Knowledge sharing facilitators in highly innovative manufacturing firms: Interaction terms shaping employees' orientation in exchanging information

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Abstract

Knowledge is a critical resource for firms operating in dynamic markets, since their effectiveness strongly depends on internal knowledge exploitation. Accordingly, they need to carefully manage their knowledge assets by implementing appropriate knowledge sharing (KS) activities which allow employees to mutually exchange ideas, contributing to firm's innovation and superior performance. However, knowledge is usually hard to transfer and employees may be reluctant in sharing what they know as they may lose power. This paper empirically tests a research model trying to expand the contribution of prior researches investigating the micro-foundations of KS behaviours. By analyzing survey data of 754 workers from 24 international and highly innovative manufacturing firms, we provide empirical evidence about the important role played by employees' enjoyment in helping others in supporting KS activities within the firm as well as about the moderation effect that macro-level variables (i.e. extrinsic rewards and organizational integrating mechanisms) have on our dependent variable (i.e. employees' KS behaviours). We hope this paper may contribute to build a better understanding about the micro-foundations of knowledge processes, which call for first considering the primary role played by the individuals in influencing knowledge creation and knowledge sharing processes within the firm. We conclude the paper by offering managerial implications and directions for future studies.

Keywords: knowledge sharing, enjoyment in helping others, extrinsic rewards, integrating mechanisms, micro-foundations

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Introduction

The issue of how organizations can value and exploit the critical knowledge embedded in their employees is not new to knowledge management scholars. Many of them have long been concerned about the way managers could lead organizational members to voluntarily share what they know within the company. In this sense, the success of many knowledge management activities is found to be strongly linked to how intra-organizational knowledge sharing (KS) is implemented: gaining a competitive advantage calls for considering how expertise and specialized know-how can be transferred from knowledgeable individuals to novices. Within the knowledge-based literature, knowledge sharing (KS) emerges as particularly critical, as it allows employees to talk and listen to each other, by stimulating mutual exchange of information, exp; it thus represents the first step for organizations that aim at improving and exploiting the knowledge existing within their boundaries.

Studying KS processes within firms becomes particularly relevant when the focus is on knowledge-intensive organizations where strategic knowledge is usually dispersed across highly skilled workers operating in different units, departments, or divisions and whose value needs to be exploited as much as possible in order to support the ability of the firm to remain competitive in its market.

In this regard, recent contributions have started emphasizing the importance of shedding more light on the role played by the individual factors in shaping KS behaviors (Foss et al. 2010; Felin and Hesterly 2007). However, despite the great array of published papers on knowledge processes, it is surprising that our understanding of micro-foundations in knowledge sharing is limited. It has been shown that researchers in KS area have mostly concentrated on the role played by organizational antecedents in shaping organizational processes (i.e. macro-macro links). In this vein, Foss et al.'s (2010) review reveals that while seventy-one of the 100 reviewed articles about KS address relationships between macro variables, only twenty of them analyze micro-micro interactions.

Building on the literature regarding the micro-foundations of knowledge-based processes, we therefore aim at focusing on the micro-level processes (i.e. those at the individual-level) which affect employees' KS processes. We thus argue that individual factors play a central role in influencing employees' orientation toward sharing knowledge with colleagues, while recognizing that they are also moderated by organizational-level factors.

Accordingly, the main contribution of this paper is to provide empirical evidence about the primary function that individuals have in influencing knowledge creation and diffusion within the organizations, as well as about the indirect effect of macro-level variables (e.g. organizational factors) on the phenomenon of interest. Moreover, this paper seeks to expand the contribution of prior researches investigating KS micro-foundations by empirically investigating a sample of 754 workers drawn from 24 international manufacturing companies facing the global dynamic competition.

1. Theoretical background

1.1. The criticality of knowledge assets

The resource-based view of the firm and the subsequent knowledge-based perspective widely state that the development, exploitation, and management of knowledge assets are crucial to the survival and prosperity in modern organizations (Huber 2001; Barney 1991). That is, knowledge is a key resource that can provide sustainable competitive advantage in dynamic economy (Grant 1996) and a principal source of value creation (Teece et al. 1997). Hence, in order to struggle with fast increasing pace of competition, organizations have to develop strategic competences and knowledge (Aulawi et al. 2009).

Though, a huge debate has risen around what knowledge is. We agree with those stating that knowledge cannot be conceived as simple information, because while information is just "a flow of messages", knowledge is rather justified by one's belief (Nonaka 1991; Polanyi 1958). This means that not only it includes information, but also know-how and experience (Kogut and Zander 1992), which by definition cannot be easily transmitted and communicated as they are usually endowed with the tacitness that makes them hard to formalize.

A particular issue involved in managing knowledge assets is thus their transferability, especially when it is considered within the firm, rather than between firms (Grant 1996). Consistently with the literature stressing that the more the knowledge is developed, managed and exploited, the more its value (Van Baalen et al. 2005; Mei et al. 2004), we build our argument on the strategic relevance of KS activities: sharing knowledge becomes a fundamental process that firms should constantly pursue in order to monitor and enhance their competitiveness. Supporting this statement is the recognition that the usefulness of knowledge increases when it is shared.

1.2. The knowledge sharing process

In order to avoid the loss of strategic intellectual capital, even after individuals leave the organization, knowledge has to be disseminated within the firm, more specifically across all organizational levels. As Quinn et al. (1996) state, "as one shares knowledge with other units, not only do those units gain information [...]; they share it with others and feedback questions, amplifications, and modifications that add further value for the original sender, creating exponential total growth" (p. 8). KS can thus be seen as a social interaction culture in which employees exchange work-related experiences, skills, and know-how with colleagues (Lin 2007). From an individual perspective, KS involves listening and talking to others, providing them with task information and know-how which may help them do something better, solve problems more quickly and, at the same time, learn from their experience and develop new ideas (Cummings 2004; Reid 2003). In so doing, it stimulates individuals to think critically and express their creativity, so new knowledge is more likely to be produced. In addition, by sharing knowledge the overall innovation capability is enhanced and learning efforts reduced (Lin 2007).

KS represents a relational act based on a sender-receiver relationship, according to which a two-side process takes place: communicating one's knowledge and receiving other's knowledge (Van den Hooff and Van Weenen 2004; Reid 2003). More specifically, sharing knowledge with others is not always a voluntary act; rather, it often follows a request. Following this, the literature distinguishes between two dimensions of KS, i.e. knowledge donating and knowledge collecting: while the former describes the employees' willingness to communicate with others and voluntarily transfer their intellectual capital, the latter is defined as the process of asking colleagues for information and help, by consulting with them in order to learn from their knowledge (Lin 2007).

In this paper we conceive KS behaviors as resulting from others' request for knowledge (i.e. the so called 'knowledge collecting' aspect). Indeed, according to previous studies (Van den Hooff and De Ridder 2004), the two KS sub-processes have a different nature and, as such, can be influenced by different factors.

However, individuals may decide not to spread their knowledge out, as it may cause a loss of distinctiveness (Gupta and Govindarajan 2000). Therefore, organizations that want to encourage their staff to share knowledge, have to understand what really matters to stimulate employees to share what they know.

1.3. The need to account for the micro-foundations in studying knowledge processes

Based on the argument that an organization's knowledge is built upon that of individuals (Lukas et al. 1996), scholars have pointed out that enhancing knowledge-based processes (e.g. knowledge sharing) first calls for understanding where such knowledge is created (Felin and Hesterly 2007; Nahapiet and Ghoshal 1998). That is, a comprehensive understanding of how and whether intra-organizational KS occurs needs to look at their fundamental constituents (i.e. individuals) (Foss et al. 2010; Felin and Foss 2005).

Accordingly, this paper builds on the individual-oriented tradition on the locus of knowledge, which, in turn, draws on the cognitive revolution in linguistics, cognitive psychology, and philosophy studies as well as on the theoretical works of Simon (1991) and Grant (1996). This stream of research also recognizes the contribution of Chomsky (1959) as a cornerstone.

Along with this perspective, the individuals are seen as the crucial locus of knowledge and the fundamental basis for understanding both the process of value creation and the organizational outcomes (Felin and Foss 2005). Grant (1996) clearly supports this approach: "the emphasis upon the role of the individual as the primary actor in knowledge creation and the principle repository of knowledge [...] is essential to piercing the veil of organizational knowledge and clarifying the role of organizations in the creation and application of knowledge" (p. 121). This implies that individual competencies and behaviors are far more important than environmental or social influences in explaining knowledge-related as well as learning processes within firms (Felin and Hesterly 2007). In other words, whenever higher-level outcomes are to be investigated, individuals' behavior and their interaction should be taken into consideration (Stinchcombe 1991). This is what Coleman's (1990) 'methodological individualism' approach suggests: in order to understand a social system, it is necessary to

study its micro-foundations, by making a clear distinction between micro- and macro-level of analysis (Figure 1).

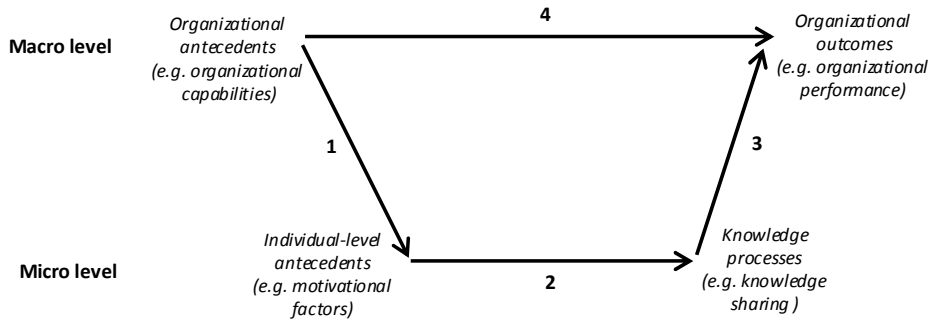

Figure 1
Coleman's bathtub of social phenomena analysis
Source: adapted from Foss (2007)

Figure 1 illustrates that social processes (e.g. knowledge-based processes) should be seen as multi-level phenomena in which four different types of links between micro- and macro-level of analysis result: macro–macro (Arrow 4), macro–micro (Arrow 1), micro–micro (Arrow 2), and micro–macro (Arrow 3) links.

For the purpose of this study, macro refers to the organizational level while micro refers to the level of individual action and interaction. For simplifying our argument, we follow Foss et al. (2010) and limit our focus to only these two levels of analysis, although we are aware that knowledge processes may involve further levels (e.g. groups, departments, divisions, networks of firms, etc.).

The underlying principle of our argument is that explanations which focus only on macro variables (i.e. on macro-macro links) neglect the micro-level processes which actually mediate between macro variables (cf. Gupta et al. 2007). For instance, organizational structure or culture is likely to influence organizational performance (i.e. macro-macro link) not because of a direct effect; rather, because it affects individual conditions, actions, and interactions.

Thus, when organizational-level knowledge processes are to be explained, it is necessary to take into account micro-level constructs, such as individual motivation, goals, attitudes, behaviors, and so forth. Only when these constructs are considered, it is possible to investigate how they aggregate up to organizational outcomes (Arrow 3), what are their firm-level antecedents (Arrow 4) and how these, in turn, affect such micro-level constructs (Arrow 1) (cf. Abell et al. 2008).

2. Hypotheses development

2.1. KS individual enablers

Following the literature, employees' enjoyment in helping others has been found to strongly influence employees' behaviours in sharing knowledge and information with colleagues. It derives from the concept of altruism (Kankanhalli et al. 2005; Organ 1988) and is defined as the perception of pleasure obtained from helping others through knowledge contribution. Especially when knowledge is viewed as a public good that is socially generated, maintained, and exchanged (Brown and Duguid 1991), employees are more likely to desire to support others in solving problems or accomplishing tasks.

Scholars have demonstrated that people contributing their knowledge gain satisfaction stemming from their intrinsic enjoyment in helping others (Bock et al. 2005; Wasko and Faraj 2000). Thus, workers who enjoy helping colleagues may be more inclined toward sharing knowledge. According to this, we posit that:

Hp1: Enjoyment in helping others is positively associated with employees' knowledge sharing behaviours within the organization.

2.2. Interaction between enjoyment in helping others and extrinsic rewards

Building on social cognitive theory, prior studies have demonstrated that organizational rewards are likely to inhibit attitudes toward KS (Bock et al. 2005; Wasko and Faraj 2000) because they deteriorate employees' intrinsic motivation to interact and communicate with colleagues. In particular, cognitive evaluation theorists (Deci and Ryan 2000) argue that, when firms provide extrinsic rewards related to the engagement in or the accomplishment of a specific behaviour, the individual would perceive the locus of causality of that behaviour as external and would then be less inclined to perform it (Bartol and Srivastava 2002).

Following this, we claim that extrinsic rewards may play a significant moderating role in shaping the relationship between individuals' enjoyment in helping others and their KS behaviours. We particularly argue that the implementation of extrinsic rewards for participating in KS is likely to lead to a lower propensity to share knowledge especially in those individuals that strongly feel enjoyment and pleasure in helping their colleagues. We expect that when employees are extrinsically rewarded for their participation in KS activities, the relationship between enjoyment in helping others and KS is negatively influenced. That is:

Hp2: The positive association between employees' enjoyment in helping others and knowledge sharing behaviours is weakened when extrinsic rewards for such behaviours are in place.

2.3. Interaction between extrinsic rewards and integrating mechanisms

We also argue that to better understand the predictors of employees' KS behaviours, it is important to investigate the organizational integrating mechanisms in conjunction with the reward system that is in place. As already mentioned, prior research shows that extrinsic

rewards are likely to negatively affect employees' willingness in participating in KS activities (Bartol and Srivastava 2002). However, we believe that, when employees are provided with the opportunities to communicate and interact with each other, no matter their hierarchical level within the organizational structure, the extrinsic rewards are likely to play a less negative role in affecting individuals' KS behaviors. This is consistent with prior studies arguing that integrating mechanisms help establish communication channels between separated units (Mintzberg 1979); in so doing, they are likely to facilitate knowledge dissemination and acquisition within the organization by implementing the use of task forces and multi-functional teams (Gupta and Govindarajan 2000). In particular, integrating mechanisms occurring via lateral "consultation rather than vertical commands" (Burns and Stalker, 1961: 121) are more appropriate for KS as they allow more flexibility in task execution and fasten the achievement of solutions. According to this premise, we build our argument on the claim that, since highly innovative firms usually face great internal interdependency among tasks and employees, they require horizontal coordination mechanisms to support intra-organizational KS. Moreover, as organizational activities often do not follow the vertical hierarchical structure (Galbraith 1973), lateral relations better reflect how coordination activities take place within the company.
Given this, we offer the following hypothesis:

Hp3: The negative association between extrinsic rewards and employees' knowledge sharing behaviours is weakened when organizational integrating mechanisms are in place.

The above discussion is summarised in Figure 1 below.

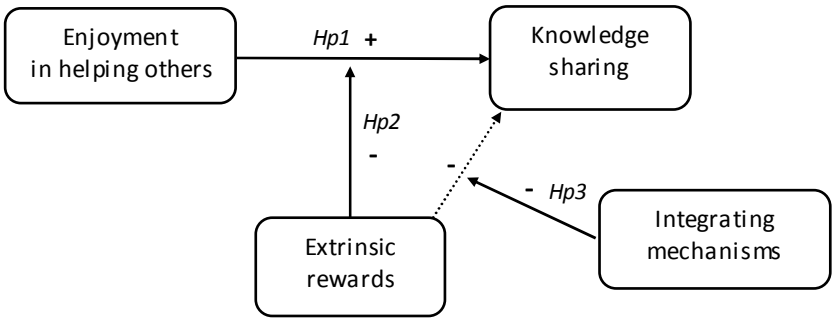

Figure 2
The research model

3. Sample selection and research method

A draft questionnaire was pilot tested with 53 middle managers of three companies to ensure that its content and wording were free of misunderstandings. We then revised the questionnaire and retested it with 45 managers. For the purpose of this paper, we collected

web-survey data from 24 highly-innovative manufacturing firms located in a critical economic area in central Italy (Tuscany) and operating in international markets. The need to specifically analyze manufacturing sectors emerged as part of a broader institutional research project, aiming to understand the distinctive features characterizing such industries, which play an important role in the region's competitiveness. Moreover, the need for leveraging intangible assets is particularly relevant for manufacturing companies, as they are increasingly experiencing a rapid change in their traditional manufacturing system, which has radically changed, from a single-site factory to a corporate international network.

A meeting with each of the twenty-four Human Resource Directors was carried out in order to explain the research purpose as well as the relevance of the phenomenon of interest. Together with them, we selected a sample of employees to be involved in the research. We particularly looked at those who are considered nodes of knowledge as they operate at the center of strategic information flows. Hence, the sample included employees that are directly involved in KS processes: in all cases they possess critical knowledge that may concern clients, and/or suppliers, and/or R&D, and/or markets and/or specific technical issues. We meant to involve gatekeepers roles, that are those which, according to the literature (Cohen and Levinthal 1990), stand at the interface of either the firm or the external environment or between organizational subunits, and can significantly contribute to the firm's learning ability (i.e. absorptive capacity). In order to facilitate the exchange of different kinds of knowledge, these workers translate information into a form that can be more easily understood by anyone in the firm, playing a crucial role in supporting KS activities. Of the 1503 invitations sent out for participation in the survey, 754 questionnaires were filled in (50.1% response rate). The average response rate within the companies involved in the study has been of 74.3% (27.6% the minimum; 100% the maximum).

3.1. Measures

According to Spector (1994), we used self-reported measures for operationalizing all variables in the questionnaire. All scales we adopted come from previous studies and all of them are multiple items- and seven-point Likert type scales.

Dependent variables. Consistently with previous literature, Van den Hooff and Van Weenen (2004) provided the items used to measure KS behavior (four-item scale). As already stated, we conceive KS as the process of sharing knowledge by helping colleagues who specifically ask for information (Lin 2007). Respondents were asked to express their opinion regarding statements such as "I share information I have with colleagues when they ask for it".

Independent variables. We adopted Wasko and Faraj (2000) four-item scale to measure employees' enjoyment in helping others in order to analyze their perceptions of pleasure obtained from sharing knowledge. Organizational rewards were measured using four items derived from Hargadon (1998) and Davenport and Prusak (1998), while the measure of integrating mechanisms is derived from Galbraith (1973) and Gupta and Govindarajan (2000) and enriched with one item developed de novo by the authors of this paper.

Control variables. We controlled for a number of possible confounding effects that may impact on the employees' orientation to share knowledge with others. We thus include the following control variables in the empirical analysis: employees' age, their education level (years of education), whether the play a managerial role within the firm (dummy variable), their level of autonomy in the job (the measure is provided by Hackman and Oldham's Job Descriptive Index, 1974) and the extent to which they make use of ICT facilities to share knowledge (two-item scale taken from Lee and Choi 2003).

4. Findings

Descriptive statistics and correlation matrix for all variables are reported in Table1. In Table 2 we provide the results of multiple regression analysis run using Stata on our dependent variable (i.e. employees' KS behaviors). All four models for knowledge sharing in Table 2 include control variables related to individuals' opportunities to engage in KS activities (the extent to which employees use ICT facilities to share knowledge, the degree of autonomy in the job, age, level of education, and whether they play a managerial role within the firm).

In Model 1 we included only the control variables. Model 2 includes all first-order associations between knowledge sharing and enjoyment in helping others, extrinsic rewards, and integrating mechanisms, respectively. Model 3 adds the first interaction and Model 4 adds the second interaction. Before generating the interaction terms, we standardized the three variables (i.e. enjoyment in helping others, extrinsic rewards, and integrating mechanisms). Furthermore, in order to detect the presence of multicollinearity among explanatory variables, for each model we calculated the variance inflaction factor (VIF). The VIF values are presented together with the regression result in Table 2.

As for control variables, we found that the extent to which employees make use of ICT facilities as well as their degree of autonomy in the job are positively associated with their KS behaviors. The results also show that older employees are less oriented toward engaging in KS activities when colleagues ask them for help. Conversely, both employees' level of education and whether they play a managerial role in the firm do not have a significant impact on their willingness to contribute to KS.

Model 2 provides evidence about the positive association between individuals' enjoyment in helping others and KS participation ($\beta = .44$, $p < .001$). Hypothesis 1 is thus strongly supported.

Model 3 shows a significant and negative moderator effect of extrinsic rewards on employees' enjoyment in helping others ($\beta = -.08$, $p < .05$), thus supporting Hypothesis 2. Our findings also provide support for Hypothesis 3, which posits the organizational integrating mechanisms as negative moderators of the relationship between extrinsic rewards and employees' KS behaviors. In this regard, Model 4 reveals that the hypothesized relationship is strongly significant ($\beta = -.10$, $p < .001$).

By looking at the variation of the R^2, we found that it increases from .16 in Model 1 to .35 in Model 4, which is equivalent to an increase of 19 percent.

	Mean	S.D.	Min	Max	1	2	3	4	5	6	7	8	9
1. Knowledge sharing	6.00	.94	2	7	*.84*								
2. Enjoyment in helping others	6.39	.84	1	7	.47*	*.96*							
3. Extrinsic rewards	3.87	1.67	1	7	.10*	.03	*.85*						
4. Integrating mechanisms	4.35	1.42	1	7	.22*	.20*	.07*	*.64*					
5. ICT use	4.65	1.67	1	7	.19*	.14*	.12*	.34*	*.76*				
6. Autonomy in the job	5.31	1.34	1	7	.33*	.20*	.04	.26*	.18*	*.90*			
7. Age	40	8.51	22	71	-.04	.03	-.08*	-.01	.06	.13*	-		
8. Years of education	16	2.88	6	10	-.02	.03	-.06	.21*	.02	-.03	-.17*	-	
9. Managerial role	-	-	0	1	-.02	.07*	-.21	.25*	.04	.19*	.27*	.14*	-

*Correlation is significant at the .05 level.

Alpha coefficient is shown in italics on the diagonal.

Table 1

Descriptive statistics and correlation matrix for all variables (n = 754)

	Knowledge sharing			
	Model 1	**Model 2**	**Model 3**	**Model 4**
ICT use	0.09***	0.03†	0.03†	0.04*
	(4.48)	(1.72)	(1.87)	(2.14)
Autonomy in the job	0.24***	0.18***	0.17***	0.17***
	(7.85)	(6.08)	(6.02)	(6.21)
Age	-0.01*	-0.01*	-0.01*	-0.01*
	(-2.27)	(-2.38)	(-2.32)	(-2.37)
Level of education	-0.00	-0.01	-0.01	-0.01
	(-0.50)	(-1.29)	(-1.17)	(-1.19)
Managerial role	-0.11	-0.14*	-0.14*	-0.14*
	(-1.63)	(-2.27)	(-2.29)	(-2.24)
Enjoyment in helping others		0.44***	0.45***	0.45***
		(10.00)	(10.80)	(10.91)
Extrinsic rewards		0.02	0.03	0.02
		(1.38)	(1.56)	(1.44)
Integrating mechanisms		0.07**	0.07**	0.07**
		(2.77)	(2.66)	(2.69)
Extrinsic rewards*Enjoyment in helping others			-0.08*	-0.06†
			(-2.49)	(-1.72)
Integrating Mechanisms*Extrinsic rewards				-0.10***
				(-3.35)
Intercept	4.82***	2.30***	2.22***	2.25***
	(14.66)	(6.44)	(6.63)	(6.81)
Vif	1.10	1.17	1.16	1.15
R^2	0.16	0.33	0.34	0.35
df_m	5	8	9	10

† $p < .10$
* $p < .05$
** $p < .01$
*** $p < .001$

Table 2
Results of multiple regression analysis for knowledge sharing (n = 754)

5. Discussion

5.1. Conclusion and implications for practitioners

Following prior research about the need to study the micro-foundations of knowledge processes (Foss et al. 2010; Felin and Hesterly 2007), this paper aims at providing a better understanding of how individual variables affect employees' KS behaviors. Firstly, for the firms involved in the survey, the empirical analysis shows the importance of the employees' pleasure in helping colleagues in fostering their KS participation. It also demonstrates that when extrinsic rewards for KS participation are in place, the impact of the individuals' enjoyment in helping others is weakened. This is consistent with prior literature claiming that the implementation of extrinsic rewards for participating in KS decreases employees' willingness to share knowledge especially for those individuals that strongly feel enjoyment and pleasure in helping their colleagues with their knowledge (Bartol and Srivastava 2002). Indeed, in such a case, the individual would perceive the locus of causality of that behaviour as external and would then be less inclined to perform it. Moreover, as we expected, we found that when organizations put in place appropriate lateral integrating mechanisms likely to foster the horizontal communication and interaction, the negative impact that extrinsic rewards have on employees' KS orientation decreases. This result demonstrates the importance of facilitating social relations to support employees' willingness to participate in KS activities.

Table 2 shows that the most relevant R^2 increase is provided when first-order variables are added in the analysis (Model 2); in particular, the role played by the individual variable (i.e. enjoyment in helping others) is found to be strongly significant in affecting employees' KS behaviors. This evidence is consistent with the theoretical background underlying our argument: in order to fully understand the knowledge processes occurring within the firms, it is fundamental to account for the micro-foundations, by emphasizing the individuals as the main actors in knowledge creation and sharing.

We think that these preliminary findings may produce relevant implications for the managers of the companies included in the sample. The development and improvement of effective intra-organizational KS activities require managers to take into consideration that individuals are the primary locus of knowledge; that is, individual behaviors are far more important than organizational and social influences when knowledge-related processes are to be explained (Felin and Hesterly 2007). Although individual behaviors can hardly be changed, managers can act upon organizational factors, which, as our findings demonstrate, can play a relevant indirect effect (e.g. moderator effect) on employees' orientation toward KS. In other words, practitioners need to build a new understanding of KS processes by firstly taking into account the relevance of individuals' orientations, attitudes, competences, and then recalling that they can implement organizational tools in order to influence such orientations, attitudes, and competences.

5.2. Directions for future research

The paper provides preliminary empirical evidence about the relevance of studying the micro-foundations of intra-organizational KS processes while at the same time of looking at the

moderating effect of macro-level variables within a sample of 24 knowledge-intensive manufacturing firms.

However, we are aware of some limitations of this study. Because of the sampling criterion, the results cannot be easily generalized; that is, given that data collection was limited to organizations operating in a highly specific area (i.e. Central Italy), probably our findings could not be applicable to firms of different national cultures (Bock et al. 2005; Hofstede 1991). Nevertheless, we think that they can provide some interesting insights for future studies.

The paper focuses only on the employees' enjoyment in helping others as the individual KS enablers; future research could take into account other factors such as further demographic determinants (i.e. employees' organizational tenure, career stage), individual competences or other kinds of individual motivation (e.g. identified regulation, introjected regulation; Gagné et al. 2010) in order to extend the study of micro-foundations. In this research we involved the boundary spanners' role (Cohen and Levinthal 1990) within the firms, but future studies could consider the contribution given by further organizational roles to intra-organizational KS processes. Moreover, as suggested by Wang and Noe's (2010) review of KS research, an objective measure of KS should be developed, by collecting, for instance, third-party and archival data in order to enrich our understanding about the more common self-perceptual assessment of KS activities. Similarly, the authors suggest that more qualitative research focused on specific KS issues could be useful. Consistently, we agree that our study could benefit from face-to-face interviews as well as from direct observations both of managers and employees to deepen our comprehension about the findings resulted from this empirical work. Finally, as very few empirical studies in this field have an authentic multilevel nature, we think that an interesting step further will be to develop a multi-level KS study, by building on Coleman's (1990) bathtub of social phenomena analysis (Figure 1). In this regard, we agree with those stating that a multi-level research that simultaneously looks at two or more levels of analysis and more concretely explores how knowledge-based processes occur is needed (Foss et al. 2010; Felin and Foss 2005).

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