

Reciprocity of Knowledge Flows in Internal Network Forms of Organizing

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| ABSTRACT AND KEYWORDS | |
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| Abstract | <p>Fundamental changes in the competitive landscape triggered many firms to leverage and build competencies by focusing on transition processes towards internal network forms of organizing. These forms ameliorate exploration through knowledge creation and transfer. Internal networks are characterized by horizontal knowledge flows that supplement and supplant the vertical knowledge flows that characterize other organization forms like the functional and multi-divisional forms. As these horizontal knowledge flows facilitate knowledge integration, internal networks have an advantage over other organization forms in leveraging and building competencies. One characteristic that makes these horizontal knowledge flows work is the reciprocity ensuing them. Reciprocity relates to the interdependence and coordination modes that characterize internal networks. As reciprocity is influenced by managerial coordination, by the intention to deploy knowledge, and by goal attainment, creating and maintaining reciprocity of knowledge flows can be considered as a managerial competence.</p> <p>In this paper, the attributes of organization form that impact the reciprocity in a firm are explored from structural, managerial and knowledge perspectives. Hypotheses are developed which suggest that specialization and the use of formal meetings restrict reciprocity, whereas job rotation, the number of employees with a coordination function, and teams have a positive effect on the level of reciprocity. These hypotheses are tested by means of a questionnaire administered in a business unit of a multinational financial services firm. Reciprocity of knowledge flows was found to be dependent on the characteristics mentioned above in a predicted way. Since none of the hypotheses needed to be rejected, the evidence suggests that reciprocity is a fundamental feature of internal networks and the horizontal knowledge flows that characterize them. This suggests reciprocity to be an important managerial competence.</p> |
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**RECIPROCIETY OF KNOWLEDGE FLOWS IN INTERNAL
NETWORK FORMS OF ORGANIZING**

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KNOWLEDGE RECIPROCITY AS A MANAGERIAL COMPETENCE: THE DETERMINANTS OF RECIPROCITY OF KNOWLEDGE FLOWS IN INTERNAL NETWORK FORMS OF ORGANIZING

ABSTRACT

Fundamental changes in the competitive landscape triggered many firms to leverage and build competencies by focusing on transition processes towards internal network forms of organizing. These forms ameliorate exploration through knowledge creation and transfer. Internal networks are characterized by horizontal knowledge flows that supplement and supplant the vertical knowledge flows that characterize other organization forms like the functional and multi-divisional forms. As these horizontal knowledge flows facilitate knowledge integration, internal networks have an advantage over other organization forms in leveraging and building competencies. One characteristic that makes these horizontal knowledge flows work is the reciprocity ensuing them. Reciprocity relates to the interdependence and coordination modes that characterize internal networks. As reciprocity is influenced by managerial coordination, by the intention to deploy knowledge, and by goal attainment, creating and maintaining reciprocity of knowledge flows can be considered as a managerial competence.

In this paper, the attributes of organization form that impact the reciprocity in a firm are explored from structural, managerial and knowledge perspectives. Hypotheses are developed which suggest that specialization and the use of formal meetings restrict reciprocity, whereas job rotation, the number of employees with a coordination function, and teams have a positive effect on the level of reciprocity. These hypotheses are tested by means of a questionnaire administered in a business unit of a multinational financial services firm. Reciprocity of knowledge flows was found to be dependent on the characteristics mentioned above in a predicted way. Since none of the hypotheses needed to be rejected, the evidence suggests that reciprocity is a fundamental feature of internal networks and the horizontal knowledge flows that characterize them. This suggests reciprocity to be an important managerial competence.

KEYWORDS

Competence leveraging and building; Internal networks; Organizational attributes; Reciprocity of knowledge flows; Knowledge integration.

INTRODUCTION

In the past decade, the competitive landscape has changed drastically. Corporate and business environments have been changing progressively and competitive interactions have intensified. To enable flexible adaptations firms have focused on exploration and innovation rather than exclusively on exploitation (Volberda, 1996; 1998). Knowledge as a competitive resource received considerable attention (Boisot, 1998; Grant, 1996; Nonaka and Takeuchi, 1995). Firms increasingly focused on the ability to create and integrate new knowledge as a crucial competence of firms as well (Sanchez, Heene and Thomas, 1996).

Strategies aimed at increased knowledge creation have led many knowledge-intensive firms to initiate transition processes towards internal network forms of organizing (Van Wijk, 2003). While organization forms such as the functional and multidivisional organization have been found to be less appropriate for the creation of knowledge (Hedlund, 1994), internal network forms of organizing provide an important context that enables knowledge creation (Pettigrew et al., 2003). Since ‘knowledge is fundamental to organizational competence’ (Sanchez and Heene, 1997: 5), internal networks may therefore be considered competencies themselves (Van Wijk and Van den Bosch, 2000). Organizational knowledge creation involves knowledge transfer among employees and organizational units (Grant, 1996; Nonaka, 1994).

A key attribute that characterizes internal network forms of organizing is the configuration of knowledge flows that emphasizes horizontal knowledge flows guiding knowledge transfer rather than vertical ones (Hedlund, 1994; Van Wijk and Van den Bosch, 1998). Employees, knowledge workers, and organizational units in internal network forms of organizing communicate and interact directly without

adhering to the chain of command. These horizontal knowledge flows are therefore multidirectional instead of unidirectional as vertical knowledge flows normally are. Moreover, reciprocity facilitates connecting existing stocks of knowledge, that is leveraging, and by doing so creating new knowledge, that is building. This suggests that reciprocity underlies the knowledge flows between employees and between organizational units. Furthermore, reciprocity is likely to be crucial to the proper functioning of internal networks, and to the leveraging and building of competencies (Sanchez, Heene and Thomas, 1996).

Except for a study of joint ventures by Kogut (1989), who found that knowledge creation and transfer could be attributed to the presence of reciprocity, *reciprocity from a knowledge perspective* has been a sparsely developed construct. Reciprocity has been mainly the focus of game theorists in studies of prisoner's dilemma and dictator games (e.g., Axelrod, 1984); of management theorists in negotiation studies (e.g., Brett, Shapiro and Lytle, 1998) and studies of international cooperation and contracting (e.g., Kashlak, Chandran and Di Benedetto, 1998); and of economic theorists in studies of transaction costs, economic anthropology and principal-agent relationships (e.g., Guth, et al., 1998). Within the management field, also a considerable amount of studies have examined interdependence and coordination (e.g., Thompson, 1967; Van de Ven, Delbecq and Koenig, 1976), which are constructs that closely relate to reciprocity.

The *purpose of this paper* is to examine the role of reciprocity in knowledge creation and transfer both theoretically and empirically. Organizational attributes are discerned from structural, managerial and knowledge perspectives, and their effects on reciprocity are subsequently investigated. That is, based on the contributions of Thompson (1967) and Van de Ven, Delbecq and Koenig (1976) it is argued that

specialization, job rotation, number of employees with coordinating functions, teams and formal meetings can be considered as organizational attributes that influence reciprocity. On the basis of a questionnaire administered in a business unit of a multinational financial services firm, the impact of these attributes are investigated empirically in the context of an internal network form of organizing.

The *agenda of this paper* is as follows. In the second section, the role of reciprocity in knowledge creation and transfer, and consequently in internal network forms of organizing is examined. The third section theorizes on the effects of the organizational attributes specialization, job rotation, the number of employees with coordinating roles, teams and formal meetings on reciprocity. Then, in the fourth section, the research design of the study reported in this paper is elaborated on. The fifth section reports the results of the current study. Finally, in the sixth section, the findings are discussed, and conclusions are drawn.

KNOWLEDGE, INTERNAL NETWORKS AND RECIPROCITY

Internal networks can be distinguished from other organization forms by their configuration of knowledge flows that underlies the knowledge creation and transfer process in a firm. In internal network forms of organizing, the vertical knowledge flows that characterize more orthodox organization forms such as the functional and multidivisional form have been supplanted and supplemented by horizontal knowledge flows (Hedlund, 1994). As such, Van Wijk and Van den Bosch (2000) claim that internal networks are competencies themselves.

Besides a different knowledge flow configuration, the directionality of knowledge flows is also distinguishing internal networks from other organization forms. For example, in organization forms like the functional form knowledge flows

are primarily vertical, either bottom-up in the shape of proposals to top management, or top-down in the shape of decisions to be executed by front-line management (see, e.g., Nonaka, 1988; 1994). In contrast, in internal networks, these unidirectional vertical knowledge flows have been supplanted or supplemented by multidirectional horizontal knowledge flows (Hedlund, 1994; Nohria and Ghoshal, 1997; Van Wijk and Van den Bosch, 1998). Such a configuration of knowledge flows enables sharing knowledge and circumventing the hierarchical chain of command. The result of this shift is that swifter responses to competitive dynamics are possible (Hedlund, 1994). As Nohria and Ghoshal (1997: 208) stress, the key advantage of an internal network ‘arises from its ability to create new value through the accumulation, transfer, and integration of different kinds of knowledge ... across its dispersed organizational units’ (p. 208).

Crucial to proper functioning of horizontal knowledge flows is that some degree of reciprocity between the interacting actors is present. In terms of knowledge flows this means that the amount of knowledge flowing into an actor roughly equals the amount of knowledge flowing out of that actor (cf. Gupta and Govindarajan, 1991). In the context of this paper, these actors are *organizational units*, but by the same token, these actors can be employees, teams, entire organizations (Boisot, 1998), or strategic alliances (Kogut, 1989). In the absence of reciprocity, some actors receive more knowledge than they transmit, which may be detrimental to the knowledge creation processes pursued by a firm. For example, on the basis of a ‘knowledge is power’ argument, the presence of *asymmetrical knowledge flows* might result in units gaining more *power*. In turn, this fosters units’ awareness of the potential benefits that may accrue from pursuing any political strategies in a firm (cf. Pfeffer, 1992), while a balanced power structure is one of the characteristics that makes internal networks

efficacious in knowledge creation (Handy, 1992). Reciprocal interaction may therefore prevent an unbalanced power structure from developing.

A characteristic that underlies reciprocity is *interdependence*. Thompson (1967) discerns three types of interdependence: pooled, sequential and reciprocal interdependence. One can speak of pooled interdependence when actors perform separate tasks, but are only dependent to the extent that all tasks are to be completed, not to jeopardize the firm from achieving its goals. Sequential interdependence denotes an activity where the output of actor A is the input for actor B. An activity that is reciprocally interdependent is one where the output of actor A is the input of actor B, whose output is the input of actor A again. Van de Ven, Delbecq and Koenig (1976) have expanded on Thompson's classification by incorporating team interdependence as a fourth type of interdependence. Team interdependence is manifested in a situation where activities come into the unit and the employees diagnose, problem-solve and collaborate as a group at the same time to deal with the activities (Van den Ven, Delbecq and Koenig, 1976). It goes without saying that reciprocity in knowledge flows most closely relates to reciprocal and team interdependence, and not to either pooled or sequential interdependence. Also, given that pooled and sequential interdependence constitute more impersonal coordination modes, while reciprocal and team interdependence constitute more personal and group coordination modes (Van de Ven, Delbecq and Koenig, 1976), reciprocity is more important to the creation and transfer of tacit knowledge than explicit knowledge. This is illustrated by, for example, Grant (1996) and Nonaka and Takeuchi (1995) who argue that tacit knowledge can be transferred by involving employees in activities, on the basis of which these employees can observe and repeat the crafts that are involved in these activities.

That internal network forms are important organization forms for knowledge creation and transfer is also reflected in their structure, which is characterized by a high degree of interdependence. As Baker (1992: 424-425) points out, internal networks are ‘*integrated* across formal groups created by vertical, horizontal, and spatial differentiation for any type of relation’. Strong interpersonal networks and high levels of interunit communication exist, which result in higher levels of social capital (Nohria and Ghoshal, 1997). Furthermore, owing to increased decentralization, in internal networks the role of top management has diminished to the extent that middle managers are responsible for creating and maintaining the linkages across organizational units (Bartlett and Ghoshal, 1993; Ghoshal and Bartlett, 1997; Van den Bosch and Van Wijk, 2000). These linkages are largely effectuated through teams in which new experiments and explorations are performed by ‘varying constellations of actors’ (Hedlund, 1994: 83). These characteristics, which manifest themselves from structural, managerial and knowledge viewpoints, underscore the importance of reciprocity in order to leverage and build competencies.

DETERMINANTS OF RECIPROCITY IN INTERNAL NETWORKS

Although internal networks seem to require and benefit from reciprocity, the question remains as to which organizational attributes influence the level of reciprocity. In their influential paper, Van de Ven, Delbecq and Koenig (1976) tested the effects of task uncertainty, task interdependence, and unit size on three different coordination modes used in firms: impersonal mode, personal mode and coordination mode. Their findings confirmed the additive effect of the different types of interdependence that was hypothesized by Thompson (1967): at the aggregate level all types of coordination modes are increasingly used when moving from pooled to team

interdependence. However, use of rules, plans and vertical channels was less for team interdependence than for pooled interdependence, while horizontal channels and meetings were used more frequently in the former. Moreover, they found that as ‘tasks increase in uncertainty, mutual work adjustments through horizontal communication channels and group meetings are used in lieu of coordination through hierarchy and impersonal programming’ (Van de Ven, Delbecq and Koenig, 1976: 332). Finally, they found that coordination modes get impersonalized as the organizational unit increases.

Stimulated by the above discussed literature and taking into account three conditions that have to be met by a competence—coordination, intention and goal attainment (Sanchez, Heene and Thomas, 1996)—, in this paper the effects of *five organizational attributes* on the level of reciprocity are examined: (1) specialization, (2) job rotation, (3) number of employees with coordination roles, (4) teams, and (5) the use of formal meetings. In terms of Van de Ven et al. (1976), specialization and job rotation are impersonal coordination modes, the number of employees with coordination roles constitutes a personal coordination mode, while the use of teams and formal meetings are group coordination modes. The first refers to programmed coordination, whereas the last four refer to coordination by feedback.

Specialization

With its close relationship to departmentalization and differentiation (Scott, 1996), specialization is an important coordination mechanism, which not only has implications for the interdependence among the units of a firm but for the reciprocity in a firm. When specialization in a unit is high, interdependence among units tends to be pooled or sequential, whereas in cases where specialization in a unit is low,

interdependence among units tends to be reciprocal or team-based (cf. Thompson, 1967; Van de Ven et al. 1976). Note that specialization at one level impacts interdependence at a higher level. For example, interdependence *within* a specialized unit may still be reciprocal or team-based, because employees are better able to collaborate since they share common activities.

This argument can be explained from a knowledge-based perspective. It goes without saying that when specialization in a unit is high, employees in that unit perform similar activities. Conversely, when specialization in a unit is low, employees perform different activities. Consequently, the knowledge employees deploy is specialized or deep in the former case, whereas it is generalized or broad in the latter. Leonard-Barton (1995) refers to a person positioned in the middle as having T-shaped knowledge, where the stem constitutes the depth of knowledge and the bar the breadth of knowledge.

In case an actor transfers or shares knowledge, it must have absorptive capacity, which is the ability to evaluate, absorb, and utilize new knowledge (Cohen and Levinthal, 1990; Van den Bosch, Van Wijk and Volberda, 2003). Since absorptive capacity is largely a function of the level of prior related knowledge, the degree of specialization has an impact on knowledge transfer, and the reciprocity surrounding knowledge transfers. Cohen and Levinthal (1990) argue that specialization influences absorptive capacity to the extent that deep knowledge fosters knowledge absorption in a certain knowledge or activity domain, while broad knowledge fosters knowledge absorption in a variety of domains. It follows then that when units' knowledge is broad---that is their absorptive capacity is broad in scope---more opportunities to transfer knowledge are present, and thus reciprocity is more

likely to develop than when units' knowledge is deep. This leads to the following hypothesis:

Hypothesis 1: As the degree of specialization increases, reciprocity will decrease.

Job rotation

Another determinant that influences the reciprocity of knowledge flows in a firm is job-rotation. Job rotation involves policies and procedures regarding the movement of employees from job to job. Employees perform a greater variety of tasks allowing them to increase their experience and knowledge of those tasks. At the same time, employees can transfer knowledge they have learned on previous jobs and occasions on to their colleagues. Job rotation as a control and coordination mechanism (cf. Edström and Galbraith, 1977) facilitates reciprocity. From another point of view, job rotation increases employees' breadth of knowledge, and with that increases the scope at which new knowledge may be absorbed (Van den Bosch, Volberda and De Boer, 1999). In that vein, the overlap of the knowledge domains of various employees and the units they are working for enhances. This overlap facilitates the transfer of knowledge in and out of the unit. In other words, job rotation facilitates reciprocity of knowledge flows to develop. Summarizing,

Hypothesis 2: As the degree of job rotation increases, reciprocity will increase.

Coordinating employees

The roles and activities managers perform to coordinate is another organizational attribute that enables knowledge transfer across organizational units.

Especially in internal network-based forms this coordination mechanism is important. In their case study at Asea Brown Boveri, Bartlett and Ghoshal (1993) found that in internal network-based forms the roles and activities performed by managers at various organizational levels has changed fundamentally when compared to managerial roles in other organization forms. As a result of higher degrees of decentralization in internal network-based forms, managerial discretion has moved to lower level managers. In internal network-based forms, the roles of ‘entrepreneurial initiative’, and of leveraging this initiative ‘by linking dispersed resources and expertise and transferring best practices across units’ (Ghoshal and Bartlett, 1997: 216) are with front-line and middle management respectively, not with top management, as they are in, for example, a multidivisional corporation (see also, Hedlund, 1994).

Based on Bartlett and Ghoshal’s (1993) findings, it can be argued that the number of employees that have discretion to coordinate activities within and across units increase knowledge transfer and reciprocity. Managerial roles aimed at coordinating and linking knowledge exist by the virtue of facilitating knowledge transfer. Since these coordination roles and activities pertain more to reciprocal and team interdependence than to pooled and sequential interdependence, reciprocity is increased as well. This suggests the following hypothesis:

Hypothesis 3: As the number of employees with discretion to coordinate increases at the same organizational level, reciprocity will increase

Teams

Another coordination mechanism that has been implemented in internal networks in particular is the use of teams (Hedlund, 1994; Nonaka and Takeuchi, 1995). In teams various people from various organizational units and functions are grouped together to perform activities aimed at a specific goal. Teams enable the integration, combination and socialization of knowledge and expertise (Grant, 1996; Nonaka and Takeuchi, 1995), so as to explore new opportunities. Van de Ven, Delbecq and Koenig (1976) refer to teams as a personal or group coordination mechanisms based on mutual adjustment. This mutual adjustment indicates that in teams employees give and take, and with that operate on a reciprocal basis. Teams are implemented so as to enable employees from one unit to make their knowledge available to other employees from other units, to learn new things and gain knowledge from others, and to integrate that knowledge collectively to achieve the goal of the team. This leads to the following hypothesis:

Hypothesis 4: As the degree to which teams are used increases, reciprocity will increase.

Formal meetings

A final mechanism through which activities in a firm are coordinated that is of interest here is the use of formal meetings. Formal meetings bring together various managers and employees to discuss the operations of a firm. In contrast to informal meetings, which emerge as a result of personal relationships between and social capital of employees, formal meetings exist as a consequence of rules and procedures that guide behavior in a firm (cf. Grant, 1996; Scott, 1996). Although formal meetings

are an example of coordination by feedback, a group coordination mode in particular (Van de Ven et al. 1976), from a knowledge perspective they tend to relate to the transfer of explicit knowledge (Sanchez, 1997). Informal meetings and gatherings, on the other hand, relate to the transfer of tacit knowledge. In contrast to tacit knowledge, which is best transferred in internal network-based forms (Hedlund, 1994), explicit knowledge is best coordinated in hierarchical forms (cf. Burns and Stalker, 1961). This is reflected in that formal meetings are more unidirectional, top-down means of coordinating and integrating knowledge. This is also stressed by Van de Ven et al. (1976), who argue that scheduled group meetings are in place ‘to plan and coordinate the work within the unit’ (p. 327). Due to this character, formal meeting relate more to pooled and sequential interdependence than to reciprocal and team interdependence. This suggests the following hypothesis:

Hypothesis 5: As the degree to which formal meetings are used increases, reciprocity will decrease.

All hypotheses are illustrated in Figure 1, which will guide the empirical investigation in the sections to follow.

insert Figure 1 about here

METHOD

To test the hypotheses developed above, a questionnaire was administered in a business unit of Rabobank, a Dutch multinational financial services firm. The bank is the only commercial bank in the Netherlands accredited the top AAA-rating for credit

reliability. Rabobank ranks among the top 30 on the Fortune Global 500 in terms of total revenue in the banking industry. In 1992, the business unit Spectrum was created as an internal network to create new knowledge to be used throughout Rabobank, in particular to explore new and emerging opportunities (Van Wijk and Van den Bosch, 2000; Van Wijk, 2003).

Data Collection and Sample

In order to gear the items in the questionnaire to the specific context of Spectrum as an internal network organization, a qualitative inquiry was conducted. First, 15 extensive semi-structured interviews lasting 1 to 2½ hours were held in 1998 with members of Spectrum's management team, coordinating managers, and other employees. Alongside, internal documents were studied to provide a qualitative account of Spectrum's development and evolution over the period 1992-1998 (see also Van Wijk and Van den Bosch, 1999 and Van Wijk, 2003). Using the insights created, a questionnaire (see Van Wijk, 2003) was developed. After initial testing, the questionnaire was sent to all 260 employees of Spectrum. To increase the response rate the survey was issued twice with a three-week interval followed by a round of telephone reminders. On each occasion it was communicated to the respondents that the questionnaire would be treated confidentially. In the beginning of 1999, a total of 100 usable responses was obtained, reflecting an effective response rate of 38.5 percent.

Variables and Measures

To construct the indicators 15 items of the questionnaire were used. All questions needed to be ticked on a 5-point scale ranging from "a small extent" to "a

large extent". One question to substantiate the coordinating employees construct consisted of a simple count of perceived managers in the unit employees worked for. The 15 items were used to develop 9 indicators. Four indicators were modeled as reciprocity variables and thus constituted the dependent variables of the current study: K_IK_T , $K_{HI}K_{HT}$, *DEPEND* and *INDEPEND*. K_IK_T relates the perceived intensity of knowledge inflow to the perceived intensity of total knowledge flows between units. The $K_{HI}K_{HT}$ indicator was also included in the analysis as a reciprocity measure. The $K_{HI}K_{HT}$ measure differed from K_IK_T measure in that it only covered horizontal knowledge transfer between units.

DEPEND was specified as the third reciprocity measure. It was entered into the analysis as a control variable to the first two reciprocity measures. Whereas K_IK_T and $K_{HI}K_{HT}$ dealt with reciprocity in knowledge flows, *DEPEND* measured reciprocity more generally. Following Van de Ven et al. (1976), the measure describes to which degree employees perceive the activities performed in their units to be an example of team interdependence. This kind of interdependence specifies a situation in which employees collaborate as a group at the same time to execute a unit's work and activities, and is closely associated with reciprocity. In summary, each of the first three variables, K_IK_T , $K_{HI}K_{HT}$, and *DEPEND* were specified as reciprocity measures.

The fourth variable (*INDEPEND*) was modeled as the opposite of a reciprocity measure. This measure described the degree to which employees perceived the activities of their units as lacking reciprocity, i.e. people perceive unit activities to be an example of pooled interdependence. This kind of interdependence describes actors performing separate tasks, which are only dependent on each other to the extent that all tasks are to be completed (Van de Ven et al., 1976). Explaining *INDEPEND*, the corresponding model was specified as an additional model that controlled the other

reciprocity models in order to seek for additional empirical evidence to the hypotheses developed. Using this dependent variable we expected the model estimates to be opposite to the effects predicted by the hypothesis.

The remaining five indicators constitute the explanatory variables: *SPECIAL*, *JOB*, *MGT*, *TEAM* and *MEET*. *SPECIAL* was included in the analysis to describe the extent to which employees are specialized in tasks and activities in a unit. The degree to which job rotation was used as a coordination mechanism was captured by the *JOB* variable. The *MGT* variable describes the presence of coordinating employees. Due to the fact that Spectrum consisted of multiple units having different numbers of employees the *MGT* variable had to be corrected for differences in unit size. This resulted in the construction of an ordinal 3-point scale variable, which was transformed into 3 separate dummy variables. To prevent visible multicollinearity one dummy variable was omitted from the analysis. The *TEAM* and *MEET* variables describe the extent to which use is being made of cross-functional teams and planned meetings in a unit respectively. The descriptions of the 9 variables used in this study are reported in Table 1.

insert Table 1 about here

Reciprocity Models

To analyze the variability in the coefficient estimations for different reciprocity measures we specified three different models including the same explanatory variables but with different dependent variables. The population regression-model is specified as:

$$Y_{ij} = \alpha + \beta_1 \text{SPECIAL}_i + \beta_2 \text{JOB}_i + \beta_{3.1} d\text{MGT2}_i + \beta_{3.2} d\text{MGT3}_i + \beta_4 \text{TEAM}_i + \beta_5 \text{MEET}_i + \varepsilon_i$$

The subscript *j* under the dependent variable *Y* represents the three alternate reciprocity measures. In total four reciprocity models were estimated. The first two models with $K_I K_T$ and $K_{HI} K_{HT}$ as the dependent variables explained reciprocity in knowledge flows. The third model with *DEPEND* as the dependent variable explained the presence of reciprocity in general, and was denoted *control model (A)*. Finally, the fourth model with *INDEPEND* as the dependent variable was specified as control model (B), and measures the absence of reciprocity. Clearly, *control model (B)* was expected to portray results opposite to the first three models.

QUESTIONNAIRE RESULTS

Figure 2 illustrates the variety in individual perceptions concerning the relation between knowledge absorption and diffusion¹. Figure 2a illustrates the proportion of total knowledge inflows to total knowledge flows, whereas Figure 2b illustrates the proportion of horizontal knowledge inflows to total horizontal knowledge flows only. Although on average respondents perceived that they diffuse as much knowledge as they absorb, there is variation in this individual perception. Furthermore, close similarity of the relation between knowledge absorption and knowledge diffusion regarding horizontal knowledge flows and total knowledge flows is present.

 insert Figure 2 about here

Trying to explain the two above-presented variables, Table 3 shows, among other things, the estimated models 1 and 2. Both models explain the variation in the perceived relation between knowledge absorption and diffusion by the attributes of organization form outlined above. The descriptive statistics on which the estimation was based are given in Table 2. As explicated in the previous section we opted for estimating different models with different reciprocity measures. Table 3 presents the three estimated models that followed from the hypotheses developed.

insert Table 2 and 3 about here

The results of model 1 in Table 3 suggest that 22 percent of the variation in the reciprocity measure can be explained by the explanatory variables. The *SPECIAL* measure is negatively related to the dependent variable at a 5 percent significance level, and therefore supported hypothesis 1. Hypothesis 2 had somewhat weaker statistical evidence at a 10 percent significance level. Also, the *MGT* measures showed the hypothesized relation to the reciprocity measure. Both measures show that a moderate presence of coordinating employees significantly increases the reciprocity measure compared to the presence of just a few coordinating employees at a 10 percent significance level. The presence of many coordinating employees, being significant at a 1 percent level, had even a stronger positive relation, providing support for hypothesis 3. The *TEAM* and *MEET* measures were found not to be significant. Therefore the model lacked support for both hypothesis 4 and 5.

The second model differs from the first in that its reciprocity measure was restricted to horizontal knowledge flows. This model exhibits a slight increase in the

overall explanatory power of the model relative to the former one, in that 27 percent of the variation was explained. Empirical evidence was found for the same hypotheses the first model supported, except for some differences in significance levels. Stronger evidence was found for both the positive relation of job-rotation and the presence of coordinating employees on reciprocity. In comparison to model 1, the effect of specialization was diminished to a 10 percent significance level, but still provided evidence for hypothesis 1.

The third model was specified as control model (A), which controlled the first two models. Whereas the first two models explained reciprocity of knowledge flows, this model was constructed to explain reciprocity in general---that is to say, reciprocal interdependence in, for instance, activities or outcomes. The overall explanatory power amounted to 35 percent of the variation in the reciprocity measure. Support for hypotheses 1 and 2 was absent since none of corresponding coefficients was found to be statistically significant. The estimates regarding hypotheses 3, 4 and 5, on the other hand, confirmed our expectations. The two dummy variables estimating the effect of the presence of moderate and many managers were significant at a 1 percent and a 0.1 percent respectively. The *TEAM* variable related positively to the reciprocity measure at a 0.1 percent significance level providing empirical evidence for hypothesis 4. The statistically significant negative coefficient of *MEET* at a 1 percent significance level supported hypothesis 5.

insert Table 4 about here

Control model (B) presented in Table 4 was specified as a second control model, and explained a dependent variable *INDEPENT*, essentially measuring the

absence of reciprocity. Therefore opposite effects of the explanatory variables were expected. *SPEC* and *JOB* still showed the initially assumed impact on reciprocity, although only the former was significant at a 10 percent level, while the effect was insignificant for the latter. The effect of the presence of a moderate number of coordinating employees as compared to the presence of just a few coordinating employees appeared insignificant, whereas the effect of many coordinating employees as compared to the influence of just a few coordinating employees was negatively significantly at a 10 percent significance level. The estimated effect of *TEAM* matched our expectations by regressing negatively on the dependent variable at a 5 percent significance level. *MEET* related only weekly to the dependent variable.

insert Table 5 about here

Table 5 summarizes the statistical evidence across the different reciprocity models. Both *SPEC* and *JOB* significantly related to the $K_I K_T$ and $K_{HI} K_{HT}$ measures, providing support for hypothesis 1 which decreed the restraining effect of specialization on reciprocity, and hypothesis 2 which hypothesized the stimulating effect of job-rotation on reciprocity of knowledge flows. Due to the contra-intuitive significant effect to hypothesis 1 in control model (B), the results of the first and second model needed to be interpreted with necessary caution. Albeit varying in degree, hypothesis 3 was supported in all models. The presence of coordinating employees appeared to be of significant importance to reciprocity in knowledge flows as well as to reciprocity in general. Contrary to the first and second model, the third model confirms hypotheses 4 and 5, which stated that the use cross-functional teams

positively influences reciprocity of knowledge flows and that formal meetings negatively impact reciprocity of knowledge flows.

DISCUSSION AND CONCLUSIONS

This paper provides evidence about the importance of knowledge reciprocity to competence leveraging and building in a unit operating as an internal network. Most of the hypotheses postulated were confirmed by the empirical analysis. Support was found for Hypothesis 1, which stated that specialization negatively affects the reciprocity ensuing knowledge flows. This evidence confirms theoretical arguments made by, for example, Cohen and Levinthal (1990) and Leonard-Barton (1995), who argue that increases in specialization decreases the ability to absorb new knowledge. Because this capacity is diminished, the knowledge flows that ensue knowledge transfer are more likely to be unidirectional rather than multidirectional or reciprocal.

Job rotation was found to have a positive effect on reciprocity of knowledge flows. This led to the adoption of Hypothesis 2. Rotating employees across various functions and organizational units through which they gain experience appeared to increase the reciprocity of knowledge transfer. This effect upheld for horizontal knowledge transfers in particular, which can be explained by the fact that job rotation is foremost a horizontal coordination technique. This expands Edström and Galbraith's (1977) finding that transferring managers across organizational units is an important coordination and control strategy to socialize managers and enhance managers' verbal social communication networks. Since communication is increased, this enables multidirectional knowledge flows as well, tacit knowledge flows in particular. The control model, however, did not reveal any significant effect. Apparently, job rotation does not increase or decrease interdependence in general.

This finding is also as hypothesized since job rotation is primarily a coordination technique to increase the experience and knowledge of employees and managers in a variety of different tasks.

The number of employees with coordination roles and tasks was found to have a positive effect on both reciprocity of knowledge flows and reciprocity in general, confirming Hypothesis 3. Increases in the number of employees not only enhance reciprocity ensuing knowledge transfers, but reciprocity in general. This suggests that the managerial function in internal networks is of fundamental importance to proper functioning of an internal network, confirming the findings of, for example, Bartlett and Ghoshal (1993), Ghoshal and Bartlett (1997), Nonaka (1988, 1994), and Van den Bosch and Van Wijk (2001), who state that middle managers are the true knowledge engineers.

Contrary to the third model, in the first and second model the use of teams and of formal meetings did not confirm our hypotheses. The question whether this finding is due to the particular context of an internal network is addressed below. For the use of teams, no significant effect was found on the reciprocity of knowledge flows, while a positive effect was found on reciprocity in general. This contradicts earlier theoretical arguments (e.g., Nonaka and Takeuchi, 1995) that teams increase knowledge transfer across employees and organizational units. While knowledge flows between team members may still sustain in a team, they apparently do not increase reciprocity. On the other hand, the use of teams does increase reciprocity in general, suggesting that, for example, the activities within and outcomes of teams are reciprocally interdependent. For the use of formal meetings, no significant evidence was found other than a negative effect on reciprocal interdependence in general as indicated by the control model.

Although the findings reported in this paper provide overall support for the importance of knowledge in internal networks, several limitations have to be addressed in *future research*. First, the current study was conducted in a single business unit of a multinational financial services firm located in the Netherlands. Future research should focus on *other levels of analysis and contexts* like entire firms that are located in different industries and different countries. The effects of the independent variables used in this study on reciprocity may differ across industries and countries as a result of industry-specific effects and cultural effects. This could be of importance to understanding knowledge flows and their reciprocity in multinational firms as well (cf. Bartlett and Ghoshal, 1989).

Second, similar studies should be conducted in firms with *organization forms other than an internal network*. In this way, the effects of specialization, job rotation, number of employees with coordination roles, teams and formal meetings on reciprocity can be validated or not, and eventually generalized. It may be the case, for example, that the effect of teams on reciprocity of knowledge flows in a functional or multidivisional form is significant, whereas in internal networks teams are used differently or knowledge flows are enabled through other mechanisms like trust, and thus exhibit no significant dependency with reciprocity in knowledge transfer. In the present study, contradictory evidence was found as to the role of teams in achieving reciprocity. Studies in other organization forms can shed additional light on this matter.

Third, in this paper reciprocity was examined at a specific point in time. However, reciprocity may also be considered as a *dynamic construct comparing knowledge inflows and outflows over a certain period of time*. Clearly, in such a study reciprocity is to be related to learning and the transfer of knowledge over time. To that

end, time lags between knowledge inflows and outflows can be examined, which will provide a more comprehensive analysis of the reciprocity construct and its importance. Finally, an assessment of the performance effects of reciprocity is needed.

In concluding, while most studies have examined reciprocity from a dependency perspective, this paper has highlighted the importance of knowledge and competence perspectives on reciprocity. Entering a period in which coping with the present and future knowledge environment will be of great strategic importance, we believe the knowledge reciprocity construct is likely to become of crucial strategic importance for the leveraging and building of competencies enabling the transfer, creation and utilization of knowledge. Therefore, creating and maintaining a firm's reciprocity of knowledge flows has to be considered a crucial managerial competence.

ENDNOTES

¹ All models were analyzed for possible non-linearity by testing for positive autocorrelation. Using six explanatory variables and approximately 75 observations at a 5 percent confidence level the critical Durbin-Watson values to test for positive autocorrelation indicated a lower bound of d_l 1.46 and an upper bound of d_u of 1.80. Since the estimates displayed a lowest value of 1.80 in model 2, it was concluded that no positive autocorrelation was present. The presence of visible multicollinearity was tested for by regressing each explanatory variable to all other independent variables. The lowest tolerance across the various models presented a value of 0.71. Even in this case 29 percent of the corresponding explanatory variable could be explained by the other explanatory variables. This indicates that the parameter estimates were not influenced by visible multicollinearity. In addition, the models were examined for

multivariate outliers by analyzing the studentized deleted residuals. Observations presenting a studentized deleted residual with an absolute value above 2.6 were identified as possible outliers, resulting in exclusion from the model. Eventual elimination was based on disproportional influence on the model estimates.

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FIGURE 1

The Determinants of Reciprocity in Knowledge Flows

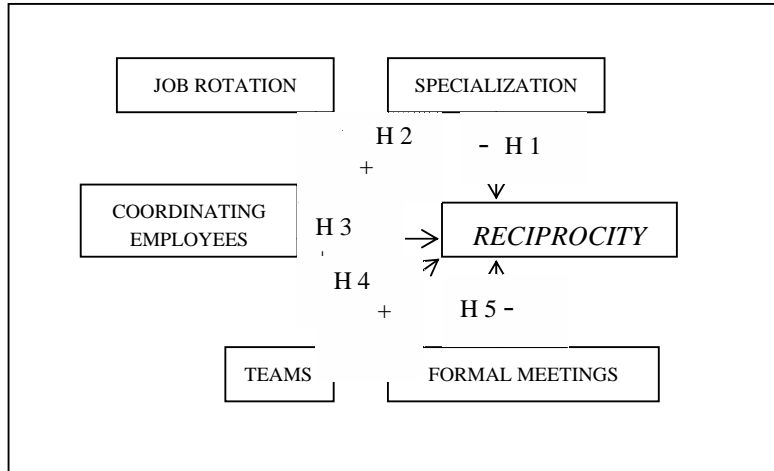


FIGURE 2

Knowledge Absorption in Relation to Knowledge Diffusion as a Reciprocity Measure:

Total effects (a) and horizontal effects (b)

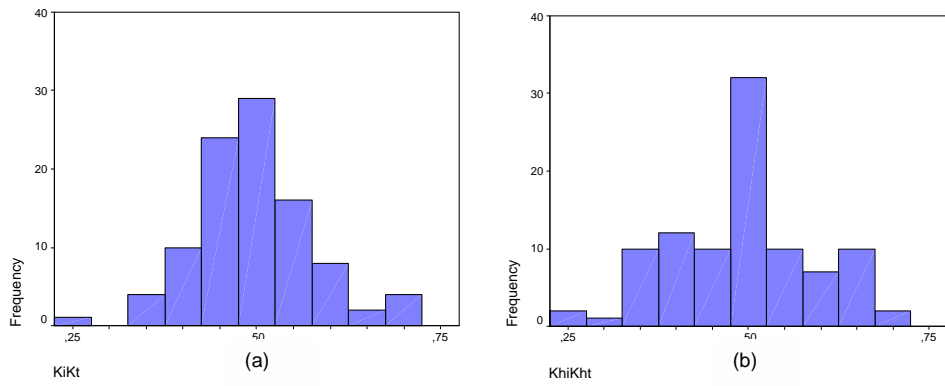


TABLE 1
Description of the Variables

| Variable | Description |
|-----------------|---|
| $K_I K_T$ | Knowledge inflows as percentage of total knowledge flows (inflows and outflows) |
| $K_{HI} K_{HT}$ | Horizontal knowledge inflows as percentage of total horizontal knowledge flows (inflows and outflows) |
| <i>DEPEND</i> | The degree to which tasks are being executed by a team of mutually interdependent employees |
| <i>INDEPEND</i> | The degree to which tasks are being executed separately by independent employees |
| <i>SPECIAL</i> | The degree of specialization |
| <i>JOB</i> | The extent to which job-rotation is used |
| <i>dMGT1</i> | The presence of just a few employees with a coordinating role |
| <i>dMGT2</i> | The presence of moderate number employees with a coordinating role |
| <i>dMGT3</i> | The presence of many employees with a coordinating role |
| <i>TEAM</i> | The extent to which teams are used |
| <i>MEET</i> | The extent to which formal meetings are used |

TABLE 2

Descriptive Statistics: Means, standard deviations, and correlations

| | Mean | St.Dev. | Correlations | | | | | | | | | | | |
|---------------------|------|----------|--------------|---------|---------|--------|-------|-------|----------|----------|-------|------|------|--|
| | | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | |
| (1) $K_I K_T$ | 0.50 | 7.61E-02 | 1.00 | | | | | | | | | | | |
| (2) $K_{HI} K_{HT}$ | 0.48 | 0.11 | 0.85*** | 1.00 | | | | | | | | | | |
| (3) <i>DEPEND</i> | 2.59 | 1.19 | 0.09 | 0.15 | 1.00 | | | | | | | | | |
| (4) <i>INDEPEND</i> | 3.54 | 1.04 | -0.17 | -0.16 | -0.294* | 1.00 | | | | | | | | |
| (5) <i>DIVISION</i> | 3.28 | 0.97 | -0.264* | -0.233† | 0.03 | -0.18 | 1.00 | | | | | | | |
| (6) <i>JOB</i> | 2.31 | 1.12 | 0.22† | 0.24* | 0.15 | 0.05 | -0.03 | 1.00 | | | | | | |
| (7) <i>DMGT1</i> | 0.32 | 0.47 | -0.20† | -0.17 | -0.35** | 0.08 | 0.11 | 0.19 | 1.00 | | | | | |
| (8) <i>DMGT2</i> | 0.41 | 0.50 | -0.02 | -0.11 | 0.07 | 0.10 | 0.05 | -0.16 | -0.58*** | 1.00 | | | | |
| (9) <i>DMGT3</i> | 0.27 | 0.45 | 0.23† | 0.31** | 0.29* | -0.19 | -0.18 | -0.03 | -0.42*** | -0.50*** | 1.00 | | | |
| (10) <i>TEAM</i> | 2.48 | 0.95 | 0.07 | 0.14 | 0.24* | -0.23† | 0.13 | 0.26* | 0.06 | -0.03 | -0.04 | 1.00 | | |
| (11) <i>MEET</i> | 3.27 | 0.89 | 0.09 | 0.13 | -0.03 | -0.25* | 0.09 | 0.05 | -0.01 | -0.09 | 0.11 | 0.15 | 1.00 | |

*** = $p < 0.001$; ** = $p < 0.010$; * = $p < 0.050$; † = $p < 0.100$

TABLE 3
Testing the Hypotheses across Different Reciprocity Models

| | | Model 1 | Model 2 | Control Model A |
|-----------------------|----------------|-----------------------|----------------------|-------------------|
| Reciprocity Measures | | $K_I K_T$ | $K_{HI} K_{HT}$ | $DEPEND$ |
| Explanatory Variables | | | | |
| Intercept | | 0.50 | 0.37 | 0.94 |
| 1 | <i>SPECIAL</i> | -2.59E-02** (0.01) | -2.32E-02† (0.01) | 0.13 (0.12) |
| 2 | <i>JOB</i> | 1.40E-02† (0.01) | 2.65* (0.01) | 0.18 (0.11) |
| 3 | <i>dMGT2</i> | 3.52E-02† (0.02) | 4.17E-02 (0.03) | 0.56** (0.28) |
| | <i>dMGT3</i> | 5.22E-02* (0.02) | 9.64E-02** (0.03) | 1.08*** (0.31) |
| 4 | <i>TEAM</i> | 4.70E-03 (0.01) | 1.47E-02 (0.01) | 0.54*** (0.13) |
| 5 | <i>MEET</i> | 4.07E-03 (0.01) | 1.25E-02 (0.01) | -0.33** (0.14) |
| | R ² | 0.22 | 0.27 | 0.35 |
| | Durbin-Watson | 1.80 | 1.94 | 2.12 |
| | n | 75 | 73 | 71 |

*** = $p < 0.001$; ** = $p < 0.010$; * = $p < 0.050$; † = $p < 0.100$

TABLE 4

Control Model B:

A control model to the reciprocity models

| | Intercept | SPECIAL | JOB | dMGT2 | dMGT3 | TEAM | MEET |
|-----------------|----------------------|--------------------|-----------------------|-----------------------|--------------------|--------------------|------------------------|
| <i>INDEPEND</i> | 5.17 | -0.22 [†] | 6.11 ^E -02 | 6.68 ^E -02 | -0.60 [†] | -0.25 [*] | -9.49 ^E -02 |
| | | (0.12) | (0.11) | (0.28) | (0.33) | (0.13) | (0.13) |
| $R^2 = 0.17$ | Durbin-Watson = 1.84 | | n = 74 | | | | |

* = $p < 0.050$; † = $p < 0.100$

TABLE 5

Support for Hypotheses across Different Reciprocity Models

| Model | 1 | 2 | Control Model A | All Models |
|----------------------------|-----------|-----------------|------------------------|---------------------------------|
| Reciprocity Measure | $K_I K_T$ | $K_{HI} K_{HT}$ | <i>DEPEND</i> | |
| Hypothesis | Support | Support | Support | Total Number of Times Supported |
| 1 <i>SPECIAL</i> | Yes | Yes | No | 2 |
| 2 <i>JOB</i> | Yes | Yes | No | 2 |
| 3 <i>MGT</i> | Yes | Yes | Yes | 3 |
| 4 <i>TEAM</i> | No | No | Yes | 1 |
| 5 <i>MEET</i> | No | No | Yes | 1 |

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