Control mechanisms in platform-based service marketplaces – Principles for control design and implementation

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Abstract

The rise of the app economy changed the software-based service industry radically over the past five years, leaving only very few winners in the so-called "platform war". Platform literature shows that a platform provider needs to control the use and evolution of the platform and its ecosystem to be innovative and sustainable. Although, control is an important factor for innovation, there is little empirical insight on how platform providers design and implement controls in platform-based service marketplaces. In this paper, we employ a mixed-method approach to analyze the design and implementations of one hundred control mechanisms in Apple's App Store. By exploring the controls of this exceptionally successful platform-based service marketplace, we provide insights, which extend organizational control theory to platform-based service marketplaces for the first time. Furthermore, we deliver practical principles for control design.

Keywords: platform governance, control, service marketplaces

Introduction

Platform-based service marketplaces (PBSM) like Apple's App Store changed the software-based service industry radically over the past five years. In contrast to traditional service development and delivery, PBSM provider offer a programming interface and development environment combined with a consumer service marketplace. By enabling third-party developers to add functionality to a core product platform via a programming interface and a development environment (Tiwana et al. 2010), a provider draws from external expertise. This enables PBSM to achieve higher innovation rates and a higher responsiveness to heterogeneous and rapidly changing consumer markets (Boudreau/Lakhani 2009). As consumers want to customize their core product for their own needs, the technology platform sponsor also offers a service marketplace and thereby establishing a mediated two-sided market for consumers and developers (Basole/Karla 2012). Such PBSM play a pivotal role in the increasingly important app economy (Basole/Karla 2011).

However, even though many latecomers have emerged to gain a market share in this emerging market only very few have succeeded in offering a thriving concept (Basole/Karla 2011). The challenge lies with maintaining the ability to capture value through organizational control of the PBSM on a technological, economically, and socially level. At the same time, the PBSM has to provide the open environment that stimulates and enables developers through transferring often extensive design capabilities to external developers (Tiwana et al. 2010). Not surprisingly, early research on PBSM debates "how open is open enough" (West/O'Mahony 2008). Yet, the two most successful PBSM, Apple's App Store and Google Play Store, exhibit very different degrees of organizational control, which indicates that there are multiple strategies to achieving higher innovation rates and a higher responsiveness in rapidly changing markets. Both, researchers and practitioners realized that the complexity of organizational control of PBSM calls for a more nuanced investigation beyond the one-dimensional view on openness (Parker/Van Alstyne 2009; Boudreau 2010).

Hence, the purpose of this study is to explore which events triggered the realignment and redesign of the organizational control set in the most successful PBSM, the Apple App Store. This investigation helps us to suggest principles for effective design and implementation of organizational controls in PBSM. Existent research concludes that the success of a PBSM provider is critically determined by the providers' capability to constantly realign the PBSM to its ecosystem through adapting the organizational control set (Tiwana et al. 2010; Manner et al. 2013). However, effective control design and implementation in PBSM has not been sufficiently studied yet. In particular, empirical evidence is missing. Previous literature lacks guidance, which brings practitioners to imitate control mechanisms

rather than to design and implement organizational controls that meet their specific needs (Burkard et al. 2012). Also, organizational control theory is rather limited when it comes to control design and implementation in PBSM as critical constructs for organizational control design such as monitoring of behavior is not applicable to the two-sided concepts of PBSM.

To study effective design of organizational controls, we conducted a single case study on Apple's App Store. We applied a structured case study approach to study triggers and design of organizational control mechanisms (Manner et al., 2013). The structured case study consists of one hundred control mechanism implementations over a period of five years, where each implementation was analyzed as subunits of the case study.

This paper proceeds as follows. In the next section we provide an overview of the theoretical background of PBSM, organizational control and platform control research. The research methodology is described in the subsequent section. Next, the data analysis strategy and results are presented, followed by a discussion of the findings. Finally, limitations are noted and further research is proposed.

Theoretical Foundation

Platform-based service marketplaces

To date there is no acknowledged classification of platforms (Gawer 2010). Hence, we begin by providing a definition for PBSM and report on the theoretical background on our view of PBSM. Platforms are socio-technical layers (Tilson et al. 2012) with underlying network effects. Based on two-sided market theory indirect network effects enforce platform owners to balance the attraction on both market sides as the success of such a market depends on the number of participants on both sides (Armstrong/Wright 2006; Katz/Shapiro 1994). PBSM – like Apple's App Store –are therefore an IT-based artifact that enable external knowledge holders to contribute IT-based services to a core product via a marketplace (Querbes-Revier 2011; Ballon et al. 2008). Thereby, they act as a mediator of two or more interdependent groups (Hagiu 2006; Kenney/Pon 2011). The platform ecosystem can be defined as a functional unit consisting of the platform provider, developers, consumers and strategic partners of the platform owner (Ghazawneh/Henfridsson 2011; Kouris/Kleer 2012). To ensure compatibility with the core product and value-adding application offers for consumers, a platform provider needs to provide resources like guidelines, documentation and rules while controlling the developers actions (Ghazawneh/Henfridsson 2010; Gonçalves et al. 2010). Platform-based service marketplaces provide consumers with the ability to search, browse, download, use, rate and comment as many applications

as they want. They provide third-party developers and other partners of the platform with the ability to publish, update, promote and market their applications.

Related work on platform-based service marketplace control

PBSM is not only a new phenomenon, but also an interdisciplinary topic which is why research is scattered in several reference disciplines of information systems like organizational science, economics, computer science and marketing delaying its maturity (Manner et al. 2012).

Control is traditionally a key concern in the study of the application of information systems (Rudmark/Ghazawneh 2011; Tiwana et al. 2010). Research on PBSM acknowledges that control is needed to manage the consumer experience (Jain 2011) as well as the developer's behavior (Rudmark/Ghazawneh 2011). Controls are considered an important factor to execute strategies (Herath 2007; Ghazawneh/Henfridsson 2010) that enable to enhance the overall organizational performance by matching the ecosystem of the firm with its internal structures (Langfield-Smith 1997) and to support innovation efforts within organizations (Cardinal 2001; Bisbe/Malagueño 2009). Following Parker and van Alstyne (2009), "to foster higher rates of innovation, the rules governing access and intellectual property must be carefully analyzed, designed, and enforced". This is because, controls can raise enormous administration costs and also hamper innovation, if implemented wrongly or ineffectively (Simons 1995; Herath 2007).

Controls enable the implementation and measurement of the effects of governance decisions, which are made in the derivation of the governance configuration for PBSM (Eaton et al. 2011; Ballon 2009; Rudmark/Ghazawneh 2011). Thereby, they are the foundation to adjust the market and or governance strategy (Jain 2011; Eaton et al. 2011; Rudmark/Ghazawneh 2011). Overall, the success of a PBSM is considered as a result of balancing third-party control (Ghazawneh 2011; Ghazawneh/Henfridsson 2012).

Understanding the control implementation process is therefore especially important for PBSM as its ecosystem changes and its provider continuously needs to adjust control while still nurturing innovativeness (Elaluf-Calderwood et al. 2011; Eaton et al. 2011; Iyer et al. 2007).

However, contrary to strategic management literature, platform management literature to date provides no "adequate theoretical framework to thoroughly analyze the complex interactions" (Kouris/Kleer 2012) for platform-based service marketplaces.

Consolidating this research, platform control is a subset of platform governance. Service Marketplace Platform Governance is defined as "the structure, power, processes, and control mechanisms that are applied by the platform owner to achieve his aims" (Manner et al. 2013). For that reason, control is an important element of platform governance and researchers suggest that the view of platform governance from the perspective of control might be valuable (Eaton et al. 2011; Tiwana et al. 2010).

Although several researchers suggest control as a fitting theoretical lens for studying the implementation of strategic interests in PBSM as well (Rudmark/Ghazawneh 2011; Yoo et al. 2010), the topic of control has not been adequately addressed within previous empirical work, neither within the organizational, nor within the platform context and thus knowledge on mechanisms and systems is very sparse (Tiwana et al. 2010; Ghazawneh/Henfridsson 2010; Manner et al. 2012).

Related work on organizational controls

The organizational control model was introduced by Ouchi and McGuire (1975). To date Ouchi's framework is the most cited and acknowledged. It was advanced by Ouchi himself (1979; 1977) and others (Snell 1992) leading to modified versions. For example, Ouchi introduced clan control, while Snell (1992) replaced clan control by input control. The model introduced is a matrix with two dimensions. The first dimension is knowledge of the transformation process (Snell 1992). Thereby meant is the understanding of the controller on the object or activity controlled. The second dimension determines the ability to measure the output. Although related often as basic theory of control, to date there is only limited research reporting on the effect of applying this model in real world and effect of doing so (Cardinal 2001; Cardinal et al. 2009).

Originally Ouchi (1979) defined three different types of control which should be implemented according to the above referred matrix dimensions. According to Lange (2008), the introduced control mechanisms are divided into formal and informal controls. By implementing these controls the controller aims to achieve coordination between himself and the agent who is performing the activity and who may have different intentions and goals.

Behavior control, sometimes also referred as process control, provides standards, norms, rules and procedures that enable the controller to continuously influence and guide a certain behavior of an individual performing the processes (Cardinal et al. 2009; Das/Teng 2001; Langfield-Smith 1997). This control follows the principle that controlees are rewarded according to the degree they comply with defined rules and procedures. Following Henderson and Lee (1992) who only concentrate on the formal controls outcome and behavioral, behavioral control has three dimensions: the clarification of

the workers role, the specificity of work assignment as well as the enforcing of how the work should be done. The conformance of the individual's behavior within these dimensions is rewarded. Hence, behavioral control is to be used only when the controller has full understanding of the accurate process steps of a controlled activity and has no problem to measure the controlee's compliance. It is most efficient when the process controlled is fully known by the controller but the outcome is not satisfactory measurable (Ouchi 1979; Snell 1992; Lange 2008)

Output control regulates the achievement of sets of output targets like profits, customer satisfaction level or production volumes (Eisenhardt 1985; Snell 1992; Ouchi 1979). Therefore, it defines the desired goal, measures how well output aligns with the set standards, and provides respective rewards and punishment for success and failure in goal attainment (Merchant 1985). Contrary to behavioral control, output control has only one major dimension known as feedback which can also be considered as a quality gate and measurement point (Henderson/Lee 1992). Following organizational norm strategies output control can either be employed if perfect measurability and perfect knowledge is present or when little knowledge of the process is present but perfect measurability is possible (Ouchi 1979). Thus, the measurability is the most distinctive characteristic of outcome control as well as the precondition for its use (Turner/Makhija 2006; Lange 2008; Eisenhardt 1985). Both, behavior and output control can be implemented when measurability is perfectly given as well as the process knowledge leaving uncertainty in this case or double control implementation. However, Ouchi (1977) states that managers would majorly select only one of the mechanisms. Moreover, Ouchi (1979) depicts outcome control as more efficient than behavior control but both singularly used are less effective for research settings than clan control.

Initially Ouchi introduced clan control as fitting when neither complete knowledge of the transformation process nor outcome measurability is applicable. Several researchers modified this control target as it was not specified enough and has led to confusion and false designation (Cardinal et al. 2009; Snell 1992; Cardinal 2001). Two more detailed controls can be derived from clan control: input control and social control.

Snell (1992) introduced input control as a substitute in the original 2x2 matrix. Input control determines which resources are used in the production process under observation, like the material, tools, vendors or the workers themselves (Snell 1992; Cardinal et al. 2009). Thereby, input control aims to align the goals of the agents by providing selected co-workers and resources to the organizational goal. According to Snell and Youdt (1995), input control should be used when the output of the process cannot be measured or directly monitored and when the manager does not have

full knowledge on how the process is done perfectly. Though, input control requires that a given input can be use align the worker with the controller's goals (Ouchi 1979).

Social control is a more and more acknowledged concept as working environments are becoming more dynamic and uncertain and thus formal controls could hamper performance (Tushman/O'Reilly 2006; Davila 2005). It is used to implement common values and shared beliefs into a social system by providing the actors with more information about the goals and the vision of the controller (Tushman/O'Reilly 2006). Social control is especially suitable when there is little knowledge of procedures the actor carries out. This also holds true if the goals cannot be set precisely (Davila 2005; Markus 2007; Ouchi 1979).

Contrary to Ouchi's opinion that control is used discretely, Kirsch (1997) argues that in organizations control often appears in a mixture of modes to coordinate intentions and goals. She implies formal controls as the main mechanism, aided by informal instantiations because of the coupling within organizations (Kirsch 1997). With work requirements becoming more complex, uncertain and ever-changing, control systems cannot be static and formal. Rather, mixed controls that also allow directed autonomy and rely on the judgment of employees informed clearly about vision and objectives of the business lead to more efficiency.

Overall, there is little empirical work on control and control development (Cardinal et al. 2009). Moreover, previous studies neglect informal controls although they have proven to be valuable (Cardinal et al. 2009; Demil/Lecocq 2006).

Methodology

Research Strategy

The goal of our research was to gain empirical insight on control implementation within PBSM and the triggers of these implementations. Apple's App Store is one of the most popular platform-based marketplaces and has been very successful for several years (Spriensma 2012). Moreover, previous research found that the App Store actively controls its marketplace and constantly aligns with its ecosystem. As Apple's App Store is also one of the longest running PBDM, it can therefore provide the required amount of control implementations. In accordance with the notion that the marketplace is undoubtedly a phenomenon holding interest of many researchers (Ghazawneh/Henfridsson 2011; Ghazawneh/Henfridsson 2012; Laugesen/Yuan 2010; Eaton et al. 2011; West/Mace 2009), it therefore represents a good research object for one of the first empirical platform-based marketplace control

studies (Tiwana et al. 2010). According to Yin (2009) as well as Eisenhardt and Graebner (2007), it is valid to use such an extreme case for theory generating, as such an exploratory study can be more valuable than providing a representative sample of cases, if studied extensively. Following research objective, control implementations are studied. Hence, we conducted a single case study with the control implementations itself as logical subunits of the analysis. Moreover, we decided to apply a mixed method research strategy, using a sequential explanatory design. A mixed method research triangulating quantitative and qualitative results is one of the most common applications (Hesse-Biber 2010). We use them complementary to gain a fuller understanding of our results (Hesse-Biber 2010, 26).

Case Analysis Structure: Triggers for control implementation within platform-based service marketplaces

PBSM are exposed to dynamics of their ecosystem that trigger changes within the marketplace to achieve sustainability (Manner et al. 2013; Tiwana et al. 2010). Especially in the software industry, platform providers "can no longer function without taking their ecosystem in account" (Jansen et al. 2009), that is to align their platform systematically. On adapting the top level governance framework for mobile platforms by Manner et al. (2012), five factors for design and control changes within PBSM can be identified within literature.

The first factor is labeled as "technical factor". Technical factors trigger changes of the platform technology that are considered of having a major innovative value (Basole/Karla 2011; De Reuver et al. 2011). The second factor is labeled as "legal factor". Legal factors trigger legal moves taken by the platform owner in response to actions taken by other members of the mobile ecosystem (developers and consumers) as well as government agencies (Manner et al. 2012; De Reuver et al. 2011). The third factor is labeled as "competition factor" and triggers moves taken by platform owners in response to competitors' actions or proactively enhancing the own strategic positions as the market develops (Tiwana et al. 2010; Ghazawneh/Henfridsson 2010; De Reuver et al. 2011). The fourth factor is labeled as "stakeholder behavior" and triggers changes in the stakeholder behavior within the mobile platform. The two major stakeholders of a platform are developers and consumers. Therefore, behavior of those stakeholders can trigger a control implementation within the PBSM (Bouwman et al. 2005; Haaker et al. 2006; De Reuver et al. 2011). Table 1 provides an overview of the five identified triggers and their subsections.

Table 1. Triggers for control implementation and their origin adapted from Manner et al. 2013

Legal [Manner et al. 2012; Ballon et al. 2005] • describe events originating from legislation, government agencies or jurisprudence
Technical [Basole & Karla 2011; Rudmark & Ghazawneh 2011] • originate from technical progress
Competitive [Ghazawneh and Henfridsson 2010, Tiwana et al. 2010] • reactive competitive behavior originating from changes in the competitor's actions • proactively enhancing the own strategic positions as the market develops
Stakeholder behavior [Bouwman et al. 2005; Haaker et al. 2006; De Reuver et al. 2011] • actions of the service consumers • actions of third-party developers or other strategic partners of platform owner

De Reuver et al. (2010) notice that changes in the actors' environment can be related to emerging new technologies, changes in regulation or changes in market developments which occur due to both, consumer behavior and behavior of competitors. Thereby, they correspond to technological and legal factors, emphasizing on the special role of stakeholder behavior in platform governance, which has also been stressed by the fact that platform success is determined by the alignment of stakeholder interests (Evans/Schmalensee 2007; Rochet/Tirole 2003; Iyer et al. 2007). The importance of competition aspects has been known for a long time, considering Porter's five forces approach (Porter 1985). Monitoring and reacting to competition changes is a key factor to differentiate (Brousseau/Penard 2007). In this manner, the observation of key industry players might reveal opportunities for specialized platforms (Iyer et al. 2007), which may cause new entries, thus decreasing profits, or by contrast can pose an opportunity for one's own platform. Adapted from Manner et al. (2013), we summarize the influence factors on platforms.

Case Analysis Structure: Organizational controls within the platform-based service marketplace context

The different views, on the one hand the control mechanism and on the other hand the control system as a mix of controls pose an opportunity to differentiate these controls within the platform context.

Based on the platform governance framework provided by Manner et al. (2013), four modes of control are derived as appropriate within the platform context. Based on the provided definitions from organizational control literature, we derive our initial definitions for characterizing the control implementations within the platform context.

Input control defines characteristics for provided input. Within the context of a PBSM it can be defined as the control of content, skills and tools provided by the PBSM provider to align its strategic goals with the individual development of third-party developers. Subscriptions for taking part in the ecosystem and dues benefiting from it are also considered an input control.

Originally, **output control** sets a desired output. We argue that output control in a PBSM is established after the development of the applications to reward if the development is consistent with the requested requirements or to penalize if it violates them. Furthermore, changes in presenting the content can be considered an output control.

Similar to Ouchi (1979), we determine process or **behavioral controls** as procedures, structures and mechanisms that steer the behavior of stakeholders to achieve wanted actions within the PBSM context.

For the PBSM context, we determine **social control** as controls used to nurture common values and to manage the community of developers. Therefore, usually information and explanations are provided and it is not observable what is done with this information. Additionally, motivational incentives or promotions done by Apple are also seen as a social control as they further support the identification with the platform's community.

Data Collection and Analysis Process

First, we followed the guidance by Ghazawneh and Henfridsson (2012) and identified possible sources for reports on changes of control mechanisms of Apple's App Store. Apart from official announcements and archival documents by Apple, we used the richness of web-based news sources (e.g. discussions or comments on techcrunch.com, mashable.com) as a promising approach to capture Apple's strategic behavior from the perspective of consumers and third-party developers as Apple's moves are usually well covered in such sources (Romano et al. 2003; Ghazawneh/Henfridsson 2011). Our sources therefore comprise a rich variety like newspapers, online magazines, tech-blogs, recorded official interviews or developer conferences and archival records. Overall, we conduct a complementary mixed-method research merging qualitative and quantitative methods for analyzing multiple subunits within one case study on Apple's App Store. Mixed-method research is acknowledged to enable a better understanding of the phenomena studied (Hesse-Biber 2010). Our case study is of exploratory nature with an inductive approach there is to date no control theory for platform control and the organizational control is incomplete for the PBSM context (Yin 2009). Inductive case approaches enable to develop novel theories as well as understanding emerging phenomena (Barratt et al. 2011; Meredith 1998).

Initially, we found 124 changes regarding the marketplace governance. We identified a case of control implementation, when a control was introduced by the platform owner within the PBSM changing the

structure or processes of the marketplace or the marketplace developer's environment to achieve the PBSM sponsors aims.

Each finding was numbered. To ensure the objective quality of our data and to gain enough information to code the cases controls for further analysis, we added evidence for the control changes by adding at least two more sources (Yin 2009). Finally, we discarded cases where not enough information was found or the case was no control implementation after reviewing all the information. Ultimately, 100 control mechanism implementations in total were extracted from March 2008 to February 2013.

Based on the literature of organizational control theory and platform governance theory, we derived initial constructs for triggers and controls for conducting an axial coding. After an initial round of coding on a subsample of reports, we reviewed coding conflicts and calibrated and elaborated the coding scheme. This process was repeated several times, thereby following Yin (2009) who proposed an iterative process with multiple feedback loops.

The iterative process was accompanied by axial coding of the cases within one control categorization. Each control was given descriptive labels that were then recirculated to the coding scheme and therefore strengthening it (*the coding scheme can be provided by the authors if requested*). To prevent bias, each case categorization was justified with substantiations by the coders and checked comprehensibility by a second expert. The same procedure was used to categorize the triggers and to derive a calibrated coding scheme.

In the next step, quantitative analyses were conducted for each – the triggers and the control categorizations. We applied frequency distributions quantitatively to explore our sample. We first analyzed the frequency of triggers. Then, a distribution frequency analysis for each year to identify changes in control characteristics over time was applied.

Finally, by using a cross tab analysis, relationships between trigger mixes and the implemented controls were found and then qualitatively analyzed. Based on the merged quantitative and qualitative results control, principles for platform control implementations were derived. Figure 1 illustrates the overall process of this research.

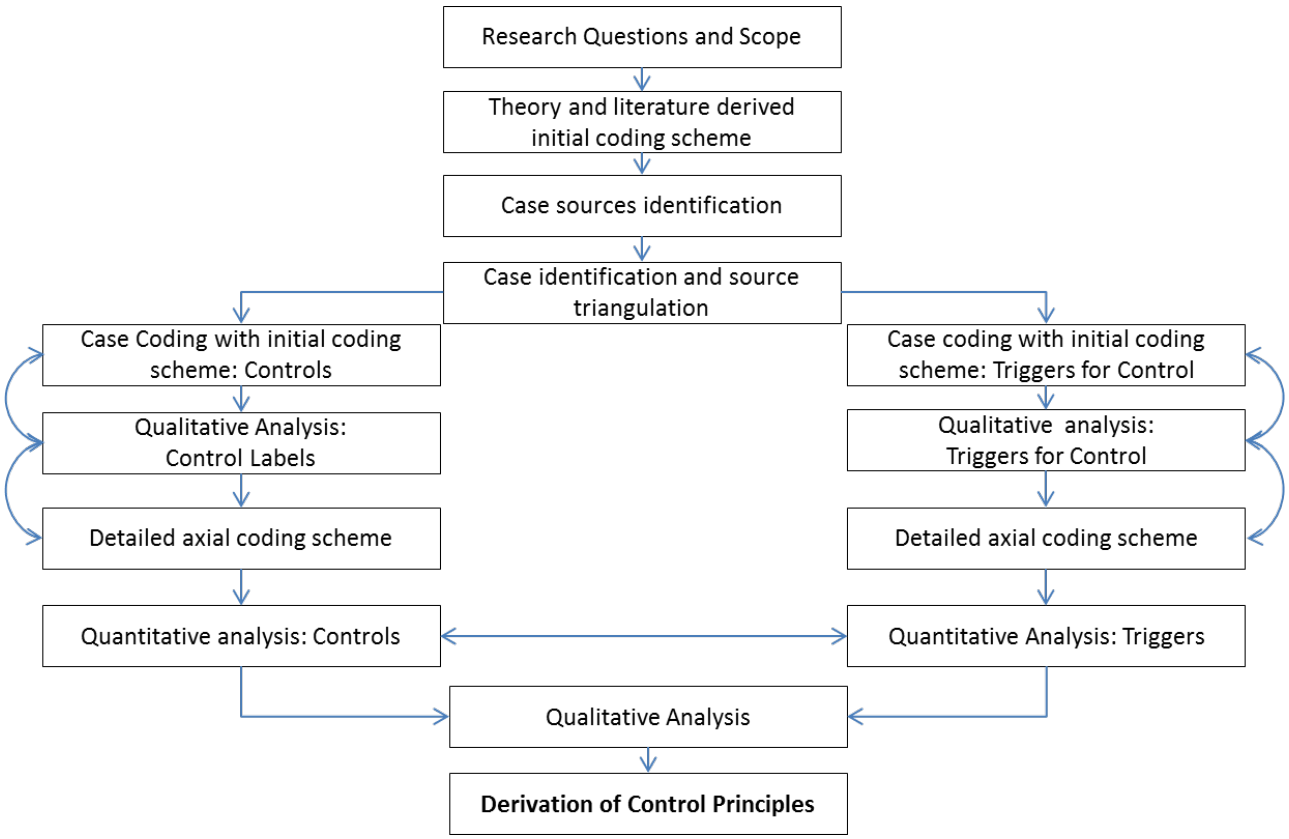

Figure 1 Research Process

Results

Overall, we identified 100 valid control changes in Apple's PBSM to analyze as case subunits from March 2008 to February 2013. We recognized an increase of control over the past years. Especially from 2009 to 2010 the implementation of controls doubled, then were slightly lowered in 2011 to see another drastic increase of around 36% from 2011 to 2012.

Table 2: Frequency of Control Changes

Year	Frequency
2008	7
2009	12
2010	25
2011	22
2012	30

2013 (-Feb.)[1]	4
Total	100

Results Ecosystem Factors triggering control changes

Studying the triggers for control change and implementation, we found that proactive competition behavior as well as reaction on developer's behavior is dominant. On applying a cross tab (Table 3), we recognized that technical triggers are never the sole reason for a control mechanism change.

Table 3: Cross Tab - Frequency of Triggers

	Technical	Legal	Proactive Comp.	Reactive Comp.	Developer Behavior	Consumer Behavior	Total
Technical	-	-	14	3	2	1	20
Legal	-	-	-	-	-	8	8
Proactive Competition	14	-	17	-	5	17	53
Reactive Competition	3	-	-	3	9	-	15
Dev. Behavior	2	-	5	9	21	-	37
Cons. Behavior	1	8	17	-	-	-	26
Total	20	8	53	15	37	26	159

Technical triggers are especially accompanied by proactive competition moves, but sometimes also by reactive moves or developer behavior and once by consumer behavior. As an example for the first group, we name the case "CoreImage for iOS". As more and more photo apps moved into the App Store, Apple wanted to support the developers by making it easier to build photo apps. This move was technically triggered, since photo apps got more and more embraced by consumers as built-in cameras improved. Nevertheless, it was a proactive competition move by Apple as no competing provider supported such a function. An example for the third group of technical triggers for controls is linked to the developer's behavior, like for example the launch of iAd Producer. Before its introduction, ad creation was done by Apple in-house and developers complained about its slow content creation process. Triggered by new technical possibilities of digital ad creation and mentioned complaining behavior, Apple introduced the iAd Producer tool.

[1] In February 2013 the collection process for control implementations ended. Therefore, the collected controls of 2013 do not reflect a whole year and can therefore not be interpreted within the time series analysis.

Legal factors are only involved in around 10 percent of the control mechanism implementations and are always accompanied by consumer behavior, mainly complaints about data protection and privacy. For example, the consumer behavior demanding a password for in-app purchase as children were able to buy in-app subscriptions too easily. Legal factors just started to come up in the beginning of 2010 as the store ecosystem grew and discussions on e.g. the platform provider's responsibilities increased. Typical legal factors control mechanisms are the ban of DUI (driving under the influence) checkpoint apps after congress pressure and the introduced option to deactivate location data after privacy discussions.

Consumer behavior triggered 26 percent of all control mechanisms within Apple's App Store but never as the sole trigger for a control mechanism implementation. The majority of consumer behavior triggers were accompanied by proactive moves, like launching the App Store in new countries or offering a B2B App Store program as demanded from business customers. As already mentioned, the second group of mixes with consumer behavior triggers constitutes the combination with legal triggers, such as the introduction of stricter rules against adult content to protect children.

We recognized 37 control mechanisms implementations that are triggered by **developer behavior**. They are supported by reactive factors (9 times) like offering a Facebook API, as developers more and more integrated Facebook in their apps. Also proactive or innovative competition moves (5 times) supported developer behavior triggers like introducing Genius for apps as developers lost interest in the App Store due to difficulty to gain a dominant position. However, in most of the cases the sole behavior of developers triggered new controls, for example, when developers tried to bypass the app ranking system via incentivized app downloads which were then banned by Apple.

Controls introduced as **reaction to the competition** were identified in 16 percent of all cases. An example is the exclusion of Google Maps, which at first was an integrated part of iOS. With becoming one of the most used apps and an interesting opportunity to gain more information about consumer's usage, Apple – as a reaction – released its own mapping service and removed Google Maps from iOS. Similarly, iBooks was released as a reaction to Amazon's success. Reactively triggered mechanism changes are also accompanied by others like developer behavior. This happened, for instance, when Apple sped up the review process as complaints emerged and other platforms started to offer quicker reviews.

The major amount of control implementations in the App Store was **proactively** installed. In total, 53 percent of the mechanisms have been installed proactively. Reviewing the installation according to their date, we recognized a significant rise of proactive changes (Table 4). As supporting triggers, we identified consumer behavior to be the prominent factor. Examples are the mentioned introduction of

the B2B program as demanded by business customers. But also technical triggers like the introduction of the iPad and the resulting new possibilities based on it accompanied proactive triggers.

For the overview of the chronological sequence of identified triggers in Table 4, we counted every trigger individually. As mentioned earlier, mixes of triggers were found in most of the cases (59 percent). However, we decided on not using more than two triggers at the same time for better distinction. If there were cases where more than two triggers could be identified, we identified those that had the main impact on triggering the control implementation.

Table 4: Chronological Frequency of Triggers

	Technical	Legal	Proactive Competition.	Reactive Competition.	Developer Behavior	Consumer Behavior	Total
2008	1	-	5	-	3	1	10
2009	3	-	7	3	6	3	22
2010	2	1	10	7	12	4	36
2011	5	5	11	3	5	9	38
2012	7	2	18	2	9	9	47
2013 (-Feb.)	2	-	2	-	2	-	6
Total	20	8	53	15	37	26	159

Results types of control changes

In order to be able to categorize our cases into those four norm strategies of control, we derived specific labels from a qualitative analysis of the data set. Those labels combine cases which share common governance and control intentions and help to maintain a distinct control strategy categorization. Additionally, we identified the triggers for control implementation in the platform ecosystem for each case individually.

Within Apple's App Store 100 sole and mixed control mechanisms were implemented since 2008. On ranking absolute frequency of controls and control combinations which resulted from our analysis (Table 5), input control as a sole control is represented most (25 times), output control can be found 21 times (behavioral control 3, social control 16).

Table 5: Cross table of absolute frequency of controls and control combinations

	Input	Output	Behavioral	Social	Total
Input	25	13	0	22	60
Output	13	21	0	0	21
Behavioral	0	0	3	0	3
Social	22	0	0	16	16
Total	60	34	3	38	100

Moreover, we found 35 control implementations over the observed period of slightly more than five years where controls were implemented in combinations of two (Table 6). As with the triggers, we decided on using not more than two different controls within one case, i.e. the main control implemented, in order to maintain a distinct categorization.

Predominantly, input controls and social controls occurred mixed (22 times). Input control is mixed with output control in 13 cases. Other combinations of controls besides these two did not occur.

Table 6: Chronological Frequency of Controls and Control Mixes

	Single Controls	Two Controls Mixed	Total Control implementations
2008	5	2	7
2009	7	5	12
2010	15	10	25
2011	14	8	22
2012	20	10	30
2013 (-Feb.)	4	0	4
Total	65	35	100

Reviewing the implementation of mixed controls over the whole period, no tendency can be derived. However, a high importance of mixed controls for PBSM can be determined as about one third of all control implementations occurred as mixed controls.

The control mechanism distribution (Figure 2) highlights the supremacy of output and input control or their combinations. Social controls are also implemented regularly, but often in combination with input controls while behavioral controls are barely implemented.

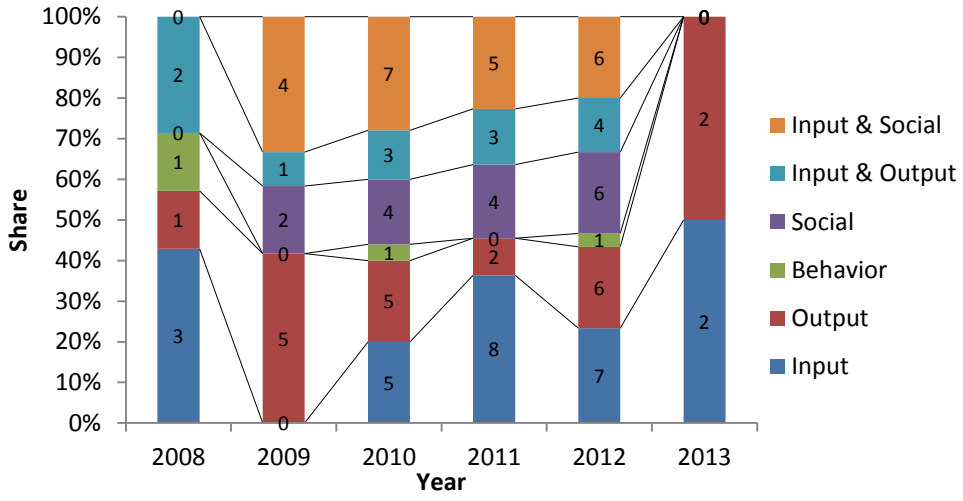

Figure 2: Control mechanism distribution over the years

Reviewing cases of **input control**, we recognized 25 implementations and divided them into four different labels. Triggered by a technical factor as a proactive move, label I1 combines all means and tools of general developer enablement without connection to a specific Apple or non-Apple service (besides the App Store itself). The second label I2 summarizes all measures which restrict developers in their usage of provided means and tools in order to protect the platform owner's goals. Here an input control is triggered by developer behavior, which is potentially harmful to goals like revenue (case 97) or app experience (case 22). Comparable to label I2, label I3 also is an input control restricting developers, but in order to protect consumers' data and privacy. Input controls under this label are triggered by consumer complaints and legal rulings. Together with I2, these controls represent the most implemented input controls. The last label I4 sums up all input controls concerning dues for taking part in and benefiting from the App Store and its ecosystem. Proactive measures for securing a competitive strategic position were identified to trigger those input controls.

Table 7: Example cases of input control (of a total of 25 occurrences)

Input Control				
Label	Trigger	#	ID of example	Case Tag
I1: Enabling developers (general enablement, not directly connected to specific Apple service)	Technical, proactive competition	4	1	First iPhone SDK release
			119	Developer Toolset updated to version 4.6
I2: Restricting developers to protect own goals	Developer behavior	10	13	Incentivized App downloads banned
			22	Stricter rules concerning quality of apps
I3: Restricting developers to protect consumers	Legal, consumer behavior	8	7	In-app-purchases require password
			36	New privacy policy standards in co-operation with world's major app store owners
I4: Dues for taking part in and benefiting from ecosystem	Proactive competition	3	67	Apple retains 30% of every App Store purchase
			123	Apple increases App Store prices in Europe

To divide the 21 cases of **output control**, three different labels were defined. The most implemented output control was labeled O1, which combines all cases referring to the usability management and maintenance of the App Store with respect to e.g. design, categorization and discovery of apps. These output controls are triggered by a proactive move and certain behavior of either developers or consumers. Additionally, labels O2 and O3 sum up cases which concern the App Store approval process itself. The former describes all cases which show an ease or non-enforcement of set up

guidelines triggered by developer behavior and a reactive competition move. The latter constitutes the opposite, a tightening or strict enforcement of set up guidelines which was triggered by certain developer behavior violating those.

Table 8: Example cases of output control (of a total of 21 occurrences)

Output Control				
Label	Trigger	#	ID of example	Case Tag
O1: Usability management and maintenance of App Store (e.g. design, discovery of apps, categories)	Proactive competition, consumer/ developer behavior	12	15	Genius for Apps released
			26	Apple tweaks App Store search algorithm #1
			27	New layout: horizontal scrolling and cards
O2: Ease or non-enforcement of set up guidelines in and after approval process	Reactive competition, developer behavior	5	19	Apple tolerates third-party apps which use private APIs
			42	Apple approves third-party browsers
			80	Ringtone makers allowed
O3: Tightening or enforcement of set up guidelines in and after approval process	Developer behavior	4	59	Apple rejects apps that only offer similar iOS functionalities
			124	Apple rejects apps that use their own tracking system instead of Apple's

Social control was found to be the most implemented control (37 occurrences). Of those, however, 22 were implemented in combination with input controls and only 16 as social controls alone. We defined three labels of social controls in the context of the App Store which all target the management of the developer community, but with different intentions. Cases labeled S1 were triggered by proactive factors and social controls were applied to enhance and further nurture community by offering motivational incentives or promoting selected apps. Label S2 combines all cases where social controls were used to mitigate discontent caused by certain practices of Apple or other third-parties. The implementation of those social controls was triggered by developer behavior and competitive factors. Cases of discontent caused by technical failures or shortcomings on Apple's side were grouped into label S3.

Table 9: Example cases of social control (of a total of 16 occurrences)

Social Control				
Label	Trigger	#	ID of example	Case Tag
S1: Managing developer community - Enhancement (e.g. motivational incentives, promotions, information)	Proactive competition	6	54	Apple launches "Free App of the Week" and Editor's Choice
			89	Apple gives away design awards

S2: Managing developer community - Social mitigation (e.g. complaints due to lack of transparency, legal protection)	Proactive/ reactive competition, developer behavior	7	20	iPhone developer resource center introduced after complaints on communication with developers
			56	Apple protects developers in Lodsys case
S3: Managing developer community - Technical mitigation (e.g. complaints due to technical failures or shortcomings)	Technical, consumer/ developer behavior	3	47	Apple highlights third-party mapping services in the App Store
			51	Apple resets app ratings after App Store server crash

In terms of **behavioral control**, only three cases were found to fit the criteria and which expectedly were triggered by developer behavior. We labeled two of those cases as *contracts with and legal action against developers (B1)*, telling developers exactly how to behave and enforcing legal consequences when those guidelines are not followed. The remaining case also is a behavioral control, however limited to the App Store and without legal consequences. It was therefore labeled as *code of conduct (B2).*

Table 10: Cases of behavioral control (total of 3 occurrences)

Behavioral Control				
Label	Trigger	#	ID of example	Case Tag
B1: Contracts with or legal action against developers	Developer behavior	2	3	Non-disclosure agreement (NDA)
			86	Apple goes against misuse of beta testing accounts
B2: Code of conduct for developers, a non-compliance leads to negative consequences	Developer behavior	1	85	Apple removes App Store name squatters

After having described all cases in which only one single control was implemented, 35 cases remain in which controls were implemented in combination. This is common, when a case affects several aspects and dimensions of the PBSM and could not be divided into separate cases. As mentioned earlier, we decided on using not more than two different controls within one case to maintain a distinct categorization. Only combinations of input with either output control or social control occurred.

As a **combination of input and output control,** we defined cases which *enable developers or content providers in sense of a directed enablement (IO1),* that is an enablement which is directly connected to one of Apple's specific standalone services. These were triggered by proactive factors to gain a strategic advantage over competitors. Examples are the release of Newsstand (case 9) or iBookstore (case 75) in which content providers can promote and sell their magazines, books or related offerings.

We furthermore introduced the label *distribution management and sales area expansion (IO2)* for the combination of input and output control. It sums up all cases in which the how and where of app distribution is defined, like selecting potential new countries to enter next (case 48) or the introduction of a volume purchasing program for businesses (case 55). Controls of this group were triggered also by a proactive factor, but together with consumer behavior.

Table 11: Example cases of combined input and output control (of a total of 13 occurrences)

Input and Output Control				
Label	Trigger	#	ID of example	Case Tag
IO1: Enabling developers or content provider (directed enablement, directly connected to one of Apple's specific services)	Proactive competition	5	2	App Store release for iPhone
			9	Newsstand release
			29	Passbook release
			75	Introduction of iBooks and iBookstore
IO2: Distribution management and sales area expansion	Proactive competition, consumer behavior	8	48	App Store launches in 32 new countries
			55	B2B App Store: Apple introduces volume purchasing for businesses
			98	B2B App Store program available in Germany

In contrast to IO1, we defined cases which enabled developers also in a directed way, but connected with a specific non-Apple service or a non-standalone Apple service (IS1) to be a **combination of input and social control**. Those cases introduced features which can be used to enrich the functionalities of apps, like Airplay (case 6) or push notification (case 71), or make it easier for developers to communicate with third-parties and their services, like Facebook (case 4) and various Google services (case 69). They are regarded as a combination of input and social controls because Apple provided its developers new but controlled input, while at the same time these explorative extensions also enhanced their belief in the Apple ecosystem and community. Developers' needs and complaints are taken seriously by the platform provider and based on those, Apple offers new and innovative tools that enable developers to create new kinds of applications or simplify the development process itself when communicating with other services. With this broad spectrum of possibilities, triggers for label IS1 were not as homogeneous as for the other labels and came in three different combinations. Most cases under this label were triggered by a combination of technical and competition factors. Others were triggered by only competition factors, while the remaining cases labeled IS1 were triggered by developer behavior. Under the second label IS2, we combined all guidelines for Apple services which are optional for developers to be integrated into their apps, like Technology Usage Guidelines for Game Center (case 108), but also the publication of best practices

like iOS 6 Human Interface Guidelines (case 106). IS2 is related to I2 and I3, but gives developers the choice to decide whether to comply with those guidelines or not. Cases of label IS2 were triggered by a combination of technical and proactive competition factors.

Table 12: Example cases of combined input and social control (of a total of 22 occurrences)

Input and Social Control				
Label	Trigger	#	ID of example	Case Tag
IS1: Enabling developers (directed enablement, directly connected with a specific non-Apple service or a non-standalone Apple service)	Technical, proactive/ reactive competition	10	4	Native Facebook support in iOS 6
			68	P2P Bluetooth feature integrated in iOS 3
			71	Push-notifications possible
	Proactive/ reactive competition	6	96	iAd Release (US)
	Developer behavior	3	72	In-App purchases now possible for free apps
IS2: Guidelines for optional Apple services and best practices	Technical, proactive competition	3	106	iOS 6 Human Interface Guidelines
			108	Added Technology Usage Guidelines for “Game Center”

In total, we identified eleven different triggers and trigger combinations in our data set (Figure 3). Putting them all together and reviewing their influence on which control has been implemented, we found structures that indicate certain strategies of the platform provider.

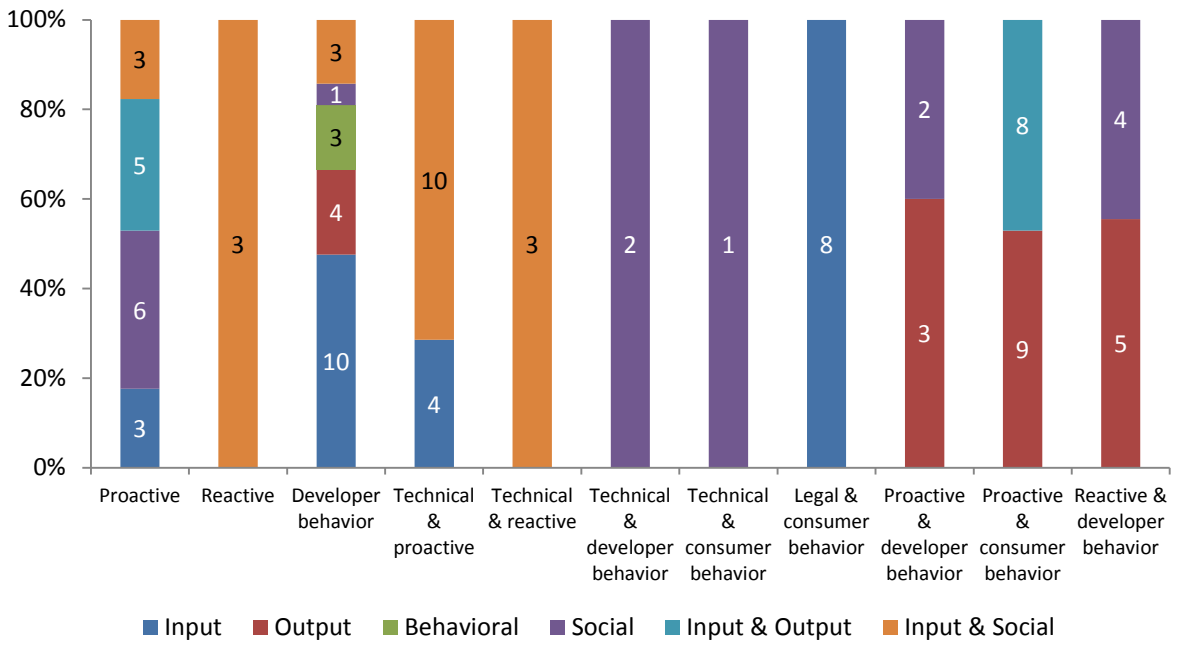

Figure 3 Trigger combinations and their resulting control implementations

Five of those eleven trigger combinations always resulted in one certain control or control combination. This is especially true for legal trigger, as they only appear in combination with consumer behavior. Technical developments, influences or issues almost always call for one certain control except for mixes with proactive moves, where input control can also be accompanied by social control. Combinations of proactive actions with stakeholder behavior or combinations of reactive actions with stakeholder behavior respectively result in an either or decision between two different control combinations. Four trigger combinations where found to fall into this group. For the two remaining trigger groups, proactive moves or developer behavior identified as the sole trigger for a control implementation, structures are not as clear. Both trigger groups can result in various different control implementations.

Discussion and Control Principles

The empirical findings of this paper are based on a single but outstanding case which therefore qualifies for new theory building or extension (Yin 2009). The case consists of 100 subunit cases, each reflecting an implementation of an organization control. To ensure validity of our results, several experts were consulted which cross-checked the axial coding. Furthermore, substantiations were formulated for each classification. The research process presented in Figure 2 illustrates the iterative process of this case research promoted by Yin (2009). With this inductive case study approach, we explored the applicability of organizational controls within the PBSM setting and linked it with state

of the art research within the PBSM context by parallel investigating the literature derives change triggers originate by Manner et al. (2013, 2012)

On reviewing the quantitative analysis results, it can be acknowledged that the number of control implementations within Apple's PBSM increases progressively. Behavior of the developers is often found to trigger a control implementation. On reviewing the complete period, many controls were implemented in connection with developer behavior at first. However, in the last two years this aligned with consumer behavior. For example in 2012, 9 times developers and 9 times consumers were linked to a control change. This could be an indicator for Apple to start balancing the market sides as suggested by literature (Haaker et al. 2006; Ghazawneh/Henfridsson 2012).

A frequent trigger combination is proactive competition action in combination with technical factors. We believe this indicates that Apple as the PBSM provider proactively adapts the ecosystem by constantly monitoring the technical possibilities. We argue that such a proactive change linked with technological factors could be a reason for the long-term success of the platform. Overall, 17 percent of the control implementations are solely proactive actions without other triggers, showing that Apple strives to maintain and improve the platform. Also within this study, we found evidence for the need of the proactive and tight alignment with the stakeholders (Iyer et al. 2007; Manner et al. 2012) . Another 22 percent of the total control implementations are either triggered by a proactive move linked with developer or consumer behavior. Hence, we argue a successful provider should monitor the stakeholder behavior closely and react swiftly and accordingly to align the control dynamically to the ecosystem (Rudmark/Ghazawneh 2011).

As suggested by literature, legal regulations have an influence on the PBSM. Not surprisingly, all occurrences of legal triggers are connected to consumer behavior. In total, all the triggers we identified within the platform context literature can be considered as relevant to PBSM. However, as the cross table analysis shows the categorization provides many overlaps.

The identified control implementations show a significant use of mixed controls. Input control, which is considered an informal control, is often mixed with either output or social control. The link between input and social control matches control literature where input as well as social controls are often investigated alternately instead of jointly. However, we find them also often as single controls, displaying that differentiation can lead to more accurate labeling. It is not surprising that we found only three behavioral controls implemented. Literature regards behavioral controls as cost and time consuming and also less efficient (Lange 2008). From a practical perspective, the scarcity of behavioral control in the App Store in general is also not surprising given the characteristics of the relationship between the platform provider and its third-party developers. Both sides are not bound to

each other in terms of a typical employer-employee-contract. Apple does not define a specific outcome (i.e. which kind of app and its design) to be achieved by developers. It rather is an enabler who provides developers the means and tools to achieve a goal which they themselves can define, though within boundaries defined by Apple. Not knowing which outcome to expect, the process to achieve those outcomes remains unknown. However at the same time, the outcome itself is perfectly measurable through inspection and testing in the approval process.

All other controls are implemented frequently as solitary mechanisms by Apple with a slight dominance of input. Informal controls like input control and control systems partially consisting of input (output with input controls) are altogether majorly used and indicate the relevance of fully or partially informal control systems. Fully or partially informal control systems are acknowledged by literature as supportive for innovation and thus are in line with Apple's success (Ouchi 1979; Cardinal 2001). The absence of a mixed social and output control occurrence is logical as social controls "operate through normative pressures and the force of social obligation" (Lange 2008) and thus completely contrary to the measurement of the outcome after the task is done.

Evaluating these results, we find similarities between empirical findings within organizational control and the PBSM setting we analyzed. However, empirical findings on organizational control also provide only limited insights on control development (Cardinal et al. 2009). To gain insights on control development for PBSM, we now discuss the qualitative findings of this study.

The presented quantitative results which are in line with literature and merging these with the qualitative results indicate that the App Store provider Apple indeed has strategies to enforce its controls.

By analyzing qualitatively the triggers which resulted in control implementations, we recognize ten principles for control design of PBSM:

1. **New technical implementations as a proactive move against the competition** not directly connected to specific Apple service indicate to implement an input control implementation. Thereby the aim is a general enablement of developers that is not directly connected to a specific Apple service. If it is uncertain of how to use the implementations by developers the input control should be aided by a social control. This means the platform provider should provide guidelines and best practices for supporting the developers after the technical implementations. This support also aims to align the expectations of the provider with the output of the developers. Such a combination is also implemented when the move was triggered **reactively.**
2. Changes in **legal regulations** affecting the marketplace linked with **consumer behavior** should be answered by an input control that is restricting the developers. This is mostly done

by setting up binding guidelines to protect consumers, especially in terms of data security and privacy.

3. Furthermore, such an input control should also be implemented, if a **harmful developer behavio**r can be recognized in order to protect the PBSM provider's own goals, like e.g. ensuring high quality of apps or ensuring authority over app promotion within the App Store or within apps.
4. **Proactive** expeditions and exploration of new potentials for service development are implemented by a mix of input and output control. Such a proactive exploration can also be linked with **consumer demands**. Since an input control for exploring new potentials cannot be designed in such a way that the service developed is securely in accordance with the wished consumer experience, an output control needs to be implemented as well.
5. **Proactive moves of increasing the usability of the App Store** with respect to e.g. design, categorization and discovery of apps are mainly driven by consumer behavior and occasionally by developer behavior. The platform provider wants to distinguish itself from its competitors by providing its customers an easier, more appealing and overall better platform experience. As the platform provider has full control over how the platform software should look like and operate, output controls are applied.
6. **Proactive competitive actions,** especially concerning the dues for taking part in the App Store and its ecosystem and benefiting from it, shall be implemented using input controls. The platform provider can decide on its own how to price its platform services, though at the same time it has to reflect on how its platform can gain a competitive advantage in the market.
7. **Technical changes as a reactive move to** competitors' actions shall be integrated with a combination of input and social control. The platform operator provides developers with the means to have features comparable to services of other platforms, but also provides them with guidance on how to use them properly to improve the quality of their services and products.
8. **Observed harmful developer behavior** should, if possible, be controlled by input or output controls. Those **that cannot be controlled by input or output controls** need to be answered by behavioral control. In those cases contracts with threatening legal actions when violations occur or codes of conduct need to be implemented.
9. **Developer behavior that reflects discontent** with certain Apple practices (e.g. lack of transparency) or discontent due to technical failures or shortcomings should be considered by implementing social controls. However, if the discontent is with possibilities in the app development, like the ban of AdMob or restricting Google Voice apps, and the platform provider wants to mitigate this discontent, input controls shall be added to the social controls in order to further support developers.
10. Finally we also find several **proactive competitive actions introduced by the provider to motivate developers** for taking part as service providers in the marketplace. Such proactive incentives should be implemented by social control (e.g. informing about changes in advance, supporting app detection and enhancing marketplace marketing to enlarge consumer base).

Contributions and concluding remarks

Our results are in line with previous findings on organization controls. However, as they also extend the previous theory on organizational control these results need further refinement for theory testing as well as further empirical results from another case.

Yet, although there are still many open issues on control design in the PBSM context, we believe to have found supportive managerial principles for practitioners. Moreover, we are the first to review this control perspective on such an empirical setting of 100 analyzed subunits (Eaton 2012; Tiwana et al. 2010). The employed structure for the case analysis was evaluated as being a suitable structure for this complex environment that was yet missed to assess the strategies of PBSM providers (Kouris/Kleer 2012). Finally the results of this research also propose a first bridge between the abstract results of strategic management research and economic research in the field of transaction cost theory (Manner et al. 2012). Further research should concentrate on analyzing the Google Play Store and conducting a cross-case analysis. As both PBSM are considered to be managed heterogeneously, insights for stronger theory building could be found (Yin 2009).

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