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HOW PERFECT ARE MARKETS FOR SOFTWARE SERVICES? AN ECONOMIC PERSPECTIVE ON MARKET DEFICIENCIES AND DESIRABLE MARKET FEATURES

Sebastian Schlauderer

Sven Overhage

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Schlauderer, Sebastian, University of Augsburg, Universitätsstraße 16, 86159 Augsburg, Germany, sebastian.schlauderer@wiwi.uni-augsburg.de

Overhage, Sven, University of Augsburg, Universitätsstraße 16, 86159 Augsburg, Germany, sven.overhage@wiwi.uni-augsburg.de

Abstract

Global service markets, which efficiently coordinate the supply of services with the demand, are a cornerstone for the breakthrough of service-oriented computing (SOC). With the increasing popularity of SOC, forecasts hence predicted that service marketplaces would rapidly evolve and work profitable. Despite such promising prospects, only a few marketplaces were able to establish themselves until now, however. Trying to explain this situation, we analyzed leading service marketplaces like Salesforce's AppExchange or Google's Apps Marketplace from an economic perspective. Based on the theory of perfect markets with perfect competition, we describe several characteristics of service markets that cause market deficiencies. To adapt to the special characteristics of service markets, agents have to adjust their business strategies accordingly. While current literature primarily focuses on providing strategies for providers and consumers, marketplace operators as essential intermediaries are barely considered. We therefore derive desirable market features that can be integrated into the business strategies of marketplace operators and summarize them in a conceptual architecture of a model service marketplace. As a validation, we conducted a series of semi-structured interviews with SOC experts, who corroborated most of our findings and attested their practical relevance.

Keywords: Service-Oriented Computing, Service Markets, Economic Analysis.

1 Introduction

With its concept of "composing applications by discovering and invoking network-available services to accomplish some task" (Papazoglou et al., 2007), service-oriented computing (SOC) fosters the move to an industrialized development of enterprise applications, which reuses software services that exist around the globe (Cox, 1990, Turner et al., 2003). Reusing existent services is expected to bring many improvements that range from reducing the development time to raising the quality and enhancing the flexibility (Barros and Dumas, 2006, Papazoglou et al., 2007). Accordingly, SOC and related approaches such as Software as a Service have gained great attention both in research and industry (Weerawarana et al., 2005). Analysts even predicted SOC to become "a prevailing software engineering practice, ending the 40-year domination of monolithic software architecture" (Natis, 2003).

A prerequisite for realizing the advantages of reuse-based application development and truly leveraging the SOC concept is the formation of global service markets (Papazoglou and Georgakopoulos, 2003, Riedl et al., 2009, Barros and Dumas, 2006). Service markets play a key role in SOC scenarios as they coordinate the supply of software services with the demand of consumers. Since 2003, numerous market forecasts and scientific publications have therefore prophesied that service marketplaces would quickly evolve and grow in size (Turner et al., 2003, Shekhar and Anderson, 2005, De Souza et al., 2008). Specialized marketplaces to trade platform-specific services have moreover been envisioned to build a cornerstone for the emergence of so-called (Web) service ecosystems. Such ecosystems are expected to grow around software platforms like Salesforce's customer relationship management (CRM) core framework or Google's Apps (Barros and Dumas, 2006, Riedl et al., 2009).

In practice, only a few service marketplaces were able to establish themselves however. Even the Universal Description, Discovery, and Integration (UDDI) registry, a global Web service marketplace driven by a consortium of large software vendors, was discontinued as it never attracted a critical mass of providers or consumers. To avoid such „chicken-and-egg" problems, in which consumers hold off until there is a sufficient number of providers and vice versa (Varian, 2001), marketplace operators step in and offer own services to actively make the markets lift off. With such support, marketplaces like Salesforce's AppExchange and Google's Apps Marketplace were subsequently able to attract additional providers. Yet, service trading volumes continue to lag behind the expectations in many market segments (Igou and Hale, 2010). Although SOC has become widespread today and a significant demand for software services exists across the different market segments (Mertz et al., 2009), the prophesied market (r-) evolution thus still remains to happen.

In light of this observation, analysts have examined the key issues for service trading. As one issue, they found that deficiencies in current markets unnecessarily complicate the trading process and limit the trading volumes (Genovese et al., 2006, Igou and Hale, 2010). E.g., they criticized that current marketplaces do not provide sufficient information for consumers to discriminate the functionality and quality of services (Genovese et al., 2006). To increase service trading volumes, analysts therefore advise to uncover and eliminate such market deficiencies (Igou and Hale, 2010). Starting from this context, we present findings of a study in which we used economic theory to identify deficiencies in current service markets and to derive marketplace features that facilitate the trading process. As kernel theory, we used the criteria of perfect markets with perfect competition which characterize mature, efficiently working markets. These criteria serve as a benchmark to analyze service markets against. In particular, we address the following research questions: *How differ service markets from perfect markets with perfect competition and how does this affect the trading of services? Which marketplace features can help to mitigate identified market deficiencies?*

To identify market deficiencies, we examined StrikeIron, Salesforce's AppExchange, and Google's Apps Marketplace, which currently are among the leading service marketplaces (Igou and Hale, 2010). Marketplace features to mitigate identified deficiencies were deductively derived on the basis of relevant economic theories and by looking at measures that have been successful in other software mar-

kets (e.g. markets to trade software components). To confirm the practical relevance of identified market deficiencies and derived market features, we conducted a series of semi-structured interviews with SOC practitioners. The presented study is part of a research project that aims at designing and instantiating the architecture of a model service marketplace. This project is based on the design science paradigm (Hevner et al., 2004) and follows the design process depicted in Figure 1. In the paper, we focus on presenting the results of the process steps, in which the solution concept is created. To also inspect results of the subsequent solution instantiation, the reader is referred to www.componex.biz.

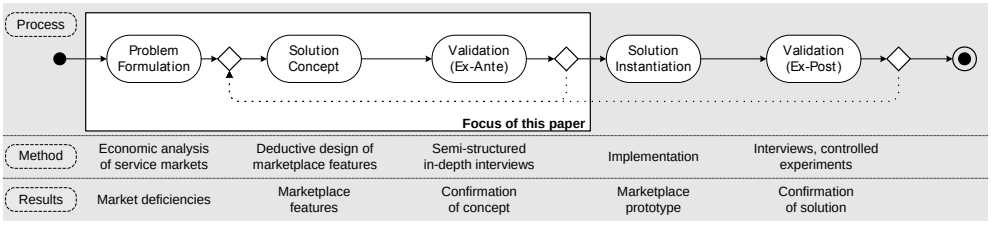

Figure 1. Overall design science process and focus of the paper, based on Takeda et al. (1990).

The paper is organized as follows: next, we discuss related approaches to set the context and confirm the research gap. We then provide the criteria of perfect markets with perfect competition (section 3) and describe deficiencies of current service markets (section 4). In section 5, we introduce desirable market features and show the resulting conceptual marketplace architecture. Section 6 focuses on the empirical evaluation before we conclude by discussing implications of our work and future directions.

2 Related Work

Global service markets that efficiently coordinate supply and demand have been recognized as a cornerstone for the breakthrough of SOC in research and practice (Papazoglou and Georgakopoulos, 2003, Turner et al., 2003, Shekhar and Anderson, 2005, De Souza et al., 2008). Correspondingly, there already exist initiatives to facilitate the trading of software services with new marketplace features in both disciplines. The majority of them aims at providing technical support to facilitate the finding of suitable services, e.g. by introducing cataloging schemas (Ludwig et al., 2007), service description techniques (Cardoso et al., 2010), or semantic search algorithms (Muñoz Frutos, 2009). Usually, however, these initiatives each focus on developing and improving a specific marketplace feature. As such, they are rather driven by technological considerations than being grounded in a concerted business strategy to adapt the design of marketplaces to the specific characteristics of service markets.

Insights into the specific characteristics of service markets can be gained from economic research and theories. For example, theories of two-sided markets and of markets for information goods can be conveyed to explain the mechanisms in markets for software services (Hahn and Turowski, 2003). On the basis of such theories, it is possible to analyze the influence of lock-in effects, transaction costs, standardization, or network effects on the coordination of supply and demand (Varian and Shapiro, 1998, Varian, 2001, Buxmann, 2001). If the coordination in a market is influenced by such characteristics, the participating agents need to adapt their behavior accordingly. While there exist concrete recommendations for providers and consumers how to handle such situations (Varian and Shapiro, 1998), comparable business strategies for marketplace operators are still under research. In one of the very few approaches, Conte et al. (2010) use the theory of network effects in order to deduce a novel distribution method that aims at increasing the number of providers.

Yet, dedicated studies of service market characteristics with the goal of deriving recommendations for the business strategies of marketplace operators and for the features of their exchange platforms do not exist. We address this research gap by analyzing service markets against the criteria of theoretically efficient markets to gain insights into the specific characteristics that have an influence on coordination.

3 Perfect Markets with Perfect Competition

In general, markets can be described as real or virtual locations that focus on trading economic goods to achieve coordination between demand and supply. To realize such a coordination efficiently, any kind of friction that interferes with the coordination process should be avoided (Walras, 1954). In theory, the perfect market with perfect competition describes the most efficient way to achieve coordination (Jevons, 1970, Williamson, 1985). We therefore use the criteria of perfect markets with perfect competition as an ideal to analyze service markets against. Although real-world markets will probably never meet these criteria completely, they serve as a popular benchmark to identify market deficiencies that interfere with an efficient coordination (Kamerschen et al., 1989). The conclusions derived from such comparative analyses provide the ground for reasoning about specific market characteristics and mechanisms to cope with them (Gould and Lazear, 1989). Admitting that the criteria of perfect markets with perfect competition sometimes differ in literature, we consider the following criteria C1-C6 for the analysis of service markets (Gould and Lazear, 1989, Jevons, 1970, Williamson, 1985):

Competitive agents (C1). Buyers and sellers are competitive, which means they are price takers that do not have enough market power to influence the price setting. To fulfill this criterion, it is not mandatorily required that participants compete in a large number. The crucial determinant rather is that "each economic agent acts as if prices are given" (Gould and Lazear, 1989).

No market barriers (C2). Agents are free to enter or leave the market at any time and without having to incur special expenses (e.g. due to copyrights, patents etc.). A new agent in the market is hence able to sell its product as easily as a long-established one.

Substitutable goods (C3). To ensure that buyers are indifferent regarding the various sellers, there must be substitutable goods provided by sellers. Substitutable goods do not need to be completely identical. Rather, they must be comparable in some key characteristics so that agents are able to switch between them. Ideally, preceding acquisitions of goods then have no effect on subsequent acquisitions.

Perfect information (C4). Agents are fully informed about the price, quality, and overall structure of goods. This information is an important basis for buyers to assess whether goods are suitable to satisfy their needs. It also assures that agents know if a specific price is adequate.

No transaction costs (C5). Goods can be traded without supplementary costs. This implies that especially processes like selection, contract negotiation, and settlement do not cause any costs.

Spot markets (C6). No temporal or regional constraints regarding the good exchange apply. Trading is consequently not affected by the location of participants, time differences, or opening hours.

4 Deficiencies of Today's Service Markets

During an analysis of current service markets, we identified the following causes ①-⑦ for violations of the aforementioned criteria. As violations of the criteria indicate frictions which interfere with the coordination process, we interpret them as market deficiencies that marketplace operators should adapt their business strategy to. For our analysis, we examined StrikeIron, Salesforce's AppExchange, and Google's Apps Marketplace which belong to the leading service marketplaces today (Igou and Hale, 2010). When comparing these marketplaces with the criteria of perfect markets with perfect competition, it becomes obvious that criterion C6 is fully satisfied: due to the digital, intangible nature of software services, service marketplaces can be well regarded as spot markets (C6). Using a network such as the Internet, they can be accessed without temporal or regional constraints.

By contrast, we found two problems when analyzing the criterion of competitive agents (C1). As on the one hand, SOC – despite its success – is not yet a mainstream approach for developing business applications, today's market size is still limited. As a result, many market segments on the inspected marketplaces were only sparsely populated (①). Even on leading marketplaces like Salesforce's App-

Exchange, we were e.g. not able to find more than 105 services for the entire finance domain. Other marketplaces like StrikeIron (or Google) do not offer more than 75 (190) services for the whole business domain (i.e. finance, project management, marketing, customer management etc.). On the other hand, the reputation of providers plays a key role in the good exchange on today's service markets (②). E.g., reputation as a mechanism of trust is fostered by consumer's concerns about the longevity of providers, which have been detected on service markets in a recently published study (Mertz et al., 2009). Believing that well-established and large-sized providers will not risk losing their reputation by discontinuing services or offering low-quality services, consumers develop a stronger confidence in well-reputed providers and prefer their services (Shapiro, 1983). However, reputation-based markets foster the creation of personal preferences, so that providers with high reputation will be able to dominate (even more densely populated) markets (Jurca and Faltings, 2005).

Reputation-based markets furthermore violate the ideal of absent market barriers (C2). As less notable, new, and smaller sized providers without competitive reputation are disadvantaged, they will, in the worst case even be unable to successfully participate in the market. Market barriers are further strengthened by provider-specific and mutually incompatible interface layouts and implementation conventions. Due to such dependencies, the acquisition of a service easily generates a lock-in effect that binds service consumers to specific providers (③). On Salesforce's AppExchange marketplace, it is e.g. not easily possible to combine Salesforce's charting services with services offered by StrikeIron to calculate customer value. They work, however, with the Salesforce variant of those services.

The constitution of such lock-in effects not only creates market barriers, but also violates the criterion of substitutable goods (C3). To promote a large-scale substitutability of services, mandatory technical and domain-specific standards for the development of services would be required (④). SOC, however, is far from such an extensive standardization. Besides, it is unlikely that even an exhaustive standardization would be able to avoid the emergence of platform dependencies and heterogeneities in practice, as it would cement the state of the art and interfere with innovations (Szyperski et al., 2002). It is therefore not realistic that standardization will exceed the level of basic (technical) standards. The substitution of services is further complicated since even leading marketplaces like Salesforce's App-Exchange and Google's App Marketplace only provide a free-text description of services. Providers often fill them with marketing messages. Comparing alternative services on the basis of arbitrary free-text descriptions is a cumbersome task, however, particularly as the content of descriptions differs from provider to provider (⑤). Where consumers are not capable of assessing and discriminating between offered goods, the corresponding market in general is likely to fail, though (Akerlof, 1970).

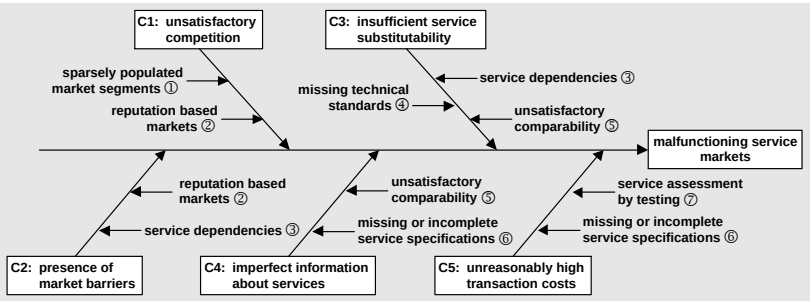

Figure 2. Cause-effect diagram to depict causes of deficiencies in today's service markets.

The unsatisfactory comparability violates the criterion of perfect information (C4), which requires that agents are fully informed about the characteristics of offered goods. Today, consumers are not even able to get precise information about functional and quality characteristics of provided services (⑥).Therefore, consumers would require information as it is contained in more formal service descriptions (Turner et al., 2003, Papazoglou et al., 2007). However, only StrikeIron goes beyond providing free-text descriptions and at least delivers a description of the programming interface, which is documented in the Web Service Description Language. While this information helps binding and invoking

a service, it is not sufficient to evaluate the provided functionality and quality in detail, though (Turner et al., 2003, Genovese et al., 2006, Papazoglou et al., 2007). Left unable to assess such characteristics until after buying, consumers are hence forced to treat services as experience goods (Nelson, 1970).

This situation furthermore causes noticeably high transaction costs (C5). Having recognized the lack of information about provided services as a potential problem, both Salesforce's AppExchange and StrikeIron offer consumers to evaluate test versions prior to the acquisition of a fully functional version. While this gives consumers an opportunity to gather additional information, it also burdens them with additional efforts, in particular if multiple services have to be tested during the search for suitable candidates (⑦). Easily, such extensive testing and the complex processes of narrowing down a set of candidates can exceed any savings obtained by reuse of services (Weyuker, 1998). Figure 2 sums up the causes for market deficiencies that we could identify in our analysis of today's service markets.

5 Desirable Market Features as Design Options

Coping with the deficiencies of service markets by introducing adjusted marketplace features can help marketplace operators to support a more efficient trading of services. To provide a basis for such adjustments, we propose the following eleven market features F1-F11. These features were derived by examining relevant economic literature and by looking at strategies of markets for other software goods (e.g. software components). We focused on three categories of features to address the causes of deficiencies. The first category aims at *improving the coordination* between consumers and providers to raise sales and the number of participants (①). The second category addresses *reputation as key factor for good exchange* (②), while the third category aims at *enhancing the provided information* about services (⑤, ⑥, ⑦). No features are proposed to improve the technical standardization of SOC (③ and ④), since an exhaustive standardization would be unsustainable on the market (cf. section 3).

Improving the coordination between providers and consumers is an essential task for marketplace operators to ensure a profitable amount of service trading. In markets for information goods, economic theory recommends providers to target as many consumers as possible and then differentiate the product according to their individual needs (Varian and Shapiro, 1998). Transferring this strategy to marketplace operators implies to cover many market segments (F1) and so avoid marketplace specialization until the number of services provided in individual market segments has reached a sufficient level. So-called universal service marketplaces are likely to better leverage investments as they aggregate profits from different segments and outperform specialized competitors which have difficulties in gaining profitable market shares. While most marketplaces currently cover different domains such as finance or marketing, nearly all of them are limited to particular platforms. Universal marketplaces will, however, have to appropriately support different market segments and fulfill consumer-specific demands (e.g. regarding the search and presentation of services, which may differ from segment to segment). Marketplaces should thus provide a structured catalog (F2), which distinguishes specific segments to separate services provided for different ecosystems or domains. Of today's service marketplaces, only Salesforce's AppExchange has implemented a sophisticated functionality. It e.g. provides a structured catalog with multiple levels of segmentation.

Fostering the amount of traded services can further be achieved by intensifying the interaction between consumers and providers as well as by notifying participants about recent offers. Such strategies have already been discussed for software component markets (Apperly, 2001). The interaction between providers and consumers can be intensified by inverting their relationship and permitting consumers to call for tenders (F3). This enables them to publish their requirements as a specification and use it to invite tenders from interested service providers, if a demand remains unsatisfied. The marketplace files calls for tenders and publishes them to providers who, upon acceptance of their tender, implement a suitable service. So far, only Google's Apps Marketplace follows a related strategy, in which they allow consumers to informally suggest apps. By offering notification services (F4), marketplace operators can automatically inform consumers of newly provided services and providers of recently published calls for tenders to match supply and demand more actively. Providers and

consumers should therefore be allowed to store search queries which are executed regularly. Based on such queries and user profiles, marketplace operators can also offer alternative or supplemental services to consumers. Such features could not be detected on the analyzed service markets, though.

Another way to increase the trading volume is to attract additional providers and consumers with a smart marketplace platform. Features F5-F8 have been derived from successful strategies of other online marketplaces and were adjusted to fit into the business strategies of service marketplace operators. Consumers can for instance be supported by offering specific entry points for target groups (F5), such as forums to trade services for different ecosystems, and by providing a seamless marketplace access from third-party applications (F6). Especially integrated development environments like Eclipse can be directly connected to marketplaces by providing specialized plug-ins. To support the development of such plug-ins, marketplace features should be made accessible at a common application programming interface (e.g. using the Web service technology). Until now, both features could not be found on today's service marketplaces. Consumers can furthermore profit from having access to community tools (F7), which allow them to provide a feedback on acquired services, engage into discussions, ask others for support etc. The recently introduced review sections from Google's Apps Marketplace or Salesfoce's AppExchange are steps towards such features. Providers on the other hand could be supported by minimizing their effort, e.g. by providing services to manage the settlement of transactions (F8) like taking over solvency checking or collection. As such features were not detected on current service marketplaces, they could moreover open up new sources of income for marketplace operators who can realize economies of scale and offer them at competitive prices.

Reputation as key factor for good exchange not only establishes market barriers for new and small-sized providers, but also inhibits competition. Since reputation already impeded the development of markets for software components, measures to systematically increase the trust in new and small providers were discussed in that field (Flynt and Desai, 2001, Aoyama, 2001). Service market operators can contribute to this by providing certification services and so conferring his/her reputation to service providers (F9). A certificate is a written guarantee (i.e. a digitally signed document) that a service complies with a published description and correctly implements advertised features (IEEE 1991). It may additionally attest conformity with standards to provide information about the substitutability of services. To better account for the long-term usability of provided services for consumers and to take precautions against discontinued support or bankruptcy of providers, marketplace operators can offer escrow services (F10). By offering to keep source codes and documentation of services in escrow, marketplace operators can act as fiduciaries who hand these artifacts over to service consumers in case of discontinued support. While such an instrument will not prevent discontinued support, it is in practice at least able to mitigate the risk of acquiring third-party services and especially to enhance the confidence in services of small- and medium-sized providers (Aoyama, 2001). On today's service marketplaces, we could not identify any features or strategies to moderate the role of reputation.

By **enhancing the provided information about services**, marketplace operators moreover support the discrimination of services and decrease the transaction costs associated with service testing. As already recognized by Papazoglou et al. (2007), consumers require comprehensive service descriptions to efficiently evaluate the characteristics of provided services. Service marketplace operators should therefore allow providers to publish service specifications (F11). In such specifications, providers explicitly document information about their services which is required to distinguish them from others and to assess if they fulfill a consumer's requirements. Yet, it is unclear which properties should be documented to describe the effects of services, since the specification of services generally continues to be an open research question. Following the current state of the art, specifications should not only document the programming interface, but also describe functional and quality characteristics as well as dependencies to other services or platforms (Overhage and Schlauderer, 2010). We hence propose a sample specification framework (Figure 3 right) which organizes such aspects into five so-called pages. Adopting a specification framework has critical importance for the entire business plan as it in fact also is a prerequisite for the design of certification and call-for-tender services. Since specification approaches on the other hand require a lot of data to be delivered by the service providers, marketplace

operators should not enforce the provisioning of complete specifications. It can be left to the market mechanisms to arrange for the availability of suitable service descriptions as providers of more extensive specifications allow consumers to better assess their services and so create a competitive advantage. As already discussed in section 4, current marketplaces do not go beyond providing free text descriptions and (in some cases) documenting the programming interface.

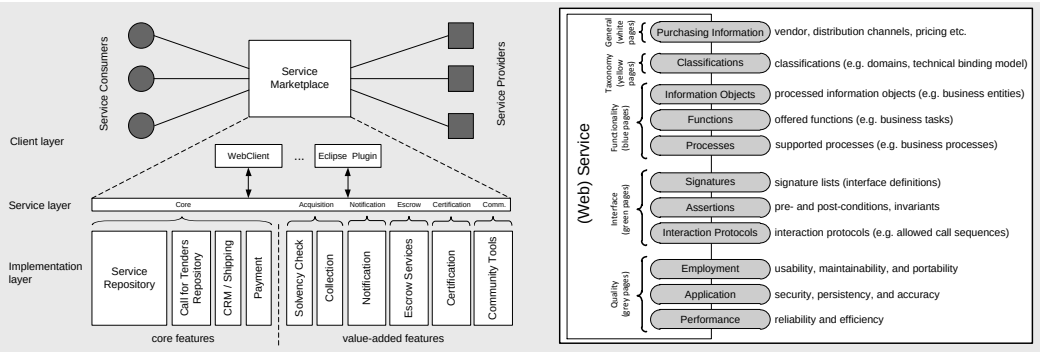

Figure 3. Service marketplace architecture (left) and sample service specification framework (right).

Figure 3 (left) shows how the proposed features can be included into an overall conceptual architecture of a service marketplace that goes beyond the state of the art. This architecture comprises three layers: the implementation layer realizes the functionality and is made up of several components. Core features thereby have to be realized to enable service trading, while value-added features further facilitate the trading process. The service layer provides a common application programming interface which exposes the marketplace functionality to clients. The client layer encompasses the actual Web site of the marketplace, segment-specific portals, and plug-ins to connect third-party applications.

6 Evaluation

To evaluate our findings and complement our theory-driven analysis, we decided on conducting a series of semi-structured in-depth interviews. The interviews started with a survey on demographic and general information as well as the participants' expertise about SOC. Subsequently, participants were asked questions about each of the detected deficiencies and the proposed market features. To better analyze the obtained feedback, we uniformly categorized the answers according to predefined classification schemes as depicted in Figure 4. These schemes provide top-down courses of questions that begin with the awareness of some concept and end by determining its severity. To assess the relevance of detected deficiencies, we firstly asked if a certain market characteristic is needed and if the need was met. If it was not met, we further asked whether this was felt to be a problem or even a critical problem. To examine the effectiveness of the proposed market features, we asked whether a certain feature is appreciated by the participant. If the response was positive, we wanted to know whether such a feature would be a major benefit or even crucial for using a service marketplace. We then categorized answers as type I (no support) to IV/V (strong support) responses (see Figure 4).

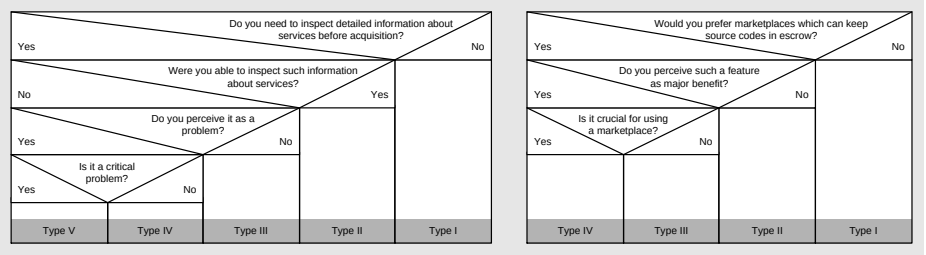

Figure 4. Classification Schemes for evaluating deficiencies (left) and market features (right).

Our setting to conduct semi-structured interviews was adopted from an approach proposed by Davies et al. (2004), which has been repeatedly used to test the relevance of theoretical findings from a practitioner's perspective (Recker et al., 2005). We used such a questionnaire structured in a top-down fashion as we wanted to start evaluating if our theoretical concepts are relevant at all, which is why we did not consider comparative questions as an alternative questionnaire setting, as such questions already imply their importance.

Participants in the experiment were 24 SOC practitioners from five German companies: two software manufacturers, two banks, and a consulting firm. All of the practitioners had several years of experience in different development projects and voluntarily participated in the experiment. Following Batra et al. (1990) the only incentive offered to them was an in-depth feedback on current SOC concepts, however we still observed a high motivation. The participants had a slightly varying SOC background but all of them had either much (42%) or very much (58%) experience. In their projects, six worked as business analysts, five were designers, six were programmers, four had the role of developers (with multiple tasks), and three were project leaders. The majority worked on SOC projects more than four years (83%) and regularly tried to reuse services from marketplaces (92%). Of them, only 9% could repeatedly reuse services, while 32% failed to reuse existing services at all.

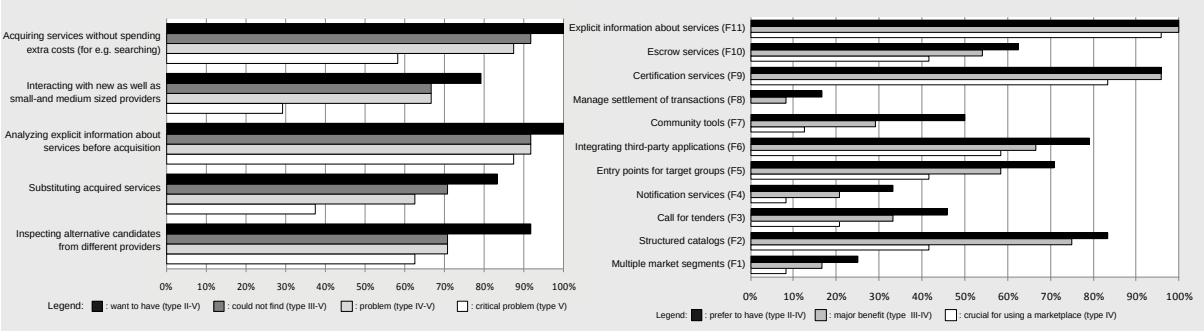

Figure 5. Responses to detected deficiencies (left) and proposed market features (right).

As Figure 5 (left) shows, the interviewees found all the identified deficiencies to be practically relevant market shortcomings. More than 75% expressed a demand to analyze explicit information about services, to abandon extensive service testing, to choose between alternative providers, to acquire substitutable services, and to also interact with specialized small- and medium-sized providers (type II-V). Consistently over 67% were unable to fulfill these demands when acting on current service markets (type III-V), however. The interviewees' judgment with regard to the severity of detected deficiencies admittedly varied more considerably. Still, more than 60% determined the evaluated deficiencies to be problems that need addressing (type IV-V). Yet, while over 80% found the lack of explicit information about services also to be a critical problem which prevented them from finding reusable services (type V), e.g., only 37% deemed a lacking substitutability of services as being equally critical.

In most cases, we could justify such variations of the severity with arguments from theory and practice, though. In the specific case, the lack of information about services had already been emphasized as a substantial problem in service markets by analysts (Genovese et al., 2006) and economic theory has proven such a situation to be severe enough to cause markets to fail (Akerlof, 1970). By contrast, acquiring services that cannot be substituted was felt as being less severe since service substitution often was not part of the interviewees' projects yet. As the participants mainly were service consumers, they found the issue of transaction costs to be an important one. A majority of the participants also acknowledged the advantages of interacting with new as well as small and medium sized service providers, although this was often not considered to be a critical aspect for using a marketplace.

While the detected market deficiencies all in all have been corroborated, support for the proposed market features differed more. As Figure 5 (right) shows, more than 67% of the interviewees judged the provisioning of explicit information (F11), certification services (F9), the integration into third-

party applications (F6), and structured catalogs (F2) to be a major benefit in practice (type III-IV). 50% or more still felt escrow services (F10) and specific entry points for target groups (F5) to be a major benefit (type III-IV), while at least 33% on average would prefer to have (type II-IV) call for tenders (F3), notification services (F4), or community tools (F7). No apparent support could be determined for the coverage of multiple market segments (F1) and the settlement of transactions (F8).

A majority of interviewees furthermore specified the provisioning of explicit information (F11), certification services (F9), and the integration into third-party applications (F6) to even have a crucial influence on their decision to use a service marketplace (type IV). The essential importance of a specification framework was implicitly confirmed twice, since certification services also build upon them as input. Hence service marketplace operators should think about adopting a specification framework and so giving service providers an opportunity to provide additional information. They could furthermore provide a common application programming interface to support the development of plugins and therewith the integration into third-party applications. Additionally, service marketplace operators should consider to provide structured catalogs (F2), specific entry points for different target groups (F5), and escrow services (F10) as more than 33% of the interviewees deemed them as being crucial to use a service marketplace (type IV). Among the features that only got weaker support were call-for-tenders (F3), community tools (F7), and notification services (F4). While at least one-third of the participants would prefer to have these features when using a marketplace, they did not consider these features to be of immediate help to satisfy a demand. Nevertheless, some of the interviewees would want to perform calls for tenders to outsource service development steps. Finally, the coverage of multiple market segments (F1) and the settlement of transactions (F8) were not considered to be of great importance by the participants. These features were instead deemed as being mainly beneficiary for marketplace operators or service providers and, accordingly, remain to be fully validated.

7 Conclusions

In this paper, we analyzed leading service markets against the criteria of perfect markets with perfect competition. As a result, we identified numerous deficiencies that help explaining the apparent discrepancy between the expected and observed development of service markets. To mitigate detected deficiencies, we derived eleven desirable market features as result of a comprehensive examination of other software markets and of relevant economic theory. During an empirical evaluation, all of the identified deficiencies as well as most of the proposed market features were corroborated as being relevant by SOC experts. The results of our research have implications for practice and academia.

For practice, they provide insights into shortcomings of actual service markets and show how the coordination of services might be better achieved. The discussion of market deficiencies, potential causes, and desirable market features provides a prolific theoretical basis for practitioners to evaluate existing service markets against, and goes beyond results of analyst reports. Marketplace operators can use these findings to validate their business strategy against. The presented marketplace architecture furthermore suggests innovative features which they might consider to take over and include into their solutions. To adopt such features, marketplace operators do not necessarily have to provide implementations themselves. Instead, they might choose to outsource features such as solvency checking or payment to specialized intermediaries. In doing so, they contribute to the rise of (Web) service ecosystems, in which multiple intermediaries are involved in commercial transactions (Barros and Dumas, 2006). Service providers and consumers can use our findings as a reference against which actual service marketplaces can be compared to in order to find a suitable trading platform.

For academia, our results signal the need to build and test theories to explain the economy of software services. While it is often demanded that such theories should make use of a new service-dominant logic (Maglio et al., 2009), established economic theories have turned out to provide an effective basis as well (Varian and Shapiro, 1998). On this basis, strategies for the behavior of consumers and providers in service markets have already been examined (Damsgaard and Karlsbjerg, 2010, Katzmarzik, 2011). However, research should also analyze strategies for the behavior of marketplace operators as

they play an important role in coordinating the supply of software services with the demand (Barros and Dumas, 2006). Therefore, it has to be investigated more closely how service market mechanisms work, which cause-effect relationships apply, and where deficiencies hinder coordination. Moreover, it should be examined further how such deficiencies can be mitigated. In this context, many research questions related to the creation of novel technologies will have to be addressed, e.g. to determine how services should be specified so that they can be certified, found in catalogs, and assessed by consumers. Since such technologies are enabling factors for an efficient trading of services, their exploration should be driven by requirements stemming from theories about the economy of services.

The presented research is a step into this direction. On the basis of the conducted analysis, we outline a framework of topics which are worthwhile to be investigated further and give indications for research priorities. While we will focus on evaluating additional deficiencies that were mentioned by the interviewed SOC experts in future work, we also invite other researchers to further investigate into service markets and create new insights – e.g. by using additional economic theories as the basis for analyses. Gained insights should be integrated into a framework of theories about the economy of software services, which could be a cornerstone of the Service Science, Management, and Engineering discipline.

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