Composite Solutions for Consumer-Driven Supply Chains: How to Control the Service-enabling Ecosystem?

by Simone Scholten (SAP Research), Ulrich Scholten (KIT) and Robin Fischer (KIT)

1 Introduction

Electronic platforms for e-procurement are increasingly being adopted especially in markets seeking for cost reductions like in the automotive market. In this segment, platforms like General Motors' SupplyPower, Covisint, which is operated by European and American Manufacturers, or the Bosch dominated SupplyOn represent efforts for building electronic supply chains, integrating e-procurement and simultaneous engineering as well as leading negotiations in industry standards' (Howard et al., 2005). A study, conducted by Howard et al. showed that most benefits are generated in fields like cost reduction, strategic planning, transparency, control over spending, reduced paperwork, improved supplier and business process development.

With the emergence of modular product and service design, however, more dynamic and flexible ways of creating customer value appear on the horizon. Solution providers can now empower their customers to design composite services based on individual preferences on top of a platform. These services are built based on loosely coupled supply chains of services, provided by a service-enabling ecosystem. Within the current paradigm of modular platform solutions the consumer is empowered to compose service combinations that best suit their needs. This shift has tremendous implications on value creation and capture within the supply chain and requires the platform operator to strategically stimulate and channel external efforts of service supply. The platform operator is obliged to control the business ecosystem, characterized as a complex self-organizing web of direct and indirect relationships between independent actors to co-create and deliver value, while the value of the total offering is determined and driven by the consumer. Ensuring efficient managerial control over the business ecosystems turns out to become a primary capability.

In this paper, we focus on platform-based ecosystems that have already adopted aspects of self-organization. The perspective ranges from pure IT- or service-centered solutions, e.g. by StrikeIron or PayPal, to actual material supply such as Amazon or Ebay. We begin most fundamentally by reviewing the shift from classical supply chains to more dynamic value net designs. In chapter 3, we analyze the changed requirements on control in the new supply chain design with the help of system theory. Subsequently, we categorize the resulting control mechanisms and discuss them at examples in chapter 4. Finally, we draw conclusions and end with an outlook to further studies.

2 The Shift from Classical Supply Chains to Value Nets

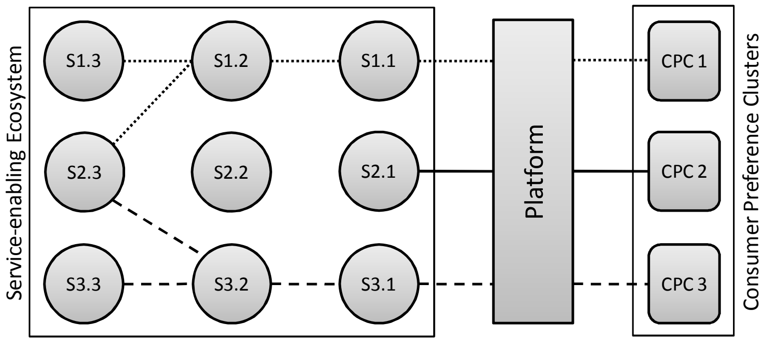
The IT sector is undergoing a major restructuring process, where according to business analysts, an important share of formerly transactional business designs will be replaced by Software-as-a-Service. Examples are IBM's shift from a software supplier (Jetter et al. 2009) to a globally-integrated service enterprise or the media-covered success of Salesforce. Financial service providers are also strongly embracing the Internet as infrastructure for value creation. Today, all credit card companies are firmly Internet-based. Companies like PayPal complement these services through new email-based payment solutions. Also the boundaries between the market segments disappear. Microsoft is "working with industry leaders eBay Inc., Equifax and PayPal to offer customers online integrated services for Microsoft® Office Small Business Accounting" (Microsoft, 2006). E-commerce-based providers such as Amazon or Ebay are creating completely new brands of trade within their ecosystem. The consumer's role is becoming much more central to the supply chain with an increased volatility of preference patterns. Consumers "demand product and service customization, speed and high levels of quality of service, all in a seamless fashion and preferably from a single provider. In many instances, consumers will only use and continue using products and services, if their value preferences and criteria are met or exceeded by the services provider" (Basole & Rouse, 2008). Demand and preferences change rapidly, driven by demand for innovation, flexibility and shorter time-to-market (Cherbakov et al. 2005). Market requirements may even change while the product is still under development (Iansiti & MacCormack, 1999). New and flexible development and innovation mechanisms are needed in response to this enforced dynamism. To be able to cope with these new requirements without losing the focus on core competencies, companies started delegating the process of value generation into the supply chain (Schmidt, 2000), limiting themselves to a role of substantiating basic value contribution.

Today, most supply chain structures have started softening with respect to the supply chain concept as defined in the SCOR-Model (Supply Chain Council, 2009). Responding to the respective requirements of flexibility and dynamics in supply and innovation, the value net concept finds increasing approval. A Value Net is defined as a digital supply chain" to achieve both superior customer satisfaction and company profitability. It is a fast, flexible system that is aligned with and driven by new customer choice mechanisms" (Bovet & Martha, 2000). In the following we will further elaborate the important characteristics of value nets and respective platform-mediated business designs.

2.1 Structure

As depicted in figure 1, the complete business ecosystem embraces the platform operator, complementary service enablers, lead producers, competitors, consumers and other stakeholders. We define service-enabling ecosystems as that part of the overall ecosystem that takes account of the service enablers only. Service Value Nets (SVN) can be read as instances of business ecosystems, consisting of service enablers, the intermediary, the consumers as well as their respective relations within one period of composite service generation and consumption. The intermediary in SVNs and the provider of a base value is called platform operator. He mediates between service consumers and service enablers.

Figure 1: Business Ecosystem



For further clarification of figure 1, consider a setting that consists of a service platform that mediates between a first tier of services and a set of service consumers: A first tier service (S1.1, S2.1, S3.1) may be a basic service (S2.1), or a complex service (S1.1, S3.1), aggregated from sub-services (e.g., S1.2). We consider service-enabling ecosystems to be open pools of services. Thus, service-enabling ecosystems comprise both services that are consumed in an SVN (e.g., S2.3) and those that are not involved in any type of business transaction (e.g., S2.2).

2.2 Complexity Aspects of Decentralized Management

It has been stated before that in the fast moving environment of the IT-service-platforms, innovation tends to be generated through the interplay of loosely coupled network participants. The level of complexity of such a Value Net can be described as (Basole & Rouse, 2008, p.55):

$$C = \sum_{i=1}^{T} pt_i * \sum_{j=1}^{N} (-\left(\frac{pn_j}{pt_i}\right) \log_2(pn_j/pt_i)),$$

T : Number of types of transaction in the network
N: Number of nodes in the network
pt_i: Probability of a type i transaction
pn_j/pt_i: Conditional probability that the jth node is involved, given the transaction i

It becomes evident that with an increasing number of service enablers (nodes) and transaction types, C grows rapidly to a level of complexity which is difficult to be centrally controlled by one single entity in the classic supply chain approach.

But what is the reason for complexity being unmanageably high in some markets and low in others? With system theory we can identify market dynamics as an important impacting factor on system complexity. Evidence for this is given on theoretic grounds: Equilibrium or quasi-equilibrium systems do not show complex structures comparable to those of dynamic systems (Prigogine & Nicolis, 1977; Goldenfeld & Kadanoff, 1999). In simple words, if there was enough time, companies would not need to move value creation and innovation into the supply chain. They would have enough time to develop products and amortize the respective development costs. However, if time presses, complexity evolves.

To handle this, many of the players in these markets have introduced degrees of decentralized control and respectively autonomy to the service enablers. For comparison consider a web-shop owner in Ebay or Amazon, who is to a great extent the master of his product-mix and pricing and who is fully responsible for the choice of his sub-supply chain. With regards to the above introduced formula, the reduction of nodes and transactions in the influence sphere of Ebay or Amazon drastically reduces their handling complexity.

Giving up much of the shaping influence on product-mix and reducing to substantiating services migrates value creating activities into the service enabling ecosystem. It turns into a federation of capabilities where cooperation happens based on real time flows and integrated IT systems (Cherbakov et al., 2005). The integrator's role is more and more transformed from the supply chain shaper to a mediating platform operator.

2.3 Delivering Consumer-centric Composite Solutions

The consumer, who traditionally used to be considered a network externality rather than being part of the actual service production process, gains a prominent role in the co-creation of value (Katz & Sharpio, 1985, 1986). Illustrative examples are social platforms like Facebook which gain an important share of their value through their actual user community. In the mobile communication segment, the quantity of users within a specific supplier network defines the number of people who can benefit from free on-net calls. Additionally, the consumer increases platform value through his choice in terms of relevance and reputation (Scholten et al., 2009).

Enabling those consumer-centric composite solutions requires a platform operator to have a clear understanding of their core competencies and the new capabilities they need to develop in order to satisfy individual customer needs. In particular, companies have to decide which capabilities can be provided in-house as a substantiating value (base value) and which will be complemented by service enablers in order to provide the "whole product" (Moore, 1999). At root, they need to ensure that the customer perceived value of the overall solution is greater than the sum of its parts (Davies et al., 2006). The customer perceived value - defined as the ratio between perceived benefits and perceived sacrifice (Monroe, 1991) respectively as "the consumer's overall assessment of the utility of a product based on a perception of what is received and what is given" (Zeithaml, 1988) - is subjective and individual. It, therefore, varies among consumers. To compete effectively, companies moving into customer solutions face the challenge of being required to offer a high variety of products and services. They thus increase the likelihood that each consumer finds exactly the option desired allowing each consumer to enjoy a diversity of options over time (Kahn, 1998). In the light of disparate and uncertain demand, however, it turns out too risky for a single company to carry the burden of high development costs of creating an all-encompassing variety on their own (Haas, 2006).

Thus, successful platform operators depend on robust, highly productive service-enabling ecosystems to co-create the platform's overall value proposition and to support its market adoption (Gawer & Cusumano, 2002). Therein, "the performance of a firm is a function not only of its own capabilities or of its static position with respect to its competitors, customer, partners, and suppliers, but of its dynamic interactions with the ecosystem as a whole" (Iansiti & Levien, 2002). These ecosystems (also: business ecosystems) are understood as an "economic community supported by a foundation of interacting organizations and individuals [...]. This economic community produces goods and services of value to customers, who are themselves members of the ecosystem"(Moore, 1993). The participants of the business ecosystem "work co-operatively and competitively to support new products, satisfy customer needs, and eventually incorporate the next round of innovations"(Moore, 1993). They co-evolve their capabilities and roles over time, and tend to align themselves with the directions set by one or more central companies, the platform operator. These dependencies, however, evoke indirect network effects, determining the platform's market success and profitability: The more external companies join the value net in order to create complementary innovations, the more valuable the platform becomes. This dynamic causes more users to adopt the platform and more complementors to enter the ecosystem (Cusamo, 2008). The mutual dependences between platform owners and their value net make clear that the performance of the single company is increasingly dependent on constant innovation: on creating value that is critical to the whole value net's continued price/performance improvement (Iansiti & Levien, 2004). This implies a continuous services portfolio optimization and provision of superior customer value.

The platform operator is obliged to control the business ecosystem. However, given the non-linear and autonomous behavior of independent services enablers, the platform operator cannot simply demand a supply of innovative or optimized services, but has to encourage suppliers to keep on optimizing the complementary offerings and, therefore, the complete offer. This implies empowering and stimulating service enablers to invest in optimizing their service offerings.

3 Management Control in Service-enabling Ecosystems for Improved Service Supply

Previous sections have shown that controlling value creation efforts in service-enabling ecosystems has become a critical function to the platform provider. Failures can rapidly lead to reputation damage, financial losses and possibly, even to the ecosystem's decline. However, due to the lower stakeholding power of a platform operator compared to a centrally controlled supply chain, mechanisms of management control in service-enabling ecosystems significantly differ from centralized supply chain management and control approaches. As our study shows, it is rather the adept combination of different proactive and reactive control mechanisms that is most successful. We understand management control in service-enabling ecosystems as the platform operator's efforts and activities to ensure that the behavior of the ecosystem and the decisions made by autonomous service-providers are consistent with the overall objectives and strategies set by the platform operator. In particularly, management control in business ecosystems involves:

- Envisioning and - as far as possible in a self-organized system of autonomous service enablers - planning the overall evolution of the business ecosystem.
- Evaluating information about the overall system evolution as well as about emerging opportunities and threats within the business ecosystem.
- Attracting service-enablers to support the platform's overall customer value proposition.
- Ensuring strategic coherence and congruence, this means that the efforts of the participating service-enablers should be consistent with the strategic intentions of the platform operator.
- Deciding, which value creation efforts are to be done in-house and which to be complemented by external service-enablers.

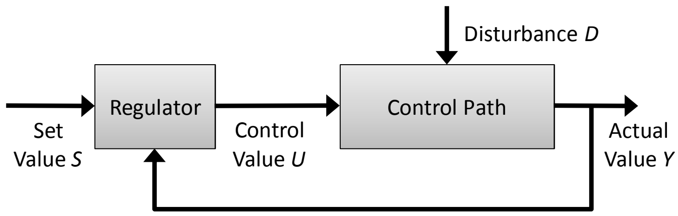
Communicating information about the ecosystem's strategic vision and investment for third party service-enablers, about the terms of joint collaboration applying when selling services on top of the platform, and information about customer behavior in order to optimize service offering according to the most recent consumer requirements.In summary, the looser the network's coupling, the more difficult it becomes for the platform operator to influence quality and range of offer (Scholten et al., 2009) How can the platform operator drive the service enablers to create fertile grounds for a product-mix-proposition that leads to sustainable success? How can they insure that the service proposition, offered through their service ecosystem and manifested in the value nets, matches the target groups' utilities? How can they drive industry-wide innovation in the ecosystem through their evolving strategic goals? We will provide answers to those questions in the following chapters.

In our solution, we make use of system theory to describe, model and manipulate services in the context of a service platform. To do so we first introduce the concept of feedback as found in system theory, in particular in control engineering (Föllinger, 1990).

3.1 Controlled Systems

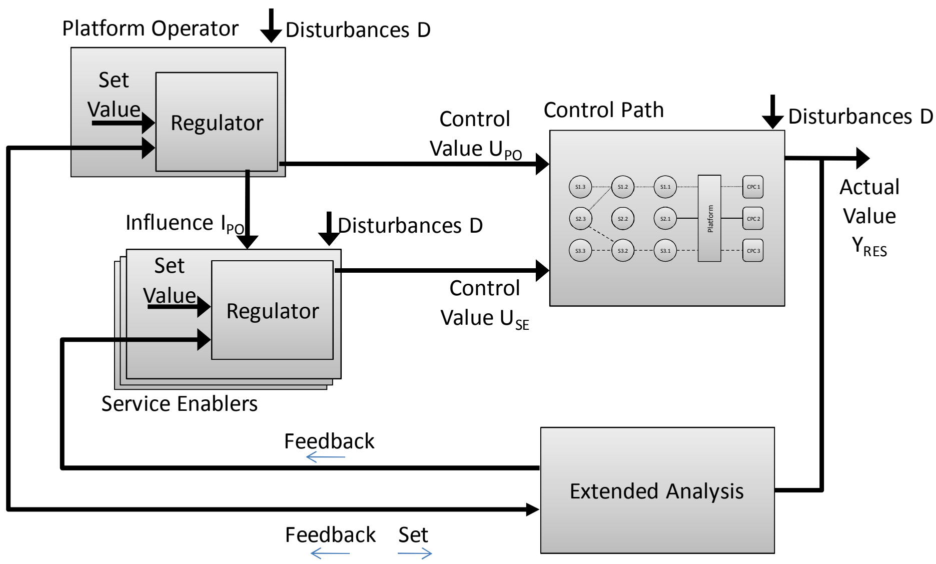
Controlled systems aim at adapting the actual value to the level of the set value by leveling the control path. This is done by monitoring the actual value Y tapped at the end of the control path (see figure 2). Then, an active regulator deducts the actual value Y from the given set value, resulting in a modified control value U. Based on the newly adjusted control value the new actual value is tapped again, which is where the feedback loop is closed. Since disturbances may influence the control path by random noise or a steady change in the external environment, the actual value may be disturbed. In these cases the feedback to the regulator allows for re-leveling actual and set value.

Figure 2: Feedback Control System in System Theory



Given these introductory considerations on feedback control systems, we are now able to design a feedback control system for SVNs, likewise constituted by the interconnected entities control path and regulator (see figure 3). The SVNs (services, platform and consumers) represent the control path CP of the feedback control system. The actual value is tapped as raw data to generate feedback to multiple service enablers or the platform operator.

Figure 3: Overview of the SVN with feedback loop as a controlled system

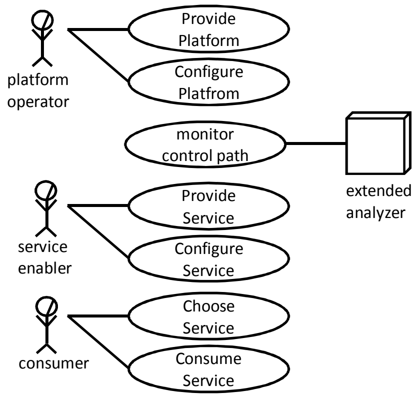


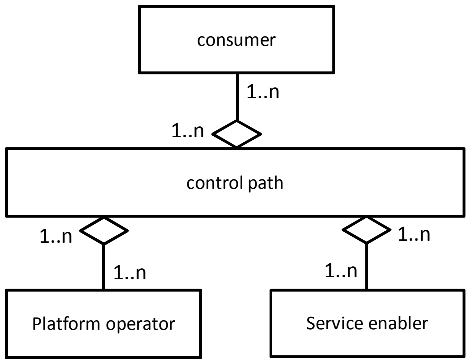
Based on received feedback on his actual performance and in alignment with his commercial goals (set value), each service enabler now may readjust his service proposition. While his service offering is placed within the control path, he is an outside spectator, influencing the process through the modification of his respective service. The set screw for service parameter modification is depicted in a detached imaginary component, called regulator. Hence, the network self-organizes. Service enablers may modify their value proposition in one or more of the SVN's services (within the control path) by internal "process transformation" (Bernet, 2000) or through a selective replacement of their respective supplying services. This then causes a "system transformation" (Bernet, 2000).

Similarly, the platform operator is part of the loop. Platform operators differ from service enablers, as they possess a configuring power on the extended analysis component. In some platform designs, the platform operator may also exert direct or indirect influence mechanisms I_{PO} on service enablers. I_{PO} is indicated in figure 3 as the influencing arrow pointing from the platform operator to the service enablers. It is not linked directly with the regulator like the feedback-loop but acts on each service enabler as a whole. The reason is that it might impact the service enablers' set values. The external influence is summarized in control theory as disturbance, a term that describes an impact causing a deviation from an original set, but which is not meant pejoratively. Disturbances can be influences from outside the system such as changes in market conditions or through outside stakeholders. They take effect upon the control path as well as on the actors such as the funding bank which causes the change of the set value of a specific service enabler.

In the figures 4a) and 4b) we analyze the control path in depth. It can be understood as the space in which services, platform and consumers create the service value nets. Figure 4a) describes the tasks accomplished by each actor. The platform operator provides and configures the platform. The service enabler provides and configures the services and the consumer finally chooses and consumes the services. The extended analyzer is a component we introduce to analyze service enabling and consumption patterns. The class diagram (4b) summarizes our understanding of the control path.

Figure 4a): Control Path, Use Case Diagram *Figure 4b): Control Path, Class Diagram*





To unambiguously describe the control path, we can now formalize it as C:

$$CP := \left\{\exists PO_i \land \exists SE_j \land \exists C_k\right\} \mid Y = f(U_{PO}, U_{SE}\ , D)\}$$
$$: PO_i \subseteq PO;\ SE_j \subseteq SE; C_k \subseteq C; \{U_{PO}, U_{SE}; D; Y\} \subset \ \mathbb{R}^n$$

PO: Set of platform operators
SE: Set of all service enablers
C: Set of consumers
Y: Denotes the actual value
U_{PO} and U_{SE}: Control values by the PO and individual SEs

Although, the model and reality provide scope for several platform operators within the same controlled system, we limit our consideration in this paper for the sake of simplicity on one platform operator only. Y aggregates all relevant actual data of the system. Also we can assume that U_{PO}, U_{SE} and D carry a whole set of data. We hence define them as vectors within $\mathbb{R}^n$.

3.2 Self-organizing Systems

In the following, we elaborate on individual actors in business ecosystems. All actors have different expectations (set values) as regards the performance of their services. These expectations may be influenced by intrinsic motivation, external stakeholders or feedback from the market. Although all systems have different goals, the macroscopic behavior of the system is coherent as it produces value for the consumers. It does this in a self-organized and adaptive way. Providers (be it service enablers or platform operators) leave the ecosystem if they do not see potential for the satisfaction of their goals within this business ecosystem. Others might join the ecosystem instead. Such systems are called emergent, as they evolve self-organized in a way that makes them robust against environmental changes e.g. customer demand.

Self-organized systems are characterized by a small cause, large effect principle through non-linear interactivity: The interaction of the service enablers, platform operator and consumers causes a so-called macroscopic effect – meaning a coherent behavior of the SVNs. Feedback incites enforced reverse adaptation on the micro-level (the service enablers' offerings). The results of a first optimization (e.g. reaction on shifting consumer preferences) again will trigger feedback. Over time, the complete business ecosystem will line up to a temporary equilibrium: Once there is no deviation anymore between the service enabler's commercial goals (set value) and the actual value, the configuration stops growing until the next adaptation is initiated (De Wolf & Holvoet, 2003; Prigogine & Nicolis, 1977).

3.3 Centralized versus decentralized control

The question is how a platform operator can actively control the ecosystem of service enablers (service-enabling ecosystem) in order to better respond to market requirements or simply to its own goals. Acting too dominantly (e.g. through directives) might reduce the level of self-organization in a way that emergence and hence robustness against changing conditions are no longer guaranteed. However, a lack of influence may lead to the fact that quality expectations or coherence with the platform operator's goals are not met.

Centrally controlled systems are subject to inertia, caused by an increased lead time. This is explained through the purely reactive and hence sequential adaptation process of the service enablers to the platform operator's directives. In centrally controlled systems reverse adaptation on the micro level (meaning self-organized adaptation by the service enablers) is excluded. Any system reaction in such a constellation depends on a linear cycle where the system's total setting time is defined by the transient process of the value net dominator's set points and the value net partner's reactive adaptation process. The dominator's advantage is a strong influence on system output and particularly on quality. As already highlighted in chapter 2, the consequence is that this kind of structure becomes increasingly difficult to manage, the more a value net gets complex and the more an environment gets dynamic. The options for the dominator are either to show best efforts to reduce system complexity or to open up the control process to a higher level of self-organization.

Systems of decentralized control mechanisms with self-organizing service enablers show a more proactive behavior. That is faster and more reactive than a purely centralized approach. However, the platform operator loses influence on system output and quality.

4 Control Mechanisms in Service-enabling Ecosystems

Chapter 3 shows that underperformance of service-enabling ecosystems can be particularly caused by a lack of coherence, motivation, information, legal, and/or financial resources. Correspondingly, the application and combination of different control forms needs to vary with the situation and concrete strategic goals that impact performance of the overall value net. We will now introduce and categorize control mechanisms, which we derived based on our explorative study and discuss those at prominent examples.

Control in service-enabling ecosystems can be implemented within different phases (a) while initial service specification, (b) while service development, and/or (c) while services are in use. The flow chart in figure 5a) depicts a variety of optional or combinatory mechanisms, instruments, rules, and processes to control system behavior by controlling the behavior of autonomous service enablers. In addition it shows a filtering component. By introducing an access filter between service development and the usage of services, we enable platform operators accept or deny services.

We differentiate between 6 categories of control applying to service-enabling ecosystems. The numbers in brackets indicate the control mechanisms, applied by the platform operator. Figure 5b) shows the respective closed-loop system at the example of one service S_i, provided by the service enabler SE_i. The indications of the respective influence points I_{PO}, I_{FB} and I_{Access} illustrate where the types of feedback from figure 5a) act upon in the example system (figure 5b).

- Restrictive Control [1]: Legal and quality related intellectual property agreements such as statements of rights and responsibilities, platform access regulation
- Co-regulative Control [2]: Guiding principles of service development, providing development rules or tools for coherent and observable service supply,
- Market Regulative Control [3]: Consumer based service verification and auditing
- Sanctional Control [4]: Platform access regulation
- Motivational Control [5]: Development support, community building, funding
- Informative Control [6]: Information about consumer behavior, platform evolution, value creation opportunities

Figure 5a): Management Control Process in Service-enabling Ecosystems

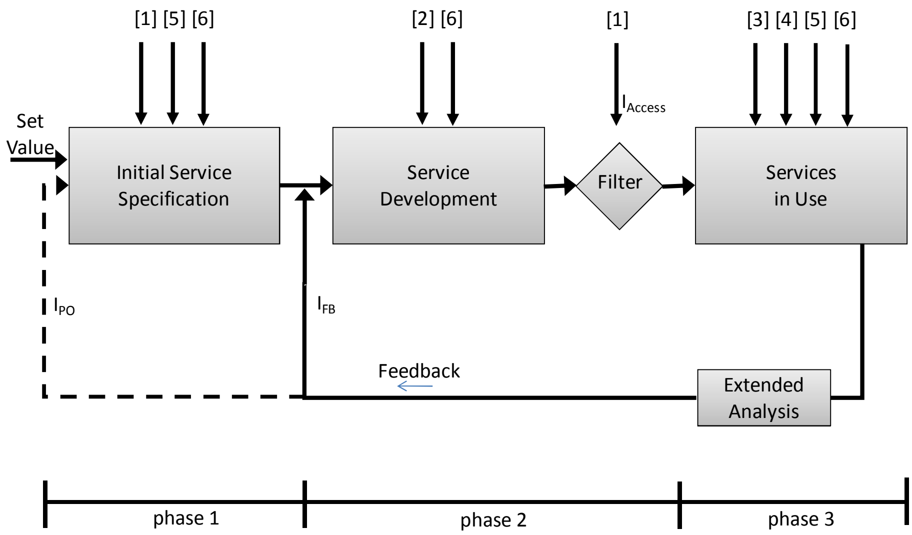
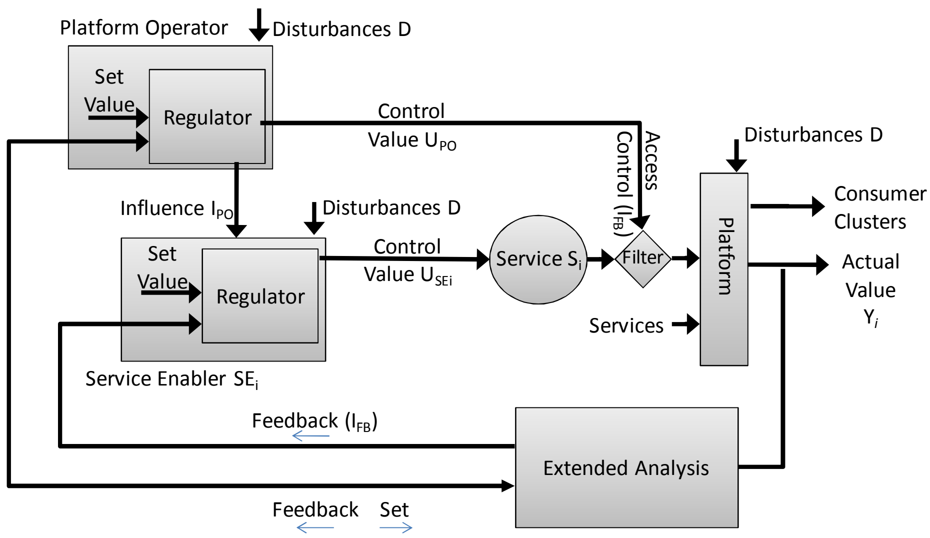


Figure 5b): Closed-loop System with Management Control Loops for one Service (S_i)



4.1 Restrictive Control [1]

These mechanisms apply pro-actively prior to the implementation of a service. Most of the platform operators regulate platform access and strictly define terms and conditions for service supply on top of their platform, which go beyond the assurance of legal correctness. This way, a basic coherence of the platform operator's expectations and the service enablers' deliverables is insured. To verify this, many of the platform operators offer automated entrance assessment methods. We analyzed in our explorative study those at eSigma, Xignite and StrikIron. Each service enabler has to run through an automated link-in procedure and is only allowed to participate in the service-enabling ecosystem once the assessment has been successfully accomplished. In the routine quality and interoperability-features are tested.

Ebay has established policies and rules (Ebay, 2009) for vendors. Those rules include prohibition and restrictions of items, listing practices and performance guidelines. Violation will lead to sanctions, i.e. listing cancellation, forfeit of eBay fees on cancelled listings, limits on account privileges, loss of power seller status, account suspension.

According to the company's official communication, Microsoft allows open access to its app store for service enablers. However, it has rigorous testing mechanisms for quality and suitability of "user experience" (Kretschmann, 2009)

Apple shows a strategy-driven restrictive product range management to avoid conflicts with its own base value contribution or with its own other products. Products like Google Voice were refused in July 2009 as it seemed to be in conflict with Apple's business model (Chen, 2009). Unauthorized products are technically blocked in the iPhone-environment.

With respect to security-sensitivity, ecosystem participation in the financial service industry is very restrictive. Certification is mandatory for service enablers in the credit card industry. Participation in the ecosystem of the leading credit card suppliers is exclusive for service enablers which are Payment Card Industry's Data Security Standards certified (PCI DSS). A company processing, storing, or transmitting cardholder data must be PCI DSS compliant, including secure networks, data protection systems, vulnerability management programs, strong access control, regular monitoring and testing procedures and information security policy.

4.2 Co-regulative Control [2]

Through the provision of development rules or tools, coherent and congruent service supply is ensured and observable through-out the whole life-cycle of a service. In many cases, service enablers are required to develop products with software, interfaces and/or according to development guidelines that allow the platform operator to observe the function of the services in detail. These guidelines often go hand-in-hand with escalation routines which allow rapid reaction after early notification by service enabler and platform operator. Hosting the application on its own platform or infrastructure further enables the platform operator to ensure the transactional qualities like availability, sufficient replication or computing performance etc. Software-based service solutions which are stored and operated within the platform operator's domain are called native. As automated quality checks and reactive measures are much easier for native solutions, Force.com limits its quality commitment only on native third party services.

Microsoft obliges its service-enabling ecosystem to develop native solutions, meaning designed in a predefined architecture with proprietary tools and stored in its own domain (Kretschmann, 2009).

4.3 Market Regulative Control [3]

Through consumer based service verification and auditing and its respective publication, aspects of the service-enabler's performance are made publicly visible. Many platform operators use reputation mechanisms. Whereas some are limited on a quantitative scoring approach, others like Amazon or Force.com allow descriptive reviews for offered services or products. At Ebay, high-performers, i.e. those who get a 98% score in feedback receive a "power seller" status which increases visibility and trustworthiness. In a more formalized approach, some platform operators (e.g. Force.com) offer annual informative certification for the offered services or for service enablers. This primary goal of market regulative control is to inform and to put pressure on the service enabler, as his performance is made publicly visible and will impact the service enabler's financial success. However, operators like Ebay have also established reactive procedures which could lead to sanctions towards a service enabler, if his scores are too low. In this case, market regulative control is put into a sequence with sanctional control

4.4 Sanctional Control [4]

In contrast to the market regulative methods, the assessed performance has direct consequences on the service enabler. Many platform operators apply reactive methods to remove an offering from their platform. In Ebay's Verified Rights Owners (VeRO) program, the platform operator enables rights owners "to easily report and request removal of listings offering items or containing materials that infringe their intellectual property rights" (Ebay, 2009). Through semi-automated procedures, Ebay removes offerings from its platform.

4.5 Motivational Control [5]

This control approach includes measures to indirectly control the service-enabling ecosystem through incentives. Examples can be development support, community building or even funding.

An intrinsic motivation is the provision of a large consumer-base. Apple was a first mover for platform-mediated apps for his own telephones. With its apple app store, it generated a turnover of 2.4 billion USD in 2008 with a commission of 70% to the respective app developers (Malik, O., 2009). The relevance of the ecosystem's confidence in success and critical mass is the reason why platform operators with strong or dominating market positions have an advantageous starting position through their customer base. This explains why companies like Microsoft, Apple or Salesforce are favored entrants into platform businesses. New players in the market like StrikeIron have to fight for a critical mass.

Amazon motivates its customers with distribution support via its platform, but also a base value through the handling of financial and logistic transactions (fulfillment by Amazon). Additionally, Amazon's service enablers benefit from a significant critical mass and an efficient logistics infrastructure.

4.6 Informative Control [6]

Information about consumer behavior, platform evolution and value creation opportunities is communicated. Many platform operators today provide basic feedback to their service-enabling ecosystem. Companies like StrikeIron, Xignite or Skype communicate error-feedback to their service enablers. Basic statistical feedback is also provided e.g. by StrikeIron.

Still the participants face the problem of information asymmetry (Williamson, 1981): Neoclassical theory postulates total disposability of market information to the vendor allowing for market-conform adaptation of his service portfolio (Kleine, A, 1995). Being positioned in a dyadic relation with the platform operator (or the next tier service enabler) constitutes a significant limitation of accessible information (information asymmetry). The consequence is services that are out of phase with the actual market demand.

4.7 Scope for Subsequent Improvement

The supply of extended user information offers the broadest ground for an improvement of platform-based control by communicating the consumers' service preferences based on their actual consumption. In order to identify service preference clusters, we suggest applying OASIS' web service quality model WSQM. The model categorizes quality into Business Value Quality, Service Level Measurement Quality, Business Process Quality, Suitability for Standards, Security Quality, and Manageability Quality. We further divide those categories into 21 subgroups, leading to a customer's preference bundle P = $\{\omega_1 * q_1, \ldots, \omega_{21} * q_{21}\}$. In this bundle, each q_i stands for one of the 21 quality parameters and each ω_i represents the respective importance from the perspective of a specific preference cluster. The central position of the platform empowers the platform operator to track and analyze the consumer preferences directly or indirectly (for details see Scholten et al., 2009). Clusters of consumption bundles can be built and correlated with their respective revenue. Communicating customized feedback to each service enabler will stimulate the self-organizing forces in the complete ecosystem.

Consumer benefit is improved through a better, faster and self-organized response to the consumers' needs. The driving force of the service enablers is the expectation of increased revenue. We foresee improved market exploitation by service enablers and the platform operator and a strengthened positioning against competitive business ecosystems. Leveraging the ability to collect, process and feedback all relevant information into the service-enabling ecosystem endows the platform operator with a tool to indirectly control its service-enabling ecosystem into the direction of higher consumer value generation.

5 Conclusion

In this paper we reviewed the shift from classical supply chains to more dynamic value net designs. We elaborated on the required changes in managerial control to successfully manage a coherent supply of external services on top of a platform to provide customer centric platform solutions. Therefore, we introduced six categories of platform mechanisms that platform operators use to control the overall ecosystem evolution as well as individual service enabler behavior. Finally, we showed that provision of extended user information offers the broadest ground for an improvement of platform-based control by empowering autonomous service enablers to optimize their service portfolio according to the most recent consumer needs and, therefore, to increase the customer perceived value of the overall platform solution.

References

Basole, R. C.; Rouse, W. B. (2008): Complexity of Service Value Networks: Conceptualization and Empirical Investigation, IBM System Journal, 47 (1), pp. 53-70.

Bernet, B. (2000): Technologie an der Schwelle des 21. Jh., In: Belz, C.; Bieger, T. (ed.): Dienstleistungskompetenz und innovative Geschäftsmodelle; Thexis, St. Gallen.

Bovet, D.; Martha, J. (2000), Value Nets: Breaking the Supply Chain to Unlock Hidden Profits, Mercer Consulting, Wiley, New York.

Cherbakov, I.; Galambos, G.; Harishankar, R.; Kalyana, S.; Rackham, G. (2005): Impact of Service Orientation at Business Level, IBM Systems Journal, 44 (4), pp. 653-668.

Chen, B. X. (2009): Rejected by Apple, iPhone developers go underground, CNN, http://www.cnn.com/2009/TECH/08/07/iphone.app.developers/index.html.

Cusumano, M. (2008): The Changing Software Business: Moving from Products to Services, IEEE Computer, 41(1), pp. 78-85.

Davies, A.; Brady, T.; Hobday, M. (2006): Charting a Path Towards Integrated Solutions. In: MIT Sloan Management Review, 47 (3), pp. 39-48.

De Wolf, T.; Holvoet, T. (2003); Adaptive Behavior Based on Evolving Thresholds with Feedback. Proceedings of the AISB'03, Aberystwyth, pp. 91-96.

Ebay (2009): http://pages.ebay.com/help/sell/questions/what-rules-selling-items.html.

Föllinger, O.: (1990) Regelungstechnik – Einführung in die Methoden und ihre Anwendungen, Heidelberg.

Gawer, A.; Cusumano, M.A. (2002): Platform Leadership: How Intel, Microsoft, and Cisco Drive Industry Innovation. Harvard Business School Press, Boston.

Goldenfeld, N.; Kadanoff, L. P. (1999): Simple Lessons from Complexity, Science 284, pp. 87-89.

Haas, M. (2006): Management of Innovation in Network Industries: Mobile Internet in Japan and Europe, Dt. Universitäts-Verlag, Wiesbaden.

Howard, M.; Vidgen, R.; Powell, P. (2006): Automotive e-hubs: Exploring Motivations and Barriers to Collaboration and Interaction. The Journal of Strategic Information Systems, 15 (1), pp. 51-75.

Iansiti, M.; Levien, R. (2002): The New Operational Dynamics of Business Ecosystems: Implications for Policy, Operations and Technology Strategy. Harvard Business School Press, Boston.

Iansiti, M., Levien, R. (2004): The Keystone Advantage: What the New Dynamics of Business Ecosystems Mean for Strategy, Innovation, and Sustainability. Harvard Business School Press, Boston.

Iansiti, M.; MacCormack, A., (1999): Developing Products on Internet Time. In: Tapscott, D.: Creating Value in the Network Economy. Harvard Business School Press, Boston.

Jetter, M., Satzger, G., Neus, A. (2009): Technologische Innovation und die Auswirkung auf Geschäftsmodell, Organisation und Unternehmenskultur - Die Transformation der IBM zum global integrierten, dienstleistungsorientierten Unternehmen. Wirtschaftsinformatik (2009-01), pp. 37-45.

Kahn, B. E. (1998): Marketing in the 21th Century - Dynamic Relationships with Customers: High-Variety Strategies. In: Journal of the Academy of Marketing Science, 26 (1), pp. 45-53.

Katz, M. L.; Sharpio, C. (1985): Network Externalities, Competition and Compatibility, The American Economic Review, pp. 424-440.

Katz, M. L.; Sharpio, C. (1986): Technology Adoption in the Presence of Network Externalities, Journal of Political Economy, 94 (4).

Kleine, A. (1995) Entscheidungstheoretischer Aspekte der Principle-Agent Theorie, Physica, Heidelberg.

Kretschmann, T. (2009): Microsoft öffnet seinen App-Store, http://www.tomshardware.com/de/Microsoft-Windows-Mobile-Marketplace,news-242849.html

Malik, O. (2009): How Big Is the Apple iPhone App Economy? GIGOM, http://gigaom.com/2009/08/27/how-big-is-apple-iphone-app-economy-the-answer-might-surprise-you/).

Monroe, K.B. (1991), Pricing – Making Profitable Decisions, McGraw-Hill, New York.

Moore, G (1999) Crossing the Chasm, Harper, NY.

Moore, J. F.: Predators and Prey: A New Ecology of Competition, HBR, (1993), 71, pp. 75-86.

Microsoft Press Pass (2006): Microsoft Announces Integrated Services with Industry Leaders and New Features for the Next Version of Microsoft Office Small Business Accounting, http://www.microsoft.com/presspass/press/2006/may06/05-24SBANewFeaturesPR.mspx.

Prigogine, I.; Nicolis, G., (1977): Self-Organization in Nonequilibrium Systems: From Dissipative Structures to Order through Fluctuations. Wiley, New York.

Scholten, U.; Fischer, R.; Zirpins, C. (2009): Perspectives for Web Service Intermediaries: How Influence on Quality Makes the Difference. EC-Web, Linz.

Schmidt, B. F. (2000): Was ist neu an der digitalen Ökonomie. In: Belz, C., Bieger, T. (Eds.) Dienstleistungskompetenz und innovative Geschäftsmodelle, Thexis, St. Gallen, pp. 178-196.

Supply Chain Council (2009): Supply Chain Operations Reference – Model, www.supply-chain.org.

Williamson, O. E. (1981): The Modern Corporation. Journal of Economic Literature, 19 (4), pp. 1537-1568.

Zeithaml, V. A. (1988), Consumer Perceptions of Price, Quality and Value: A Means-end Model and Synthesis of Evidence, Journal of Marketing, 52 (July), pp. 2-22.