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Mario Schaarschmidt
University of Koblenz-Landau

Thomas Kilian
University of Koblenz-Landau

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PERIPHERAL MOTIVATION AND CREATIVITY IN CONTROLLED PLATFORMS: AN ANALYSIS BASED ON FACEBOOK AND iPhone APPLICATION DEVELOPERS

Mario Schaarschmidt, University of Koblenz-Landau, Universitaetsstr. 1, 56070 Koblenz, Germany, mario.schaarschmidt@uni-koblenz.de

Thomas Kilian, University of Koblenz-Landau, Universitaetsstr. 1, 56070 Koblenz, Germany, kilian@uni-koblenz.de

Abstract

In this paper, we describe how intrinsic motivation, extrinsic motivation, and the willingness to take risks influence the activity of Facebook and iPhone application developers. Both Facebook and Apple utilise a platform business model but differ in terms of their openness towards external development. However, in any platform business model, a platform owner must encourage peripheral contributions to strengthen its market position. In this paper, we use a questionnaire to investigate the influence of different motivation structures on participation. In particular, we seek to answer the following basic questions: (1) How do voluntary developers differ from developers who are paid by professional firms in terms of their motivation? (2) How do developers working on applications for an open platform (e.g., Facebook) differ from developers working for a rather closed platform (e.g., iPhone)? (3) How does perceived support for creativity affect the motivation of a sponsored individual? We conclude by providing managerial implications and suggesting avenues for further research.

Keywords: Open innovation, Platform Business Model, iPhone Applications, Facebook Applications, Creativity, Motivation

1 Introduction

Platform business models are an increasingly popular method of transforming technological innovations into economic value (Teece, 2010). A platform is defined as an infrastructure that connects two distinct markets that are usually independent from one another (Boudreau, 2010). For example, Sony's PlayStation is a platform, as it combines the market for end users and the market for game developers (i.e., from Sony's perspective, its primary selling and buying markets). Recently emerged types of platform business models do not even demand monetary compensation from individuals for using a platform (e.g., online auction platforms, social software), contributing to a platform (e.g., Facebook), or even accessing the platform itself (e.g., open source operating systems).

Facebook, which is likely the most well-known example of a platform business model today, allows free developers and software firms to develop their own applications for the platform. Rather than utilising a closed platform, Facebook made the strategic decision to open its technical infrastructure to foster peripheral development of applications (i.e., small programmes that are optimised for a specific purpose). These applications considerably increased the attractiveness of Facebook for end users, and this feature is believed to be important for remaining attractive as an advertising channel (Chesbrough, 2006). However, possible future revenues from these applications must be shared with external parties despite their limited value without a platform.

Similarly, mobile phones have been enhanced in recent years to act as platforms. Initially, the primary function of mobile phones was to enable phone calls, whereas it is currently possible to access various services via a mobile device. These services include professional services, such as online trip planning and ticketing and games. Thus, in terms of consumer purchase decisions, the ecosystems of mobile phones are as important as the technical quality and design of the devices (Chesbrough, 2011).

Although both applications for Facebook as well as technical services and games for mobile phones increase the value of the platform, there is a considerable difference between these two types of business models. A platform such as Facebook is not intended to be sold separately but is designed to act as an advertising channel. In contrast, mobile phone vendors utilise a business model that simultaneously aims to sell the platform itself. Additionally, with regard to possible revenue streams, Facebook does not demand advance fees for developing applications for its platform, but vendors of mobile devices such as Apple do demand such fees (Remnland-Wikhamn et al., 2011). Therefore, in our view, the platform business model of Facebook is more open than that of Apple because the incentive structure for the Apple model is more restrictive.¹

However, although the degree of openness might differ between the two platforms, both firms welcome the development of applications by external parties to complement their own functionalities. However, researchers have devoted little attention to the question of how developers can be encouraged to assign themselves to platforms. For example, recent management research has found that the decisions of individuals to allocate their free time and effort to collaborative innovation projects are driven by both intrinsic and extrinsic motivations (Bitzer and Geishecker, 2010; Deci, 1972; Deci and Ryan, 1987). However, the majority of these studies investigated open source software projects (e.g., Bitzer et al., 2007; Wu et al., 2007; Xu et al., 2009). Although these detailed studies may act as valuable sources with which to obtain knowledge on how to control a platform with linked external parties, platforms such as Facebook or Apple's iPhone differ from open source projects. With respect to open source projects, no one "owns" such products, and intellectual property protection mechanisms are difficult to apply; in contrast, a platform that is dedicated to a platform business

¹ Today, even Facebook takes a share of the revenue from application providers, such as Zynga, by means of their Facebook currency. Although we still view Facebook as more open than Apple with respect to our analysis, Facebook truly was more open than Apple when we sent our surveys.

model is usually owned by a single entity (Eisenmann et al., 2008). As this ownership status may affect a developer's motivation to allocate his efforts to one platform or to another platform, it is important for a platform provider to determine how to motivate developers to stimulate external contributions to the focal platform.

Thus, the aims of this study are twofold. First, we are interested in determining how the motivations of developers differ according to the openness of the platform to which they contribute and in relation to their professional affiliations. Second, we seek to determine how a firm's internal organisation of creativity affects the motivations of developers who earn pay for their work on applications.

To contribute to the discussion on how to encourage external entities to allocate their resources and applications to a platform, we asked Facebook and iPhone application developers about their motivation, the time they devote to development, and their output in terms of lines of code. Professional developers were further asked to specify whether their organisational culture supports creativity, as opportunities for creativity may affect a developer's output (Dewett, 2004; Dewett, 2007; George and Zhou, 2001; Oldham and Cummings, 1996).

2 Conceptual background and driving phenomena

2.1 Platforms and platform business models

From an economic perspective, platform business models are based on the mechanisms of two-sided network effects in which it is possible to provide something for free and benefit from a complementary good or service (Parker and Van Alstyne, 2005). Similarly, researchers have often referred to the logic of the business model as the razor-razor blade model in which the device (e.g., video game console) can be more effectively marketed with attractive software or applications (i.e., video games) (Magretta, 2002; Pisano and Teece, 2007; Teece, 2010). However, contrasting with the pure razor-razor blade model that has existed for decades, platform business models combine two distinct market actors. In the model of the razor and razor blade, a simple buyer and seller relationship exists, whereas relationships among buyers, sellers, and platform providers are more complex in the platform model (Eisenmann et al. 2008).

For example, with respect to video consoles, personal computers, or mobile devices, a user must purchase a platform before he can use such products. However, a stand-alone platform constitutes little value for users. Users will not perceive value from using such a platform until games accompany video consoles, different software packages accompany personal computers, and a network of possible callees accompany mobile devices. Thus, complementary products and services are vitally important in platform business models (Chesbrough, 2006). Because third parties can theoretically offer complementary services and product supply to a platform and take a share of the total turnover, platform providers are confronted with questions of whether to offer their own complementary products and services and how to price platform usage (Mahadevan, 2000).

In particular, platform providers could completely exclude the external development of complementary products by simply hiding interface descriptions. In this situation, no external developer has an opportunity to contribute to a platform, and a platform provider can capture all revenue shares. In a more open form, a platform provider could deliver interface descriptions to external contributors only if an external contributor pays for usage. However, the most open form is a platform the interfaces of which are completely open. In this open format, platform providers will not earn any revenue from external contributors, but external contributions assist in increasing the attractiveness of a platform and eventually its diffusion (West, 2003). More precisely, if a platform provider intends to work with external contributors, four models are theoretically possible:

1. The platform provider offers interface descriptions for free and does not demand any fee.
2. The platform provider can demand a fee for using the platform as a developer.
3. The platform provider offers free interface descriptions but takes a share of the revenue that is generated by external developers.
4. The platform provider demands both a fee for using the platform as a developer *and* takes a share of the revenue of its contributors.

These approaches to handling external developers in terms of compensation of future revenues on their side may be considered to be situated on a continuum between open and closed. The open form (i.e., providing interface descriptions for free) might even be considered a form of open innovation because such platform providers accept this arrangement to obtain a smaller portion of a potentially larger revenue source (Bogers et al., 2010; Chesbrough, 2003; West and Lakhani, 2008).

Comparing the platform model of Apple to that of other mobile operating systems, such as Symbian or Android, Apple is rather closed in terms of the system core hardware services, background services, application development platform, and application distribution platform (Bergvall-Kareborn et al., 2011; Schlagwein et al. 2010). In contrast, Facebook may be considered rather open compared with its direct competitors (i.e., other social networking sites) and other platform providers, such as Apple.

However, for platform providers, it is crucial to know when to open platforms and how to motivate external parties to develop adequate applications. The first question predominantly encompasses economic aspects (Eisenmann et al., 2008) with regard to free external developers, whereas the latter question concerns behavioural aspects, which have thus far been neglected by business model researchers. Therefore, the following section presents a discussion regarding motivation and creativity.

2.2 Motivation and creativity in organisations

Various researchers have noted that innovation processes begin with creativity (e.g., Dewett, 2007; Kratzer et al., 2004). In turn, creativity is influenced by various behavioural aspects, such as motivation, risk, support, and even dissatisfaction (Zhou and George, 2001). Although the concept of creativity is comparatively broad, the majority of researchers focus on employee creativity, that is, the creativity that emerges within the boundaries of formal organisations (e.g., Amabile and Gryskiewicz, 1989; Dewett, 2006; Van Dijk and Van den Ende, 2002; Yuan and Woodman, 2010). For example, Dewett (2007) refers to employee creativity as a function of the willingness to take risks, which in turn is a function of an individual's intrinsic motivation.

However, individuals are believed to exhibit two types of motivation: intrinsic *and* extrinsic motivation (Ryan and Deci, 2000). In general, intrinsic motivation refers to motivation that derives from enjoyment in doing something and inherent joy in pursuing an activity. In contrast, extrinsic motivation refers to situations in which people are externally pressured to do something. However, in some situations, it is difficult to delineate intrinsic from extrinsic motivation. For example, the motivation to gain a reputation within a community (or a firm) is initially viewed as intrinsic because the focal person has not been coerced in his search for reputation. However, because reputation is granted by a group of external sources, aiming to gain a reputation may equally be considered extrinsic.

Within organisations, people perceive a permanent extrinsic motivation as a consequence of their employment. Because they are paid to pursue defined tasks, people feel obliged to provide something in exchange for their salaries. Consequently, organisation researchers have predominantly focused on intrinsic motivation in relation to creativity (e.g., Remedios and Boreham, 2004; Woodman et al., 1993). However, with respect to the external contributions to platforms that are described in Section 2.1, both developers who are paid by firms and unpaid volunteers contribute code. Because platform providers welcome both types of contributions, it is important to understand the complex motivation structure of paid and unpaid developers to be able to provide the right incentives. Therefore, the

following hypotheses refer to the motivation of paid and unpaid developers and to the differences between those working for open or closed platforms.

3 Hypotheses

3.1 Open versus closed platform approach

As discussed previously, any platform operator or provider welcomes external contribution to increase a platform's attractiveness. These contributions can originate from either volunteers or individuals who are employed by firms with a business model that depends on the platform (Tiwana et al., 2010). Various approaches exist for the creation of active eco-systems of external developers that essentially range from closed to open approaches. Generally, openness in the sense of the first approach (see Section 2.1) entails low barriers for external developers to dedicate their time to application development but also entails low shares of possible revenue. Conversely, closeness in the sense of the fourth approach allows for capturing higher revenue shares but impedes the evolution of a platform eco-system.

With regard to the distinction between voluntary and professional developers (i.e., developers who are paid by a firm with a business model that depends on its platform and often known as "sponsored developers"), both groups are likely to feel attracted by open platforms because of the absence of entry barriers, such as fees. However, given that firms can dedicate more resources to the development of applications for a platform rather than a group of individual developers, open platforms ought to attract more professional developers than closed platforms. Therefore, we hypothesise the following:

Hypothesis 1:

Open platforms attract more professional (i.e., firm-paid) developers than do closed platforms.

Similarly, low barriers enforce the creation of larger application development projects. Both, the group of individual volunteers and the group of professional developers don't perceive any barriers for participation. An open platform mirrors an open programming culture which, in turn, attracts developers of all kind. Thus, we posit:

Hypothesis 2:

Application development projects for open platforms constitute more developers than projects for closed platforms.

With regard to the motivation of individual developers, developers who are paid by firms with a business model that is dependent on their platforms are extrinsically motivated. In contrast, because of the absence of external stimuli, free developers are more intrinsically motivated than their paid counterparts. However, for platform operators, it is extraneous whether external contributions are derived from free or professional developers. Rather, the important issue is whether the motivation of developers differs depending on whether a platform is open or closed. In other words, a platform operator must know how to stimulate external development in relation to the openness of his platform rather than know the differences between the motivation of free and professional developers.

However, if we assume that Hypotheses 1 and 2 are supported, then open platforms attract more professional developers than do closed platforms. In turn, because professional developers ought to be more extrinsically motivated, developers who are attracted by open platforms ought to be more extrinsically motivated. Therefore, we offer the following hypotheses:

Hypotheses 3a-d:

Developers who develop applications for open platforms a) are more extrinsically motivated, b) are less intrinsically motivated, c) are less willing to take risks, and d) perceive less autonomy than developers of applications for closed platforms.

3.2 Internal organisation of application development

In a shift in the focus from platform providers and operators to firms that develop applications and their personnel, application development constitutes a creative activity. As discussed earlier, creativity researchers, such as Amabile and Grysiewicz (1989), Dewett (2006; 2007), and Kratzer et al. (2004), emphasise the role of intrinsic motivation, perceived support for creativity, and willingness to take risks as antecedents for creative outcomes.

As discussed previously, the majority of creativity researchers have focused on the emergence of creativity within the boundaries of firms (cf. Schaarschmidt and Von Kortzfleisch, 2011). In this situation, intrinsic motivation is believed to increase a person's willingness to take risks, which, in turn, is associated with increased creative performance (Dewett, 2006). However, with regard to external development, both individuals who are embedded within the boundaries of a firm and free developers contribute to application development. It can be argued that intrinsic motivation positively affects the willingness to take risks and autonomy, whereas extrinsic motivation negatively affects both the willingness to take risks and autonomy. However, individuals who are employed by a firm with a business model that is dependent on a platform feel less intrinsically motivated and more extrinsically motivated. We posit that motivation affects the willingness to take risks and autonomy in the following way:

Hypothesis 4a:

Being sponsored by a firm mediates the relationship among intrinsic motivation, extrinsic motivation and the willingness to take risks.

Hypothesis 4b:

Being sponsored by a firm mediates the relationship among intrinsic motivation, extrinsic motivation and autonomy.

Firms that deploy a business model that embraces the development of applications for platforms are dependent on the creativity of their employees. Thus, firms are likely to support creativity within their boundaries to secure their innovative performance (Dewett, 2004). Therefore, developers who perceive that they are supported in their creative work should be willing to take more risks than developers who perceive less support for creativity. Thus, we hypothesise as follows:

Hypothesis 5:

Perceived support for creativity within organisations mediates the relationship between intrinsic motivation and the willingness to take risks.

The following statement summarises Hypotheses 4a, 4b and 5: the expected positive relationship of intrinsic motivation with the willingness to take risks and autonomy is amplified by support for creativity, whereas the expected negative relationship of extrinsic motivation with the willingness to take risks and autonomy is further diminished by firm sponsorship.

4 Empirical analysis

4.1 Research context

To address the hypotheses that are presented above, we developed a questionnaire. The link to this online survey was sent to various mailing lists, news forums, and blogs for iPhone and Facebook application developers. Because we aimed to use the iPhone as an example of a rather closed platform approach and Facebook as an example of a rather open approach, we also asked developers about their perception of openness. All developers shared our perception of openness in relation to Facebook and Apple.

For the survey, we drew on established scales and obtained a final questionnaire of 34 questions that were measured on a 7-point Likert scale. After two rounds of posting the web-based survey to various news forums and mailing lists, we received 87 valid answers from application developers. Due to this approach it is not possible to provide a response rate.

4.2 Variables

The constructs that were used for this study include reflective variables that consist of multiple items as well as variables that consist of a single item. Intrinsic motivation was measured using six items from the study of Ryan and Deci (1987). Extrinsic motivation was measured using six items from the work of Deci (1972). The willingness to take risks is based on items that were derived from the research of Dewett (2006). Autonomy is based on two items that were drawn from the work of Ibarra and Andrews (1993). Perceived support for creativity is based on four items that were obtained from the study of George and Zhou (2001), but these items were only presented to those who stated that they work for a firm with a business model that is dependent on either iPhone or Facebook.

We included a number of variables that act as control variables in our model to test Hypotheses 4a, 4b, and 5. These variables consist of the number of application development projects in which a person is currently involved (Boundary Spanning), the average number of people who work for a project in which a person is involved (Project Size (People)), the average number of lines of code for projects in which a person is involved (Project Size (LOC)), the number of application development projects on which a person has worked (Experience), gender (Gender), the average time per week that a person works on an application (Working Hours), and whether a person is sponsored by a firm with a business model that is dependent on either iPhone or Facebook.

4.3 Results

| Construct | Cronbach's alpha |
|--|------------------|
| <i>Intrinsic Motivation</i> (6 items from Deci and Ryan 1987) | .696 |
| I do this work because I enjoy it! | |
| I do this work because I want to learn new things! | |
| I feel driven to do my job because I genuinely like the tasks I work on! | |
| I do this work because I identify with it! | |
| I do this work in order to improve my technical skills! | |
| <i>Extrinsic Motivation</i> (6 items from Deci 1972) | .744 |
| I do this work because I have to do it! | |
| I do this work because I earn money with it! | |
| I do this work because I finance my living with it! | |
| I do this work because I want to be better than others! | |
| I do this work in order to receive appreciation! | |
| I want others to think that I am good in my work! | |
| <i>Willingness to take risks</i> (2 items from Dewett 2006) | .548 |
| When I think of a good way to improve the way I accomplish my work, I will risk potential failure to try it out! | |
| In order to enhance the quality of features, I risk a possible delay in the release cycle! | |
| <i>Autonomy</i> (2 items from Ibarra and Andrews 1993) | .551 |
| In this project I am allowed to decide on my own, which task I work on first! | |
| I don't have to pay attention to a project's schedule! | |
| <i>Perceived Support For Creativity</i> (4 items from George and Zhou 2001; only paid) | .718 |
| Creativity is encouraged at my company! | |
| Our ability to function creatively is respected by the project leadership! | |
| The reward system here encourages innovation! | |
| My company publicly recognizes those who are innovative! | |

Table 1 The constructs that are used in this study

With regard to the reflective constructs, the composite reliability score that was measured by Cronbach's alpha exceeded the recommended threshold of 0.7 (Nunnally 1978) in three of five cases (Table 1). The willingness to take risks and autonomy yielded values below 0.7, but scores above 0.5 constitute an acceptable range given the relatively small data set and given the fact that each construct only consists of two items (Peter 1979).

With respect to the respondents, 47 developers work on Apple iOS (i.e., the operating system for Apple products), 24 developers work on Facebook applications and 16 work for other systems, such as Symbian or Microsoft. As expected, the developers who are paid for their work by a firm spend more time on projects than their voluntary counterparts (32.78 hours for paid developers vs. 20.69 hours for non-paid developers, on average).

Based on the descriptive statistics (Table 2), it is notable that approximately 57% of the developers in the sample are paid for their work. Similar to the results of other studies that address developers (e.g., Bitzer and Geishecker, 2010), 98% of the developers in this sample are male, and the average age is approximately 30 years (mean of 30.88 years). Projects consist of an average of four developers. Additionally, intrinsic motivation is reported to be higher (mean of 5.46) than extrinsic motivation (mean of 4.37).

| Variables | M | SD | Min | Max | 1 | 2 | 3 | 4 | 5 | 6 |
|-------------------------|-------|-------|------|-------|--------|---------|--------|--------|-------|---------|
| 1 Boundary Spanning | 2.89 | 2.77 | 1 | 20 | 1 | | | | | |
| 2 Project Size (People) | 3.96 | 3.18 | 1 | 20 | -.224* | 1 | | | | |
| 3 Experience | 1.05 | 3.17 | 0 | 15 | .060 | -.134 | 1 | | | |
| 4 Gender | 0.98 | 0.15 | 0 | 1 | .105 | -.147 | .051 | 1 | | |
| 5 Age | 30.88 | 7.85 | 14 | 52 | -.010 | -.062 | .407** | .096 | 1 | |
| 6 Working Hours | 29.69 | 12.19 | 3 | 50 | -.110 | .353** | .152 | -.067 | .238* | 1 |
| 7 Project Size (LOC) | 16360 | 56958 | 0 | 500T | .072 | .235* | .090 | .044 | .123 | .167 |
| 8 Project Size (LOCLN) | 7.46 | 3.16 | 0 | 13.12 | -.030 | .121 | .033 | .364** | .098 | .201 |
| 9 Firm-Paid | 0.57 | 0.49 | 0 | 1 | -.108 | .504** | -.146 | -.132 | .011 | .584** |
| 10 Intrinsic Motivation | 5.46 | 0.95 | 2 | 7 | .226* | -.274* | -.086 | .047 | -.118 | -.213* |
| 11 Extrinsic Motivation | 4.37 | 1.17 | 1 | 6.5 | .060 | .093 | .087 | -.181 | .153 | .375** |
| 12 Willingness | 4.15 | 1.20 | 0.75 | 7 | .006 | -.122 | -.205 | .155 | .018 | -.144 |
| 13 Autonomy | 4.35 | 1.46 | 0 | 7 | .102 | -.419** | .124 | .196 | .079 | -.298** |

| Variables | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|-------------------------|---------|--------|-------|---------|--------|-------|--------|----|
| 6 Working Hours | 1 | | | | | | | |
| 7 Project Size (LOC) | .167 | 1 | | | | | | |
| 8 Project Size (LOCLN) | .201 | .352** | 1 | | | | | |
| 9 Firm-Paid | .584** | .170 | .238* | 1 | | | | |
| 10 Intrinsic Motivation | -.213* | .040 | .026 | -.274* | 1 | | | |
| 11 Extrinsic Motivation | .375** | .117 | -.039 | .287** | .249* | 1 | | |
| 12 Willingness | -.144 | .080 | -.044 | -.258* | .124 | -.076 | 1 | |
| 13 Autonomy | -.298** | .114 | -.057 | -.541** | .320** | -.206 | .370** | 1 |

*p<.05; **p<.01; ***p<.001

Table 2 Descriptive statistics and correlations

To test our hypotheses, we used an analysis of variance (ANOVA) for Hypotheses 1-3d and an OLS regression for Hypotheses 4a-5 (cf. Hair et al., 1998). In Hypotheses 1 and 2, we suggested that open platforms attract more professional developers and host projects with more developers than closed platforms. Again, in this study, we interpreted Facebook as being more open than Apple.

In support of Hypothesis 1, our results revealed that 79% of Facebook developers and 51% of Apple developers are paid for their work on these platforms (p<.1) (Table 3). Consequently, in support of Hypothesis 2, the number of people who work for a project is significantly (p<.05) higher for the group of Facebook developers.

Hypotheses 3a-d were related to differences in motivation, the willingness to take risks and autonomy. In support of Hypotheses 3a and 3c, iPhone developers are more intrinsically motivated and perceive

more autonomy than Facebook developers ($p < .1$). In contrast, Hypotheses 3b and 3d could not be supported because the ANOVA did not yield significant results for extrinsic motivation and willingness to take risks (Table 3). Surprisingly, perceived support for creativity, which was measured only for paid developers, is significantly higher for iPhone developers ($p < .05$).

| | Facebook application developers | | | iPhone application developers | | |
|---------------------------------------|---------------------------------|-------------------------|-------|-------------------------------|-------------------------|-------|
| | N | M | SD | N | M | SD |
| Intrinsic motivation | 24 | 5.16^a | .97 | 47 | 5.67^b | .92 |
| Extrinsic motivation | 24 | 4.35 ^a | 1.12 | 47 | 4.29 ^a | 1.22 |
| Willingness to take risks | 24 | 4.16 ^a | 1.11 | 47 | 3.98 ^a | 1.47 |
| Autonomy | 24 | 3.79^a | 1.28 | 47 | 4.53^b | 1.45 |
| Perceived support for creativity | 19 | 4.89^a | 1.53 | 24 | 5.83^c | .89 |
| Number of projects involved | 24 | 3.00 ^a | 3.90 | 47 | 2.98 ^a | 2.27 |
| Number of people working on a project | 24 | 5.75^a | 4.69 | 47 | 3.21^c | 1.85 |
| Number of applications | 24 | 3.12 ^a | 4.02 | 47 | 3.27 ^a | 3.26 |
| Working time | 24 | 30.25 ^a | 11.19 | 47 | 28.29 ^a | 12.32 |
| Application size (LOC) | 24 | 30T ^a | 101T | 47 | 9T ^a | 15T |
| Firm sponsorship | 24 | .79^a | .41 | 47 | .51^b | .50 |

Table 3 Means (M) and standard deviations (SD) after the ANOVA on factor PLATFORMTYPE. Within each row, means with a different superscript significantly ($p < .05$ for c; $p < .1$ for b; bold) differ from one another.

To test Hypotheses 4a-5, we used ordinary least squares (OLS) regression (Hair et al., 1998) (Table 4). Because we were interested in the mediating role of sponsorship and perceived support for creativity, we used a stepwise regression that is recommended by Baron and Kenny (1986). As expected, Model 1A shows that intrinsic motivation is positively related to the willingness to take risks, the dependent variable. Extrinsic motivation is negatively related to the willingness to take risks. Both findings support the results of former studies of motivation and creativity (e.g., Dewett, 2007). In the second step (Model 1B), Firm-Paid was included as an additional variable. In support of hypotheses 4a, the sponsorship of developers negatively ($p < .001$) affects their willingness to take risks. Moreover, the effect of intrinsic and extrinsic motivation on the willingness to take risks has been deflated and is no longer significant; thus, this effect indicates full mediation (Baron and Kenny, 1986). Additionally, the explanatory power of Model 1B increased compared with that of Model 1A ($\Delta R^2 = .131$).

| | Model 1A DV=WTR | Model 1B DV=WTR | Model 2A DV=Autonomy | Model 2B DV=Autonomy | Model 3A DV=WTR | Model 3B DV=WTR |
|-------------------------|--------------------|--------------------|-------------------------|-------------------------|--------------------|--------------------|
| Gender | .141 | .128 | .100 | .088 | .182 | .143 |
| Age | .149 | .146 | .112 | .109 | .038 | .046 |
| Experience | -.066 | -.154 | .138 | .053 | -.073 | -.037 |
| Intrinsic Motivation | .335** | .170 | .420*** | .262* | .023 | .019 |
| Extrinsic Motivation | -.246* | -.078 | -.322** | -.161 | | |
| Perceived Support | | | | | | .100 |
| Firm-Paid | | -.421*** | | -.405*** | | |
| N | 87 | 87 | 87 | 87 | 49 | 49 |
| R ² | .174 | .306 | .246 | .368 | .040 | .047 |
| R ² adjusted | .123 | .254 | .200 | .321 | | |
| ΔR^2 | | .131 | | .121 | | |

*** $p < .001$; ** $p < .01$; * $p < .05$

Table 4 Regression results concerning Hypotheses 4a, 4b, and 5

In Model 2A, autonomy is the dependent variable. Again, intrinsic motivation (positively) and extrinsic motivation (negatively) affect autonomy, and these effects constitute a prerequisite for

mediation (Baron and Kenny, 1986). In Model 2B, the sponsorship of developers (Firm-Paid) was included as an independent variable. As in Model 1B, Firm-Paid mediates the relation among intrinsic motivation, extrinsic motivation and the dependent variable, which is autonomy in Model 2B. The increase in explanatory power is considerable ($\Delta R^2=.121$). However, extrinsic motivation is fully mediated, whereas intrinsic motivation still has a significant effect, which signals partial mediation. In summary, Hypothesis 4b can be supported.

Finally, Hypothesis 5 is related to the mediating role of perceived support for creativity. Because only those who perceive support are embedded in organisational structures, only firm-paid developers have been considered in Models 3A and 3B. For this group, no significant effect of intrinsic or extrinsic motivation on willingness to take risks is observable. Because this effect is a prerequisite for mediation, we must eliminate Hypothesis 5 from consideration.

5 Discussion and conclusion

5.1 Managerial implications

The aim of this study was twofold. First, we investigated how the motivations of developers differ according to the openness of the platforms to which they contribute. Second, we considered the manner in which the sponsorship of a developer affects the relationship between motivation and the willingness to take risks, which has been reported to be an important antecedent for creativity (Dewett, 2004).

Our results yielded several interesting implications for managers. First, our results confirm the notion of the complex interplay among openness, motivation, and professional participation. In particular, we argued that if a platform is too open, external professionals might harness the entire platform, whereas platforms that are too closed will exclude professional firms and voluntary developers. The example of Facebook shows that open platform projects consist of more developers than do projects for more closed platforms, such as Apple.

Second, the results showed that the effect of intrinsic motivation on the willingness to take risks is fully mediated by sponsorship. Creativity, an important prerequisite for innovations (Amabile and Gryskiewicz, 1989), is dependent on the willingness to take risks, which we expect to be smaller for firm-paid developers, as such developers might lose their jobs as a consequence of risk-taking behaviour. This implies that creativity in a platform can be impeded by sponsorship. However, creative applications particularly contribute to the attractiveness of a platform. Thus, even “useless” applications, such as a virtual grill for iPhone, offer enjoyment for users. In turn, these types of applications will be limited if a) a platform is too closed or b) if a platform is dominated by professional developers. Therefore, managers of platform operators should further encourage contributions from free external developers.

5.2 Theoretical implications, limitations, and further research

Similar to any research, this study has certain limitations. First, although we asked developers about their perceptions of the openness of Facebook and iPhone, designing objective measures of openness requires further development. Accordingly, future research should replicate this study with more objective examples of open and closed platforms. Second, we noted that openness might be ranked according to a continuum. Therefore, future studies should include more types of platforms to capture additional modes of openness. The third limitation stems from the quality of the data. Because the data set is comparatively small (N=87), two of three constructs showed poor values for composite reliability.

With regard to theoretical implications, our study has advanced our understanding of the interplay among intrinsic motivation, the willingness to take risks, and sponsorship. Prior studies predominantly

investigated creativity within the boundaries of firms, whereas this study explicitly addressed the creativity of both free and professional developers. Surprisingly, perceived support for creativity did not influence the relationship between intrinsic motivation and the willingness to take risks. Therefore, future research should investigate how perceived support for creativity might affect the relationship between the willingness to take risks and creativity to explore the next step in the creative process.

5.3 Conclusion

This paper started to investigate motivational structures of application developers. Regarding the contribution of this paper, we find support for three main effects. First, circumspcctly speaking due to the limited sample size, platform openness has an effect on the number of application developers a project. Second, as in organizational settings, intrinsic motivation has a positive effect while extrinsic motivation has a negative effect on willingness to take risks and autonomy – both known to be antecedents of creativity. Finally, from a managerial point of view, it is important to note that being paid by a firm fully mediates the relationship between intrinsic motivation and willingness to take risks.

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