How Coopetitive Rewards Are Different in Determining Information Sharing Behaviors?

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How Coopetitive Rewards Are Different in Determining Information Sharing Behaviors?

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ABSTRACT
A growing body of literature indicates the crucial role of cooperative or competitive reward structures in determining information sharing behaviors, and in turn group performance. The real situations are, however, a mixture of cooperative and competitive- coopetitive- reward structures in different intensities and combinations. This study aims to provide a better understanding of coopetitive structures and their impact on group interactions. More specifically, this study investigates how two types of coopetitive reward structures (dominant cooperative and dominant competitive reward structures) are different in determining information sharing quality over time. A theoretical model of coopetitive reward structures is proposed. The model postulates that the relationship between coopetitive reward structures and high-quality information sharing is contingent upon task complexity and group dynamics. Laboratory experimental research is employed to examine the proposed model. Research and practical implications are discussed.

Keywords
Coopetition, co-opetition rewards, information sharing, knowledge sharing.

INTRODUCTION
Team-based structures are increasingly being employed by organizations (Sundstrom et al. 1990, Beersma et al. 2009, Johnson et al. 2006). Longitudinal surveys of Fortune 1000 organizations indicate that the use of team-based rewards in promoting group performance and coordination of efforts is on the rise (Garvey 2002). However, there are different views regarding the kinds of reward structures that are most effective for co-created value and performance at the group and individual levels.

Reward structures are defined as the basis upon which rewards are distributed among two or more individuals (Johnson and Johnson 1989). They are considered to be flexible tools through which group members are motivated and resources are allocated (Ferrin and Dirks 2003). Rewards are shown to directly or indirectly affect work-related outcomes such as group performance, job satisfaction, and interpersonal trust (Wageman and Baker 1997, Rosenbaum 1980).

The extant literature draws attention to two typical reward structures of cooperative and competitive rewards (Beersma et al. 2003). Social interdependence theory suggests that the impact of cooperative and competitive reward structures on group performance is basically mediated by information sharing behaviors among team members (Deutsch 1949, Johnson et al. 2006). In contrast to the view that reward structures provide a flexible means of influencing motivation, changing individuals’ communication behaviors can be expensive and can meet with mixed results. Hence, for practical as well as theoretical reasons, it is important for organizational researchers to develop a fuller understanding about how changes in reward structures can potentially lead to more effective information sharing behaviors.

Many earlier studies examined the relation between pure cooperative or competitive rewards and numerous outcome variables, which is despite the fact that beside a dominant climate, real situations typically include mixed reward structures (Beersma et al., 2003). This study is one of the first studies to have examined the impact of simultaneous cooperative and competitive reward structures on the information sharing of team members, particularly over time (see also Stein et al. 2012). In addition, it is not yet clear how different combinations of cooperative and competitive reward structures (referred to in this paper as coopetitive reward structures) affect information sharing behaviors. This study is undertaken to answer the following question: how different coopetitive reward structures are different in determining high-quality information sharing among individuals? We postulate a conceptual model that explains how two divergent types of coopetitive reward structures affect information sharing behaviors. The model and the hypotheses are examined through experimental research methodology.
CONCEPTUAL MODEL

Mixed Rewards
Cooperative rewards are given based on the performance of the group, and are equally divided between group members. Competitive rewards are given based on the performance of the one who has made the most contribution to the performance. In other words, individuals are rewarded for outperforming their colleagues (Johnson and Johnson 1989).

Prior studies have created mixed rewards in two ways (i) average of cooperative (group-rewarded) and competitive (individualistic) rewards (Rosenbaum 1980, Ferrin and Dirks 2003), (ii) cooperative-individualistic hybrid (moderate cooperative condition) and zero sum (moderate competitive condition) (Gordon et al. 2000, Wageman and Baker 1997). To create a cooperative reward structure, Serrano and Pons (2007) designed experiments in a university context in which 70% of the grade of each team member was based on the mean of other team members’ scores and 30% was based on their individual score. This refers to the cooperative-individualistic approach discussed above, and is in alignment with the viewpoint that real situations include a mixed reward structure with a dominant climate of cooperativeness or competitiveness (Tjosvold 1998, Beersma et al. 2003, Ghobadi and Daneshgar 2010). Based on this, two types of mixed reward are defined. The first used a dominant cooperative structure (type 1), and the second a dominant competitive structure (type 2). Following from Serrano and Pons (2007), the dominant cooperative structure consisted of a 70% cooperative and 30% competitive reward mix. The dominant competitive structures consisted of a 70% competitive and 30% cooperative reward mix.

Coopetitive Reward Structures and Information Sharing
It is expected that cooperative reward structures will motivate individuals to engage in cooperative behaviors such as sharing information completely and accurately. This is because doing so is the key to joint success and, hence, the acquisition of rewards (Brandenburger and Nalebuff 1996, Beersma et al. 2003). As a result, cooperative reward structures are believed to increase learning by encouraging people to pool their knowledge and produce more fruitful ideas and a better understanding of the nature of their tasks (Goldman et al. 1977). This refers to the exchange of high-quality information among people, fulfilling the needs of group members (Von Hippel 1994, Li and Hsieh 2009). Individuals may also use the shared information as a source of information for inferring their level of trust in the partner to share more effective knowledge (Ferrin and Dirks 2003). In contrast, competitive rewards are expected to motivate individuals to engage in an opposite set of behaviors such as withholding information and sharing information inaccurately because withholding important information maximizes individual's performance at the expense of colleagues (Brandenburger and Nalebuff 1996, Beersma et al. 2003, Johnson and Johnson 1998, Lucker et al. 1976).

According to the above discussion, our first hypothesis asserts that tasks with dominant cooperative reward structures will have better information being shared in comparison to tasks with a dominant competitive reward structure:

Hypothesis 1: The quality of the information being shared is higher under dominant cooperative reward structures than dominant competitive reward structures.

Task Complexity
According to Wood (1986), all tasks contain three essential sub-components consisting of: (i) products, (ii) required acts, and (iii) information cues. The major difference between simple and complex tasks may be the result of the differing number of cues that must be processed and the number and complexity of the required processes (Speier et al. 2003, Wood 1986). Accordingly, simple tasks require processing fewer cues (pieces of data), whereas complex tasks (where the cues are typically interrelated) require significantly more processing of information cues, to be able to find creative methods for accomplishing tasks.

Complex tasks require more creativity and innovation compared to simple tasks, and this can occur by more effective information sharing. Cooperative rewards are suggested as a means of promoting information sharing. Therefore, complex tasks, which are heavily dependent upon information sharing, can benefit from cooperative rewards more than simple tasks. In other words, the positive impacts of cooperative rewards on the quality knowledge sharing should be greater for complex tasks in comparison to simple tasks. Therefore, it is expected that the difference between the quality of the shared information in cooperative and competitive structures is more when the task is complex. This constitutes our second hypothesis asserting that:

Hypothesis 2: The difference in quality of the information being shared under dominant cooperative reward structures and dominant competitive reward structures is greater under complex tasks than simple tasks.
Past History of Working Together

There is an emerging conceptual consensus, which views teams as complex, adaptive, and dynamic systems that perform over time (Johnson et al. 2006, McGrath et al. 2000). This conceptualization has led to new insights on the concept of a group’s past history, and its impact on group processes and outcomes (Harrison et al. 2002, Johnson et al. 2006).

For instance, Structural Adaptation Theory explains how teams react to changes in reward structures: cooperative to competitive and vice versa (Johnson et al. 2006). This theory introduced two concepts of ‘cutthroat cooperation’ and ‘friendly competition’ to explain how teams react to changes in cooperative or competitive rewards. More specifically, Johnson et al. (2006) empirically showed that cooperative reward structures lead to the establishment of positive relationships and norms of behaviour that allow an easier shift to competitive reward structures. Similarly, Tjosvold et al. (2003) showed that colleagues with a history of working together cooperatively may behave quite differently in a competitive environment than would unfamiliar participants. Johnson et al. (2006) proposed the concept of friendly competition shifting from cooperative to competitive reward structures. Accordingly, the cooperative experiences of these teams allowed them to engage in competition with each other thereby increasing their speed but decreasing their accuracy. Similarly, the concept of cutthroat cooperation was explained by Johnson et al. (2006). Johnson et al. argued that the benefits associated with cooperative reward structures will be less forthcoming in groups that have a past history of competition. Accordingly, teams that switch from competitive to cooperative reward structures experience “cutthroat cooperation”. Cutthroat cooperation results in lower information sharing, lower team decision accuracy, and higher speed: outcomes that resemble those from competitive teams more than cooperative teams.

In summary, the concept of group’s past history makes team members react in a way that affects others as well as group performance. As a result, having a history of cooperation encourages teams to have more collaborative communication with each other. Whereas, having previous competitive experience increases the feeling of competition in similar situations. Therefore, this study proposes that the difference discussed in Hypothesis 1 is higher when a group has previously worked under a similar reward structure:

**Hypothesis 3:** The difference in quality of the information being shared under dominant cooperative reward structures and dominant competitive reward structures is greater when the group has a history of working under a similar reward structure.

The above idea has similarities with the extant game theory literature which explains why players make choices that potentially influence other players’ interests. Like the prisoner’s dilemma, information sharing among competitors is a common type of coopetition (Tsai 2002). The intention to share information could be viewed from the perspective of this dilemma (Loebbecke et al. 1999). From this viewpoint, the value of information has two components. One is the basic value of information (r) and the other is value-added (v) that reflects the advantage of receiving information by the receiver while the sender is not aware that is lost by sharing. Therefore, a concept called payoff, which represents the desirability of an outcome, can be measured to demonstrate the value people receive and lose in a game. However, the importance and value of information might impede information sharing between players where people prefer to hoard information and get payoffs. This dilemma is called the employee’s dilemma. In order to facilitate information sharing under strategic games, prior research suggests a different factors: creating long-term commitments, focusing on trust, reciprocity and longevity, incentives and reward structures, and shaping small teams with good relationships (Shih et al. 2006). In this study, team members share their information on the basis of their past experience of information sharing with their peers. For example, if participants found information sharing with other team members helped to achieve effective outcomes, they will continue to share information in future activities. We adopt the concept of ‘information sharing satisfaction’ (Willem and Buelens 2009) to explain the group’s past history and its impact on future information sharing.

**Hypothesis 4:** The quality of Information being shared among group members is affected by their past experience of information sharing and their perception of the effectiveness of information sharing in order to be awarded the determined rewards.

Taken the proposed hypotheses together, Figure 1 illustrates the theoretical model of this study:
FIGURE 1: THEORETICAL MODEL

METHODOLOGY

The research strategy involved a laboratory experiment utilizing a 2*2 factorial design, with students as the participants. Laboratory research experiment with the employment of students was used because this methodology is in alignment with the previous studies in this domain (e.g., (Ferrin and Dirks 2003, Beersma et al. 2009, Gordon et al. 2000)), and it also allows us examine specific observatory relationships in the model and draw conclusions about causality in a controlled environment. The factors were R2 (dominant cooperative reward / dominant competitive rewards) and T2 (complex task / simple task). The dependent variables were ‘high-quality information sharing’ and ‘information sharing satisfaction’. Co-variant factors included age, and gender.

MEASUREMENT

Independent Variables - Experiment Task

The experiment involved solving a design problem in a dyad relationship. The experimental task was intended to be representative of project team work where team members are assigned a functional position and are required to work together to solve a design problem. Joint problem-solving activities are central to many organizational phenomena and theories (e.g., participative leadership, negotiation, decision making). Students engaged in joint problem solving are interdependent because they must share and integrate information. However, they are also exposed to an element of risk that a team member might not reciprocate information and effort to the task. It was guaranteed that students won’t know the identity of their peers, and therefore we could control for the potential past relationships between individuals. During the experiment, communication between peers was through instant message software called SPARK. SPARK provided an exact record of the dyads’ problem solving processes.

To create simple and complex tasks, we referred to differences between simple and complex tasks including the number of cues that must be processed and the number and complexity of the required individual processes (Speier et al. 2003, Wood 1986). Eight tasks were designed representing simple and complex tasks (four for simple and four for complex tasks). The order of the tasks assigned to each dyad was random. Tasks involved resolving errors in Java program codes. The tasks were coordinated by the lecturer in charge (a professor in computer science and has taught this course for several years) of a Java programming course at the university where the experiments were conducted.
Four algorithms in Java (with simple level of complexity) were chosen for the basis of our simple tasks. Each simple algorithm contained five manipulated errors. Four algorithms in Java (with complex level of complexity) were chosen for the basis of our complex tasks. Each complex algorithm contained ten manipulated errors. Dyads were asked to find and resolve errors in the codes and then to post their findings to the researcher through SPARK.

**Independent Variables - Rewards**

The dominant cooperative reward included 70% cooperative and 30% competitive rewards. The dominant competitive reward included 70% competitive and 30% cooperative rewards. Students were given a form, which informed them of the reward system and the incentives that they could earn based on their performance. The reward system was designed in a way that individuals find a sense of simultaneous cooperation and competition (with either dominant cooperative or competitive behaviors), so that this affects their behavior in the task completion. Table 1 shows the example of the reward system they were given for simple/dominant cooperative condition.

<table>
<thead>
<tr>
<th>Group-Based Points</th>
<th>Best Performer Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Based on The Number of Solved Error by Group)</td>
<td>19.5</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>4.55</td>
<td>9.1</td>
</tr>
</tbody>
</table>

Table 1. Example of the Reward System

After each round, the group announced how many errors each individual solved. In the case of conflicts, a third-party (a PhD candidate) checked the archive of their communication, and resolved the situation. The final decision was based on the opinion of the third party.

**Dependant Variables**

Measures related to the construct of ‘Information Sharing Satisfaction’ were adopted from the extant literature (Willem and Buelens 2009). Four questions using a five-point Likert scale ranging from ‘strongly disagree’ to ‘strongly agree’ were selected. ‘High-Quality Knowledge Sharing’ was measured by three ‘knowledge quality’ questions using a five-point Likert scale ranging from ‘strongly disagree’ to ‘strongly agree’ (Li and Hsieh 2009). The items related to each construct were averaged to yield a single score of responses for each individual.

**EXPERIMENT PROCEDURE**

The research methodology involved 32 experiments that were conducted with 32 students who had prior experience in programming Java. Each dyad was assigned to two cells of the experimental design. In other words, each student was involved in two experiments.

Students were told that the experiment is a Java coding task that should take no more than 1.5 hours, and they will be paid up to $50, based on their performance in the task. At the time of registration for the experiments, they were asked about their prior background in Java (we asked them for how long they have coded in Java). Based on their prior programming background, each individual was assigned to ‘simple’ or ‘complex’ tasks. Upon their entrance to the experimental lab, the researcher checked to see which type of task they should be given. Then, each individual was given an ID and a dyad ID. Each individual was assigned, randomly, to either a ‘dominant cooperative’ or ‘dominant competitive’ reward structure. Students did not know their peers, and the ID numbers ensured anonymity. Figure 2 shows the experiment procedure for each individual.

Each experiment had two rounds of activity with a five minute break in between. During the break, participants were kept within the lab and could not talk to others. Each round took 20 minutes, and included one task that should be completed at the end of that round. Before the first round of the first experiment, students were asked a number of demographic questions. They were given guidelines for the experiment including the reward structure and the task itself. After the completion of the first round, students were asked questions about ‘high-quality information sharing’ in the first round. The rewarded points were then estimated. Students were told of the group and individual points (both for themselves and for their peers). After the break, students were asked questions measuring ‘information sharing satisfaction’. After the completion of the second round, students were asked a series of questions that measured ‘high-quality information sharing’ in the second round. Manipulation check questions were asked to ensure that research efforts in creating experiment conditions had been successful. Based on their performance in the two rounds, their total points and rewards were estimated, and they were paid respectively. After
this, there was 5 minutes break. Then, students were given another ID and a dyad ID, and they were assigned to a similar task and different reward structure than the previous experiment. A similar process to the first experiment was followed.

**RESULTS**

**Manipulation Checks**

To avoid non-independence of observations, only data provided by one random member of each dyad was used. Reward experimental manipulation was assessed with a one-item, 5-point Likert scale. One end of the scale, dominant cooperative reward structure, was the statement that: To be rewarded, the assigned task required more cooperative work than competing with the group mate. Another end of the scale, dominant competitive reward structure, was the statement that: To be rewarded, the assigned task required more of outperforming the peer than cooperative work.

Task experimental manipulation was assessed with a one-item, 5-point Likert scale. Task complexity was measured by an item asking respondents to indicate their opinion regarding the complexity of the assigned task.

Wilcoxon Signed Rank Test was carried out to assess the effectiveness of manipulations. Results indicated a strong significant effect for each of the manipulations in predicting the associated manipulation check scales. Respondents in the dominant cooperative reward structure viewed reward system more cooperative than did those in the dominant competitive reward structure (z=-4.58, p<0.01, large effect size: r=0.68). Respondents in the simple tasks reported the assigned task to be simple, and those in the complex task condition reported that the assigned task to be difficult to be accomplished (z=-4.78, p<0.01, large effect size: r=0.49).

**Validities**

Cronbach’s alpha and composite reliability were used to assess reliabilities for all measures. The alpha coefficients and the composite reliability values varied from 0.88 to 0.94, suggesting adequate reliability. Confirmatory factor analysis was carried out. All items had relatively high factor loadings. This indicated the convergence of the high factor indicators to their constructs. The average variance extracted (AVE) for all the constructs exceeded the 0.5 criterion. Subsequently, the construct discriminant validity was examined. First, the square-root of AVE of the individual constructs was compared with the correlation between construct-pairs. The square-roots of AVE exceeded the correlations, and this confirmed the discriminant validity for the measures.

**Hypotheses Testing**

The descriptive statistics are shown in Table 2. A Mann-Whitney U test revealed significant difference in high-quality information sharing of subjects under dominant cooperative (Md= 4.6, n=16) and dominant competitive (Md=3.00, n=16) reward structures (Hypothesis 1; U=11.00, z=-4.45, p<0.01, r=0.7). For the second and third hypotheses, the Linear Model, Univariate analysis was carried out, and the differences were checked to see if they are significant. The result of the analysis showed confirmed H2, which means the difference in the quality of the information being shared under dominant cooperative reward structures and dominant competitive reward structures was greater under complex tasks than simple tasks (F=6.654; Sig=0.016). In addition, the plot of the analysis showed two separate lines. The line related to simple task, showed the difference between high-quality information sharing under cooperative and competitive rewards. The line related to complex
task, showed the difference between high-quality information sharing under cooperative and competitive rewards. Comparing the two lines, the second difference was proved to be larger.

<table>
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<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Kurtosis</th>
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<td>Statistic</td>
<td></td>
<td>Statistic</td>
<td>Std. Error</td>
<td>Statistic</td>
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<tr>
<td>Task</td>
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<td>1.50</td>
<td>.090</td>
<td>.508</td>
</tr>
<tr>
<td>Reward</td>
<td>32</td>
<td>1.50</td>
<td>.090</td>
<td>.508</td>
</tr>
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<td>.1337</td>
<td>.756</td>
</tr>
<tr>
<td>InformationSharingSatisfaction</td>
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<td>4.008</td>
<td>.1869</td>
<td>1.057</td>
</tr>
<tr>
<td>InformationSharingQuality2</td>
<td>32</td>
<td>4.273</td>
<td>.231</td>
<td>1.311</td>
</tr>
<tr>
<td>Valid N (listwise)</td>
<td>32</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2. Descriptive Statistics

For H3, Analyses were conducted using transformed normal variables. A two-way between-groups analysis of variance was conducted to explore the impact of task complexity of the difference between information sharing quality in dominant cooperative and competitive reward structures. The interaction effect between task complexity and reward structure was significant (p=0.014). The profile plot showed two lines for first and second round of experiments. The line related to the first round, showed the difference between high-quality information sharing in the first round under cooperative and competitive reward. The line related to the second round, showed the difference between high-quality information sharing in the second round under cooperative and competitive rewards. Comparing the two lines, the second difference appeared to be larger.

For H4, analyses were conducted using transformed normal variables. A one-way repeated measures ANOVA was conducted to compare ‘information sharing quality’ difference between two reward structures at first and second round of experiments. There was a significant difference between them. The result of analysis confirmed H4 (F=87.66, p<0.01). The profile plot showed two lines for first and second round of experiments. The line related to the first round showed the difference between high-quality information sharing in the first round under cooperative and competitive reward. The line related to the second round showed the difference between high-quality information sharing in the second round under cooperative and competitive rewards. Also comparing the two lines, the second difference appeared to be larger.

DISCUSSION AND CONCLUDING POINTS

This study is step toward a better understanding on the concept of coopetitive reward structures in groups and their consequences. We postulated and examined a theoretical model that explains how coopetitive reward structures are different in determining high-quality information sharing.

This study is among the first attempts in investigating the consequences of coopetitive reward structures, particularly in terms of effective information sharing behaviors. The model showed that (i) rewards influence high-quality information sharing directly and over time through information sharing satisfaction, and that (ii) the impact of two types of coopetitive rewards on information sharing is dependent upon task complexity and history of working under similar reward structures. As discussed in the outset, reward structures are flexible organizational means, and they represent a potentially useful tool for managers who wish to change the employees’ behaviors. While the ability of rewards in this area is well-recognized, many practitioners as well as researchers do not fully appreciate that reward structures are not purely cooperative and competitive, and it is also important to understand how to design the ideal reward structure based on the task complexity and the history of the group (information sharing satisfaction and history of group rewards).

The model of this study is useful in this context, because the model shows the powerful influence that task complexity and group history may have on behavior. Studies such as this can inform research by improving our understanding of how coopetitive reward structures can generate information sharing behaviors towards enhancing group performance and effectiveness.

Opportunities for future research remain based on this study. As the data was collected from the population of students, it might not be ideal to allow us to draw conclusive evidence of causality, despite strong theoretical arguments. Empirical studies in practical groups are likely to provide stronger causal understanding of the proposed model. The constructs were measured through self-reports and hence may be subjected to bias. Self-reporting is a suitable approach since respondents are able to make judgments based on their unique perspectives concerning the behaviors. Nonetheless, validity can be improved by collecting more objective data, such as through observation of conversations.
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