Reverse Commerce

Adding Information System Support for Customer-centric Market Coordination

Robert Neumann, Konstantina Georgieva, Reiner Dumke
Department of Distributed Systems
Otto-von-Guericke University Magdeburg
39106 Magdeburg, Germany
{robneuma, ina, dumke}@ivs.cs.ovgu.de

Andreas Schmietendorf
Berlin School of Economics and Law
Fachbereich II
10245 Berlin, Germany
andreas.schmietendorf@hwr-berlin.de

***Abstract*—While it is sometimes hard for individuals to find all suppliers in a market in order to be able to determine the one with the lowest price for a product or service, they pay often more than necessary. There might have been another cheaper supplier, which –due to the opaqueness of the market- they have not found. Furthermore, if suppliers for a product or service are scarce, individuals tend to accept lower service quality, because they are happy to have found after all the item of their desire. If consumers were able to simply announce their demand on a global level where implicitly all suppliers were integrated, they could leave the process of investigating the market and negotiating prices completely to the suppliers. In this article, we are going to provide a formal model that describes a consumer-centric approach for market coordination and leverages the support of information systems.**

Keywords-Electronic Commerce; market coordination; efficiency; electronic markets; fixed pricing; dynamic pricing.

I. INTRODUCTION

In the Internet era, electronic commerce (e-commerce) plays an important role for both consumers as well as suppliers. E-commerce enables individuals to procure goods and services from their computers at home. Suppliers on the other hand benefit from a distribution channel that is cheap and very close to the customer. The number of internet users has increased considerably since the mid-1990s. At the same time, the revenue that is generated by internet-based e-commerce has increased steadily and keeps increasing [1].

While the development of e-commerce and its technological change are remarkable, the fundamental way of how e-commerce is conducted has not changed at all. Generally spoken, if consumers use the e-commerce channel for fulfilling their demand, they browse through a number of websites of suppliers that offer the product or service and decide for one. Though tools, such as product search engines, kept improving thus providing even richer experiences to the consumer, our contemporary understanding of e-commerce is still very supplier-biased.

Especially, the information phase of an e-commerce transaction is marked by a high level of pro-activity on the consumer side [2]. After consumers have realized that they have a demand for something, they need to investigate the market, browse through websites of potential suppliers, negotiate the price and finally decide on a supplier they want to bargain with. The suppliers on the other hand want to keep the market just transparent enough to still being visible to the consumer, but too opaque for the consumer to be able to find other, maybe even cheaper suppliers that offer better service.

The outcomes of such market constellation are manifold, though we tend to not often recall them to our mind. While it is sometimes difficult for us to find all suppliers in a market in order to be able to determine the best offer, we pay more than necessary as there might have been another cheaper supplier, which we have not found. Furthermore, if suppliers for a product or service are scarce, we tend to accept lower service quality as we are happy to have found the item of our desire at all.

If consumers were able to simply announce their demand on a global level where implicitly all suppliers were integrated, they could leave the process of investigating the market and negotiating prices completely to the suppliers. This way, they would avoid spending time on drilling through the opaqueness of markets and at the same time receive a number of bids from all suppliers that could potentially deliver the desired product or service. Their task would simply be to choose the supplier that offers the lowest bid. Thereby, consumers in such kind of markets would benefit from lower prices and eventually even better service.

Throughout this article, we will refer to the traditional way of e-commerce conduct as “Forward Commerce”. Contrarily, we will introduce a model that emphasizes customer-centric market coordination and refer to it as “Reverse Commerce”. We will provide a conceptual framework that underlines the essence of Reverse Commerce. Furthermore, we will emphasize the role of information systems and show how they build the technological backbone of Reverse Commerce. Finally, we will detail economical implications and discuss the potential of Reverse Commerce to positively affect both the overall service quality as well as the total welfare of an economy.

II. RELATED WORK

The fundamental idea behind Reverse Commerce is not new. Dynamic price making as well as price making through

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bidding are mechanisms that are well known from virtual or real marketplaces that support auctioning. Reverse Pricing and Reverse Auctioning [3] are concepts that can be found on very specific and mostly B2B-only trading platforms, but that are not yet generally accepted among end-consumers.

While reversed market coordination allows for much higher dynamicity and fluctuation of prices and quantities traded, it also seems to be capable of much more accurately capturing and exhibiting short-term perceptions, moods and feelings of market participants. Fixed pricing [4], contrarily, due to its very nature aims at flattening out the fluctuations that exist in dynamic pricing, thereby making the market more reliable, stable and anticipatable.

As we will discuss later, however, reliability and stability in fixed pricing are traded for welfare. The reason for that can be comprehended by taking a look at the border cases that exist in fixed pricing. Though consumers and suppliers exist that would agree on a bargain below the fixed price, there is no way for both to communicate this to each other. Consequently, certain consumers cannot fulfill their demands while certain suppliers cannot make profit. The overall economy misses out on welfare.

Even though dynamic price making promises certain benefits for both consumers as well as suppliers (compared to fixed pricing it is "Pareto optimal" [5]), end-consumer markets are still dominated by fixed price systems. Sufficient examples exist, however, that dynamic price making works fine in end-consumer markets (e.g. eBay, stock markets) bringing up the question of why it has not yet gained wider acceptance.

Throughout the remainder of this article, we will combine the two concepts dynamic pricing with RFQ (request for quotation) [6]. We will emphasize how new technology can help with expanding the field of application of those concepts into end-consumer markets, thereby referring to the overall effort as Reverse Commerce.

III. MARKET COORDINATION

In this article, we propose Reverse Commerce as an alternative to the traditional way of business conduct and refer to the status quo as "Forward Commerce". Based on [7], we define a market M as:

$$M = (\Sigma \cup \Gamma \cup \Delta, R_M) \tag{1}$$

Thereby, $\Sigma = \{\sigma_1, \ldots, \sigma_n\}$ is the set of involved suppliers, $\Gamma = \{\gamma_1, \ldots, \gamma_m\}$ is the set of consumers, $\Delta = \{\delta_1, \ldots, \delta_k\}$ is the set of available items in this context and R_M summarizes the relation between all participants in the market above.

Furthermore, an electronic market M^{eB} can be defined as:

$$M^{eB} = (\Sigma^{eB} \cup \Gamma^{eB} \cup \Delta^{eB}, R_M{}^{eB}), \tag{2}$$

whereby $\Sigma^{eB} \subseteq \Sigma$, $\Gamma^{eB} \subseteq \Gamma$, $\Delta^{eB} \subseteq \Delta$ and $R_M{}^{eB} \subseteq R_M$. Note that some σ_i are not part of the electronic market M^{eB}. Otherwise, this could also infer that some $\sigma_i{}^{eB}$ are not part of Σ. In this case, $\Sigma^{eB} \supset \Sigma$, which is a phenomenon that corresponds well with recent trends, but will not be considered throughout this article. Though we are aware of differences existing between M and M^{eB}, throughout the remainder of this article we are going to neglect them and will use M^{eB} as synonym for M, Σ^{eB} as synonym for Σ, Δ^{eB} as synonym for Δ and $\sigma_i{}^{eB}$ as synonym for σ_i.

In order to describe certain aspects of M, we need to refine our perspective on Σ, Γ and Δ and provide more detail. Therefore, we define $\sigma = \{ident_\sigma, presentation_\sigma, reputation_\sigma, \{\delta_\sigma\}\}$, $\delta = \{ident_\delta , price_\delta\}$ and $\gamma = \{ident_\gamma, motivation_\gamma, \{\delta_\gamma\}\}$.

IV. FORWARD COMMERCE

The contemporary understanding of how consumers find the product they are looking for and the supplier they want to bargain with has grown with the evolution of the human being as a very static and manifested pattern. If an individual is searching for a new item it wants to buy, this pattern is best described through the following process [2]:

1) Individual experiences need for an item δ_i
2) Individual starts investigating the price ($price_\delta$) of the item by visiting various suppliers (Σ)
3) Individual decides for the supplier σ_i that it personally likes best (influenced by price, reputation, etc.)
4) Individual enters bargain with supplier σ_i and obtains the item in exchange for a liability or funds

The above process is marked by a very strong proactivity of the consumer towards the bargain. What that means is that regarding the supply side, all the supplier usually needs to do is offering and advertizing the item that s/he wants to sell. The rest of the engagement is covered by actions of the consumer. The consumer investigates on products and suppliers (in-store, on the internet or in magazines). The consumer contacts the supplier and/or visits shops. Eventually, the consumer negotiates the price with the supplier, since it is in the immediate interest of the consumer to yield a lower price.

In essence, in Forward Commerce the consumer γ, when searching for a product δ_γ, is influenced by the supplier's product presentation and his reputation. The three components δ_γ, $presentation_\sigma$ and $price_\delta$ get projected onto a supplier σ in the market who can deliver the product. Finally, the supplier σ -depending on the price of the product and the consumer's motivation- decides, whether to sell δ to the consumer or not.

$$\begin{gathered}\gamma \Longrightarrow (\delta_\gamma, presentation_\sigma, reputation_\sigma) \Longrightarrow \sigma \\ \sigma \Longrightarrow (\delta_\sigma, motivation_\gamma, price_\delta) \Longrightarrow \delta\end{gathered} \tag{3}$$

V. REVERSE COMMERCE

The concept of Reverse Commerce proposes that in order to find the item δ_γ as well as the supplier σ the consumer wants to bargain with, all the individual needs to do is announce or "advertise" its interest in the item. Suppliers that are able to deliver the requested item receive a note about a new bargaining opportunity. They apply at the consumer for a bargain by providing a quote at which they are willing to sell the item. The consumer decides from the list of suppliers that have applied for a bargain for a favorite supplier. The payment is completed and the item delivered. The Reverse Commerce process is listed below [2]:

1) Individual experiences need for an item δ_i
2) Individual posts a request the item δ_i
3) Suppliers Σ apply for a bargain with the consumer γ by providing a quote
4) Individual enters bargain with chosen supplier σ and obtains the item in exchange for a liability or funds

From a consumer's point of view, the concept of Reverse Commerce would allow for a totally new consumer experience. Individuals who wanted to buy an item do not need to spend time on investigating items and suppliers anymore, but would rather simply announce that they have a demand that is to be fulfilled. The remaining actions would lie on the side of those suppliers that could potentially fulfill the demand.

In contrast to Forward Commerce, in Reverse Commerce the consumer solely decides for a product while in his decision making he leaves the supplier completely out. The decision for a product δ_γ is driven by the consumer's motivation to buy the product ($motivation_\gamma$) as well as the product's price ($price_\delta$). The three components δ_γ, $motivation_\gamma$ and $price_\delta$ get projected onto the product δ. Afterwards, the consumer gets automatically assigned the best feasible supplier influenced by his presentation and his reputation.

$$\gamma \Longrightarrow (\delta_\gamma, motivation_\gamma, price_\delta) \Longrightarrow \delta$$
$$\delta \Longrightarrow (\delta_\sigma, presentation_\sigma, reputation_\sigma) \Longrightarrow \sigma \quad (4)$$

VI. OPAQUENESS MARGINS

The key benefit of Reverse Commerce is that consumers do not need to understand the market behind the items they are interested in anymore in order to be able to find the best offer. While suppliers are competing against each other, consumers benefit from this competition by picking the supplier that offers the best deal. They leave the price making and negotiation as it occurs in Forward Commerce to the competing suppliers.

Contrary to Forward Commerce, Reverse Commerce implicitly ensures that the consumer finds the supplier that offers the best price. This is because in Reverse Commerce only the supplier that offers the best deal out of all suppliers that exist in the market will enter the bargain with the consumer. This is not to be taken for granted as normally in Forward Commerce the cost for the consumer to fully explore the market and reveal all suppliers within is very high. As in Reverse Commerce the consumer more or less "pulls" the offers out of the market, all suppliers that could potentially fulfill a demand will implicitly provide the best offer as their bid competes with the bid of other competitors.

In Forward Commerce, the responsibility of finding the best deal lies with the consumer. Depending on how well s/he investigates the market, the consumer will find the supplier that offers the lowest bid. Thereby, it is very likely that the consumer -no matter how intensively s/he investigates the market- will not find the lowest bid. In many cases, the market opaqueness is simply too high as there might be a huge number of suppliers that are spread across a large geographic area and not easy to locate. The opaqueness of the market will finally compel the consumer to restrict his search and employ an individual search heuristic. The consumer will choose a supplier that in accordance with the applied heuristic offers the lowest bid. In the average case the consumer chooses the average bid as depicted in Figure 1.

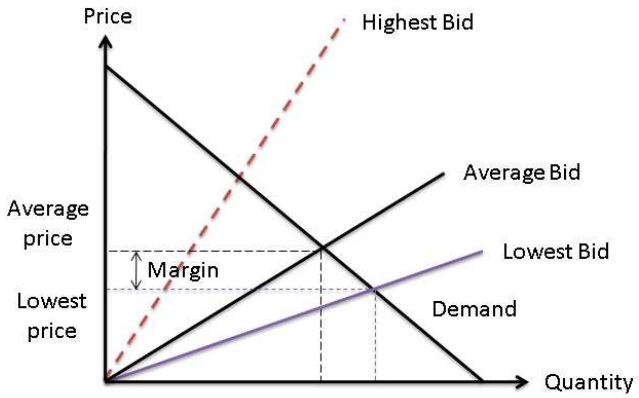

Figure 1. Best heuristic bid in Forward Commerce.

While the search heuristic allows the consumer to yield relatively good results (the average case) when dealing with the opaqueness of the market, the consumer will likely not find the best possible bid. In this case, the consumer will pay a price for the item that is by a "margin" higher than the lowest bid available in the overall market (see Figure 1). We will from now on refer to this margin as opaqueness margin. The opaqueness margin is the margin the supplier makes with the consumer not having found the lowest bid available in the market. Thereby, it is important to note that the supplier can only realize the opaqueness margin because the market is not completely transparent to the consumer. On the other side, the opaqueness of markets equips suppliers with a certain advantage in terms of bargaining power. Baileys and Bakos have referred in their fundamental work on electronic markets to this phenomenon as "bargaining asymmetry" [8]. While markets aim at aggregating buyer demand in order to achieve economies of scale to reduce supplier-biased

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bargaining asymmetry, markets that function in line with traditional Forward Commerce will hardly be able to completely abandon the opaqueness margin and thus remove the supplier-biased bargaining asymmetry.

VII. CONCEPTUAL BASICS OF REVERSE COMMERCE

In the following, we are going to provide a theoretical framework that outlines the conceptual difference between Forward and Reverse Commerce and points out the significance of the concept that underlies the opaqueness margin.

Let δ be the item an individual is looking for in order to fulfill a demand. Let μ be the determinator function that an individual employs when choosing a supplier to bargain with from a set of multiple suppliers. Let furthermore φ be the search heuristic an individual follows when searching for suppliers in a market which is not completely transparent and σ be the supplier the individual finally decides to bargain with. Let Σ^{δ} be the wholeness of suppliers that exist in an opaque market and that could potentially deliver the desired item δ. Let Σ^{δ}_{NC} be the wholeness of suppliers that exist within an opaque market and that due to the heuristic φ that was employed by the consumer to search the market, were not found and could not be considered. Finally, let OM be the opaqueness margin.

Reverse Commerce variables:

δ: desired item
Σ^{δ}: suppliers who can deliver δ
$\Sigma^{\delta} = \bigcup_{i=1}^{n} \Sigma^{\delta}_{i}$
Σ^{δ}_{NC}: suppliers not considered by consumer
φ: individual search heuristic
μ: determinator function that chooses supplier to bargain with
σ:chosen supplier
OM: opaqueness margin

with:

$$\varphi: \gamma \Longrightarrow \left(\delta_{\gamma}, \text{motivation}_{\gamma}, \text{price}_{\delta}\right) \Longrightarrow \delta$$
$$\mu: \delta \Longrightarrow (\delta_{\sigma}, \text{presentation}_{\sigma}, \text{reputation}_{\sigma}) \square \sigma$$

In traditional Forward Commerce, the supplier σ, which the individual determines, can be expressed as a function μ of Σ^{δ}, the individual search heuristic φ and the desired item δ. Thereby, Σ^{δ} represents the suppliers which exist in the opaque market (M) and which can deliver δ.

$$\sigma = \mu(\Sigma^{\delta}, \varphi, \delta) = \mu\left(\varphi(\Sigma^{\delta}, \delta)\right) = \mu(\varphi(\Sigma^{\delta})) \tag{5}$$

The number of suppliers the consumer found in the opaque market after having employed the search heuristic φ can be expressed as $|\varphi(\Sigma^{\delta})|$. Accordingly, the total number of suppliers that exist in the opaque market and that could potentially deliver the item δ can be expressed as $|\Sigma^{\delta}|$. If the quotient of both the number of suppliers the consumer found and the total number of suppliers in the market is smaller than 1, this implies that the consumer –due to the heuristic search- did not find all suppliers who could potentially deliver the desired item δ.

$$\frac{|\varphi(\Sigma^{\delta})|}{|\Sigma^{\delta}|} < 1 \rightarrow \text{not all suppliers were found} \tag{6}$$

The set of suppliers that –due to the heuristic search- were not considered by the consumer for a bargain is represented by Σ^{δ}_{NC}. Thereby, Σ^{δ}_{NC} is simply the quantitative difference between the total of suppliers in the market and the set of suppliers the consumer found after having applied φ to Σ^{δ}.

$$\Sigma^{\delta}_{NC} = \Sigma^{\delta} \setminus \varphi(\Sigma^{\delta}) \tag{7}$$

If there is a supplier in Σ^{δ}_{NC}, which the consumer does not know about, but which, if hypothetically chosen by the consumer, offered a better bargain than the best supplier within the set of suppliers the individual had to choose from after the heuristic was applied (φ(Σδ)), then the opaqueness margin OM is larger than zero. In this case, the chosen supplier σ made a margin with the market being not completely transparent.

$$\mu(\Sigma^{\delta}_{NC}) \succ \mu\left(\varphi(\Sigma^{\delta})\right) \rightarrow OM > 0 \tag{8}$$

In case of Reverse Commerce, above argumentation would look fundamentally different. One difference in Reverse Commerce lies in σ_{RC} being chosen from the total of suppliers in the Reverse Commerce market. The individual heuristic in Reverse Commerce (φ_{RC}) implicitly yields the wholeness of suppliers to the consumer. In Reverse Commerce, φ_{RC} makes all suppliers in the market visible to the consumer as all suppliers that would potentially want to bargain with the consumer themselves receive a notification from the market that a new bargaining chance exists. Suppliers automatically start providing the consumer with offers while readjusting their bids when competing with other suppliers' bids. The consumer merely needs to pick the lowest bid.

$$\varphi_{RC}(\Sigma^{\delta}) = \Sigma^{\delta} \tag{9}$$

Consequentially, the supplier which the consumer chooses from the set of suppliers it gained after having employed the heuristic $\varphi_{RC}(\Sigma^{\delta})$ is determined by $\mu\left(\varphi_{RC}(\Sigma^{\delta})\right)$ or in other words $\mu(\Sigma^{\delta})$. Thereby, the best supplier, which the consumer chooses from $\varphi_{RC}(\Sigma^{\delta})$, is also

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the best supplier which the consumer would hypothetically choose from Σ^{δ}, if the market was completely transparent to him. This results into the opaqueness margin OM being zero.

$$\sigma_{RC} = \mu\left(\varphi_{RC}(\Sigma^{\delta})\right) = \mu(\Sigma^{\delta}) \rightarrow OM = 0 \tag{10}$$

Finally, the quotient of $|\varphi_{RC}(\Sigma^{\delta})|$ and $|\Sigma^{\delta}|$ equals one, as no supplier exists that could not be found and taken into consideration by the consumer.

$$\frac{|\varphi_{RC}(\Sigma^{\delta})|}{|\Sigma^{\delta}|} = 1 \tag{11}$$

The consumer has found the supplier that offered the best deal without actively searching for it.

VIII. INFORMATION SYSTEM SUPPORT

While the above conceptual framework has outlined that customer-centric market coordination as it occurs in Reverse Commerce eliminates opaqueness margins, we are now going to detail how information systems can support large scale Reverse Commerce scenarios.

One essential requirement for Reverse Commerce to function properly is that both consumers and suppliers are given a medium via which they can communicate. In case of Forward Commerce, consumers are utilizing search engines in order to find the supplier they want to bargain with. In many cases, however, the search results are fuzzy, as neither the consumer was able to exactly describe what s/he was looking for, nor did all the suppliers appear in the search results. Even though price search engines specialized on increasing the response quality of queries that were placed by consumers, the accuracy of the returned results is still not very high. While easy queries already yield good results, more complicated queries that contain several restrictions on the product the consumer is looking for still fail in returning precise offers. With respect to an ongoing automation of matching consumer demand with bids posted by suppliers in Reverse Commerce, it is essential to increase the accuracy of query results.

In Forward Commerce, we do not see that the customer is provided with a "simplified and pleasing interaction" [9] that allows for an instantaneous gathering of product information. We believe that this is because of the shortcomings of the general approach of matching queries posted on web search engines with offers posted by suppliers, maybe even on their private website. No matter how smart the algorithms that search engines employ, they will always try to match poorly structured queries with poorly structured offers placed on the worldwide web. In order for Reverse Commerce to function properly, this concept needs to be able to rely upon high query accuracy.

In order to underline our argumentation above, let us assume the following theoretical example. Given a query Q that consists of n components $c_1..c_n$:

$$Q = \{c_1, c_2, c_3, ..., c_n\} \tag{12}$$

This query is provided (most likely as a string) to a search engine E that returns a result R consisting of the components $c_1..c_m$.

$$R = \{c_1, c_2, c_4, ..., c_m\} \tag{13}$$

Thereby, the search engine E projects the query Q onto the result R.

$$E: Q \rightarrow R \tag{14}$$

Intentionally, the user of the search engine would expect Q to be equal to R, as he expects the search engine to return accurate results. In this case, subtracting R from Q would yield an empty set ∅. Furthermore, m would equal n.

$$Q \setminus R = \emptyset \tag{15}$$

In most cases, however, due to search engines operating upon both weakly structured queries as well as weakly structured product descriptions, Q and R will be different.

$$Q \setminus R \neq \emptyset \tag{16}$$

This could indicate that either R does not contain all components of Q or it contains more components than Q as m would be different from n. The reason for the distortion that exists between Q and R is the poor structure of the query as well as the product description. Our approach towards a solution to the above problem includes strongly structured queries on the consumer side as well as strongly structured product descriptions on the supply side. Our approach aims at ensuring that $Q \setminus R$ always yields ∅.

In an earlier work, we have talked about Organic Product Catalogs (OPCs) [10] that aim at providing suppliers with a centralized, cloud-based and low-cost platform on the internet to describe and maintain their products and expose them to the worldwide web. We have designed the architecture of our OPC as in Figure 2.

Figure 2 provides two perspectives on a cloud-hosted OPC. In the horizontal perspective, based on the cloud platform, the tenant layer ensures that each participant has access to an own customized content area. The actual EPC distinguishes and individually manages the product descriptions for each client separately and thus provides full support for multitenancy. Furthermore, the OPC provides a general purpose product description language (PDL) that can be used to describe the products and services of each tenant.

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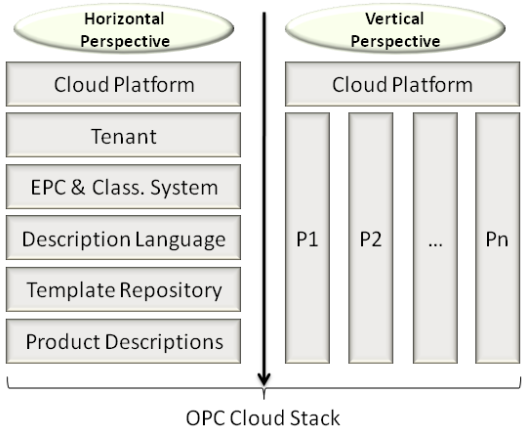

Figure 2. Cloud stack of an OPC.

In most cases, however, tenants will use templates that were created by other tenants earlier for describing their products [10] [11]. Finally, the bottom-most layer of our OPC centrally stores all product descriptions that a tenant is maintaining. The vertical perspective (or the per-tenant perspective) visualizes that on each layer in the horizontal perspective, tenants are provided with their own customized (multitenant) experience.

The general purpose product description language serves as basis for the definition of products and services of any kind. Thereby, it is important to note that the PDL aims at being universal. What that means is that the PDL is capable of modeling any product or service, no matter how trivial or complicated it is. One fundamental assumption we make in order to correspond with the universality requirement says that every product or service can be expressed as a list of hierarchically ordered attributes.

While our PDL can be considered as an XML dialect, it adds structure and with that machine readability to the product description. In accordance with our organic product catalog approach, we want to achieve the same structured machine readability regarding the queries that are posted by the consumer. The only way to achieve this is to equip the consumer with a possibility to express his demand in a standardized way. Regardless of how we will obtain the standardized query from the consumer (in the most trivial case s/he will write XML), once we have transformed the query into a machine-readable format, we will be able to run it on our organic product catalog.

The accuracy of the query result depends on the level of detail the consumer has provided in his query description. If a one hundred percent matching of the query with existing product descriptions is possible, the consumer will get immediate response from the system and with that an immediate quote. If the matching is only partially successful, because the consumer specified characteristics in his product that no product available in the product catalog has, suppliers would receive a notification from the system that they could potentially fulfill a demand, but need to customize their offers. In addition to that, suppliers could update their quotes, if they were outbid by competitors who posted lower bids. Of course, the outbid competitors could again update their bids, so that eventually the price of the final quote would be determined dynamically. In any case, the consumer would receive the lowest bid available in the market.

IX. TOWARDS A REVERSE COMMERCE PROCESS MODEL

As we have indicated earlier, in order to function properly, structured queries are necessary. Figure 3 features a process flow for how Reverse Commerce transactions could conceptually look.

The consumer begins with a web-based keyword search in order to determine the type of product s/he is looking for (1). S/he enters the search string similar to what is known from web-based search engines and submits it to the server. (2) If templates for the query are available, the consumer will proceed with customizing the query template while adding query components (1..n) to his query (Q). In addition to substituting template placeholders with concrete values, new components, which are not part of the original template, can also be added. Once the query was constructed, it is submitted in (3) and applied to the organic product catalog (OPC). As there can be multiple products matching the same query, the OPC returns a list of found products -the result set (R)- to the consumer (4). After the consumer has chosen his favored product (5), suppliers that could potentially deliver the product start placing bids on the price (6), either manually or automatically. Finally, once the consumer believes s/he has received sufficient quotes, s/he can decide for a supplier and the process concludes (7).

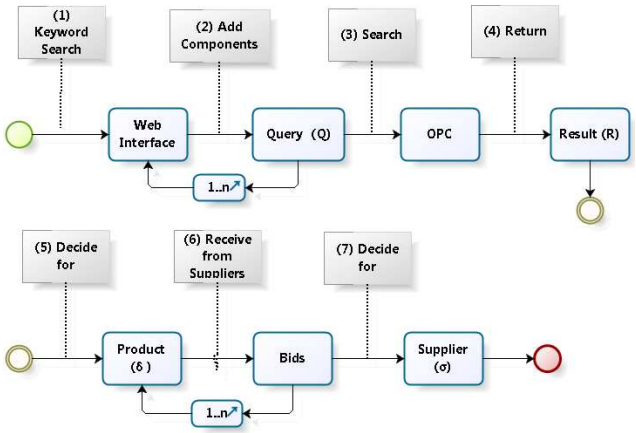

Figure 3. Process model for designing structured queries based on an OPC.

X. ECONOMIC IMPLICATIONS OF REVERSE COMMERCE

Since in Reverse Commerce, the opaqueness margin is implicitly abandoned while ensuring that the consumer receives the lowest bid without any meaningful action on his side, this could have significant economic consequences. We are now going to show how Reverse Commerce-driven markets could eventually even impact the welfare of a society.

In order to understand the concept of welfare, we will quickly review the match making process as it occurs in markets. According to Figure 4, the point where supply meets demand is represented by the tuple E = (market

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clearing quantity, market clearing price), whereby E is the market clearing equilibrium [12]. Figure 4 furthermore depicts that, if the supply tilts to the right, the supply hits the demand at a lower angle, thus resulting into a lower market clearing price and a larger market clearing quantity.

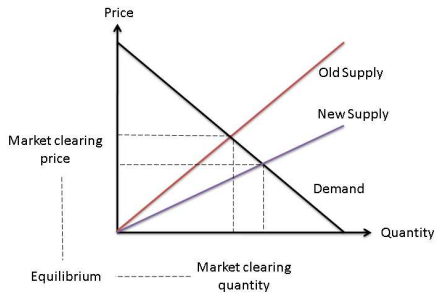

Figure 4. Market Coordination [12] [13].

According to [13], welfare is defined as the aggregation of the utility of single individuals or groups. Graphically seen, welfare can be expressed as the triangle between the demand and the supply function (see Figure 5).

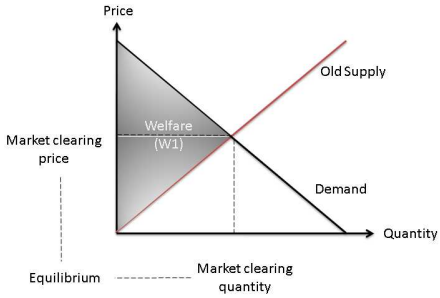

Figure 5. Graphical representation of welfare [13].

In accordance with Figure 4, by lowering the prices and thus tilting the supply function to the right, the area of the triangle between demand and supply increases. At the same time, a larger triangle means a higher welfare (see Figure 6).

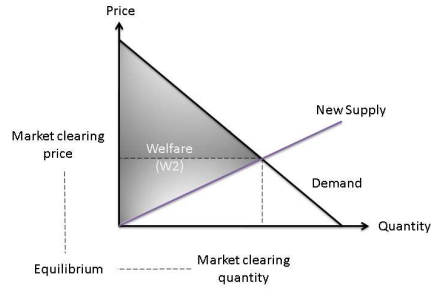

Figure 6. Increasing welfare by reducing prices [13].

Since we earlier stated that Reverse Commerce implicitly yields the lowest bid for the consumer, the Reverse Commerce demand function meets the supply function with the maximum possible right tilt. As the area of the triangle that determines the welfare exclusively depends on the tilt angle, the smaller the inclination of the supply, the higher is the welfare. While in Forward Commerce the consumer's demand function could as well meet steeper supply functions, the welfare is not implicitly maxed out, as it is the case in Reverse Commerce.

It is important to note that the welfare argumentation above is not exclusively applicable to Reverse Commerce. It is a phenomenon of electronic markets in general. While electronic markets typically show lower transaction costs of business transactions as compared to traditional markets [14], the consumers benefit from lower prices. This, however, does still not imply that consumers always find the bid with the minimum possible price. Solely the concepts and structures of Reverse Commerce ensure that consumers always find the lowest possible bid, which means that their demand meets the supply function with the flattest slope.

XI. INTRINSIC SERVICE QUALITY

At this point, we would like to discuss another economic implication of Reverse Commerce. With Intrinsic Service Quality (ISQ) we refer to the service quality which customers experience when interacting with vendors or suppliers. Even though there is no universal definition of quality, the general contemporary understanding is that quality means "meeting or exceeding customer expectations" [15]. The ISQ describes our attempt towards the definition of a concept that measures the quality of service which customers experience when interacting with vendors or suppliers.

In Forward Commerce, due to the opaqueness margins, which suppliers make with their customers, there is no immediate need for suppliers to guarantee a high level of service quality to their customers. This is because in Forward Commerce suppliers are often not chosen by consumers for a bargain because they offer the best service, but because they allegedly offer the lowest bid. In Reverse Commerce, however, the consumer implicitly assumes that every supplier who wants to bargain with the consumer already offers the lowest bid possible.

As we have shown earlier, in Reverse Commerce prices would eventually converge against the lowest bid available in the market as no consumer would voluntarily pay more than necessary. The only way for suppliers to distinguish their offers from competitors in Reverse Commerce is by excelling in the way they deal with their customers. By offering an intrinsic service quality to the consumer that is better than the competitors' ISQ, suppliers will convince consumers to enter a bargain with them. Figure 7 visualizes the conceptual difference of the ISQ in Forward Commerce and Reverse Commerce respectively.

As in fully supplier-biased markets consumers will encounter severe problems with finding alternative suppliers (e.g., monopoly), the bargaining power for products or services is more or less to a 100% with the supplier. Accordingly, the supplier can decide about prices and with this about the opaqueness margin OM s/he wants to make. Furthermore, there exists no incentive for the supplier to offer a high service quality (ISQ → 0%) as from the

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consumer's point of view he is the only supplier to deliver the item.

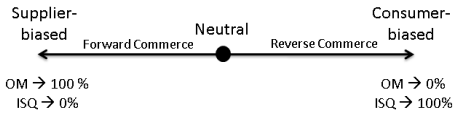

Figure 7. ISQ in Forward Commerce vs. Reverse Commerce.

In a fully consumer-biased market as it can appear in Reverse Commerce, the market would be totally transparent to the consumer. The consumer would implicitly know about all alternative suppliers in the market as those would "apply" at him for a bargain with their bid. As those suppliers that are not able to provide bids on the same price level as the cheapest bid in the long run would vanish from the market, there would be no opaqueness margin to make any longer (OM → 0%). On the contrary, if all suppliers offer the same low bid, the only way of distinguishing themselves from competitors is by offering a better service quality (ISQ → 100%).

XII. CONCLUSION AND FUTURE WORK

In this article, we have introduced the concept of Reverse Commerce and have opposed it to the traditional way of e-commerce market coordination. We have described in a formal model how Reverse Commerce could support customer-centric market coordination by reducing prices on products and services while at the same time improving service quality. We have furthermore detailed that Reverse Commerce can only function properly, if it is supported by information systems.

For this reason, our team has already started developing a prototype of the first Reverse Commerce-enabled electronic marketplace. Due to our Reverse Commerce marketplace eventually becoming subject to a comparatively high load, we have decided to leverage the power of the Cloud Computing [16] paradigm and implement the marketplace as a cloud-based application. Concerning the cloud platform, we have decided for Microsoft's Windows Azure, since the available tools as well as the infrastructure seem to be highly effective.

Once we put our first functioning prototype of a Reverse Commerce marketplace online, we hope to be able to soon gather data on consumer behavior and the acceptance by consumers as well as suppliers. If Reverse Commerce turned out to be the new way of e-commerce conduct, consumers could soon relax and lay back watching how the prices on their requests keep dropping with every new bid that was posted by a supplier.

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