on each user’s willingness-to-pay [7].

5 Conclusions and further research

Pricing is a strategic tool in manager’s hands, where finding a good price model brings success for the companies. On the other hand, it is a challenging task with long-term consequences, where decision makers have to take into consideration many factors, such as the offering itself, the target market segment with specific customer needs, the competitors’ similar offerings, the costs, etc. With the sudden growth of different cloud solutions, also pricing has become increasingly complex resulting in a ”constantly changing labyrinth” of pricing [8]. In this research, we attempted to find a systematic way to describe the pricing models in order to help decision makers plan, develop and speak about pricing alternatives. The proposed 7-dimensional model is an extended and customized version of the SBIFT model developed for cloud industry, that takes into consideration both the general knowledge about pricing and the specific cloud characteristics.

² <http://www.humblebundle.com/>

In this paper, an empirical study has been carried out in order to identify the currently used pricing models of the cloud solutions. We found, that the pricing models of IaaS, PaaS and SaaS offerings have similar patterns, that leads us not to distinguish between different service categories but rather concentrate on pricing of cloud solutions. In line with Kihal et al. [29] and Cusumano [8], we found out also, that the big diversity in the pricing models makes price comparison difficult.

Our study has some limitations that provide avenues for further research. Besides our analysis of pricing information available online, data has to be gathered and studied from other sources as well, e.g. through cases studies or quantitative research. In further research, dependencies between the dimensions and categories have to be studied also. Because of the the dynamic nature of cloud value networks [33], the interaction between different actors of an ecosystem has an impact also on pricing. Offerings are interconnected and pricing models have to be established in a complex service system with multiple stake-holders [30]. Further work is needed to analyze how the pricing models of different actors enable or limit each other's pricing models [11].

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