CORA Cork Open Research Archive
Cartlann Taighde Oscailte Chorcaí

| | |
|---|---|
| Title | Company soldiers and gone-natives: role conflict and career ambition among firm-employed open source developers |
| Authors | Schaarschmidt, Mario;Stol, Klaas-Jan |
| Publication date | 2018-12-01 |
| Original Citation | Schaarschmidt, M. and Stol, K.-J., (2018) 'Company Soldiers and Gone-Natives: Role Conflict and Career Ambition Among Firm-Employed Open Source Developers', forthcoming conference, ICIS 2018, San Francisco, 13-16 December. |
| Type of publication | Conference item |
| Link to publisher's version | https://aisel.aisnet.org/icis2018/management/Presentations/5/, http://hdl.handle.net/10468/6644 |
| Rights | © 2018 the authors. |
| Download date | 2026-11-15 13:40:44 |
| Item downloaded from | https://hdl.handle.net/10468/6970 |



UCC
University College Cork, Ireland
Coláiste na hOllscoile Corcaigh

# Company Soldiers and Gone-Natives: Role Conflict and Career Ambition Among Firm-Employed Open Source Developers

*Completed Research Paper*

**Mario Schaarschmidt**
University of Koblenz-Landau
Institute for Management
Universitätsstraβe 1
56070 Koblenz
mario.schaarschmidt@uni-koblenz.de

**Klaas-Jan Stol**
Lero, the Irish Software Research Centre, University College Cork
School of Computer Science and Information Technology
k.stol@ucc.ie

## Abstract

*Software companies are increasingly shifting their role in open source software (OSS) projects from passive adopters to active contributors, and creators of OSS projects. Many firms now employ developers to work on OSS projects to influence their further development. These developers may gain considerable influence in OSS communities, though this typically takes a long time. Previous research found that those individual developers' agendas are not always aligned to that of the firm. While so-called "company soldiers" strongly identify with their firm, other developers may have "gone native": they identify more strongly with the OSS community rather than the firm. We study the effect of such an imbalance of identification on firm-community role conflict, which may lead to an intention to quit either the firm or the OSS community. We also consider the moderating effects of developers' career ambitions on this relationship. Furthermore, we include the effects of developers' desired career paths on their intentions to quit the firm and community. We test our model using a sample of 177 firm-employed OSS developers, and find that identification imbalance is associated with firm-community role conflict and that these conflicts drive both intentions to quit the firm and the community. Other findings include a significant negative moderating effect of developers' firm career aspirations on the relation between role conflict and intentions to quit the firm. Several of our hypotheses were not supported, but we found "regions of significance," which suggests several avenues for further research. We conclude with recommendations for managing firm-community relationships.*

**Keywords:** open source, paid developers, survey, role conflict, career ambition

## Introduction

The traditional notion of Open Source Software (OSS) communities has changed dramatically in the last two decades or so. While early studies of OSS characterized open source developers as primarily voluntary developers contributing to a public good (Feller and Fitzgerald, 2002; Hertel et al., 2003; Shah, 2006), today, major companies—from large financial service firms to retailers and digital companies—build their IT infrastructures and information systems using OSS (Chauhan et al., 2018; Murphy and Cox, 2016). As the importance of OSS has increased, firms have shifted their role from passive adopters to active contributors, and even creators of OSS projects (Capiluppi et al. 2012; Dahlander and Wallin, 2006; Wasserman, 2013). Consequently, several studies have suggested that a very significant portion of OSS today is developed by paid developers (Riehle et al., 2014; Rolandsson et al., 2011; Teigland et al., 2014).

While firm participation in OSS development is not a novel phenomenon (Bonaccorsi et al., 2006; Dahlander and Wallin, 2006; Fitzgerald, 2006; Rolandsson et al., 2011; Schaarschmidt and Von Kortzfleisch, 2009), the increasing scale at which firms now play a proactive role in OSS development introduces new dynamics between those firms and open source communities. As a result, new challenges emerge that have important implications for community work and the management of firm-employed developers who work on open source projects (Germonprez et al., 2016; Henkel, 2008).

Among several new challenges for aligning community work with the interests of firms, two are of particular importance. First, when large numbers of firms contribute to the same OSS project—so-called multi-vendor open source projects, for example the OpenStack project—a single firm has to invest more resources to maintain its level of influence on that project. One way a firm can achieve this is by deploying more developers to an OSS project so as to influence development trajectories through code contributions (Germonprez et al., 2016; Schaarschmidt et al., 2015). Second, the developers employed by firms who participate in open source projects may develop a high level of expertise and gain a significant level of influence in the community. In other words, firms make significant investments in these developers by employing them for a considerable amount of time, during which these developers are able to establish themselves as key contributors with considerable decision-making influence in the community. As such, these developers may become very attractive to competing firms who may try to poach those developers. Both these challenges suggest that deploying developers to OSS without guidance may potentially result in undesirable outcomes for the firm, such as developer turnover. Both the firm and the community are interested in retaining developers, because when developers leave their expertise and knowledge is no longer available in the firm or community. In open source communities, this may lead to degrading of the software quality (Foucault et al., 2015; Lin et al., 2017). For firms, replacing such experienced OSS developers is costly. In particular, in addition to administrative costs associated with recruiting, training, and onboarding, which is an issue for almost all software companies (Westlund and Hannon, 2008), in the case of influential OSS developers, it is often impossible to find appropriate people who can replace those whom left, because of the unique roles that many key developers play in OSS communities. In addition, newcomers face several barriers when joining an open source project including a lack of documentation or knowledge of social norms, and so these newly-employed OSS developers may take years to develop a similar level of influence within an open source project (e.g., Steinmacher et al., 2014a; Zanatta et al., 2017). Therefore, retaining talented developers is key to a firm's position within an open source ecosystem, which may impact its success as well as the sustainability of the firm-community relationships.

As a consequence of working in "two worlds," developers may possess an allegiance towards their employing company, towards the community they contribute to, or both (Chan and Husted, 2010). Thus, firm-employed OSS developers may develop a "dual" or "unbalanced allegiance." The latter can lead to tensions if the firm does not align its interests with those of the OSS community. Dual as well as unbalanced allegiance is a managerial challenge as it may affect the actions and behavior of individuals (Chan and Husted, 2010; von Weltzien Hoivik, 2002). Although firms and communities may have overlapping interests, such as their shared interest in project visibility, growth, and success, there are often significant differences in relation to strategic decisions (O'Mahony and Bechky, 2008). These differences, which may be rooted in different ideologies, may put employed developers who are perceived as a firm's representative by other community members in uncomfortable situations. In particular, any change request that clearly mirrors their firm's interests may lead to personal accusations of firm-employed OSS developers. This in turn may lead to increased stress and reduced well-being, both of which are known typical drivers of turnover (Kim and Stoner, 2008). Firms are therefore well advised to prepare their seconded developers for such situations.

Despite extensive research that has focused on a variety of aspects of OSS developers (e.g. motivation (Oreg and Nov, 2008; von Krogh et al., 2012), their role within the community (Steinmacher et al., 2014b) or their intentions to leave an OSS community (van Wesel et al., 2017; Zhou et al., 2016)), given the importance of developer retention for companies, there is a scarcity of literature focusing on role conflicts of OSS developers and their consequences. Some notable exceptions include Daniel et al. (2011) who showed that organization-developer value incongruence is negatively associated with organizational commitment, and Homscheid and Schaarschmidt (2016), who linked developers' perceived corporate reputation of their employer to reduced quitting intentions.

Given this lack of research on antecedents of developer retention, this study aims at investigating drivers of employed developers' intentions to quit their job or to leave the community. In particular, we develop a theoretical model that proposes *identification imbalance,* a concept that resonates well with unbalanced allegiance, as a dominant cause of firm-community role conflict, which subsequently results in quitting *intentions* towards the company or the community. However, to the best of our knowledge, this imbalance between these allegiances has not been studied. Given a firm-community role conflict, would developers rather leave their employer or the community? In addition, this research also considers developers' future career ambitions (i.e. company vs. community) and career paths (i.e. technical vs. managerial) to explain effects of firm-community role conflicts on quitting intentions.

The contributions of this paper are threefold. First, by focusing on firm-employed OSS developers exclusively, it addresses a gap in the literature that hitherto predominantly investigated firms' motivations to contribute to OSS projects, ignoring the role an individual employed OSS developer plays in complex firm-community relationships. In particular, by focusing on intentions to quit as an undesirable outcome, this study identifies factors that firms might control in order to reduce turnover intentions within the own developer workforce. Second, this study is among the first to combine aspects of *role conflict* with OSS developers' *career ambition* (Riehle, 2015), linking previously unconnected research streams. Third, by identifying moderation effects, the results of this study suggest actionable recommendations on managing employees who are confronted with identification imbalances and role conflicts that result from investing in developer communities beyond the firm's boundaries.

# Theory Development

## *Allegiance, Role Conflict, and Intention to Quit*

Employees may consider a variety of factors when they decide to quit their job. Griffeth et al. (2000) identified factors such as personal characteristics, job satisfaction, and a range of other dimensions such as pay satisfaction, environmental factors, behavioral predictors and cognition, and behavior about the withdrawal process. While these factors may play an important role in software developers' decision-making process as to whether or not to quit their job, in an open source development context other forces come into play due to the fact that developers must not only consider their employer, but also the community they become a part of.

Coalescence between an individual and an organization has been a focus of social scientists for a long time. This coalescence is a consequence of close interactions between an individual and the organization, and over time, manifests in an individual's identity. If a person's identity and the identity of the organization overlap, researchers speak of *organizational identification* (e.g., Ashforth et al., 2008). In business scenarios, organizational identification is associated with numerous attitudes and behaviors which are favorable for a firm. For example, organizational identification reduces employee turnover and generally results in a willingness to devote increased effort to the organization (*ibid.*).

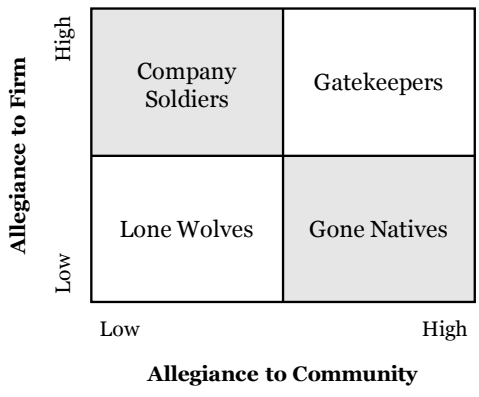



**Figure 1. Developers' dual allegiance (adapted from Chan and Husted, 2010)**

However, employees can identify with *multiple* entities. For example, employees may develop identifications with both their firm and a union (Blader, 2007), consultants may form an identification with their employer and the customer (Webber, 2011), and people with multiple jobs may develop an identity with each of their employers (Walsh et al., 2016). While general consensus exists that dual identification as well as resulting dual allegiance is possible (George and Chattopadhyay, 2005), this duality becomes a major managerial challenge when it leads to an *imbalance* of identification and allegiance.

In the context of OSS, Chan and Husted (2010) distinguish four types of employed OSS developers based on their level of allegiance towards the firm and allegiance towards the community (see Figure 1). So-called *Lone Wolves* have a low allegiance to both the firm and the community. *Company Soldier*s have a strong sense of loyalty to their firm, and little or no loyalty to the community. The opposite of company soldiers is what Chan and Husted (2010) refer to as *Gone Natives*; over time, these employees have developed an allegiance towards the community which has become stronger than their loyalty to their firm. The last type of firm-employed OSS developers are *Gatekeepers*. Gatekeepers have a high level of allegiance to both the firm and the community, and have a keen ability to maintain a balance between the two. Gatekeepers are usually aware of the organizational politics both within the firm and the community (Husted and Michailova, 2010). In this paper, we focus on *Company Soldiers* and *Gone-Natives* (shaded in Figure 1) because those types of developers are most likely to exhibit an identification imbalance.

Each of the four types of firm-employed OSS developers has a different attitude towards the firm and the community, and maintain a different balance in their "dual allegiance." While paid developers contribute to an open source project on behalf of their firm, they may identify themselves more strongly with the community than the firm—or vice versa. Henkel (2008) observed that employed programmers identify primarily with their firm rather than the community, but this may not always be the case. We posit that developers who identify themselves as a community member as opposed to a firm-employed developer—or vice versa: they see themselves as a firm employee rather than a community member—have an *identification imbalance*. In other words, rather than a "dual allegiance," such developers have a primary loyalty towards either the community ("Gone Natives") or the firm ("Company Soldiers"). Consequently, such skewed loyalty may lead to an increase in firm-community *role conflict*, which refers to the incompatible demands that an individual might face (Ilgen and Hollenbeck, 1991). Hence, we submit the following hypothesis:

**HYPOTHESIS 1 (H1):** *A high degree of identification imbalance is positively related with role conflict.*

There is a considerable body of literature suggesting that role conflict tends to lead to tensions and low job satisfaction (Jackson and Schuler, 1985). A low level of job satisfaction in turn may increase developers' intention or desire to leave their job. In a similar way, Yu et al. (2012) found that developer dissatisfaction increases developers' intention to leave a project. As this basic theoretical rationale applies to both organizational forms, that is, company and community, we offer the following two hypotheses:

**HYPOTHESIS 2 (H2):** *Employees' role conflict is positively related to their intention to leave their employer firm.*

**HYPOTHESIS 3 (H3):** *Employees' role conflict is positively related to their intention to leave the open source community.*

## *Career Path: Technical, Managerial, and Progression to the Center*

In addition to the role conflict that firm-employed developers might experience, these developers may pursue different career directions or paths—that is, developers may find themselves at a career crossroads. Some developers may wish to pursue a career path in management, perhaps ultimately at the executive level. Such developers may see their current developer job as a stepping stone towards this goal, and the fact they develop for an open source project is for them incidental. Other software developers may either have more interest in growing as a developer, aspiring a technical career, while others may aspire a more prominent role in the open source community (Kimmelmann, 2013). We argue that the aspired career path of firm-employed OSS developers will affect their intention to quit their firm or the community. We propose the following set of six related hypotheses. First, developers who aspire a managerial career may want to do so in their current firm.

**HYPOTHESIS 4a (H4a):** *Developers who aspire a managerial career have a lower intention to quit their employing firm.*

**HYPOTHESIS 5a (H5a):** *Developers who aspire a managerial career are more likely to quit the open source community they contribute to on behalf of their employer.*

Second, we argue that developers who aim for a technical career are more likely to want to leave their current employer in order to further develop their technical expertise. Developers may find other employment options more appealing because a new position may offer new opportunities to work with new technologies. However, an open source project still offers such developers a fruitful ground to put their technical skills to good use, which is why we argue they are less likely to quit the OSS community they contribute to on behalf of their employer.

**HYPOTHESIS 4b (H4b):** *Developers who aspire a technical career have a higher intention to quit their employing firm.*

**HYPOTHESIS 5b (H5b):** *Developers who aspire a technical career are less likely to quit the open source community they contribute to on behalf of their employer.*

A third career path is what Dahlander and O'Mahony (2011) have called *"progressing to the center."* Developers may pursue a central role in the open source community they are a part of, without giving much consideration which firm will pay them to do so. In traditional forms of work within the boundaries of a firm, employees tend to climb a *vertical* or *hierarchical* ladder. In contrast, in OSS projects, where hierarchy is usually rather flat, developers pursue *horizontal* or *lateral* authority by progressing to the center of a project (Dahlander and O'Mahony, 2011). They can do so through either managerial (coordination) work or technical contributions, although coordination work usually follows a period of technical contributions (Dahlander and O'Mahony, 2011). Thus, while achieving a more central role in an open source community typically requires significant technical competency, personal and social competencies are also needed (Kimmelmann, 2013).

We argue that those who make use of this third option are more likely to quit their firm as getting close to the center may require a significant time investment—and often more than the time that is covered by the firm. In contrast to gaining, for example, new development skills, this investment is community-specific and cannot be easily transformed to other communities. Clearly, developers who wish to grow in a community will be very unlikely to quit the open source community.

**HYPOTHESIS 4c (H4c):** *Developers who aspire a central role in the open source community have a higher intention to quit their employing firm.*

**HYPOTHESIS 5c (H5c):** *Developers who aspire a central role in the open source community have a lower intention to quit the open source community they contribute to on behalf of their employer.*

### *Career Ambition: Community versus Firm Career*

Finally, we argue that developers' *career ambitions* have a moderating effect on the relationship between role conflict and the intention to quit the *firm* or *community*. While a developer's career direction (path) characterizes the nature of the work, the term career ambition here refers to in which setting developers prefer to perform that work—in this research we distinguish between the community and the firm. We acknowledge that firm-employed OSS developers are linked to both the firm and the community, with little need to prioritize one work setting. However, given career aspirations of software developers in general (Muratbekova-Touron and Galindo, 2018), it is not clear whether developers uphold their dual obligations throughout their entire career. At some point, they might decide to concentrate on other non-OSS firm projects or shift their attention to OSS projects exclusively.

While we have hypothesized that role conflict leads to an intention to quit the firm or the community, this intention itself might be moderated by a developer's career ambition. In particular, when experiencing role conflict, developers who wish to develop a career in the community (rather than the firm) will be more likely to quit the firm, but not the community. Developers who hold influential positions in prominent open source projects will easily find employment elsewhere (Riehle, 2015). Hence, we propose the following two related hypotheses:

**HYPOTHESIS 6a (H6a):** *Developers who experience a role conflict have a higher intention to quit their firm if they have an open source community career ambition.*

**HYPOTHESIS 6b (H6b):** *Developers who experience a role conflict have a lower intention to quit the community they contribute to if they have an open source community career ambition.*

Similarly, developers who experience role conflict and wish to grow a career with their firm are less likely to quit their paid job, but have a higher intention to leave the community.

**HYPOTHESIS 7a (H7a):** *Developers who experience a role conflict have a lower intention to quit their firm if they aspire a career in their firm.*

**HYPOTHESIS 7b (H7b):** *Developers who experience a role conflict have a higher intention to quit the community they contribute to if they aspire a career in their firm.*

Figure 2 presents the resulting research model that summarizes our hypotheses.

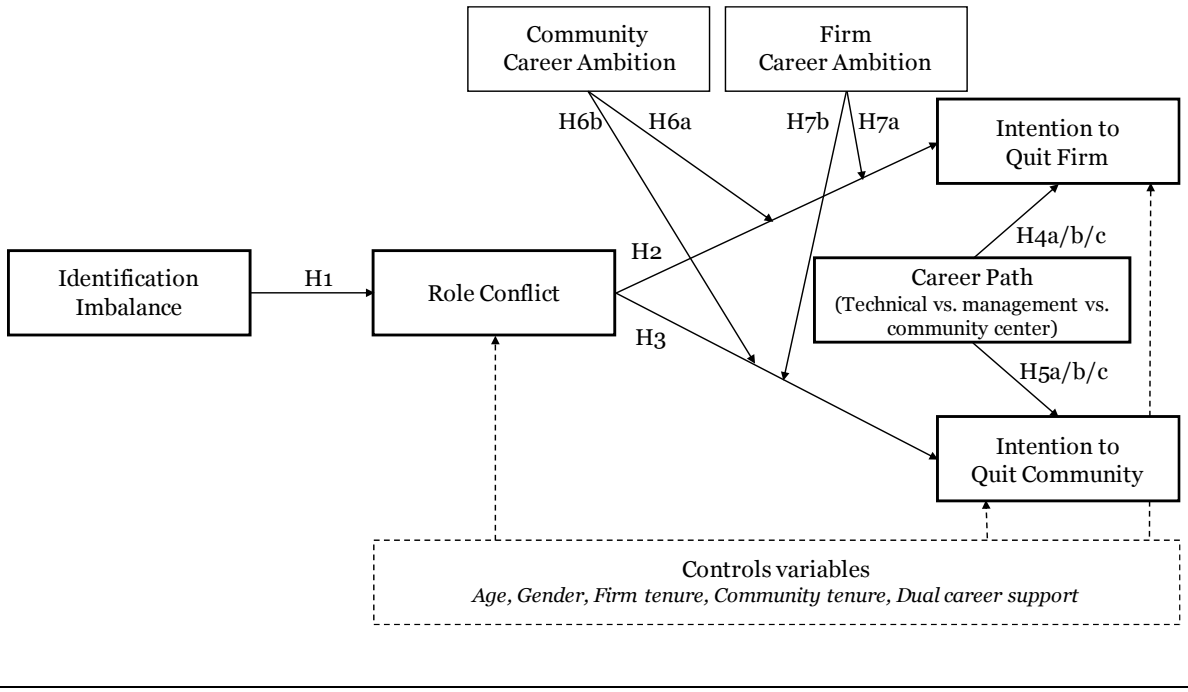



**Figure 2. Research Model**

# Method

## *Research Design and Construct Operationalization*

We chose a quantitative research design to test our set of hypotheses. We developed a questionnaire which consisted of validated measurement instruments for the various theoretical constructs in our model as well as a set of self-designed questions. Specifically, we adopted and tailored a number of measurement instruments from prior literature. To capture *Identification Imbalance*, we used a common approach of first assessing the targets of identification separately, and then calculating difference scores (Walsh et al., 2016). Both *Firm Identification* and *Community Identification* were measured using instruments developed by Mael and Ashforth (1992). To calculate identification imbalance among developers we first calculated difference scores, subtracting the composite value for community identification from organizational identification (Daniel et al., 2011; Sheldon and Niemiec, 2006). Thus, this imbalance score ranges from −6 (indicating a maximum imbalance towards the community—reflecting "Gone Natives") to

+6 (indicating a maximum imbalance towards the firm—reflecting "Company Soldiers"), while a zero score represents perfect balance. As we were interested in imbalance regardless of its direction, we took the absolute value of this score.[1]

We measured *Firm-Community Role Conflict* with three items adapted from Rizzo et al. (1970). For this study, we selected only those items out of the original eight that fit within the context of our study, and those who had sufficiently high factor loadings. We adapted the items to capture typical issues of OSS firm-community role conflict. The two constructs *Intention to Quit Firm* and *Intention to Quit Community* were adapted from an instrument by Smith et al. (2012).

We developed a number of items ourselves. To validate these self-designed items, we conducted a qualitative pilot study prior to the survey study. We interviewed four employed OSS developers to develop a better understanding of their future *career ambitions* (i.e. company vs. community) as well as *career directions* (i.e. technical vs. managerial vs. progressing to center). Based on this we developed a parsimonious set of items, which we presented to the four informants as a form of member checking. All informants agreed that the items captured the essence of the constructs they purport to measure. The final set of items consists of three-item measures for company and community career ambition as well as single-item measures for developers' career direction (see the complete measurement instrument in the online appendix (Schaarschmidt and Stol, 2018).

For all items, seven-point Likert scales were used, with scale anchors '1' (fully disagree) and '7' (fully agree). In addition to the multi-item measures, demographic questions were included such as age, gender, community and firm tenure (in months), and whether or not a firm offers dual career support.

### *Data Collection*

We used four approaches to contact respondents: 1) A link to the online survey instrument was distributed to companies which regularly contribute to OSS (e.g., RedHat, Suse) along with a request to spread the questionnaire among their developers; 2) we posted the link on several of OSS-related websites and discussion forums. 3) The Open Source Business Alliance (OSBA), which consists of more than 120 member companies, distributed the link on our behalf, and 4) we contacted employed developers directly through professional networks including LinkedIn. To increase the likelihood of participation, we offered developers a *"you decide, we donate"* option (Kull and Heath, 2016): for each completed response, we offered to donate two euro to one of six social projects; those projects later received our combined donations. In total, 1,393 individuals visited the survey website. As the first page stated that the survey is about "employed developers," a large number of potential respondents dropped out at this stage, most likely because they did not qualify based on this criterion. Finally, 185 respondents completed the survey (13.3% conversation rate). Of these, 56 made use of the *"you decide, we donate"* option. We excluded eight respondents because they indicated they were not employed (at the time of the survey), leaving 177 responses for our analysis.

Ten out of 177 respondents (5.6%) are female and the mean age is 35.7 (SD=9.8) with a range from 22 to 68. About 75% of the respondents indicated that they had a form of dual career support, meaning that the firm supports efforts for progressing in the firm as well as in the community.

## Results

### *Measurement Validation*

We analyzed the data in two phases. First, we assessed the quality of the measurement model through a Confirmatory Factor Analysis (CFA) with SPSS AMOS 23 using Maximum Likelihood (ML) estimation. We included all latent theoretical concepts with their 27 items and correlated them. The resulting model revealed a borderline acceptable fit with the data ($\chi^2$ = 670.60, df = 301, $\chi^2$/df = 2.23, Comparative Fit

[1] We note that other procedures than calculating difference scores on composite values are possible to capture constructs such as imbalance (e.g., multinomial regression) (see Edwards, 2001). However, in our case, a calculated difference score reliability of .89 is comparable to the reliability of the components, which is why it is suitable to use difference scores (see Furr and Bacharach, 2008; Watkins, 2008).

Index (CFI) = .89, Goodness-of-Fit Index (GFI) = .80, Root Mean Square Error of Approximation (RMSEA) = .084 with 90% Confidence Interval bounds of .075 and .092, and Standardized Root Mean Square Residual (SRMR) = .085).

Because the fit of this model was not ideal, we conducted a separate exploratory factor analysis (EFA) to identify potential cross-loadings which would limit our model's validity. The analysis with Varimax rotation resulted exactly in seven factors (exactly reflecting our latent constructs), and only one item for *community identification* was slightly cross-loading onto the organizational identification factor (r=.421). Furthermore, this item had only a small loading on its own construct. All other items had loadings of at least .75 on the intended factor, and no cross-loadings of over .4 emerged. We reran the CFA without the *community identification* construct. The resulting model fit was good ($\chi^2$ = 336.50, df = 173, $\chi^2$/df = 1.95, CFI = .93, GFI = .88, RMSEA = .073 with 90% confidence interval bounds of .062 and .085, and SRMR = .067). All values except GFI met recommended cutoff values. Given that no substantial cross-loadings are observable in the EFA, together with good fit values for a model without community identification, we continued our analysis with the full model although fit values are only borderline. This procedure is driven by the fact that measurements of different identification targets usually correlate highly (Walsh et al., 2016).

Next, we analyzed factor reliability as well as discriminant validity. The Composite Reliability (CR) values were all greater than the recommended threshold of .7, and the Average Variance Extracted (AVE) was at least .5 (Bagozzi and Yi, 1988), which suggests all measures are reliable. Finally, the square-root of the AVE exceeded shared variance for each construct, in support of discriminant validity (Fornell and Larcker, 1981). Table 1 reports correlations and reliability values for all multi-item measures, as well as the square-root of the AVE values on the diagonal.

As we collected data from a single source, correlations between independent and dependent variables could potentially be the result of a systematic measurement error known as Common Method Variance (CMV). We tested for the presence of CMV using two procedures. First, we applied Harman's single factor analysis, which involves a factor analysis in SPSS without rotation (Podsakoff et al., 2003). Putting all items representing the underlying constructs in such a factor analysis results in a single factor that explains about 20%, which is well below the recommended maximum threshold of 50%. Second, we applied the unmeasured common latent factor technique (using AMOS) (Chin et al. 2012), which could be considered an extension of the Harman's single factor test (Lindell and Whitney, 2001). All indicators are modeled to load onto their designated factor as well as on one common latent factor. Factor loadings of models with and without the common latent factor are compared. Large deviations in factor loadings may suggest CMV as an issue. However, we observed no substantial differences in factor loadings (greatest deviation $\Delta r$ = .06). Thus, the results of these two tests indicate that CMV is not a concern in this study.

**Table 1. Composite Reliability (CR), Average Variance Extracted (AVE), and correlations**

| | CR | AVE | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|---|
| 1. Intention to quit firm | .92 | .80 | **.89** | | | | | | |
| 2. Firm identification | .88 | .55 | -.38 | **.74** | | | | | |
| 3. Community identification | .92 | .66 | -.20 | .14 | **.81** | | | | |
| 4. Firm career ambition | .83 | .63 | .12 | .11 | -.03 | **.79** | | | |
| 5. Community career ambition | .88 | .70 | .21 | .10 | .06 | .52 | **.84** | | |
| 6. Firm-community role conflict | .81 | .59 | .55 | -.07 | -.18 | .12 | .22 | **.77** | |
| 7. Intention to quit community | .86 | .66 | .11 | -.05 | -.11 | -.00 | -.26 | .21 | **.81** |

Note: Square root values of the AVEs are listed on the diagonal in boldface.

### *Regression Results*

A model with multiple dependent variables (intention to quit firm or community) in combination with mediation constructs (i.e., role conflict) and latent constructs suggests the use of structural equation modeling (SEM). However, typical SEM-software has drawbacks when testing moderation such as complex calculations of interaction terms (Hayes et al., 2017). Instead, we used the PROCESS macro for SPSS, which rests on Ordinary Least Square (OLS) regressions, to calculate *indirect effects* and *moderation effects* simultaneously (Hayes, 2018). The PROCESS macro has several advantages compared to piecemeal procedures for testing mediation and SEM, including a robustness against violations of normal distribution and data processing, which allows for additional analysis and visualization. In addition, results of PROCESS and SEM calculations have been shown to be similar (Hayes et al., 2017).

We first discuss direct effects, followed by the mediation and moderation results. The PROCESS macro defines a set of 92 pre-programmed models, which are documented in detail by Hayes (2018). We used Model 16 (Hayes, 2018, pp. 592), which mirrors our conceptual model. We included control variables for age, gender, firm tenure, community tenure, and dual career support to account for alternative influences on role conflict, intentions to leave the community, and intentions to leave the firm. None of these controls yielded any significant relation with the aforementioned dependent variables (see Table 2).

**Table 2. Regression Results**

| | Model 1: Role Conflict | Model 2: Intent to Quit Firm | Model 3: Intent to Quit Com. |
|---|---|---|---|
| ***Control Variables*** | | | |
| Age | -.00 (.01) | -.01 (.01) | .00 (.01) |
| Gender | -.11 (.31) | -.52 (.42) | -.35 (.26) |
| Firm Tenure | -.00 (.01) | .01 (.01) | .00 (.01) |
| Community Tenure | -.01 (.01) | -.01 (.01) | -.01 (.01) |
| Dual Career Support | .16 (.17) | .17 (.23) | -.08 (.14) |
| ***Independent Variables*** | | | |
| Identification Imbalance | .14 (.05)* | .17 (.09)× | -.04 (.05) |
| Management Career Path | | .04 (.06) | .12 (.04)** |
| Technical Career Path | | .06 (.09) | .01 (.05) |
| Progressing to the Center | | .06 (.08) | -.12 (.05)* |
| ***Mediating Variable*** | | | |
| Role Conflict | | .94 (.11)*** | .27 (.07)*** |
| ***Moderating Variables*** | | | |
| Firm Career Ambition (FCA) | | -.01 (.13) | .03 (.08) |
| Community Career Ambition (CCA) | | .05 (.12) | -.23 (.08)** |
| ***Interactions*** | | | |
| Role conflict × FCA | | -.35 (.12)** | .13 (.07)× |
| Role conflict × CCA | | .17 (.10) | -.10 (.06) |
| $R^2$ | 5.6% | 43.9% | 33.5% |
| *N* | 177 | 177 | 177 |

×$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$, unstandardized coefficients, standard deviation in brackets

First, in support of *H1*, in a regression of firm-community role conflict on identification imbalance and controls (Model 1), role conflict is positively associated with identification imbalance ($b$ = .14, $p$ < .05, $R^2$ = 5.6%). Second, the effects of role conflict on quitting intentions were calculated separately for firm and community.[2] For intentions to quit the firm (Model 2), we found a significant positive association with role conflict in the presence of all control variables, the mediator and the moderator (i.e. fully saturated model). This effect supports *H2* ($b$ = .94, $p$ < .001, $R^2$ = 43.9%). Similarly, we found a significant and positive association between role conflict and intentions to leave the community in support of *H3* ($b$ = .27, $p$ < .05, $R^2$ = 33.5%, Model 3). With the same Models 2 and 3, we also assessed the relation between career directions and the dependent variables. For intentions to quit the firm, none of the career directions (i.e., managerial career, technical career, or progressing to the community's center) has a significant association with the intention to quit working for the firm, thus we reject H4a/b/c (Model 2).

For intentions to quit community work, mixed results emerged. Pursuing a managerial career is significantly related to quitting intentions ($b$ = .12, $p$ < .01, Model 3), indicating that developers who pursue a career in management are more likely to leave OSS communities, which resonates with *H5a*. Pursuing a technical career has no significant relation with an intention to quit the community, hence we reject *H5b*. Finally, in line with *H5c*, if developers have ambitions to progress to the center of a community, they are less likely to quit the community work ($b$ = -.12, $p$ < .05, Model 3). In addition, it is worth noting that we found a significantly negative direct relation between community career ambition and intentions to quit the community ($b$ = -.23, $p$ < .01, Model 3). Hence, developers who aspire a community career are unlikely to quit the community.

## *Moderation Effects*

To test moderation effects, we applied mean centering to the independent variable as well as the two moderators to limit the threat of multicollinearity. A test of *variance inflation*, which is a trustworthy indicator of multicollinearity, revealed values for the Variance Inflation Factor (VIF) of less than 2.2 for all predictor variables in Models 2 and 3, which is well below recommended thresholds in the literature (a common threshold is 10 (Kline, 2016)). To support the claim of a moderation effect, the interaction between the predictor variable and the moderator should have a significant association with the dependent variable. To this end, only *H7a* is supported because of a significant effect of the interaction (firm-community role conflict × firm career ambition) on the dependent variable (intention to quit the firm). In other words, when developers have firm career ambitions, they are less likely to quit the firm in case of firm-community role conflicts ($b$ = -.35, $p$ < .01, Model 2).

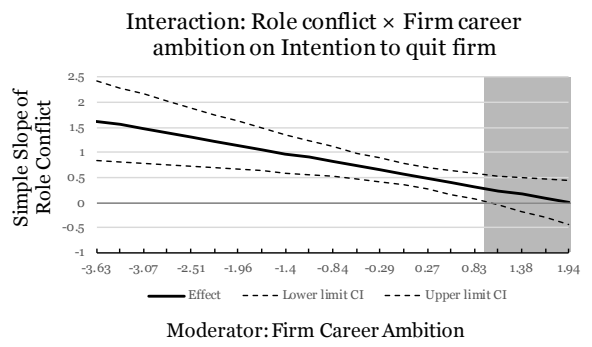
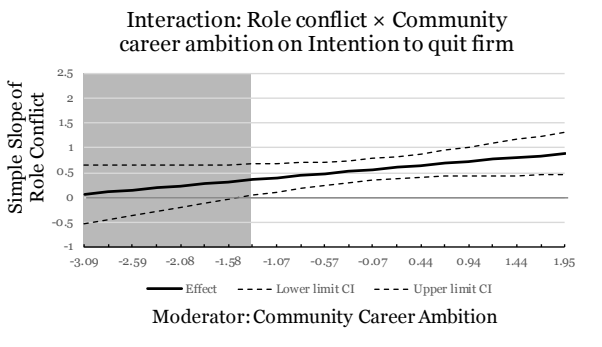
The calculations to test moderation effects are usually conducted using so-called *"spotlight analysis,"* commonly using values for the mean plus and minus one standard deviation. Hayes (2018, pp. 254) points out that such conventions are entirely arbitrary, despite widespread recommendations in the literature to do so. More recently, several authors have called for determining the nature of interactions by focusing on *regions of significance,* or what Spiller et al. (2013) have called *"floodlight analysis."* To this end, we applied the Johnson-Neyman (JN) technique to all four interactions, not just to the significant one. The JN technique helps to analyze in which *regions* of the moderating variable's distribution the moderator has a significant effect on a given relationship. The PROCESS macro implements the JN technique by slicing the distribution of a moderator into 21 values (Hayes, 2018, pp. 256), and performing calculations for each. The results can be conveniently visualized with a spreadsheet program—Figures 3 and 4 were generated following this procedure.

Figure 3 shows the curve progression for firm-community role conflict on intention to quit the firm at different levels of the moderators. On the left-hand side, the moderator is firm career ambition. Higher levels of firm career ambition *reduce* the effect of role conflict on intention to quit the firm. The effect is significant in the *unshaded* area (and insignificant in the *shaded* area). Thus, the graphical representation lends further support for the proposed moderating effect and *H7a*. The figure on the right-hand side shows the moderating influence of *community career ambition* on intentions to quit the firm when there is a role conflict. We hypothesized that with increasing community career ambitions, the effect of role conflict on intention to quit the firm increases (*H6a*). Although the interaction term is not significant, the graphical

[2] PROCESS Model 16 has only one dependent variable, which is why we ran two separate analyses, one for company and one for community quitting intentions.

representation supports the hypothesized *direction*—however, compared to the figure on the left-hand side, the shaded area (i.e., the region where the effect is insignificant) is relatively large, and the slope of the curve is rather flat. Thus, while not statistically significant, we argue there is "mild" support for *H6a*, but further research is needed to investigate this effect in more detail.

**Dependent variable: Intention to Quit the *Firm***

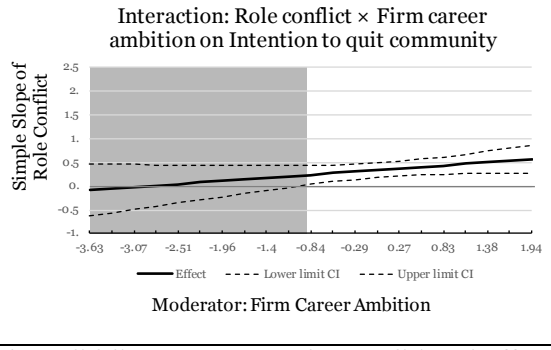
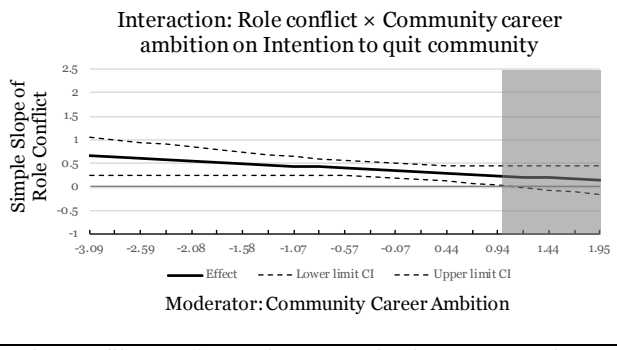
| **Moderator: *Firm* Career Ambition (H7a)** | **Moderator: *Community* Career Ambition (H6a)** |
|---|---|
|  |  |

The solid lines represent the conditional effects of role conflict on intention to quit the firm at different levels of firm career ambition (*left*) and community career ambition (*right*). Dashed lines frame the 95% confidence interval of the estimates. Estimates of slopes are significant in unshaded areas only.

**Figure 3. Interaction results and regions of significance for intention to leave the firm**

We applied the same procedure for interaction effects on *intention to quit the community* (see Figure 4). We hypothesized that firm career ambitions strengthen the path from role conflict to an intention to quit community work *(H7b)*. The related interaction effect is significant at a 90% level but not at the stronger 95% level. The left-hand side of Figure 4 shows the related conditional effect (or "simple slope"). The region where this effect is non-significant is relatively large and the slope is quite flat. However, the overall picture suggests there is some support for the notion of the moderation. However, further research is needed to confirm this.

**Dependent variable: Intention to Quit the *Community***

| **Moderator: *Firm* Career Ambition (H7b)** | **Moderator: *Community* Career Ambition (H6b)** |
|---|---|
|  |  |

The solid lines represent the conditional effects of role conflict on intention to quit the community at different levels of firm career ambition (*left*) and community career ambition (*right*). Dashed lines frame the 95% confidence interval of the estimates. Estimates of slopes are significant in unshaded areas only.

**Figure 4. Interaction results and regions of significance for intention to leave the community**

Finally, the slope on the right-hand sight depicts the interaction between *community career ambition* and intention to quit in the presence of a role conflict. The effect of role conflict on quitting intentions seems to be significant for almost all values. The slope is rather flat, which partly explains the non-significant interaction term. However, as in the previous case, the *direction* of the slope is stable and in the predicted direction, which lends mild support for *H6b*. Again, further research is needed to establish the nature of this effect in more detail.

### *Indirect Effects*

Although not formally hypothesized, a conceptual model as ours implicitly assumes indirect or mediation effects. Mediation occurs if the influence of a variable *A* on a variable *B* is mediated by a third variable. In the presence of a mediator, the direct effect from *A* on *B* usually disappears. That is, a mediation occurs if the effect through the mediator is greater than the direct effect. In our case, company-community role conflict could potentially be a mediator between identification imbalance and quitting intentions. When calculating indirect effects at different levels of a moderator (i.e. moderated mediation, Preacher et al., 2007), result tables are getting confusing. For this reason, we report indirect effects in absence of the moderators. The indirect effect of identification imbalance on intention to quit the organization through company-community role conflict was $b$ = .13 (LLCI = .04, ULCI = .23), while it was $b$ = .03 (LLCI = .01, ULCI = .07). Both indirect effects are significant, however, the mediating role for company-community role-conflict is stronger for intention to quit the organization.

## Discussion

### *Implications for Practice and Research*

In this study, we focus on *unbalanced* allegiances towards either a firm or an OSS community. Chan and Husted (2010) have labeled developers with an allegiance surplus towards their firm *Company Soldiers*, while labeling those with an imbalance towards an open source community *Gone-Natives*. What unites both groups is that they are confronted with an identification imbalance, which may lead to a firm-community role conflict. These role conflicts can lead to *intentions* to leave both the community and the employing firm; but this implication is dependent on developers' career ambitions. (Note that our study does not consider actual behavior but focuses on developers' *intentions* only.) Taken together, this study's results hold implications for practice and research that we discuss below. Table 3 summarizes the findings and implications of our study.

First, our study showed a significant relationship between developers' identification imbalance and a firm-community role conflict (*H1*). It is important that both firms and OSS communities are able to recognize such tensions as a potential source for conflict, for the benefit of the developers. Communities, firms, and developers would all benefit when such imbalances are detected early.

Second, neither communities nor firms are served by developers who wish to leave, however, quitting intentions are dominant consequences of firm-community role conflicts. For firms, it is important not to put developers in contentious situations, which could happen if employed developers contribute code on their firm's behalf that would not serve the OSS project well. While firms may have a strong interest in steering a project in their desired direction, it is imperative they do so in a way that is respectful towards the community. These findings correspond to Ågerfalk and Fitzgerald's (2008) study of the "opensourcing" phenomenon. However, while Ågerfalk and Fitzgerald (2008) investigated the relationship between a firm releasing source code to a community, in this study we focus on a firm investing in an already existing community by putting a "man on the inside" (Dahlander and Wallin, 2006). Interestingly, the association between role conflict and intentions to quit is higher towards the firm (*H2*) than towards the community (*H3*). This result calls for further theory building on open source developer careers and consequences of identification in open settings.

Third, we suggest that firms be mindful of employees' career path preferences. While none of the career paths (technical, management, progression to a community's center) had a significant impact on the intention to quit the *firm* (*H4a,b,c*), we did find a positive significant relationship between an aspired *managerial* career path and an intention to leave the *community* (*Hb5*). Thus, those developers who wish to move onto the managerial career ladder (as opposed to a technical career ladder) are more likely to leave

the open source community. As firms plan for future engagement of open source projects in light of the natural inflow and outflow of employees, it is useful to know which path developers prefer (Riehle, 2015). Furthermore, we also found a negative statistically significant relationship between developers' preference to progress towards a community's center and an intention to leave the community (*H5c*). This is not surprising, of course, because those developers who wish to play a role at the center of open source communities must invest the time to demonstrate not only their technical skills but also their communication and coordination skills.

**Table 3. Findings and Recommendations for Practice and Future Research**

| **Construct** | **Findings** | **Recommendations** |
|---|---|---|
| Identification imbalance (*H1*) | Imbalance of perception of 'self' of developers as a part of either the community or employing firm leads to role conflict. | (1) Both firms and OSS communities should recognize and remain cognizant of this potential source of conflict. For firms it is important that they do not put developers in contentious situations. |
| Role conflict (*H2, H3*) | Role conflict increases turnover intention towards both firm and community, jeopardizing sustainability of both.<br>Intention to quit the firm (as a consequence of role conflict) is higher than towards the community. | (2) Firms should aim to reduce role conflict and provide support and/or coaching to developers. |
| Career Path (*H4a, H4b, H4c, H5a, H5b, H5c*) | None of the career paths has an impact on intention to quit the employer *firm*.<br>A managerial career path is associated with an increased intention to quit the *community*.<br>A desire to progress to the center of a community is associated with a decreased intention to quit the *community*. | (3) If firms wish to sustain their involvement in a given OSS community, they should recognize developers who wish to embark on a management career path so that they can be replaced by new company representatives in a timely manner. |
| Community Career Ambition (CCA) (*H6a, H6b*) | CCA does not significantly moderate relation between role conflict and intention to quit the *firm*, but JN technique suggests a *region* of significance.<br>CCA does not significantly moderate relation between role conflict and intention to quit *community*, but JN technique suggests a large *region* of significance, but with only a small effect. | (4) Only those with very strong community career ambitions may consider quitting the firm. Future research is needed to establish what else might distinguish those developers. Whether or not a developer has strong CCA does not seem to make a large difference on the intention to quit the community, perhaps with the realization that their paid job is more important. |
| Firm Career Ambition (FCA) (*H7a, H7b*) | FCA dampens the effect of role conflict on the intention to quit the firm.<br>Moderate effect ($p < .1$) of FCA on relation between role conflict and intention to quit the community. | (5) Firms that detect a role conflict among developers they wish to retain within their organization could offer a clear career path within the firm so as to minimize the risk that developers leave. |

Finally, considering recommendations 4 and 5 in Table 3, firm career ambition is a moderator for the influence of firm-community role conflict on quitting intentions. It clearly dampens the effect of role conflict on intentions to quit the firm (*H7a*), and also strengthens (on a 10% significance level) intentions to quit community work (*H7b*). Thus, clear firm career paths help retaining developers even in cases of identity imbalance-induced role conflicts. In contrast, open source career ambitions do not have moderating influences on the path from role conflict to quitting intentions (*H6a,b*). Possibly, open source careers are not a projectable as firm careers, limiting their ability to influence quitting intentions.

### *Limitations*

We are aware of some limitations of this study which we discuss next. First, in terms of sampling, we put a premium on contacting and including only professional, firm-employed developers for this study. Although we included a set of control questions that identified non-employed developers, we cannot state with absolute certainty that the sample did not include any non-employed OSS developers. Second, the difficulty to find employed developers caused us to not use a longitudinal design, where measures for independent and dependent variables could be captured at different points in time. Future research might consider this option, as quitting intentions might evolve over time. This study does not consider the business model of the firms (for which our respondent developers work for). For example, being a software distributor such as RedHat involves different strategies than simply adopting and adapting an open source product. Furthermore, this research does not consider the organizational position within the firm of developers—this survey was targeted at developers without further distinction. Future research could investigate whether different positions within the firm affect employees' intentions. As well, this study focused on role conflicts that arise through developers' identification with the firm and the open source community. However, we did not distinguish role conflicts caused by ideology clashes between private and collective interests from conflicts that are the consequence of different private interests. Finally, this study did not capture any data regarding respondents' geographic location nor the role of socio-cultural differences. Again, we suggest future research can focus on these factors.

Notwithstanding these limitations, this study establishes an initial baseline study, which we believe is the first to investigate developer identification, role conflict, intention to leave, as well as the moderating role of career ambition, and we believe these limitations provide excellent points of departure for future research and replications.

## Conclusion

Firms increasingly employ software developers to participate in co-development with open source communities. Some of these developers may identify themselves, first and foremost, as an employee of their firm (so-called Company Soldiers), whereas others may start to see themselves as community members—so-called Gone-Natives. An exclusive (or skewed) identification with either the firm or the community leads to what we have termed an *identification imbalance*. This paper presents one of the first studies that investigates the effects of such an imbalance on developers' intention to leave either their firm or the community. Given the increasing importance of open source projects to the software industry, it is imperative to better understand the relationships between firms and open source communities, given that forces that affect the sustainability of the latter may also negatively impact the former.

A key finding of this study is that an identification imbalance of firm-paid open source developers can lead to role conflict, which in turn can lead to an increase in developers' intention to leave their firm or community, depending on which they identify most with. The findings differ for *Company Soldiers* and *Gone-Natives* (Chan and Husted, 2010). Given the increasingly important role that open source projects represent to firms, and that establishing a "man on the inside" is a time-consuming investment, this study contributes practical insights that firms can use to manage developers. This study also demonstrates the moderating role of career ambition on the relationship between role conflict and the intention to leave either the firm or community. Finally, this study has identified a number of potential avenues for further research. In particular, we suggest future research can focus on different types of organizations, each with different business models. Further differentiation can also be sought by identifying organizational roles of respondents, i.e., executive managers, mid-level managers, and developers.

## Acknowledgments

We thank Thomas Zerbach for helping collecting the data. This work was supported, in part, by Science Foundation Ireland grant 15/SIRG/3293 and 13/RC/2094 and co-funded under the European Regional Development Fund through the Southern & Eastern Regional Operational Programme to Lero—the Irish Software Research Centre (www.lero.ie).

## Appendix

The online appendix (Schaarschmidt and Stol, 2018) includes the measurement instrument used in our survey.

## References

Ågerfalk, P. J., and Fitzgerald., B. 2008. "Outsourcing to an unknown workforce: Exploring opensourcing as a global sourcing strategy," *MIS Quarterly* (32:2), pp. 385-409.

Ashforth, B. E., Harrison, S. H., and Corley, K. G. 2008. "Identification in organizations: An examination of four fundamental questions," *Journal of Management* (34:3), pp. 325-374.

Bagozzi, R.P. and Yi, Y. 1988. "On the evaluation of structural equation models," *Journal of the Academy of Marketing Science* (16:1), pp. 74-94.

Blader, S. L. 2007. "What leads organizational members to collectivize? Injustice and identification as precursors of union certification," *Organization Science* (18:1), pp. 108-126.

Bonaccorsi, A., Giannangeli, S., and Rossi, C. 2006. "Entry strategies under competing standards: Hybrid business models in the open source software industry," *Management Science (*52:7) pp. 1085-1098.

Capiluppi, A., Stol, K., and Boldyreff, C. 2012. "Exploring the Role of Commercial Stakeholders in Open Source Software Evolution," *International Conference on Open Source Systems*, pp. 178-200, Springer.

Chan, J., and Husted, K. 2010. "Dual allegiance and knowledge sharing in open source software firms," *Creativity and Innovation Management* (19:3), pp. 314-326.

Chauhan, S., Jaiswal, M., Rai, S., Motiwalla, L., and Pipino, L. 2018. "Determinants of adoption for open-source office applications: A plural investigation," *Information Systems Management* (35:2), pp. 80-97.

Chin, W.W., Thatcher, J.B. and Wright, R.T. 2012. "Assessing common method bias: problems with the ULMC technique," *MIS Quarterly* (36:3), pp. 1003-1019.

Dahlander, L., and Wallin, M. W. 2006. "A man on the inside: Unlocking communities as complementary assets," *Research Policy* (35:8), pp. 1243-1259.

Dahlander, L., and O'Mahony, S. 2011. "Progressing to the center: Coordinating project work," *Organization Science* (22:4), pp. 961-979.

Daniel, S., Maruping, L., Cataldo, M., and Herbsleb, J. 2011. "When Cultures Clash: Participation in Open Source Communities and Its Implications for Organizational Commitment," in *Proceedings of the 32nd International Conference on Information Systems (ICIS)*, Shanghai, 2011.

Edwards, J. R. 2001. "Ten difference score myths," *Organizational Research Methods* (4:3), pp. 265-287.

Feller, J. and Fitzgerald, B. 2002. *"Understanding open Source software development,"* Addison Wesley.

Fitzgerald, B. 2006. "The Transformation of Open Source Software," *MIS Quarterly* (30:3), pp. 587-598

Foucault, M., Palyart, M., Blanc, X., Murphy, G.C., and Falleri, J.R. 2015. "Impact of developer turnover on quality in open-source software," *10th Meeting on Foundations of Software Engineering,* pp. 829-841.

Fornell, C., and Larcker, D.F. 1981. "Evaluating structural equation models with unobservable variables and measurement error," *Journal of Marketing Research* (18:1), pp. 39-50.

Furr, R.M., and Bacharach, V.R. 2008. *Psychometrics. An Introduction*, Thousand Oaks, CA: Sage.

George, E. and Chattopadhyay, P. 2005. "One foot in each camp: The dual identification of contract workers," *Administrative Science Quarterly* (50:1), pp. 68-99.

Germonprez, M., Kendall, J. E., Kendall, K. E., Mathiassen, L., Young, B., and Warner, B. 2016. "A theory of responsive design: A field study of corporate engagement with open source communities," *Information Systems Research* (28:1), pp. 64-83.

Griffeth, R.W., Hom, P.W., and Gaertner, S. 2000. "A meta-analysis of antecedents and correlates of employee turnover: Update, moderator tests, and research implications for the next millennium," *Journal of Management* (26:3), pp. 463-488.

Hayes, A.F. 2018. *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*, New York, NY: The Guilford Press.
Hayes, A.F., Montoya, A.K., and Rockwood, N.J. 2017. "The analysis of mechanisms and their contingencies: PROCESS versus structural equation modeling," *Aus Market Journal*, (25:1), pp. 76-81.
Henkel, J. 2008. "Champions of revealing: The role of open source developers in commercial firms," *Industrial and Corporate Change,* (18:3), pp. 435-471.
Hertel, G., Niedner, S., and Herrmann, S. 2003. "Motivation of software developers in Open Source projects: An Internet-based survey of contributors to the Linux kernel," *Research Policy* (32:7), pp. 1159-77.
Homscheid, D., and Schaarschmidt, M. 2016. "Between organization and community: investigating turnover intention factors of firm-sponsored open source software developers," *Proceedings of the 8th ACM Conference on Web Science*, pp. 336-337.
House, R.J., and Rizzo, J.R. 1972. "Role conflict and ambiguity as critical variables in a model of organizational behavior," *Organizational Behavior and Human Performance* (7:3), pp. 467–505.
Husted, K. and Michailova, S. 2010. "Dual Allegiance and Knowledge Sharing in Inter-firm R&D Collaborations," *Organizational Dynamics* (39:1), pp. 37-47.
Ilgen, D.R., and Hollenbeck, J.R. 1991. "The structure of work: Job design and roles." In M. D. Dunnette and L. M. Hough (Eds.), *Handbook of industrial and organizational psychology: Vol. 2*, 165–207.
Jackson, S.E. and Schuler, R. S. 1985. "A meta-analysis and conceptual critique of research on role ambiguity and role conflict in work settings," *Org Behav Human Decision Process.* (36:1), pp. 16–78.
Kim, H., and Stoner, M. 2008. "Burnout and turnover intention among social workers: Effects of role stress, job autonomy and social support," *Administration in Social Work* (32:3), pp. 5-25.
Kimmelmann, N. 2013. "Career in Open Source? Relevant Competencies for Successful Open Source Developers," *it—Information Technology* (55:5), pp. 204-211.
Kline, R. 2016. *Principles and Practice of Structural Equation Modeling*. 4th Ed. Guilford Press
Kull, A. J., and Heath, T. B. 2016. "You decide, we donate: Strengthening consumer–brand relationships through digitally co-created social responsibility," *Int. J. Res. Mark*, (33:1), pp. 78-92.
Lin, B., Robles, G., and Serebrenik, A. 2017. "Developer turnover in global, industrial Open Source projects: Insights from applying survival analysis," in *Proceedings of the 12th International Conference on Global Software Engineering* (pp. 66-75). IEEE Press.
Lindell, M.K., and Whitney, D.J. 2001. "Accounting for common method variance in cross-sectional research designs," *Journal of Applied Psychology* (86:1), pp. 114-121.
Mael, F., and Ashforth, B.E. 1992. "Alumni and their alma mater: a partial test of the reformulated model of organizational identification", *Journal of Organizational Behavior* (13:2), pp. 103-123.
Muratbekova-Touron, M., and Galindo, G. 2018. "Leveraging psychological contracts as an HR strategy: The case of software developers," *European Management Journal*, in press, corrected proof.
Murphy, S., and Cox, S. 2016. "Classifying Organizational Adoption of Open Source Software: A Proposal," in *IFIP International Conference on Open Source Systems* (pp. 123-133). Springer, Cham.
O'Mahony, S., and Bechky, B. A. 2008. "Boundary organizations: Enabling collaboration among unexpected allies," *Administrative Science Quarterly* (53:3), pp. 422-459.
Oreg, S., and Nov, O. 2008. "Exploring motivations for contributing to open source initiatives: The roles of contribution context and personal values," *Computers in Human Behavior* (24:5), pp. 2055-2073.
Podsakoff, P.M., MacKenzie, S.B., Jeong-Yeon, L. and Podsakoff, N.P. 2003. "Common method biases in behavioral research: A critical review of the literature and recommended remedies," *Journal of Applied Psychology* (88:5), pp. 879-893.
Preacher, K.J., Rucker, D.D., and Hayes, A.F. 2007. "Addressing Moderated Mediation Hypotheses: Theory, Methods, and Prescriptions," *Multivariate Behavioral Research* (42:1), pp. 185-227.
Riehle, D., Riemer, P., Kolassa, C., and Schmidt, M. 2014. "Paid vs. Volunteer Work in Open Source," *Proceedings of the 47th Hawaii International Conference on System Science*, pp. 3286-3295.
Riehle, D. 2015. "How open source Is changing the software developer's career," *Computer* (48:5), pp. 51-57.
Rizzo, J.R., House, R.J., and Lirtzman, S.I. 1970. "Role conflict and ambiguity in complex organizations," *Administrative Science Quarterly* (15:2), pp. 150-163.
Rolandsson, B., Bergquist, M., and Ljungberg, J. 2011. "Open source in the firm: Opening up professional practices of software development," *Research Policy* (40:1), pp. 576-587.
Schaarschmidt, M., and von Kortzfleisch, H.F. 2009. "Divide et impera! the role of firms in large open source software consortia," *Americas Conference on Information Systems*, San Francisco, CA.

Schaarschmidt, M., Walsh, G., and von Kortzfleisch, H.F. 2015. "How do firms influence open source software communities? A framework and empirical analysis of different governance modes," *Information & Organization* (25:2), pp. 99-114.

Schaarschmidt, M. and Stol, K. 2018. "Appendix to Company Soldiers and Gone Natives: Role Conflict and Career Ambition Among Firm-Employed Open Source Developers," available in: Cork Open Research Archive (CORA), https://cora.ucc.ie/

Shah, S.K. 2006. "Motivation, governance, and the viability of hybrid forms in open source software development," *Management Science* (52:7), pp. 1000-1014.

Sheldon, K.M., and Niemiec, C.P. 2006. "It's not just the amount that counts: balanced need satisfaction also affects well-being", *Journal of Personality and Social Psychology* (91:2), pp. 331-341.

Smith, L.G.E., Amiot, C.E., Callan, V.J., Terry, D.J., and Smith, J.R. 2012. "Getting new staff to stay: the mediating role of organizational identification," *British Journal of Management* (23: 1), pp. 45-64.

Spiller, S.A., Fitzsimons, G.J., Lynch, J.G., Jr., and McClelland, G.H. 2013. "Spotlights, floodlights, and the magic number zero: Simple effects tests in moderated regression," *Journal of Marketing Research* (50:2), pp. 277–288.

Steinmacher, I., Gerosa, M. A., and Redmiles, D. 2014a. "Attracting, onboarding, and retaining newcomer developers in open source software projects," *Proceedings of the Workshop on Global Software Development in a CSCW Perspective*.

Steinmacher, I., Silva, M.A., and Gerosa, M.A. 2014b. "Barriers faced by newcomers to open source projects: a systematic review," in: Corral L., Sillitti A., Succi G., Vlasenko J., Wasserman A.I., (Eds.) *Open Source Software: Mobile Open Source Technologies*. Berlin: Springer.

Teigland, R., Di Gangi, P.M., Flåten, B.T., Giovacchini, E., and Pastorino, N. 2014. "Balancing on a tightrope: Managing the boundaries of a firm-sponsored OSS community and its impact on innovation and absorptive capacity," *Information & Organization* (24:1), pp. 25-47

von Krogh, G., Haeflinger, S., Spaeth, S. and Wallin, M.W. 2012. "Carrots and Rainbows: Motivation and social practice in open source software development," *MIS Quarterly* (36:2), pp. 649-676.

van Wesel, P., Lin, B., Robles, G., and Serebrenik, A. 2017. "Reviewing career paths of the OpenStack developers," *International Conference on Software Maintenance and Evolution,* pp. 544-548

von Weltzien Hoivik, H. 2002. "Professional Ethics–A Managerial Opportunity in Emerging Organizations," *Journal of Business Ethics*, (39:1/2), pp. 3-11.

Walsh, G., Dahling, J. J., Schaarschmidt, M., and Brach, S. 2016. "Surface-acting outcomes among service employees with two jobs: Investigating moderation and mediation effects," *Journal of Service Management*, (27:4), pp. 534-562.

Wasserman, A.I. 2013 "Community and Commercial Strategies in Open Source Software," *it—Information Technology* (55:5), pp. 181-188

Watkins, M.W. 2008. *Reliability of Difference Scores* (Computer Software), Phoenix: Ed & Psych Assoc.

Webber, S.S. 2011. "Dual organizational identification impacting client satisfaction and word of mouth loyalty," *Journal of Business Research*, (64:2), pp. 119-125.

Westlund, S.G., and Hannon, J.C. 2008. "Retaining talent: Assessing job satisfaction facets most significantly related to software developer turnover intentions," *Journal of Information Technology Management* (19:4), pp. 1-15.

Yu, Y., Benlian, A. and Hess, T. 2012. "An Empirical Study of Volunteer Members' Perceived Turnover in Open Source Software Projects," *Proceedings of the 45th Hawaii International Conference on System Sciences*. pp. 3396-3405.

Zanatta, A.L., Steinmacher, I., Machado, L.S., de Souza, C.R., and Prikladnicki, R. 2017. "Barriers Faced by Newcomers to Software-Crowdsourcing Projects," *IEEE Software* (34:2), pp. 37-43.

Zhou, M., Mockus, A., Ma, X., Zhang, L., and Mei, H. 2016. "Inflow and retention in OSS communities with commercial involvement: A case study of three hybrid projects," *ACM Transactions on Software Engineering and Methodology* (25:2)