Signaling and Segmentation on Electronic Markets: Innovative Pricing Strategies for Improved Resource Allocation

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Abstract

The advent of the digital economy and the increasingly important role of various kinds of electronic market places provide unprecedented opportunity for suppliers of products and services to experiment with new pricing mechanisms and strategies. Economic appropriateness, technical feasibility, and purposes of such pricing mechanisms depend mainly on product characteristics and the role of intermediaries. In order to allow for advanced, efficient pricing strategies and fast price adjustments on the Web, technologically supported infrastructures and systems are crucial. New information technologies not only enable businesses to charge personalized prices on the Internet, but also allow for new price setting mechanisms in which the consumer specify their interests and requirements. This paper provides some conceptual background for developing net-based pricing strategies and reflects first empirical evidences against it.

Introduction

Microeconomic theory states that pricing depends heavily on the market structure for a certain product. In the classic case of a perfectly competitive market with many economic agents on each side, sellers are price takers and cannot influence prices (see for example Mansfield (1996) for a detailed discussion). These findings are only correct under the assumption of perfect competition. Economists speak of perfect competition as a set of market conditions, namely homogeneous products, perfect market knowledge of each participant, atomism of market participants and mobility of resources (Browning & Zupan, 1999).

In the real world, however, hardly any seller acts under conditions of perfect markets. Instead of having to accept the market price, sellers have to develop their own pricing strategies and pricing finding mechanisms aiming at public relation effects, market research insights, and optimally matching various customers' 'Willingness To Pay' (WTP).

According to the OECD (1998) "More and more products will be subject to differential pricing associated with customized products, fine market segmentation and auctions as it becomes easier to change prices." Empirical data shows that differential pricing is already ubiquitous in industries that exhibit large fixed costs like airlines, telecommunications or publishing (Varian, 1996). Some market segments could not be served without differential pricing, and it can even be shown that differential pricing can be expected to contribute to economic efficiency. So far businesses have been restricted to group pricing and versioning, when differentiating their offerings. In order to allow for more advanced, efficient differential pricing and fast price adjustments on the Web, technologically supported infrastructures and systems are crucial. Information technology not only enables businesses to charge personalized prices on the Internet, but also allows for new price setting mechanisms in which consumers specify their preferences regarding additional product attributes. Reverse auctions or so-called demand collection systems are just two examples of Web-based intermediaries, which allow customers to specify their preferences for a flight and get the best offer (e.g. www.travelbids.com). Alternatively, customers specify a price and day for a flight from A to B and get information in return whether an airline has been found that offers a seat at the given price and the details of the flight (e.g. www.priceline.com).

We will present the claim that customer segmentation and innovative pricing mechanisms lead to more efficient resource allocation and show that partial approaches for customer profiling and for flexible pricing exist. We argue that the benefits of these approaches can be increased, if they are extended and combined. As these strategies are contingent on product characteristics and industry structures, we will focus on digital products and airline tickets.

Efficient Resource Allocation based on Multiple Attributes

In most markets, customers' Willingness-To-Pay (WTP) is heterogeneous. Thus, it is advantageous to charge different users different prices. Sometimes differential pricing is the only feasible way to produce complex services such as scheduled flights and leads to prices that reflect more closely their true market value. Two problems with differential pricing occur if we assume that customers are generally anonymous. First, a seller has to determine the WTP of different groups of buyers. Second, the seller has to prevent customers with a high WTP to purchase the product intended for customers with a lower WTP. This means the market and the services have to be separable - by imposing boundaries or naturally through some actual or imputed characteristics. Also, trading or communication between market segments must be restricted.

One strategy is to differentiate prices based on the characteristics of the product like the quality or the time when it is shipped (versioning). Another strategy is to distinguish prices on some customer characteristics (individual or group level), e.g., if the customer is a business or a private person or if the customer is a student or some kind of club member. In this case we speak about group pricing or – in the extreme case - personalization (also Pigou 1920).

Versioning

Versioning is based on the distinction of product features or attributes. With different versions of a product offered, customers position themselves into different groups according to their WTP for certain product attributes. In cases, where observable exogenous customer characteristics have little to do with their WTP, versioning can be a good strategy. The seller in this situation provides at least two versions of a product and determines associated prices. A simple example is block pricing, where the price per unit declines with the quantity purchased by a particular customer (quantity discounts). This tends to result in greater turnover because heavy users pay prices closer to marginal cost. However, it does not convert all consumer surplus into profit like it is the case with perfect personalization, where the number of blocks would equal the number of customers.

Theoretically, the number of versions of a product offered should be equal to the number of types of consumers in the market. However, too many versions easily create confusion. Various empirical investigations recommend to offer three instead of two versions, as the average customer will most likely opt for the middle version. Other examples include airline loyalty cards with the versions standard, silver, and gold, or software packages differentiated in student, professional, and de luxe.

Another form of versioning results from aggregation or product bundling, where products are sold together as a package. Many software packages (e.g. Microsoft Office) are bundles of individual components. Academic journals or newspapers are bundles of articles sold as a package and also subscriptions of magazines can be seen as product bundles of several issues. Even flight tickets can be considered bundles of various product features such as 'on-board service', 'right to change booking', 'total travel time', etc. The pricing advantage of bundling goods can easily be demonstrated (Bakos & Brynjolfsson, 1998).

Group Pricing

Different from versioning, group pricing focuses on customer characteristics. Group pricing occurs when prices differ among categories or groups of consumers. People who have certain purchase histories, zip codes or behavior patterns are offered different prices. This is probably the most common practice of differential pricing. For example, it is often thought that business users have higher WTP than educational users, hence many suppliers of books and journals have educational discounts. Similarly prices often depend on whether one is domestic or foreign, senior citizens, member of a club, etc..

Group pricing is already an accepted concept for selling on the Web. Like in markets for physical goods, suppliers use mechanisms like targeted promotions and loyalty programs in order to distinguish their products from those of competitors and to establish customer relationships. Unfortunately, in many cases it is rather difficult to find out about particularities of different customer groups. For example, in case of student discounts, it is cumbersome for a supplier to check student IDs without direct access to the University Information Systems. Moreover, often an individual's WTP is not correlated with any of the characteristics mentioned.

Personalization

Personalization is a familiar concept in marketing, gaining importance and followers in Electronic Markets. It aims at identifying potential customers and offering them the required products at the right time, price and conditions. Theoretically, personalization assumes that suppliers know their customers' WTP and extract from each consumer the full value of his or her consumer surplus.

Currently, perfect personalization has limited applications. It can occur only in the few cases in which a firm has a small number of buyers and is able to guess the maximum prices those buyers are willing to accept (Luedi, 1997). Various technologies are becoming available in order to gather and develop customer profiles or even to give customers the instruments to personalize suppliers' offerings, e.g. myYahoo!.

Technologies for Customer Profiling on the Internet

On-line newspapers provide good examples for developing customer profiles. The on-line version of the New York Times does not charge users for content, but requires them to register, providing information like name, address, gender and age. The *registration information* already gives some hints about the demographics of readers, which can be related to reading habits. More elaborate approaches are based on customer-owned personal profiles, which store information such as name, address, interests, etc. and give it away on a controlled basis to Web site providers.

Another way to learn about one's customers is *tracking on-line behavior and click streams* by using cookies or scrutinizing Web server log files. Click stream analysis allows a merchant to instantaneously gauge the interest of a Web user on different products and product categories. Each time a user requests a page from a Web server, the server keeps a record of the action in a log file. That detailed record can be difficult and time-consuming to mine, and the sheer volume can be overwhelming. Several tools for analyzing log-file data are available. Once the data is processed, analyzers can create reports based on the results.

Collaborative filtering relies on the premise that patterns of customer behavior will provide useful information for individual customers with similar tastes and preferences. Collaborative filtering is basically a statistical analysis of behavioral parameters of a large sample designed to develop recommendations. Firefly (http://www.firefly.com) is perhaps the best known example of this approach. Amazon.com is using this technology. They list buying suggestions once a customer has selected an item based on the analysis of previous purchases by other customers of the specific item. Other companies working on collaborative filtering are tracking users' movements around the site and altering what is presented based on the click trails. A profile is created based on the items a customer clicks on, whether they are text, advertising, or searches for information on the Web. Resnik and Varian (1997) give a good overview about different applications of collaborative filtering.

The examples show that customer profiling is primarily driven by suppliers or intermediaries. Even those approaches that give customers an active role, like customized newspapers, restrict this choice (and the opportunity to signal their preferences) to a given and static set of attributes. These technologies are not (yet) linked to strategies of flexible pricing.

"Good-bye to fixed prices": Emerging Models for Flexible Pricing

Cortese and Stepanek (1998) have used "Good bye to fixed pricing" as headline for their Business Week Special on Electronic Commerce. Their message is that consumers will increasingly be confronted with models for flexible pricing and product differentiation. The Web has been heralded as a medium which enables and requires companies to develop new or modified business models. Especially in the services industry, we have seen the emergence of new, Web-based business models. Even though these models are usually based on familiar coordination mechanisms, those mechanisms are used to a different effect in a Web environment. We will discuss 'auctions', 'reverse auctions', 'demand collection systems', and 'demand aggregation systems'. These four examples give evidence to a trend of emerging business models. These models are often driven by intermediaries in an attempt to leverage communication cost differentials offered by the Web in order to facilitate customers' preferences for lower prices. The incentives for the suppliers are the allocation of products or services with a limited shelf-life, like tickets, or to boost sales.

Demand Aggregation System

Accompany (www.accompany.com) is a unique online buying service. Accompany is trying to initiate virtual customer pools so that individual customers can benefit from volume discounts offered by suppliers. Discounts are thus not the result of negotiations but of Web-enabled pooling and aggregation of demand. Accompany contributes to shifting bargaining power to customers while at the same time providing safeguards against frictions in the service delivery. For running aggregation processes, the time limit for joining are made transparent on the Web. Email notification is offered. The business model of Accompany is not restricted to particular product features but rather to markets where suppliers are offering volume discounts and where customer preferences can be pooled. Accompany is negotiating with suppliers to identify and get volume discounts on popular products.

Ticket Auctions

Online auctions on the Web have become a popular and wide spread instrument for flexible pricing (Heck & Vervest, 1998; Klein, 1997). The strategic rationale and impact, however, vary significantly with the range of products and the design of the auctions.

Since August 1997 Lufthansa is regularly auctioning off selected flight tickets via their Web site Info Flyaway (www.lufthansa.com.) Once a month, auctions run for a full day from 10 a.m. till 10 p.m. 50 separate auctions take place during an auction day. During one auction, which lasts for approximately ten minutes, one set of tickets is auctioned off. On average, there are 120 participants in the virtual auction room, about 20 of them are active bidders. An auctioneer is trying to induce participants to continue the competitive bidding process. The Lufthansa auction is an English auction with ascending prices, the ticket list price, however, is taken as an upper limit. Successful bidders are called after the auction in order to confirm the price and verify the credit card information. Typical bidders are participants in Lufthansa's frequent flyer program Miles & More and use Lufthansa's Web site regularly. The offered tickets are for carefully selected seats on less frequented flights to attractive destinations. Auction tickets, which often are sold with a significant discount, are frequently used for an additional weekend trip or as presents. Lufthansa has included offerings from their partners, like holiday packages, in the auctions and is exporting the auction to countries outside Germany.

The auction is run by an independent agency, infoMedia (www.infomedia.de), which offers a full auction service package. infoMedia compiles the auction catalog, registers the participants, and runs the auction system with a maximum load of 2000 concurrent participants or observers. The fee for one auction day including call center operation for 48 hours is about USD 10.000. From January 1998 through March 1999, 37 auctions have been held, 24 of them outside Germany. A total of 3935 tickets have been sold during this period at an average price of DEM 508 (approximately. USD 300).

For Lufthansa, ticket auctions are in the first place marketing events and experiments in area of electronic commerce. The auction rules have been gradually adapted and modified based on the growing experience and response from participants. One goal of the auctions has been to attract (potential) customers to the Lufthansa Web site, which is also a direct sales channel. Lufthansa has moved cautiously - without major advertising activities - in an attempt not to alienate travel agencies. Lufthansa has positioned the auctions strategically as one instrument to blur the image of a high-price airline.

Despite the fact that marginal cost for additional passengers on seats that might otherwise not been sold are very low, the revenue generated from the ticket sales hardly justifies the Web auction in its current format. The benefits for Lufthansa are primarily in the area of marketing and market research. The auctions have generated plenty of publicity in traditional media, additional traffic on the Web site and in particular customer feedback, information about customers' price preferences and insights into buying patterns for discounted tickets.

Reverse Auction

TravelBids (www.travelbids.com) is a so-called reverse auction. In contrast to the Lufthansa auction, customers take an active role to specify their preferences for touristic offerings. Customers have a wide range of

attributes which they can specify or intentionally leave open. On this market, all bids are visible, for everyone to see, so prospective customers can view other listings and see the results. The bidding period can be set between 1 and 72 hours. Unsuccessful bids can be repeated.

Customers' requests are posted on TravelBids, which is a specialized electronic market. TravelBids' fee of USD 10 for successful bids is split between travel agent and customer. On the supplier side, not tourism principles but travel agents bid to fulfill the demand. Travel agents use their knowledge to identify flights that fit the customers preferences and use part of their commission in order to gain additional orders.

Demand Collection System

At a first glance, Priceline (www.priceline.com) appears to be a similar solution: based on the assumption that supplier-side fixed prices do not always lead to an optimal allocation of products and services, Priceline has set-up a market platform for airline tickets, new cars and mortgages. Customers can specify their preferences including the price. Priceline then advertises these binding offers to airlines, car companies, or financial services companies who can decide whether they want to fulfill this additional demand at the listed price. Airline customers do, however, not give a detailed specification but specify only day, place of departure and place of arrival and request a flight operated by any major airline. In this way the airlines have sufficient scope to fulfill the demand, if they wish so to do, and the chances that the offers are met is increased. During the second week of January 1999, 10,000 tickets and 2,000 hotel rooms were sold via Priceline while about 50000 offers were not met. Priceline earns a commission for every sold ticket of USD10-20.

The specified offers are forwarded sequentially in a highly efficient and patented process to the potential suppliers. Customers' offers are binding and have been substantiated by a credit card authorization. The airlines can decide depending on their current load factor and price policy whether they want to take additional customers at the listed price. Feedback is given to the customers within hours.

In contrast to auctions, Priceline has set-up a private market. I.e. the demand is actively advertised to the airlines but neither the offers nor the deals are made public. The suppliers can decide based on internal policies; they do not risk any kind of signaling effect that a flexible price strategy otherwise might sent to the market. Priceline is called a demand collection system because it functions as an intermediary which collects customers' requests for products and services at a different than the advertised price. This demand typically is not articulated and can thus not be fulfilled. Priceline has successfully applied for a US patent for their business model.

Analysis: Contingencies and Design Parameters for Advanced Pricing Models

The applicability and success of the sketched solutions for customer profiling and pricing are based on the existence of a global computer-mediated communication environment and specialized intermediaries which balance the interests of customers and suppliers. They are, furthermore, contingent on product and market characteristics.

Product Characteristics

We see the most drastic need for newly developed pricing schemes for those products and services, which can be delivered fully over the Internet. Loebbecke (1999) refers to *Online Delivered Content (ODC)* including on-line newspapers, magazines, music, education, searchable databases, consulting, and eventually expertise and ideas. Production costs cannot be used as a guideline for pricing ODC since there is no link between input and output. Mass consumption does not require mass production. Economies of scale are determined by consumption, not by production. Further, it is impossible to determine whether it is worthwhile to obtain a given 'piece of ODC' without knowing its content (Stiglitz, 1985). In the past, there were significant costs associated with price changes. For publishers with a large product line, for example, it could take months for price adjustments to filter down to distributors, retailers, and salespeople. Especially in the case of ODC, networks allow for instantaneous signaling of price changes, and hence significant costs reductions with regard to price adjustments. For ODC, the first copy is typically very costly to produce while subsequent copies can be produced and distributed at a very low price. Furthermore, there is basically no capacity constraint for

producers. With marginal costs towards zero, cost-based pricing makes little sense and will generally not recoup sufficient revenue to cover fixed costs. This cost structure leads to substantial economies of scale – the more one produces, the lower are average costs of production (Shapiro & Varian, 1999) – and strategies focussed at increasing sales volume in order to lower average costs. As an alternative (or complementary) strategy for companies that face difficulties to extend their sales volume, differential pricing becomes more attractive.

Other information-based products such as tickets have a very different production function. Tickets per se can also be reproduced with marginal costs approaching zero. Their actual value proposition, however, is a service, e.g. the seat on a particular flight or in a specific concert hall. The production function for these services is characterized by capacity restrictions on a short term level. A concert can not be relocated to a larger (or smaller) concert hall on short notice neither can airlines switch aircraft for scheduled flights without significant lead time and additional cost.

Any risk of 'in-house cannibalization' fades when the actual products, i.e. their detailed components - do not necessarily correspond one to one. Electronically sold products may contain additional content features, may be differently bundled. Furthermore, depending on product design and pricing strategy, the electronic channel allows customers to be more in control of how much and what kind of product to obtain. Indeed, it can be expected that when complementing traditional products and channels with electronic ones, customers will request additional value such as availability (topical information, access to data from any location), presentation (multi-media such as video clips, sound, etc.), interactivity (user-friendly downloading, search functions, etc.), and innovative product features. Table 1 summarizes the comparison of product characteristics for ODC and other information goods such as flight tickets and mortgages. The comparison highlights the differences among the products and production functions which set the scope for suppliers' pricing strategies.

Products Characteristics	ODC	Ticket for scheduled flight	Mortgage
Initial production cost	High level of fixed cost (first-copy cost).	High level of fixed cost (aircraft, crew, fuel, etc.).	Fixed cost for product design and infrastructure.
Marginal cost for additional product or copy	Marginal cost close to zero.	15-20% of overall costs are related to the number of passengers (ground service, food, etc.) within a given contingent of seats.	Marginal cost is related to opportunity cost, i.e. alternative allocations of the capital.
Individualization cost	Fixed cost for initial IT solution (individual filters etc.), Variable cost for content selection and combination (not for creating new content) close to zero.	Fixed cost for setting-up yield management and booking systems, low variable cost for price discrimination based on service level and contractual features: right to return or change ticket, advance booking, restrictions regarding timing etc.	Low cost for individualization, however, long term effects result from the decisions taken.
"Shelf-life"	Depending on content, the value of stock prices etc. depends on the delay period publication.	Flight schedule defines the shelf life, after the gate has closed the over-stocked seats are worthless.	Not allocating money to a mortgage leads to a loss in interest payments if the money is not allocated at all or a loss of a fraction of the interest, in case short term interests are lower.

Table 1: Comparison of product characteristics

Role of Cybermediaries

The Web as global computer mediated communication environment is a precondition for the emergence of business models based on flexible pricing. It facilitates low signaling cost and time on the suppliers' and the customers' side and enables last minute allocation of products and services. As the Lufthansa case illustrates, this effect can be used by suppliers as part of a direct sales and marketing strategy. It has to be noted, however, that the Lufthansa auctions have been designed for fairly small numbers of offered tickets.

The other models, in contrast, have been set-up and are operated by intermediaries which are leveraging the structural advantages of the Web (Sarkar et al., 1995; Bailey & Bakos, 1996). They have strategically positioned their applications in order to generate benefits for customers and suppliers which are not feasible in a direct sales model. They

- reduce coordination and communication cost for buyers and sellers,
- generate volume for the suppliers,
- pool homogeneous demand in order to give individual customers access to suppliers' volume discounts,
- improve the likelihood for order fulfillment for the customers,
- separate or even isolate the coordination mechanism from other sales and distribution channels and by this way limit spill-over effects of price discounts,
- operate with varying levels of transparency.

Table 2 summarizes the specifics and benefits of the four pricing models from the actors' perspectives.

Model / Actor	Demand pooling	Auctions	Reverse auction	Demand collection
Role of intermediary	Accompany is identifying attrative products with significant volume discounts and pooling demand. It reduces the coordination cost for the participants.	Lufthansa is supplier and auctioneer. The auctioneer functions as trusted (third) party.	TravelBids operates an information platform in order to limit communication cost and expose bids to numerous travel agents.	Priceline functions as broker for the customers and has established an efficient process to forward the customer offers to multiple airlines.
Suppliers' benefit	Suppliers gain sales volume.	Auction as marketing event and part of market research. Sale of overstocked tickets.	Travel agents act as suppliers. They get additional sales at a lower price.	Suppliers have an additional option to sell their products at a customer-fixed price. They can learn about customers' preferences and benefit because Priceline operates as a private market which is isolated from the other channels.
Customers' benefit	Individual customers who pool their demand get access to significant volume discounts.	Customers get access to cheap tickets.	Customers can specify their offers and might get small discounts.	Customers can specify their offers with a fixed price and some flexibility regarding the other attributes.

Table 2: Comparison of the four business models based on the actors' perspectives

Extended Coordination Mechanisms Based on Signaling and Matching of Multiple Attributes

While different price discrimination strategies for suppliers have been suggested for ODC products, we have presented empirical evidence of customer-oriented coordination mechanism which aim at giving customers access to lower price services, not however ODC. Leveraging the benefits of the Web as a low-cost, information rich communication medium, in most cases intermediaries have established platforms to enable

- signaling of price preferences with varying degrees of product specification;
- extending the negotiation to complex bundles of attributes;
- shifting power to the customer by pooling demand.

The described models of price discrimination are based on intermediated coordination processes among buyers and sellers in which each side specifies an incomplete set of attributes and lets the other side decide upon the complementary attributes. Lufthansa, e.g., decides on lot size and ticket attributes sets only an interval for the ticket price (minimum offer and list price as maximum offer). The incentives for sellers to relinquish part of their control over the attributes of the offer is to gain market share, flexible allocation of overstocks or products with limited shelf-life, and market research into customers' preference patterns.

Incentives for the customers are even more obvious: get a better price in return for a compromise on some of the product or transaction attributes, e.g. specification of airline, time and route of the flight in the case of Priceline or need to coordinate with other buyers in order to pool demand. Table 3 shows which of the product attributes are specified (flexible or fixed) by supplier or customer in the respective pricing models.

Model / Actor	Demand pooling	Auction	Reverse auction	Demand collection
Supplier	Suppliers have listed discounts depending on the aggregated demand.	Lufthansa specifies ticket attributes and lot size.	Travel agents specify offer and price (in terms of reduction of their commission).	Suppliers select customer offers based on price and availability of seats that match the specification.
Customer	Customers join others to pool demand for a homogeneous product. They select product attributes except for the price.	Customers specify price in a social process of bidding.	Specify more or less complex sets of preferences and expect offer below list price.	Customers specify day, place of departure and arrival and price.

Table 3: Actors' roles in attribute specification in the respective models

Conclusion and Further Research

In this paper, we described several conceptually backed strategies for flexible pricing. Versioning and group pricing are ubiquitous concepts, which can be found in many industries today. Market segmentation in these approaches is often very coarse grained and leaves money on the table. In the end, models will become rather complex and will have to take into account the trajectories 'organizational mission', 'frangibility' and 'reusability' of content, the desires of the audience, etc, each with its own set of imperatives (Jensen, 1998).

The range of pricing schemes will get broader and more sophisticated, as the Internet provides a variety of possibilities of selling, sharing and giving away. With respect to ODC, consumers can be charged based on the actual 'use of ODC' or based on fixed access charges. Alternatively, pricing models may imply giving actual artifacts away for free and then charging for complementary services. Economists are developing theoretical solutions to the problem areas mentioned. However, some of the mechanisms developed (e.g. MacKesey and Varian, 1995) demand an enormous amount of data, thus questioning the trade-off between allocative efficiency and operational cost-effectiveness (Mitchell and Vogelsang, 1991).

New information technologies like customer profiling and collaborative filtering help to learn more about one's customers and to establish a much more detailed pricing model. Theoretically, these models allow coming close to nearly perfect price discrimination. Unfortunately, the data gathered from click-stream analysis and collaborative filtering is not sufficient for more complicated pricing schemes.

Based on the experience and principles of the described models, future modification and extensions can be envisioned which are in line with the identified principles.

(1) In addition to specifying fixed attribute combinations, intermediaries can assist customers to specify trade-off functions (alternative parameter settings combined with different prices) which would allow suppliers to respond even more flexible.

(2) While we have discussed different signaling solutions with more or less fixed offers, the communication platforms could be used to signal alternatives which closely match the specification and negotiate about parameter settings,

(3) A further step beyond this would be to facilitate customers to specify innovative attribute combinations they would cherish or to specify their preferences and requirements for future products (reverse marketing, Leenders & Blenkhorst, 1988).

But do these technological developments, the described pricing models, and the suggested extensions solve the problem of ODC pricing?

- The information paradox complicates customer requirements' specification.
- The pricing structure suggests that several measures even to the point of freebies may be chosen, if they promise, e.g. because of publicity and subsequent popularity of products, sales of the product at some stage or for some customer segments.
- Inquiries into customers' preferences might help to identify bundles of content and a proper price.
- Market research might suggest attributes of ODC products that customers would cherish.
- Smart combination of customer profiling and schema that allow customers to signal their preferences.

Further conceptual and empirical research will be needed to develop profitable and sustainable signaling approaches and subsequent pricing strategies for better resource allocation.

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