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Effects on motivation, conflict and justice –
An experimental investigation

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Exogenous vs. endogenous governance in innovation communities: Effects on motivation, conflict and justice – An experimental investigation

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Abstract

In this study we examine the effects of exogenous vs. endogenous governance rules on a virtual community handling an innovative task. Specifically we investigate the relationship between the two modes (exogenous vs. endogenous) and factors such as motivation, conflict and justice. We conducted an experiment with 70 students, divided into teams of five. We manipulated procedural legitimacy by allowing one group to choose a set of rules and giving the other group the same rules exogenously. Our study indicates, that letting a team choose its own governance rules leads to increasing level of conflict negatively impacting motivation.

Keywords
Governance, Collaborative Innovation Communities

1 Introduction

No organization, at least above a certain size, can function properly without rules and procedures. What is relevant for `conventional` business organizations seems to also hold true for the growing number of online collaborative communities of multiple contributors such as open source software (OSS) communities or Wikipedia. Recently a growing number of firms make use of collaborative communities by sponsoring them (O'Mahony, 2005; Shah, 2006). The emergence of firms shifts the focus from self-governance of volunteers to external, firm initiated, governance of communities.
Virtual communities of volunteers working collaboratively or developing new solutions exist in many forms. Inevitably, numerous overlapping terms ranging from *innovation communities*, *online communities*, *user communities* or *knowledge producing communities* exist (West and Lakhani, 2008). However, such communities do not necessarily produce innovative outcomes. We solely focus on communities' collaboratively producing innovative outcomes, which are exploited either in a private or commercial sense (Raasch et al., 2009), excluding virtual communities in the broader sense. We thus limit the scope according to the definition of West and Lakhani (2008), who define innovation communities as voluntary associations of actors who produce innovations that are brought to market. We use the term

open collaborative innovation (OCI) community, which is strongly based on Baldwin and von Hippel (2011), who speak of open collaborative innovation.

While the governance mechanisms to accomplish order within and between organizations have been comprehensively assessed as part of the research on economic governance (cf. Williamson, 2005), the issue of governance of open collaborative innovation (OCI) communities is still an important question. Important because governance within such communities is different to the classical market or hierarchy paradigm, and may represent a new mode (Demil and Lecocq, 2006). Furthermore the exchange within these communities is not that of physical goods but rather of "nonrivalrous and nonexcludable" knowledge resources (Madison et al., 2010). Some authors see the question of organization and governance as one of the key question for understanding such communities, (Baldwin and Clark, 2006; Lerner and Tirole, 2002) and also a necessary ingredient to create an organizational climate to attract participants (Shah, 2006; Markus, 2007).

Especially in the field of OSS researchers have investigated the mechanisms by which such communities govern themselves, in order to achieve direction, control and coordination among community members (Markus, 2007). Numerous mechanisms have been identified, among them the division of roles and different decision rights (de Laat, 2007; Shah, 2006), communication rules and property rights (Bonaccorsi and Rossi, 2003; Markus, 2007) and modularization (de Laat, 2007). Beyond identifying mechanisms of governance, the aspect of interrelations between governance and psychological states such as motivation and resulting behavior such as participation has been of interest (cf. Jeppesen and Frederiksen, 2006; Shah, 2006).

If firms interact with communities they can choose different modes of interaction ranging from a loose affiliation to the foundation of own communities. To a great extend different modes of firms involvement depend on the business model of the firm (Dahlander and Magnusson, 2008). A firm that regards a community as one source among many for innovation and creativity is likely to interact differently than a company that regards the value generated within the community as its major business. For that reason one has to conclude that there is not just one firm-community interaction, but many modes and configurations.

It is evident that the goals of profit oriented firms and communities of volunteers are not inevitably the same which can result in great tension (West and O'Mahony, 2008). Therefore the question of governance is central within the relationship of firm and community, since a large number of involved parties with diverse objectives, capabilities and involvement come together (Dahlander et al., 2008). The way governance is structured in sponsored communities, that is, how work is organized and activities are controlled, will influence intrinsic motivation of volunteers to contribute (Jeppesen and Frederiksen, 2006). Negative reactions by volunteers are reported if a firm executes too much control and unfair ownership demands (Shah, 2006). Firms are aware of such challenges and try to counter it by legitimizing such decisions in letting volunteers participate by making the governance accessible (West and O'Mahony, 2008; O'Mahony, 2005). While the realization that participation in procedural processes seems indispensable, to date little is known about the precise effects of participation vs. no participation on the community. Field and experimental research from other fields provide evidence that externally imposed rules may 'crowd out' endogenous cooperative behavior (Ostrom, 2000a) and preferences (Cardenas, 2004) thereby possibly negatively impacting intrinsic motivation (Frey, 1994). Valuable insights can be gained from these findings; however OCI communities differ in many ways, for instance the specific nature of innovative work and contextual factors like

communication over the internet. We therefore believe it to be worthwhile to investigate the question how a community of volunteers creating innovative outcomes copes with the influence of external regulation by an authoritarian institution like a firm.
It comes down to the question whether firms should impose governance rules on a community or rather let it loose by relying on self-governance. Generally put the aim of any OCI community is to produce (innovative) beneficial outcomes. Such a goal can only be reached if certain preconditions or influential factors (e.g. motivation of participants, conflict resolution within the community) are fulfilled. Therefore the main research question that needs to be answered is how the choice between endogenous and exogenous governance rules affects such factors. In the present study we used an experimental approach to directly manipulate exogenous vs. endogenous rules.

2 Research framework

Our research framework rests upon the IAD framework by Elinor Ostrom, which originally refers to the governance of common-pool resources (cf. Ostrom, 2005a; Ostrom, 2005b). Madison et al. (2010) have shown that with minor adaption the framework also provides a model to study the constructions of knowledge-based works. While the original framework consists of up to six components we focus on three elements. The first component is the *action situation*, which has been described as "two or more individuals […] faced with a set of potential actions that jointly produce outcomes […]" (Ostrom, 2005b, p. 32). Such action situations can be found within many contexts, for example buyer-seller exchanges, legislative processes and also the creation of knowledge resources as done in OCI communities. The second component are the *participants* who interact within the given action situation. Behavior of community members – as for any human behavior – is determined by many factors, such as psychological states of individuals and interaction between the individuals. Both components are embedded in the so called *action arena*, the central unit of analysis. As the name already suggest, the *action arena* refers to the field where the 'action' is taking place and participants interact around the given action situation. The action arena is influenced by different exogenous factors – among them *governance rules*, the third element. Governance rules can affect the behavior of participants, the way work is coordinated and exchanges of knowledge resources are secured.
Applying the proposed model to the context of collaborative innovation communities, we operationalized different elements of the model in a way to best meet the specific characteristics and also develop measures to allow the investigation of relationships between the components (see Figure 1). In the following section we first lay out the characteristics of innovative work in OCI communities, second followed by the description of governance rules. In the third final section we lay out our hypotheses regarding the effects of exogenous vs. endogenous rules on interaction behavior and psychological states of participants.

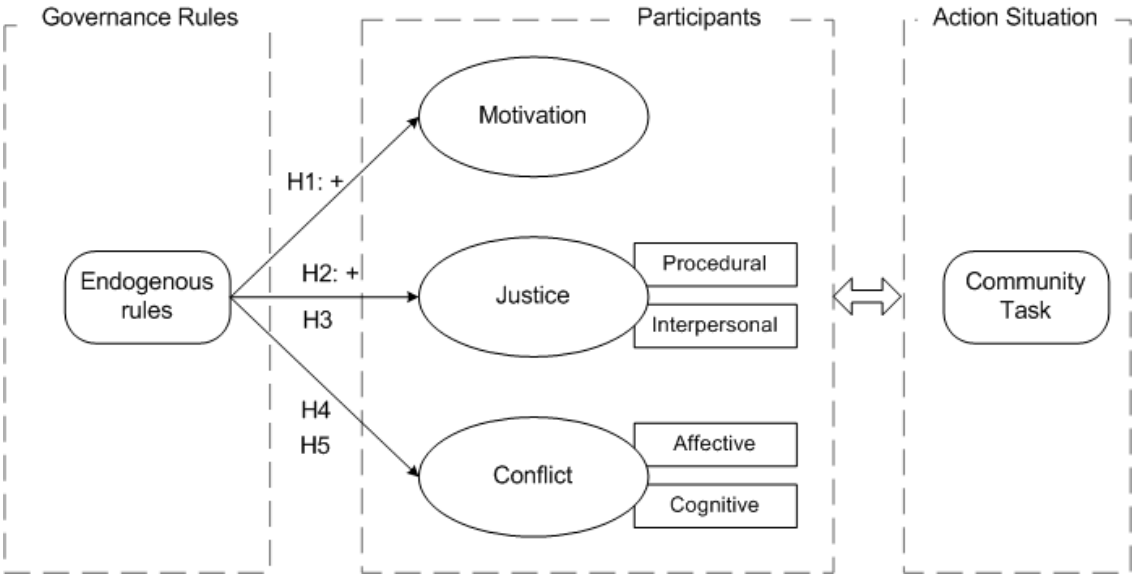

Figure 1: Theoretical framework and proposed relationships of variables

2.1 Action situation – characteristics of innovative work in OCI communities

According to Baldwin and von Hippel (2011) an open collaborative innovation project consists of contributors who share the work of generating a collective design. This indicates that a collective effort is an integral element of such communities. Raasch et al. (2009) highlight the collaborative aspect of several contributing actors. To allow for collaboration among many individuals work in OCI communities is often characterized by modular design architecture (Baldwin and Clark, 2006). Such a system distinguishes itself by elements that are partitioned into subsets and which can be processed separately (Baldwin and von Hippel, 2011). Furthermore innovative work is characterized by complexity (Katz and Tushman, 1979). This complexity is determined by many attributes, such as the option of multiple outcomes, multiple paths to reach the outcome, conflicting interdependence among paths and uncertainty about desired outcomes (Campbell, 1988).
In the light of these findings we define four features of tasks in OCI communities: the solution must reflect a *collective effort* (1), it calls for *collaborative work* (2) between actors, has a *modular* design (3) and shows features of *complexity* (4).

2.2 Governance rules

As already mentioned different categories of instruments of governance in OSS communities have been identified (Markus, 2007). These mechanisms are institutionalized through rules, for example rules that describe the responsibilities and decision powers of certain roles or rules that describe how to communicate and who can join the community. In other words all described mechanisms are embodied through a diverse set of rules. These can be either explicit or implicit. Ostroms work on rules has led to a set of seven generic governance rules (Ostrom, 2005b) which show extensive overlaps with the identified mechanisms in OSS communities (Schweik and Kitsing, 2010). We are also well aware that many 'invisible' mechanisms of governance exist. Attributes like trust, solidarity and reciprocity allow for smooth interaction within communities lacking formal mechanisms. The importance of such informal mechanisms has been highlighted by different authors (e.g. Lerner and Tirole, 2002; Bowles and Gintis, 2002).

Governance is seen as a dynamic process that evolves over time (Heide, 1994). Besides the identification of distinct mechanisms, the evolvement of governance in such communities should be considered to fully understand. It is evident that communities are not static, but grow and develop over time. For instance the need for governance increases with the size and maturity of a community. Investigations of the emergence of governance revealed different phases, from de facto governance to a stabilized system (O'Mahony and Ferraro, 2007).
While the emergence of social order is a vast field mainly reserved for sociologist and shall not be discussed in this paper (cf. Greif, 1997; Streeck and Schmitter, 1985), we propose a further view. If a community has to settle on explicit rules it undergoes a process integrating possible diverse individual positions into a consensus – a process which is characterized as a group decision process. Group decision processes have been investigated comprehensively (cf. Kerr and Tindale, 2004; Kaplan and Miller, 1987). We consider the formation of endogenous governance by a group as a group decision process since different preferences for diverse rules have to be integrated in one set of rules which is accepted by all. Contrary exogenous governance is characterized by exclusion of community members from any decision process, giving them no participation rights for designing such rules.

2.3 Actors – psychological states and group interaction

Participants' behavior and actions are crucial to the success of an OCI community. In fact, they are one of the key factors for successful outcomes in a community. It is known that motivation and cooperative behavior play an important role maintaining functional collaborative communities (Bonaccorsi and Rossi, 2003). Therefore we examined factors, namely motivation, justice, conflict and interaction behavior of group members. The rationale for choosing each factor and the expected interrelations between the two modes of governance are illustrated in the following section.

2.3.1 Motivation

One of the key questions of OCI communities is why volunteers participate. This question is especially puzzling since the contribution to a public good is counter-intuitive to the "self-interested-economic-agent paradigm" (Lerner and Tirole, 2001, p. 821).[1] Consequently different authors investigated the motivation of users in such communities. Exploring the subject of motivation includes a wide range of different aspects, for example the question why users participate (cf. Lakhani and von Hippel, 2003) and why do they innovate (cf. (Füller et al., 2007; Jeppesen and Frederiksen, 2006). Individuals vary substantially in their underlying motives (David and Shapiro, 2008). Ghosh (2005) points this out by showing the mix of different motives within a heterogenic group of participants. In the attempt to organize a bundle of such diverse motives, resorting to prior work in the field of motivation seems promising. Research on the topic of motivation typically makes a distinction between intrinsic and extrinsic types of motivation (Ryan and Deci, 2000). An activity is extrinsically motivated if it is carried out in order to attain a certain extrinsic return such as money or other rewards. Therefore the source of the motivation "[…] comes not from the activity itself but rather from the extrinsic consequences to which the activity leads." (Gagné and Deci, 2005, p. 331). On the contrary "[o]ne is said to be intrinsically motivated to perform an

[1] While the theory of a rational, self-interested individual is widely accepted, studies show that individuals may behave contrary to this paradigm, calling for a broader theory of human behavior Ostrom (2000b).

activity when he receives no apparent reward except the activity itself." (Deci, 1971, p. 105). The relationship between extrinsic and intrinsic motivation can be conflictive as substantial experimental and field evidence suggests (Bénabou and Tirole, 2003). In particular an external reward that aims at enhancing external motivation may adversely affect intrinsic motivation. One such example of the conflictive nature is described by the motivation crowding effect where external intervention (such as monetary rewards or punishment) may undermine intrinsic motivation (cf. Frey and Jegen, 2000; Frey, 1994; Alexy and Leitner, 2010). In a meta-analysis Deci Koestner and Ryan (1999) showed, that there are various types of external influences going beyond just monetary rewards ranging from verbal rewards to threats and deadlines, which conflict with intrinsic motivation. Frey and Jegen (2001) also formulate a general definition that all external intervention may affect intrinsic motivation, explicitly including regulations. With regards to OCI communities both intrinsic as well as extrinsic motivations have been identified. Features of intrinsic motivation include feelings like fun and a belonging to the group (Lakhani and von Hippel, 2003; Füller, 2006). Extrinsic motives consist of qualities such as career prospects (Lakhani and von Hippel, 2003) and development of skills and knowledge, personal need and to some degree of monetary rewards (Füller, 2006).
While both, intrinsic and extrinsic sources of motivation are important to understand community based innovation (Jeppesen and Molin, 2003), within this study we focused on intrinsic motivation. In the context of OSS communities there is evidence "[…] that enjoyment-based intrinsic motivation […] is the strongest and most pervasive driver. (Lakhani and Wolf, 2005, p. 3). Also the question whether external intervention by any form of authority (e.g. by firms) may mislay the interest and commitment of volunteers in OCI communities is raised within the field of OCI community research (O'Mahony and Ferraro, 2007). Considering adjacent research from the field of motivation crowding theory and the work of Ostrom imply that investigating the relationship between external intervention and intrinsic motivation of participants seems to be worthwhile. Ostrom (2000b) for example showed that in some settings, if individuals lose a sense of control over their own fate external interventions crowds out intrinsic preferences. Frey and Jegen (2001) identified two psychological processes by which external interventions can affect intrinsic motivation:

> "(a) *Impaired self-determination.* When individuals perceive an external intervention as reducing their self-determination, intrinsic motivation is substituted by extrinsic control. […]
> (b) *Impaired self-esteem.* When outside intervention carries the notion that the actor´s motivation is not acknowledged, his or her intrinsic motivation is effectively rejected." (Frey and Jegen, 2001, p. 594)

Applying those findings to the stated problem allowed for the formulation of following hypothesis:

> *HYPOTHESIS (H1): Choosing your own governance rules has a positive effect on Intrinsic Motivation.*

2.3.2 Procedural and Interpersonal Justice

Governance rules can solve problems of coordination and foster cooperative behavior between participants. However rules can be only effective if they are being followed by

participants. Therefore research has focused on the circumstances that must exist for individuals to comply with given rules. Models that explain individual rule compliance integrate factors from economic, psychological, and sociological theories (Jenny et al., 2007). In particular crucial to the adherence of rules is whether they are perceived as legitimate (Tyler, 2005). Within the context of governance system, legitimacy results in higher compliance of rules and therefore enduring stability (Walker et al., 1986). Thus legitimacy is a prerequisite to build functional governance systems and therefore stable business institutions and OCI communities. This raises the question under what circumstances a rule normative system is perceived as legitimate. Put differently, how can one achieve legitimacy when designing governance rules and structures? One central dimension that influences the perception of legitimacy is justice (Tyler, 2006). Consequently the construct of justice, especially in organization has been of great interest to researchers within the last decades.[2] Within the literature, justice is viewed as multi-dimensional, differentiating between distributive justice, interpersonal justice and procedural justice. Distributive justice is fostered by outcomes and focuses on people's reaction to unfair allocation of rewards or resources (Greenberg, 1987). Procedural justice centers the process by which the outcome is reached. Leventhal defines procedural justice as follows:[3]

> "The concept of *procedural fairness* refers to an individual´s perception of the fairness of procedural components of the social system that regulate the allocative process." (Leventhal, 1980, p. 35)

Leventhal (1980) states that such a process includes complex networks of events and procedures such as the appointment of decision makers and the process of reaching decisions. Regarding this definition it is evident that procedural justice directly applies to problem stated above – whether rules are perceived as legitimate or not. Since procedural justice focuses on the rules itself and not on interpersonal relationships or the outcome of rules it proves to be a precise measure to examine the effects of exogenous vs. endogenous governance rules. In addition the theory of procedural justice not only offers well-established constructs how to measure the perceived justice of governance rules, in addition it explains why endogenous rules are expected to be perceived as legitimate, because "participation rights are essential for the legitimacy of adjudicatory procedures" (Solum, 2005, p. 179).
It is known that procedural justice is not only essential for the obedience of rules but also "[…] demonstrated to result in increased job satisfaction, organizational commitment, and organizational citizenship behaviors." (Konovsky, 2000, p. 492). Moreover, procedural justice is strongly related to individual innovative behavior (Janssen, 2004). One can therefore conclude that procedural justice is more than just a precondition for functional governance but moreover a lever to boost performance and innovation. Given a group the opportunity to choose their own set of governance rules should lead to higher levels of perceived procedural justice, since participation rights (according to the procedural legitimacy thesis) increases the legitimacy.

[2] For a review of literature in the field of organizational research see Konovsky (2000).
[3] Leventhal uses the term of procedural fairness rather than justice. However the term justice and fairness within this context are used interchangeable (cf. Colquitt, 2001).

HYPOTHESIS 2 (H2): Choosing your own governance rules has a positive effect on the perception of Procedural Justice.

Interpersonal justice, also referred to as interactional justice[4], is closely linked to procedural justice. Research shows that people not only focus on the fairness of the procedure but how it is enacted by a decision maker, relating to dimensions such as truthfulness and respectful treatment (Bies and Shapiro, 1987). The close relationship between the procedure and the person endorsing is intuitive. Different studies show high procedural-interactional justice correlations (Colquitt, 2001). It is important to distinguish whether the procedures themselves are perceived fair and the enactment of those rules on the other. This is especially important when bearing in mind that rules are usually executed by a person, for example by a project leader. The strong relationship between *Procedural* and *Interpersonal Justice* leads to the assumption, that the ability to choose your own rules also relates to higher levels of interpersonal justice. However, research of group decision processes show that reaching a group decision can be a delicate issue, resulting in conflict and poor decision quality (cf. Priem and Harrison, 1995). Green by investigating different social decision schemes within groups highlights the negative effects a group decision can have on negative socio-emotional behavior (Green and Taber, 1980)[5]. Depending on whether the group comes to an easy verdict or finds itself in a difficult discussion in the process of agreeing on rules differential effects on the dimension of *Interpersonal Justice* are expected. Overall *Interpersonal Justice* is an important factor when it comes to endogenous vs. exogenous rules. However, we did not have a priori hypothesis of the directional effect.

HYPOTHESIS 3 (H3): Choosing your own governance rules has an effect on the perception of Interpersonal Justice.

2.3.3 Conflict

Faced with an innovative and complex task, groups experience problems of optimal coordination and communication which results in conflict, a struggle which governance mechanisms try to solve (Lattemann and Stieglitz, 2005). Especially innovative behavior of individuals can provoke conflict with co-workers, if innovative ideas challenge the established framework of collaborators (Janssen, 2003). Innovative tasks are therefore more likely to breed conflict for two reasons, first problems of coordination and second different intensity of innovative behavior of individuals. To some level conflict can be beneficial by generating new ideas, however, too much conflict becomes dysfunctional (Wall and Nolan, 1986). In more detail, two studies showed that innovation increases with a medium level of conflict within a team, while dropping to zero under intense conflict (de Dreu, 2006).
Not only the level of conflict is decisive, but also the type of conflict. Conflict is distinguished between two forms – task oriented and interpersonal conflict (Jehn, 1995). Amasons (1996) distinction between functional *Cognitive Conflict and Affective Conflict* is in line with this classification. *Affective Conflict* is characterized by personal incompatibilities or disputes and tends to be emotional, where *Cognitive Conflict* is task-oriented and encourages evaluations of alternatives. Therefore *Cognitive Conflict* is expected to contribute to innovation, while *Affective Conflict* may demolish innovative outcomes.

[4] Colquitt uses the term interpersonal justice however refers to the original work of other authors who apply the term of interactional justice Colquitt (2001).
[5] Socio-emotional as Green uses it refers to behaviour of others within in the process and therefore shows great overlaps with the construct of *Interpersonal Justice.*

In the light of the negative consequences too much conflict can have the matter of managing conflict within communities needs to be solved. Hence effective and good governance must hinder the emergence of too much conflict and solve it rapidly when inevitable. Kittur and Kraut (2010) found procedures and policy likely to be the only coordination device to be effective.
Such procedures and policies are consistent with the governance rules discussed above, which affect the participants within the action arena. Since we proposed that rules selected by the community may have higher perceived legitimacy (hypothesis H2) it could be expected that self-chosen rules reduce conflict better. However, the positive effect of procedures and policies can only be attained if such rules are in place. The process of agreeing on rules, as mentioned before, involves the risk of creating further conflict. Therefore once again hypotheses are formulated non directional, as for *Interpersonal Justice*:

> *HYPOTHESIS (H4): Choosing your own governance rules has an effect on Affective Conflict.*
> *HYPOTHESIS (H5): Choosing your own governance rules has an effect on Cognitive Conflict.*

To summarize we propose the difference between exogenous vs. endogenous governance to affect perceived *Motivation*, *Justice* and *Conflict.* We also propose relationships between factors set out in the previous section, which can be investigated through analysis of correlation.

3 Method

The objective of this study is to establish clear cause and effect relationships between modes of governance and factors such as motivation. Conclusions about cause and effect relationships are best drawn by experimental studies (Aronson et al., 2010). Moreover exogenous vs. endogenous rules represent two extreme manifestations which can be easily implemented in an experimental manipulation. To test the hypotheses we conducted an experiment with 70 graduate students. Students were awarded with credits for participation[6]. Two treatment conditions were employed: The first allowed participants to choose their own governance rules, while teams under the second treatment were given the matching rules exogenously.

3.1 Basic Experimental Design

To experimentally investigate the hypotheses we applied Bavelas (1950) 'five square puzzle', a task that reflects the four described characteristics of OCI community work. In this 15 various geometric shapes are distributed among a group of five players. Each player is required to build an individual square by exchanging shapes with the other players. Out of these shapes many different squares can be formed, however, only one arrangement exists which allows each player to form his own square (see Figure 2). The initial distribution of puzzle pieces is chosen such that the probability of suboptimal solutions is increased. If those solutions are maintained a group solution remains impractical. Notable is how the

[6] Credits were given for participation only and therefore did not represent an incentive to perform better.

group manages the occurrence of such `wrong` squares, since "[f]or an individual who has completed a square, it is understandably difficult to tear it apart." (Bavelas, 1950, p. 730).

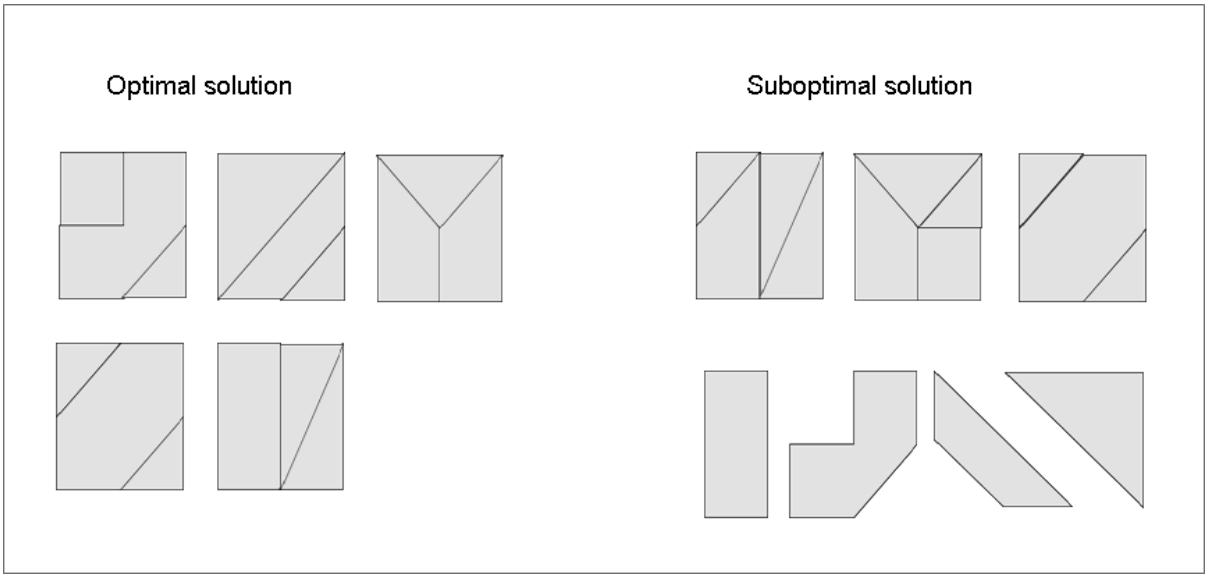

Figure 2: Task for the experiment to resemble work in OCI communities

Since a perfect solution can only be reached if everyone cooperates and trades pieces a (1) collective effort is needed. Trading pieces demands a high degree of mutual communication and interaction between participants – therefore (2) collaboration is inevitable. Furthermore it shows some signs of (3) modularity since players can work on individual solutions (symbolized by individual squares). The described task clearly shows the feature of (4) complexity (Ruef, 1996), since different paths to the solution are possible. While the chosen task meets the four established criteria some further features – that make the task even more suitable – shall be demonstrated. In order to solve the task participants are faced with a social dilemma situation, where individual interest may conflict with the group interest (van Dijk and Wilke, 1995). A mixed motive situation may occur, if players who have already formed a square are faced with the decision to break up their solution, in order to contribute to the perfect solution. Such situation can quickly lead to free-riding behavior, when a player takes advantage of his position and refuses to cooperate (Torre, 2006), an often discussed problem in OCI communities.

Players are given 40 minutes to solve the task. To increase the already in the game characteristics inherent social dilemma – when players are faced with the decision to break up a suboptimal square – a payoff function is introduced. Players are awarded with points, whereas the point allocation is determined by the individual and group performance. After the game is finished a count of completed squares for each group is carried out. Points for each player are calculated by following formula: 20 points for each individual square + Σ group squares x 10

Hence a player could reach 0-70 points depending on both the individual and group performance. To provide an incentive the 5 players with the highest number of points (across all teams) are awarded with a voucher worth 20€. If there were more than 5 participants with the same number of points, the group time needed to reach the solution was taken into account as an additional criterion.

3.2 Procedure and manipulation

Participants were randomly assigned to teams of five to solve the puzzle task. The experiment was conducted in a virtual setting where participants interacted anonymously via the internet. Players were seated in a room and were divided by blinds. No group member knew the identity of the other players. The exchange of the different pieces was carried out via a browser-based online tool which was developed for the experiment. Communication among the participants was taking place in German via group chat. The virtual set-up was chosen to duplicate the characteristics of OCI communities where communication is conducted via chat (e.g. using IRC) and exchange of artifacts (such as source code, specification, etc.) is organized exhaustive over the internet.
Upon arriving for the experimental session participants were seated in the different booths in front of a computer terminal. Participants were then advised to read the instructions, which were placed next to each computer terminal on a paper sheet. After having read the instructions a short movie explaining the use of the tool and communication via chat was shown.
The instructions for treatment A (endogenous rules) included following paragraph at the end of the instructions:

> *Before the 40 minutes are started by the administrator you have 15 minutes as a group to discuss a set of rules that might help you to come to better results as a group. The list of rules will be given to you before the discussion starts.*

The list of rules a team could choose from was presented as a print out of two set of rules to choose from. First participants could vote whether to have a project leader or not. Once they chose to have a project leader they could choose between two options of appointing a leader, either by group vote or by fortune (appointed by the administrator).
The second block of rules was concerned with the decision right to force a participant to share a piece, a situation which is likely to occur, if a player has already completed his square and is not willing to break it up. Again a team could choose between different options. One alternative was to transfer all the decision power to the project leader. Another two choices were installing different decision schemes where the simple majority of three or an exhaustive majority of four has to agree. The last option implies installing no such rule and leaving the decision up to each individual. In total the list of rules allowed 11 diverse configurations of governance rules (see Appendix for list of rules).
The instructions for treatment B (exogenous rules) included following paragraph at the end of the instructions:

> *Before the 40 minutes are started by the administrator you have 15 minutes as a group to discuss any topic you like. During the 15 minutes the administrator will give you some more directions.*

7 minutes into the group discussion the administrator announced following message via the group chat.

> *In course of the game a set of rules has to be followed. The set of rules will be passed out now.*

The administrator then handed the list of rules (again in paper form), which matched the rules chosen by the correspondent team under treatment $A_{end.}$. If the list implied the rule of voting a project leader, the group was asked at the end of the 15 minutes about their choice. The reason for introducing the rules under treatment $B_{exog.}$ after 7 minutes and not at the beginning of the 15 is as follows. The main idea is to avoid that rules are apprehended as part of the game instructions, consequently the temporal separation is believed to assist to this objective. The reason of introducing the rules in the middle of the 15 minutes and not at the end has practical reasons, since players obviously take some time to understand the meaning and implications of the rules.
The time for the group discussion was started by the administrator by announcing it over the group chat. For treatment $A_{end.}$, if the group did not announce the choice of rules by itself, the administrator asked for the group choice at the end of the 15 minutes. For both treatments time checks were announced by the administrator three minutes before the 15 minutes ended.
Upon the termination of the group discussion the puzzle game was started. After 40 minutes or when a team accomplished the optimal solution prior to that, participants were asked to fill out a questionnaire.

3.3 Data Sample

Out of the 14 teams performing the task (7 under each treatment) one team had to be excluded from the sample, since the game had to be aborted due technical difficulties. Therefore the sample consists of 13 teams (7 under treatment A, 6 for B), resulting in 65 individual responses, thereof 11 (17 %) female and 54 (83%) male respondents. Average age is 25, ranging from 22 to 30. Concerning the educational background of respondents the sample is exceptionally homogenous, since all participants are graduate students from an engineering management program from the Hamburg University of Technology. Most respondents of the sample 57 (88%) declare German as their native language, while 8 (12%) grew up with a different language. However, it can be stated that German language skills of non-native speakers can be considered good since they attend lectures in German.
Since the sample consists of students we want to justify why we believe it to be suitable. According to Stevens (2011) a student sample is appropriate if the underlying universalistic theory applies to all population and is not specific to one context. Since hypotheses were derived from general theories of motivation or justice, we believe them to be applicable to any population. Van Rijnsoever et al. (2012), also resorting to the work of Stevens, state a further justification for a student sample: Using a homogenous sample optimizes the internal validity. Another point is that the sample is overwhelmingly male. Since none effects of gender are expected this should not reduce the validity of the experiment. Anyhow gender is included as a control variable, to investigate any unwanted effects. We want to conclude with one last point. OCI communities exist in many different forms, assembled of homogenous groups such as communities of doctors or very heterogeneous groups, for example contributors of *Wikipedia*. Therefore any other data sample would not be inherently better or worse than the chosen student sample

3.4 Measures

While the rational for choosing variables and suspected hypotheses have been stated in section 2, the following paragraph details the exact measures. All variables were collected post the game via a questionnaire using established constructs by different authors. In

addition all chat messages were recorded, including information about sender and time sent.

In a meta-analysis Cameron and Pierce (1994) showed that intrinsic motivation has been measured with a variety of means, including free time on a task after withdrawal or reward, self-reported task interest, satisfaction and enjoyment and a subject willingness to participate in future projects. After a review of diverse measures, seven-point semantic differential scales developed by Crino and White (1982) are used to measure intrinsic *Motivation.* Since the task characteristics and set-up by Crino and White is similar to the one in this research project (also a puzzle game, same group size) it seems especially appropriate.

As for intrinsic motivation various measurements for the dimensions of *Procedural* and *Interpersonal Justice* exist (for an overview and validation of different measures see Colquitt, 2001). Drawing on the work of Colquitt, four established items for each construct are used to measure the two variables *Procedural Justice* and *Interpersonal Justice*.

Accommodating for the multidimensional aspect of conflict we measure dysfunctional and functional conflict with two constructs. We draw on the work of Amason (1996), who distinguished between dysfunctional `affective conflict` and functional 'cognitive conflict'. Conflict is measured using three items for *Cognitive* and four items for *Affective Conflict* previously applied by Amason.

All variables, except for *Motivation* were measured on a 5-point Likert-type scale with anchors of 1= *not at all* and 5= *to an exceptional degree*. Additional three control variables were recorded. *Native Language* and *Gender* were included in the questionnaire. *Typing Speed* was recorded post the game by taking the time a participant needed for typing a standardized sentence.

4 Analysis and results

Hypotheses were tested by statistical analysis including all self-reported measures collected via the questionnaire. To ensure robustness of findings covariate analysis and test of sub-samples were conducted. In order to gain a deeper understanding and elevate the accuracy of the explanation of statistical results a content analysis of chat messages was conducted post to the statistical analysis.

4.1 Main effects of manipulation

First we ensured reliability of constructs by investigating items using Cronbach´s alpha and corrected item correlation. We further conducted a confirmatory factor analysis using principal components extractions and rotating factors via varimax. Both analyses confirmed the applied constructs. Constructs were then built by calculating arithmetic means of the related items.

An inspection of variables for both treatment groups revealed differences in the mean scores. The group under treatment $A_{end.}$ had lower means concerning the constructs of *Motivation* and *Interpersonal Justice*, while the scores for both measures of *Conflict* showed higher means. Comparison of mean scores for *Procedural Justice* showed only minor differences between the groups (Table 1 provides a summary of group profiles for each treatment).

Means and Standard Deviations

	Condition	Mean	Std. Deviation

Motivation	Endogenous	5.23	0.78
	Exogenous	5.68	0.54
Affective Conflict	Endogenous	2.20	1.07
	Exogenous	1.68	0.77
Cognitive Conflict	Endogenous	2.21	0.90
	Exogenous	1.89	0.78
Procedural Justice	Endogenous	3.76	0.71
	Exogenous	3.71	0.80
Interpersonal Justice	Endogenous	4.14	0.72
	Exogenous	4.53	0.54

Endogenous N=35; Exogenous N=30

Table 1: Means and Standard Deviation of dependent variables detailed for both treatments

In order to test whether these differences proved to be significantly a multivariate analysis of variance (MANOVA) was run for the whole sample (N=65). The MANOVA revealed a significant multivariate main effect for the treatment, Wilks' $\lambda = .798$, $F_{(5; 59)} = 2.986$; $p = .018$, partial eta squared = .202. The power to detect the effect was .826. After having established significance of the overall test univariate effects were examined. Significant univariate effects were obtained for three of the five variables: *Motivation* ($F_{(1; 63)} = 7.035$; $p < 0.05$), *Affective Conflict* ($F_{(1; 63)} = 4.822$; $p < 0.05$) and *Interpersonal Justice* ($F_{(1; 63)} = 5.645$; $p < 0.05$) (see Table 2). The effect sizes, given partial eta squared were strongest for *Motivation*, followed by *Interpersonal Justice* and *Affective Conflict*.

Tests of Between-Subjects Effects

	Mean Square	F^a	p	η_p^2
Motivation	3.271	7.035	.010	.100
Affective Conflict	4.312	4.822	.032	.071
Cognitive Conflict	1.661	2.315	.133	.035
Procedural Justice	.038	.068	.795	.001
Interpersonal Justice	2.359	5.645	.021	.082

a. df=1,63

Table 2: Univariate tests (between-subjects effects)

Hypotheses H3 and H4 were supported by the outcome of the MANOVA. The directions of the effects indicate that exogenous rules positively influence the perception of *Interpersonal Justice* and the emergence of *Affective Conflict* (less conflict). The direction of the effect for *Motivation* is contrary to the proposed hypotheses H1, indicating exogenous rules to positively affect *Motivation*. This surprising effect was investigated in a further analysis.

4.2 Analysis of mediation effect and correlation

The finding for *Motivation* appears to be conflictive to the stated hypotheses. Letting a group choose its own governance rules has a rather negative than positive effect on

Motivation as indicated by the univariate effect ($F_{(1; 63)}$= 7.035; p < 0.05). While at first sight the result looks atypical considering existing research discussed earlier, checking back to the theory on the association of the investigated variables, it becomes evident that a relationship between *Conflict* and *Motivation* may exist that could explain the observed effect. It is known that motivation may be influenced by different contextual factors such as organizational culture (Mitchel and Daniels, 2003). Furthermore, studies show that the relationship between organizational climate and conflict has a major impact on job satisfaction (Walker et al., 1977) and negatively impacts performance (de Dreu and Weingart, 2003). Since motivation is an antecedent of performance (Mitchel and Daniels, 2003) and the constructs of job satisfaction and motivation show an overlap (Tietjen and Myers, 1998) it is expected that the association between motivation and conflict may be analogous. Furthermore analysis of chat interactions of participants during the game supported the theoretical implications (see content analysis 4.4). Bearing these findings in mind, a further hypothesis is formulated, investigating whether *Affective Conflict* mediates the impact of the independent variable on *Motivation*.

HYPOTHESIS 6 (H6): Perceptions of Affective Conflict mediate the effects of exogenous governance rules on Motivation

To test this hypothesis an approach by Sapienza and Korsgaard (1996) is applied. Drawing on the work of Baron and Kenny (1986) they consider three conditions that have to be met to support the mediation hypothesis. First, the independent variable must be related to the mediator. This requirement is supported by the previously reported MANOVA, showing a significant effect of treatment on *Affective Conflict*. Second, the mediator must be related to the dependent variables. Examining the reported correlations all relationships between the mediator *Affective Conflict* and *Motivation* are significant (see Table 3). Third, the once significant relationship between independent and dependent variables must be either eliminated or considerably reduced if the mediator is accounted for. This condition is tested by conducting a MANCOVA introducing *Affective Conflict* as the covariate. Results show that the main effect is no longer significant (p = .058). These findings indicate that *Affective Conflict* may mediate the impact of the manipulated variable (exogenous vs. endogenous) on *Motivation*, supporting the formulated hypothesis H6.

Correlation coefficients for relations between dependent variables

Variable	1	2	3	4	5
1. Motivation		-.284*	-.220	.305*	.378**
2. Affective Conflict			.603**	-.204	-.421**
3. Cognitive Conflict				-.471**	-.473**
4. Procedural Justice					.443**
5. Interpersonal Justice					

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

Table 3: Correlations of dependent variables

Relationships between dependent variables were investigated by correlations (see Table 3). High correlations between both measures for *Conflict* (p < .01) could be obtained. Measures

for *Justice* showed medium correlations ($p < .05$). *Motivation* correlates highly with *Interpersonal Justice* ($p < .01$) and on a medium level with *Affective conflict* ($p < .05$) and *Procedural Justice* ($p < .05$). A further high correlation is the one between *Affective conflict* and *Interpersonal Justice* ($p < .01$).

4.3 Control variables and sub samples analysis

To ascertain that the observed differences were not driven by individuals' differences in *Typing Speed*, *Native Language* and *Gender*, covariate analysis (MANCOVA) were conducted. The results for MANCOVA revealed no differences in the effects, thus we can be certain that observed differences were not explained by any covariates.
Interestingly the chosen configurations of governance rules under treatment $A_{end.}$ were akin. For example all teams choose to have a project leader and nearly all equipped him with extensive decision power. This fact is important to keep in mind when interpreting the statistical analysis, since no major effects of complete opposite governance configurations (no leader vs. leader) can be expected.
Out of the 13 teams 10 were able to reach a perfect solution, 5 under each treatment. Among those teams the average time to reach the solution was 17:08 minutes, ranging from 10 to 25 minutes. Hence differences in performance between teams exist. It is recognized that feedback may have an effect on motivation (Crino and White, 1982). A form of feedback within the experimental setup is the number of points players obtain for their squares. Being aware of the payoff table of how many points they receive, players can easily asses how well they performed, which consequently may influence their self-reported *Motivation*. In order to evaluate the association of feedback with the dependent variables a sub-sample for further analysis is selected. The sub-sample included all teams which reached a perfect solution, since they all received the same feedback through the number of points allocated and the assurance that they reached the perfect solution. The sample consisted of a total of N=50, 25 from each treatment. Again a MANOVA for the sub-sample, analogue to the one run for the whole sample was conducted. The MANOVA for the sub-sample revealed no significant multivariate main effect for the standard significance level of .05, however an effect for a higher significance level was revealed (Wilks' $\lambda = .794$; $F_{(5;\ 44)} = 2.284$; $p = .063$; partial eta squared = .206; observed power = .682). Comparing means and univariate effect sizes given η_p^2 it can be stated that the results for the sub-sample point in the same direction as for the MANOVA of the whole sample. Considering the reduced power for the sub-sample suggests that in order to establish a significance $p < .05$ would call for a larger sample size. We therefore feel confident that the reported effects are due the manipulation and at most marginal effects of feedback on intrinsic *Motivation* are expected.

4.4 Content analysis of group discussions

The reported results are based on the self-reported measures of participants post to the game. While this measurement provides convincing data for inferential statistics one disadvantage has to be acknowledged. The self-reported measures post to the game only provide a snapshot view, at best the overall perception of the game. Fluctuations of perceptions in course of the experimental sessions are not presented. Neither additional insights nor explanatory approaches for the perception can be gained. Therefore we chose an additional content analysis of chat messages. We first focus on the group discussion, since this is where the manipulation occurred and effects are expected. In order to observe

interpersonal behavior of participants an established category system originally developed by Bales in 1950 (Bales, 1976) and applied by various authors (cf. Hare, 1973) is used. The category system uses twelve categories to describe the process of interaction of small discussion groups. Six categories constitute social-emotional behavior, *shows solidarity*, *shows tension release*, *shows agreement* are positive reactions, while *shows disagreement*, *shows tension* and *shows antagonism* are negative reactions. These categories are complemented by six further ones related to the task, again divided into two groups: *gives suggestion*, *gives opinion* and *gives information* as problem solving attempts and *asks for information*, *asks for opinion* and *asks for suggestion* are subsumed as questions.
Applying the category system to the group discussion, by coding chat messages and interpreting percentage of the code categories in relation to the overall number of messages, teams showed two distinct profiles four both treatments (see Figure 3). Teams who choose their own rules showed distinctly more negative reactions (e.g. disagreement and antagonism), indicating more tension and conflict (on average twice the relative amount for the three categories of negative social-emotional behavior). A further finding is that they showed less solidarity and tension release, like expressions of joy or fun. Comparing task related categories, groups with external rules seemed more goal oriented, engaging more in solution proposal and less in expressing opinion.
Applying the content analysis for the course of the game showed group profiles across treatments to be much likewise. These findings support the proposition, that one major source of the measured conflict lies within the group decision process agreeing on a set of governance rules.

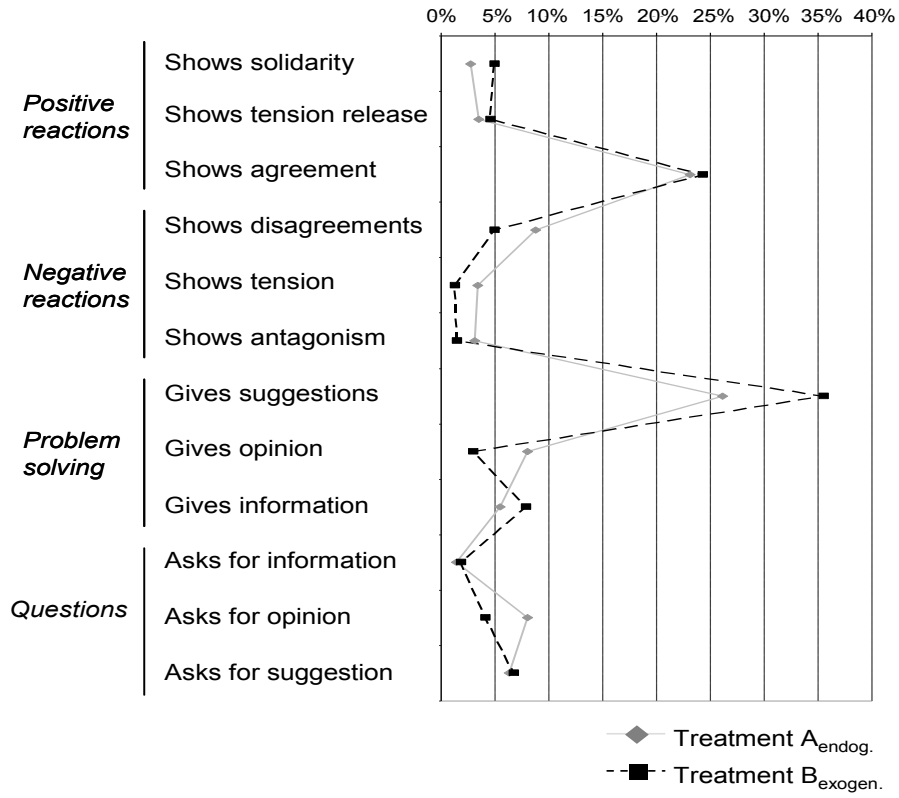

Figure 3: Group profiles of coded chat messages

5 Discussion

This study examined the trade-offs between choosing own governance rule vs. the indoctrination of external rules on variables such as *Motivation*, *Justice* and *Conflict*. Foremost the findings of this study reveal that indeed a relationship between the two modes of governance (endogenous vs. exogenous) and some of the identified success factors exist.
Interestingly, the rules themselves were perceived by both groups similar as shown by the means for *Procedural Justice*. This is especially notable since the manipulation between both treatments aimed directly on influencing *Procedural Justice.* Taking a pessimistic view one could argue that the manipulation was unsuccessful, since the manipulation-check for *Procedural Justice* failed to show any effects. Another explanation (which was also supported by the statistical analysis and content analysis) is that the rules were perceived by both groups as fair, because they helped the group to perform better. In that case it may be irrelevant if the rules are given exogenously or endogenously. A similar effect is known from motivation crowding theory, when [e]xternal interventions *crowd in* intrinsic motivation if the individuals concerned perceive it as *supportive."*(Frey and Jegen, 2001, p. 595). Whether the effect of more contradictory rules in the same setting would lead to dissimilar results is a question worthwhile revising in the future.
While the reported effects between the two treatments cannot be clarified by the rules itself, as the absence of differences for *Procedural Justice* indicate, another explanation seems very likely. As described the manipulation itself did not aim at the rules but rather on the process of how they were implemented. However, the process of agreeing on a set of rules can be quiet strenuous. Therefore the source for the reported differences between both treatment lies within this `electoral process`. As the analysis of chat protocols showed participants who had to choose rules argued intensely about the different alternatives. Such debates may result in higher levels of conflict and interpersonal friction as indicated by the reported results. This argument is also consistent with the findings of Green, who affirmed that a group decision process leads to high level of interpersonal stress (Green and Taber, 1980).
The theoretical explanation by Green is also reflected in the data as findings for the other variables indicate. The first finding suggests that teams with the ability to choose their own rules experienced higher levels of conflict – especially for *Affective*, 'inter-personal' related conflicts. Further support is provided by the result for *Interpersonal Justice* which points in the same direction providing further indication that the process to agree on rules leads to interpersonal friction. An additional finding presented in the results, is the negative relationship between the ability to choose rules and motivation. A potential explanation is provided by the analysis of mediation effect of *Affective Conflict* on *Motivation*, which indicates that high levels of *Affective Conflict* may negatively impact the *Motivation*.
One shall not neglect the limitations of this study. Foremost as for any laboratory experiment we faced the restrictions of an artificial setting. This applied to the constructed situation of a game under time pressure, while 'real' life communities exist and evolve over a long time period. Participants in an experiment might be more willing to except appointed leadership for a short period of time than if confronted with it on an everyday basis. Another issue regarding the time aspect is recognizing the extended period it takes for informal relations and norms to develop. It is known that norms like trust and reciprocity play an important role within such communities (Lerner and Tirole, 2002; Sulin, 2001), however within this study we only focused on explicit rules. Second the chosen sample of students was very homogenous, since they were all from the same age group and professional

background. Having such homogenous sample is positive for the statistical analysis of an experimental study because parallelising of groups controls for other variables that may influence the results. However, professional background and socialization may have an effect on cooperative behavior (Frank et al., 1993).
These limitations link to promising future research by replicating similar experiments over longer periods of time and across different, less homogenous groups. Furthermore it could be promising to counterpart findings from this study with field research. Especially the relationship between different modes of governance and conflict seems a promising field to investigate.

6 Conclusion

This paper offers some insights on the effects of self- vs. firm-initiated governance of OCI communities, by the use of an experimental method. While questions about collaborative innovation projects have been mainly studied through case studies and surveys, we designed an experiment which we believe to represent the characteristics of collaborative project to a high degree. Applying this research method we aim to contribute to narrow the by some criticized underrepresentation of experimental methods (Colquitt, 2008), especially when it comes to innovation research (Sørensen et al., 2010). The experimental task has proven to be very suitable to investigate further questions within OCI communities, for example different rule configurations.
Our study contributes to better understanding of the relationship between external intervention, for example by firms, and communities of volunteers. First, the results of our experiment have shown that external intervention through governance rules does not per se cripple motivation of volunteers, but quite the opposite positive effects could be observed. If rules are perceived as helpful and fair, the may significantly reduce conflict and increase motivation. Coherent the interplay of factors like justice, conflict and motivation within communities of volunteers is a further contribution of this study. Understanding this relationship provides insights for focusing on the right levers to increase motivation of volunteers.
We further showed the risks of participation processes. While they may increase legitimacy they also inherent the risk of creating conflict and tension. Examples of endless ‘vendettas’ of Wikipedia volunteers deleting and reediting articles are living proof to that observation. We shall not be mistaken, democratic processes and the participation of volunteers is an important part of such communities and probably one of the key success factors. However, grass-root democratic processes can be a double-edged sword.
Several implications for the design of governance systems in communities and the interaction between firms and communities can be derived from the results. First firms should not be afraid to execute active leadership by implementing governance structures. A promising approach for leadership beyond pure structure is found by the involvement of firm employees acting as ‘men on the inside’ in such communities (Dahlander and Wallin, 2006; Lee et al., 2012). The next logical challenge is identifying a set of applicable fundamentals for ‘good’ governance rules that are perceived as tolerable and helpful by OCI communities. Again prior work by Ostrom may provide valuable insights. Ostrom (2000a) identified a set of different design principles to create successful self-organized regimes. Several principles correspond to the context of the production of knowledge resources by communities. In particular three principles stand out: First balancing cost and benefits by

designing rules to regulate the returns one receives for his inputs. Such principle is likely to mitigate the challenge of balancing use and production of knowledge resources (Madison et al., 2010). Second, accountability and enforcement of rules should be regulated by the community, increasing the perceived fairness and identification of the community with the rules. Third, sanctions should be applied gradually, depending on the seriousness of the rule violation.

As for governance rules firms should reconsider the concern that any external intervention may cripple motivation and reduce participation of volunteers. The opposite may be the fact, where such external rules may proof to be a lever mitigating conflict and boosting the performance of such communities. However, this finding shall not be understood as a carte blanche for authoritarian external intervention. While such influence may be beneficial for a community, external governance rules still need to be designed in a careful manner. External rules can only succeed if they are perceived as fair and helpful and serve the purpose of the community. Maybe the initial question needs to be rephrased: The key of good governance lies not between endogenous vs. exogenous, but in the design of helpful, fair and purposeful governance rules and configuration. To investigate and find such configurations and processes to legitimize them is an avenue for further research.

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