

The effect of social capital on exploration and exploitation

Modelling the moderating effect of environmental dynamism

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1. Introduction

In a context of escalating expectations of quality improvement and cost reduction, healthcare managers and practitioners are struggling for the continuous innovation of current operations (Lega *et al.*, 2013). This result can be better achieved through the combination of knowledge exploitation and knowledge exploration (Menor *et al.*, 2002; Benner and Tushman, 2003; O'Reilly and Tushman, 2008; Martini *et al.*, 2013), since healthcare organizations are knowledge-intensive environments. Knowledge exploitation, in particular, refers to the organizational capability to refine and recombine internal knowledge assets into incrementally new ideas and solutions, while knowledge exploration is the capability to acquire and use external knowledge from other organizations in order to radically improve products, services and processes (March, 1991).

Several studies questioned the view that exploration and exploitation stand in a mutual trade-off (Gupta *et al.*, 2006), providing instead empirical evidence that organizations can contextually pursue both capabilities (Birkinshaw and Gibson, 2004; Gibson and Birkinshaw, 2004; Raisch *et al.*, 2009). Recent research has accordingly looked forward possible antecedents that could affect both exploration and exploitation (Fang *et al.*, 2010). The evidence has thus far mostly addressed: first, environmental factors such as exogenous shocks, competitive intensity and external dynamism; second, organizational factors such as absorptive capacity, structure, culture and size; and third, managerial factors such as risk aversion, past experience and the role of information and communication technologies (ICTs) (Raisch and Birkinshaw, 2008; Mom *et al.*, 2009; Raisch *et al.*, 2009; Lavie *et al.*, 2010). Amidst these contributions, two open gaps persist, i.e. first, the coexistence of contrasting evidence on the role played by these factors to simultaneously achieve both exploration and exploitation; and second, the lack of evidence on a whole set of factors that could be potentially relevant for the desired outcome.

In the present study, we address both gaps by exploring the effects of social capital and environmental dynamism on knowledge exploration and exploitation. In doing so, we pursue two main theoretical contributions.

First, no prior study to our best knowledge has empirically linked social capital to both exploration and exploitation. Our study fills this gap by testing the effect of internal social capital dimensions (i.e. structural, relational and cognitive) on both knowledge exploration and exploitation. The empirical test of this link is salient for developing a theoretical understanding of how the properties of internal social capital – in terms of density, strength and similarity of ties (Nahapiet and Ghoshal, 1998) – affect organizations' innovative capabilities (Nahapiet and Ghoshal, 1998; Yli-Renko *et al.*, 2001; Tsai, 2001; Anand *et al.*, 2002; Landry *et al.*, 2002; Maurer *et al.*, 2011).

Second, this study sheds new light on the effects produced by environmental dynamism. Past research indicates that the capability to explore and exploit knowledge is not indifferent to the context in which organizations, groups and individuals are embedded (e.g. Raisch *et al.*, 2009; Lavie *et al.*, 2010). These collective units actively perceive the stability or turbulence of the environment and move accordingly by providing stronger or weaker stimuli to their activities of knowledge exploitation and exploration. The nature and extent of this stimulus remains, however, ambiguous, since a few studies indicated that knowledge exploitation has more chances to occur in stable environments, and knowledge exploration in turbulent ones (Hannan and Freeman, 1984; Sidhu *et al.*, 2004), while others have also shown that environmental turbulence could undermine exploration efforts (Kim and Rhee, 2009; Posen and Levinthal, 2012). Our study seeks to provide further evidence on the role of environmental dynamism by investigating its direct effect on knowledge exploration/exploitation

as well as its moderation on the relationship between internal social capital and knowledge exploration/exploitation.

Differently from most exploration/exploitation studies, our work investigates the effects of social capital and environmental dynamism on knowledge exploration/exploitation in the peculiar context of hospital wards. Hospitals wards are knowledge-intensive units where continuous improvement of current operations depends extensively on the capability to exploit the expert knowledge produced by practitioners as well as to explore knowledge opportunities that are produced in other hospital wards, hospitals, research centers and professional communities (Djellal and Gallouj, 2005; Kennedy and Fiss, 2009; Martini *et al.*, 2013). Also, hospital wards represent professional contexts where knowledge is located at the bottom, and protected by clinicians to preserve their autonomy (Abbott, 1988; Freidson, 1988). Hospital wards are less affected by organizational structure and managerial control, and more by individual decision making (Ferlie *et al.*, 2005) and by the nature of the social network which professionals had developed over time (Addicott *et al.*, 2006; Mascia and Cicchetti, 2011). Hospital wards thus represent exemplary contexts to appreciate the role that social capital and environmental dynamism play to promote or inhibit knowledge exploration and knowledge exploitation.

2. Research framework

Our conceptual model is presented in Figure 1 (control variables are not displayed).

Our model posits a direct relationship between internal social capital and knowledge exploration and exploitation. We distinguish three dimensions of social capital (Nahapiet and Ghoshal, 1998; Tsai and Ghoshal, 1998; Lawson *et al.*, 2008): “structural capital,” which illustrates how the network of acquaintances is configured (e.g. number of ties, network density); “relational capital,” which describes the strength of ties (e.g. trust), and “cognitive capital,” which represents the mutual understanding between individuals that is achieved through shared codes, language and narratives. Furthermore, our model postulates a moderation effect operated by environmental dynamism on each link.

Henceforth, we will briefly outline the hypotheses supporting the conceptual model.

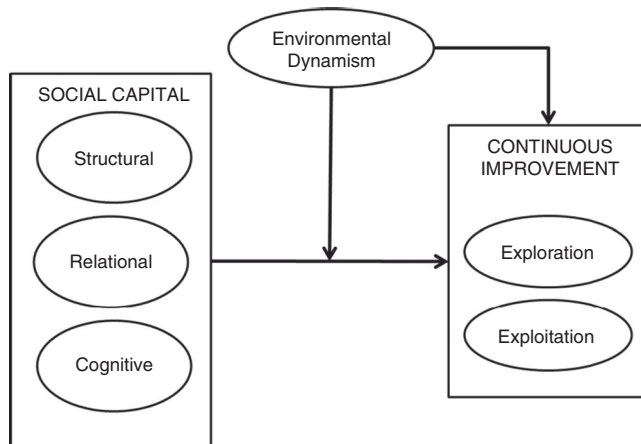


Figure 1.
Conceptual model

2.1 Social capital and knowledge exploration

Social capital represents the resources embedded within, available through and derived from the network of relationships possessed by a collective unit, e.g. organization, ward, team (Adler and Kwon, 2002; Inkpen and Tsang, 2005; Mura *et al.*, 2013; Oh *et al.*, 2006). Payne *et al.* (2011) suggested that the concept of social capital has to be investigated with regard to two dimensions: the unit of analysis, i.e. individual vs collective; and the locus of activities, i.e. internal vs external ties to its individual or collective nature of social capital. Henceforth, we will focus on internal collective social capital, i.e. the “assets and resources made available through relationships within the social structure of the collective (i.e. group or organization) that can be utilized by the collective” (p. 497).

In this background, structural social capital indicates to which extent the individuals within a collective unit are connected with each other in terms of resources made available to the other members. A collective unit with higher internal structural social capital than another, might have stronger opportunity for knowledge exploration because it provides members with a wider range of information and with access to a richer network of acquaintances (Tsai and Ghoshal, 1998; Yli-Renko *et al.*, 2001; Oh *et al.*, 2006; Balkundi and Harrison, 2006; Wong, 2008). Put differently, an individual who is connected in a dense network has available a higher quantity of resources (e.g. data, information, acquaintances) that s/he can use to explore new opportunities and new ideas.

Differently, relational social capital indicates to which extent individuals within a collective unit have strong relationships with each other – in term, for instance, of reciprocal trust. A collective unit with higher relational social capital than others might have stronger possibility for knowledge exploration because the strength of the tie allows prolonged access to external knowledge and thus more time and precision to transfer complex and valuable knowledge (Fischer and Pollock, 2004; Stam and Elfring, 2008). Put differently, an individual who is connected in a strong network has available a higher quality of resources (e.g. data, information, acquaintances) that s/he can use to explore new opportunities and new ideas.

Cognitive social capital provides a further support for knowledge exploration. It indicates, in fact, to which extent the collective unit has “consonant” goals, “visions” and norms with the others. Knowledge produced in “consonant” realities can be easier to access to and more relevant to acquire and translate in the new context – because it has been produced for similar purposes and with similar perspectives (cf. Nahapiet and Ghoshal, 1998). As such, we expect collective groups with higher cognitive social capital to have a stronger capacity for knowledge exploration. Consistently with these ideas, we propose that social capital can positively affect knowledge exploration because it provides a combination of stimuli and facilitation in the acquisition and use of knowledge from external sources:

H1. Social capital is positively related to knowledge exploration.

H1(a). Structural social capital is positively related to knowledge exploration.

H1(b). Relational social capital is positively related to knowledge exploration.

H1(c). Cognitive social capital is positively related to knowledge exploration.

2.2 Social capital and knowledge exploitation

Internal social capital can also affect the opportunities for a collective unit to exploit its internal knowledge. Knowledge exploitation occurs when a given unit is able to mobilize the expert knowledge that resides among its members. Knowledge mobilization, in fact, allows individuals to have a more systemic and structured understanding of the knowledge assets available in their collective unit – e.g. knowing which information, competencies and acquaintances are available, and who knows what (Stasser *et al.*, 1995; Moreland, 2006). Individuals can access the resources visible in the community to endorse their personal innovation purposes; as well as the collective unit can organize the visible resources to pursue unit-level innovation purposes (Leonard and Sensiper, 1998; Tsai, 2001; Perry-Smith and Shalley, 2003; Taylor and Greve, 2006). Noticeably, employees often do not make their knowledge visible to managers and peers to preserve their autonomy; or because they are unaware of the importance of sharing it (Abbott, 1988; Freidson, 1988; Husted and Michailova, 2002). As such, the mobilization of internal knowledge cannot be controlled from the top, but rather depends on a capacity to engage employees in sharing their expert knowledge with the others (Hansen *et al.*, 2005; Radaelli *et al.*, 2011). Strong social capital, in all its forms, is by definition characterized by such mobilization (Payne *et al.*, 2011). This is explained by the fact that dense, tight and cohesive ties stimulate members to make available their resources to others – by effect of social influences and stimuli – as well as practical opportunities (Inkpen and Tsang, 2005; McEvily and Marcus, 2005; Boschma and ter Wal, 2007). Drawing upon these considerations, we propose that these two reasons coalesce in an overarching hypothesis suggesting that organizations having close, tight and consonant ties can spot relevant (and, maybe, underappreciated) internal knowledge that has remained “hidden” and translate it into new uses. As such, we propose the following hypotheses:

H2. Social capital is positively related to knowledge exploitation.

H2(a). Structural social capital is positively related to knowledge exploitation.

H2(b). Relational social capital is positively related to knowledge exploitation.

H2(c). Cognitive social capital is positively related to knowledge exploitation.

2.3 Effects of environmental dynamism on knowledge exploration and exploitation

The possibility and propensity for knowledge exploration and exploitation are affected by the characteristics of the environment in which the collective group is embedded. In this regard, environmental dynamism has been investigated as a valuable predictor of knowledge exploration and exploitation. However, prior evidence led to conflicting conclusions.

On the one hand, past research suggests that dynamic environments strongly support change. In fact, while stable environments might legitimate the establishment and persistence of routines, environmental changes push organizations and groups into searching for new knowledge both outside and inside (Becker, 2004; Sidhu *et al.*, 2004) – i.e. pursuing both exploration and exploitation in order to advance processes and products. This appears especially true in service organizations such as hospitals which have a (righteous) tendency to preserve, rather than challenge, the practice. As such, in conditions of environmental stability, hospitals show limited propensity

toward – and, often, active resistance against – practice change (Kellogg *et al.*, 2006; Kellogg, 2009). Environmental changes, instead, can challenge the status quo, and provide a much needed stimulus to search and implement new ideas both outside and inside the organization. Most research has indeed investigated the role of environmental dynamism as trigger for knowledge exploration and argued that, when exposed to turbulent environments, organizations need to “look somewhere else” to generate radically new ideas and knowledge (Yli-Renko *et al.*, 2001; Ahuja, 2000; McEvily and Marcus, 2005).

Posen and Levinthal (2012) balanced this view suggesting that organizations, in times of environmental turbulence, rely primarily on knowledge exploitation. The authors indicated in fact that there is also “the possibility that the reward to generating new knowledge may itself be eroded if change is an on-going property of the environment. This observation in turn suggests that environmental change is not a self-evident call for strategies of greater exploration. Indeed, under some conditions the appropriate response to environmental change is a renewed focus on exploiting existing knowledge and opportunities” (p. 587).

Drawing upon this evidence, the following two hypotheses can be advanced:

H3. Environmental dynamism is positively related to knowledge exploration.

H4. Environmental dynamism is positively related to knowledge exploitation.

Posen and Levinthal’s (2012) notion that environmental dynamism might “erode the rewards of generating new knowledge” might be extended to believe that it would erode also the capacity (in terms of effectiveness and efficiency) of social capital to support the generation of new knowledge – both exploration and exploitation. Turbulent environments generate an uncertainty that might soften the effectiveness of internal resources, e.g. they might appear (or be) outdated, problematic and unreliable – and thus ultimately insufficient to address external threats. This does not mean that organizations stop relying on internal resources – as observed earlier, environmental dynamism might stimulate a greater creation of new knowledge, and thus might increase the access to social capital – but rather that internal resources become less effective and efficient in supporting groups and individuals to find new opportunities from internal knowledge (i.e. exploitation) and to find new useful connections to the “outside world” (i.e. exploration).

As a whole, the hypotheses are as follows:

H5. Environmental dynamism negatively moderates the link between social capital and knowledge exploration.

H5(a). Environmental dynamism negatively moderates the link between structural social capital and knowledge exploration.

H5(b). Environmental dynamism negatively moderates the link between relational social capital and knowledge exploration.

H5(c). Environmental dynamism negatively moderates the link between cognitive social capital and knowledge exploration.

H6. Environmental dynamism negatively moderates the link between social capital and knowledge exploitation.

H6(a). Environmental dynamism negatively moderates the link between structural social capital and knowledge exploitation.

H6(b). Environmental dynamism negatively moderates the link between relational social capital and knowledge exploitation.

H6(c). Environmental dynamism negatively moderates the link between cognitive social capital and knowledge exploitation.

3. Method

3.1 Sample

We tested the proposed hypotheses by collecting survey data on hospital wards in large, public Italian hospitals. Hospitals represent a rewarding context for studying the link between social capital and knowledge exploration/exploitation. Hospitals are in fact professional organizations characterized by expert knowledge that resides at and is protected by front-line employees – i.e. professionals (Abbott, 1988; Freidson, 1988). Innovation in the hospital context typically occurs through processes of knowledge accumulation and recombination that involve the coordination of different professional expertise – with an increasing reliance on teamwork and networks to achieve multi-disciplinarity. Therefore, social ties within and outside the organization play a critical role in enhancing the performance of healthcare organizations and, in particular, innovation and knowledge management (Greenhalgh *et al.*, 2004).

Also, hospitals are embedded in a demanding environment that calls for a constant update of products and delivery systems in (possibly conflicting) terms of higher quality and lower costs, higher medical specialization and lower clinical variance (Frist, 2005). As such, hospitals also represent an appropriate context to appreciate the impact of environmental dynamism – and, even, turbulence – on the rate of knowledge exploration and exploitation, as well as on the role of social capital.

We chose hospital wards as unit of analysis for at least two reasons. First, hospital wards are the reference unit for knowledge accumulation and creation. Since most practice is managed within wards, in fact, most innovations also occur at and depend on this level as they require the coordination of their physicians and nurses around a common clinical or operational problem. Second, hospital wards are relatively autonomous entities in terms of decision making and resources allocation (e.g. both physical and financial resources), and thus their behaviors can be compared to those of an organization. Accordingly, we believe that our ward-related findings can be extended to other organizational contexts outside the healthcare system.

3.2 Data collection

We surveyed hospital wards by administering a structured questionnaire to the head physician of the ward. Therefore, based on previous studies, we gathered information on hospital ward by directly asking to the head physician of the ward, considered as an informed actor who could provide relevant information on the overall ward. The questionnaire was sent by e-mail to 857 ward's head physicians belonging to large, public hospitals located in the northern part of Italy. The final data set consists of 174 usable observations, collected from February to October 2012, for a 20.3 percent response rate.

A copy of the questionnaire was delivered to each respondent. The survey consisted of multiple item Likert-type scales derived from extant literature, with minor modifications

introduced to adapt measures to our context of investigation. Specifically, we measured knowledge exploration in terms of acquisition of new knowledge, and we adapted the measurement scale from Jansen *et al.* (2005). We measured knowledge exploitation, instead, in terms of the transformation and application of existing knowledge, and we adapted the measurement scale from Jansen *et al.* (2005). With regard to social capital, we measured: first, the structural dimension in terms of density and frequency of in-work social interactions, adapting the measurement scale from Subramaniam and Youndt (2005); second, the relational dimension in terms of mutual trust and strength of the relationships adapting the measurement scale from Kale *et al.* (2000); and third, the cognitive dimension in terms of common narratives and language, adapting the measurement scale from Ko *et al.* (2005). Finally, we measured environmental dynamism as the extent to which frequent changes occurred within the last five years in terms of technology, provided services and market regulations, adapting the measurement scale from Volberda and Van Bruggen (1997).

To enhance our understanding of the context in which the constructs were investigated, we conducted a series of face-to-face interviews with personnel from one of the organizations involved. This allowed us to adjust and refine the wording of our questions. We pilot tested the questionnaire in a small hospital of about 250 beds and 35 wards located in the northern part of Italy. The final questionnaire included six scales, for a total of 23 items measured on a seven-point Likert scale anchored to 1 (I totally disagree) and 7 (I totally agree) (see Appendix for items' details).

The following control variables were also included. Type of hospital the ward belongs to: categorical variable were 1 = traditional hospital of the National Healthcare System, 2 = research-oriented hospital, 3 = specialized hospital, 4 = university hospital; number of hours dedicated to team meetings during a week: Likert-type scale were 1 stands for "zero hours" while 6 stands for "more than eight hours"; and number of protocols or guidelines that the team has produced in the last year. Likert-type scale were 1 stands for "zero guidelines" while 6 stands for "more than eight guidelines."

3.3 Data analysis

Since our data were all collected using a survey questionnaire, the impact of common method variance (CMV) on our findings could be a concern. To evaluate the extent to which CMV might influence our empirical findings, we carried out various post hoc tests on the data. First, a Harman's single-factor test was conducted on the six conceptually crucial variables of our theoretical model. The outcome of this test showed that there are six factors, and that the highest variance accounted for by one factor is 21.40 percent, indicating minimal evidence of method bias (Harman, 1967).

Also, an analysis using a single-method-factor approach advocated by Podsakoff *et al.* (2003) and by Liang *et al.* (2007) likewise showed that CMV was not problematic. This approach consists in ascertaining that, after controlling for the effects of an unmeasured latent method factor in our structural model, all path loadings of the hypothesized indicators with their respective constructs remain statistically significant (details of this analysis can be requested to the corresponding author). Taken together, these analyses show that CMV is unlikely to have any substantial impact on our results.

Next, we proceeded with the evaluation of the psychometric properties of our constructs. In order to assess the psychometric properties a CFA analysis was conducted. The CFA model was estimated using LISREL 8.80 (Jöreskog and Sörbom, 2006).

The goodness-of-fit of the model was assessed with the χ^2 statistics, the normed fit index (NFI), the non-normed fit index (NNFI), the comparative fit index (CFI) and the root mean square error of the approximation (RMSEA). Discussion of these indices can be found in Bollen (1989). Satisfactory models fit are indicated by NFI, NNFI, CFI values above 0.90 and RMSEA below 0.08. The proposed hypotheses were then validated using seemingly unrelated regression (SUR) techniques. SUR offers several advantages (Zellner, 1962) and two are particularly important for this study. First, knowledge exploration and exploitation are related constructs that are driven, in part, by the same underlying processes. This fact can be properly modeled within a SUR framework, as correlated error terms of the regressions are easily accommodated within this approach. Additionally, a system of equations produces more efficient estimates when the error terms of the regressions are correlated, as is the case in this study. As a consequence, SUR represents an appropriate data analysis technique.

4. Results

4.1 Measurement model

Results for the CFA showed that the model fitted the data well. The fit statistics were as follows: $\chi^2(215) = 437.00$, CFI = 0.98, NFI = 0.92, NNFI = 0.95, RMSEA = 0.077. Also, model constructs were considered for their psychometric properties. Discriminant validity of all factors was assessed by performing a number of χ^2 tests contrasting the hypothesized measurement model with models where, in turn, each inter-construct correlation was constrained to be equal to 1. All constrained models reported a worse fit than the unconstrained model. Additionally, all constructs were inspected for relevant cross-loadings and AVEs were calculated for each factor to assess convergent validity (all were above the 0.5 threshold level). Finally, all scales displayed adequate Cronbach's α reliability coefficients, all above 0.75. Table I describes measurement statistics and correlations among model constructs.

4.2 Hypotheses test

Prior to hypothesis testing, we inspected our model for the presence of collinearity among independent variables. Average reported VIF amounted to 1.67, while the maximum VIF among two variables was 2.98, thus indicating that collinearity is not a concern in our case.

Tables II and III show the results of the SUR using exploration and exploitation as dependent variables. Within each table, three models have been tested. Model 1 shows the effect of controls on the dependent variable, model 2 includes the main effects within the previous model, and model 3 adds the moderation terms.

	Mean	SD	1	2	3	4	5	6
1. Structural SC	6.05	1.01	(0.91)					
2. Relational SC	5.58	1.17	0.597**	(0.78)				
3. Cognitive SC	5.72	1.16	0.491**	0.397**	(0.77)			
4. Environ. dynamism	4.41	1.47	0.172*	0.079	0.137	(0.89)		
5. Exploration	5.41	1.19	0.434**	0.551**	0.392**	0.356**	(0.94)	
6. Exploitation	5.74	0.92	0.462**	0.467**	0.394**	0.356**	0.679**	(0.93)

Notes: $n = 174$. On the diagonal the Cronbach's α reliability coefficients. * $p < 0.05$; ** $p < 0.01$

Table I.
Means, standard deviations and correlations among model constructs

	Model 1 coef. (SE)	Model 2 coef. (SE)	Model 3 coef. (SE)
<i>Control variables</i>			
Type of hospital:			
Research-oriented	0.363*	0.178	0.156
Specialized	0.109	-0.298	-0.294
University	0.293	-0.181	-0.237
Team meetings	0.119*	0.052	0.031
Guidelines	0.143*	0.012	0.029
<i>Main effects</i>			
Structural SC (SSC)		-0.008	0.157****
Relational SC (RSC)		0.469***	0.339***
Cognitive SC (CSC)		0.139****	0.179*
Dynamism (DIN)		0.297***	0.308***
<i>Moderation effects</i>			
SSC × DIN			0.402***
RSC × DIN			-0.225**
CSC × DIN			-0.164*
R^2	0.115	0.449	0.544
χ^2	20.86***	112.27***	164.65***

Notes: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; **** $p < 0.10$

Table II.
SUR results for
exploration

	Model 1 coef. (β)	Model 2 coef. (β)	Model 3 coef. (β)
<i>Control variables</i>			
Type of hospital:			
Research-oriented	0.301*	0.127	0.086
Specialized	0.090	-0.416	-0.390
University	0.328	-0.336	-0.432
Team meetings	0.192**	0.107****	0.104*
Guidelines	0.107*	0.011	0.021
<i>Main effects</i>			
Structural SC (SSC)		0.116	0.325***
Relational SC (RSC)		0.303***	0.180*
Cognitive SC (CSC)		0.143****	0.168*
Dynamism (DIN)		0.255***	0.281***
<i>Moderation effects</i>			
SSC × DIN			0.430***
RSC × DIN			-0.275***
CSC × DIN			-0.066
R^2	0.136	0.449	0.510
χ^2	25.25***	91.43***	143.62***

Notes: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; **** $p < 0.10$

Table III.
SUR results for
exploitation

The relevant increase in the R^2 between models 1 and 2 and between models 2 and 3 suggests that both the main effects and the moderating effects significantly contribute to explain knowledge exploration and exploitation. With regard to model 3, we observe that control variables only marginally affect knowledge exploitation while bear no impact on knowledge exploration. In particular, team meetings appear to positively contribute to knowledge exploitation.

With respect to main effects and their impact on knowledge exploration, our results indicate that *H1* is fully supported. Each dimension of social capital, in fact, positively and significantly affects knowledge exploration. relational social capital, in particular, emerged as the most relevant antecedent of knowledge exploration ($\beta = 0.339$, $p < 0.001$) *vis-à-vis* structural social capital (only marginally significant, $\beta = 0.157$, $p < 0.10$) and cognitive social capital ($\beta = 0.179$, $p < 0.05$). Our results indicate that *H2* is also fully supported. All dimensions of social capital positively affect knowledge exploitation ($\beta = 0.325$, $p < 0.001$; $\beta = 0.180$, $p < 0.05$ and $\beta = 0.168$, $p < 0.05$, respectively, for structural, relational and cognitive social capital). Eventually, environmental dynamism also emerges as a significant antecedent of both exploration and exploitation ($\beta = 0.308$, $p < 0.001$; $\beta = 0.281$, $p < 0.001$, respectively), thus supporting *H3* and *H4*.

The last set of hypotheses explores the moderating effects of environmental dynamism on the relationship between social capital and knowledge exploration and exploitation (*H5* and *H6*, respectively). Focussing on exploration as dependent variable, our results partially support *H5*. In particular, *H5(a)* is not supported, since, contrary to our expectations, environmental dynamics positively moderate the link between structural social capital and knowledge exploration ($\beta = 0.402$, $p < 0.001$). *H5(b)*, on the other hand, is supported. Environmental dynamics negatively moderate the link between relational social capital and knowledge exploration ($\beta = -0.225$, $p < 0.01$). Finally, *H5(c)* is also supported, as environmental dynamism negatively moderate the link between cognitive social capital and knowledge exploration ($\beta = -0.164$, $p < 0.05$). With regard to knowledge exploitation, our results only partially support *H6*. Contrary to our expectations, environmental dynamism positively moderates the relationship between structural social capital and knowledge exploitation ($\beta = 0.430$, $p < 0.001$), thus *H6(a)* is not supported. The moderation effect of environmental dynamism on the relationship between relational social capital and exploitation is, on the other hand, negative ($\beta = -0.275$, $p < 0.001$), thus supporting *H6(b)*. Finally, no significant moderation effect of environmental dynamism on the relationship between cognitive social capital and knowledge exploitation is reported ($\beta = -0.066$, $p > 0.10$). *H6(c)* is therefore not supported. Figures 2 and 3 contains the plots of the moderating effects that were found to be statistically significant.

5. Discussion

This study highlights three main results: first, social capital is a positive and significant antecedent of both exploration and exploitation efforts; second, environmental dynamism has a significant and heterogeneous moderating role on the link between social capital dimensions and knowledge exploration/exploitation; and third, environmental dynamism is by itself a positive and significant antecedent of knowledge exploration/exploitation.

In the first regard, all dimensions of social capital exert a positive effect on both knowledge exploration and exploitation. Overall, these results indicate that having a dense network (i.e. strong structural capital) of close ties (i.e. strong relational capital) populated with members that share common vision and goals (i.e. strong cognitive capital) stimulates wards to perform knowledge exploitation and exploration. The main rationale for this result is that wards have access to a wider set of resources that they can use to identify and use external knowledge as well as to organize and use internal knowledge.

The results, however, reveal also notable differences in terms of how different social capital dimensions affect knowledge exploration and exploitation.

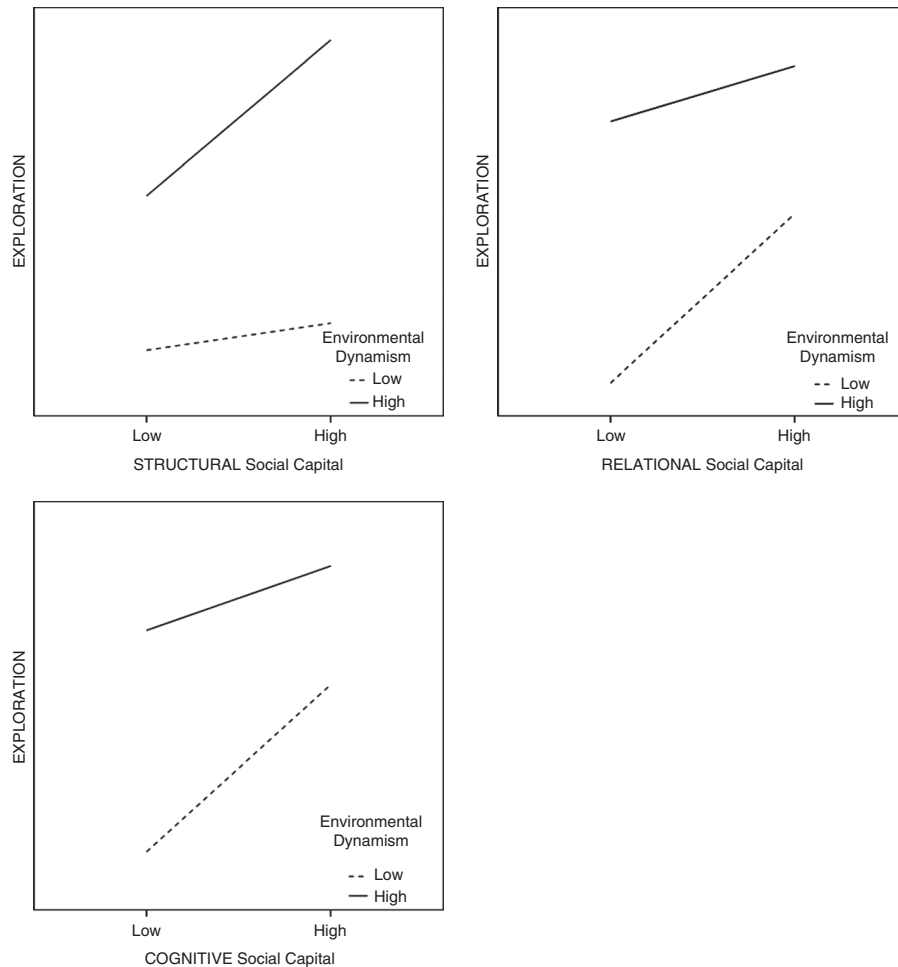
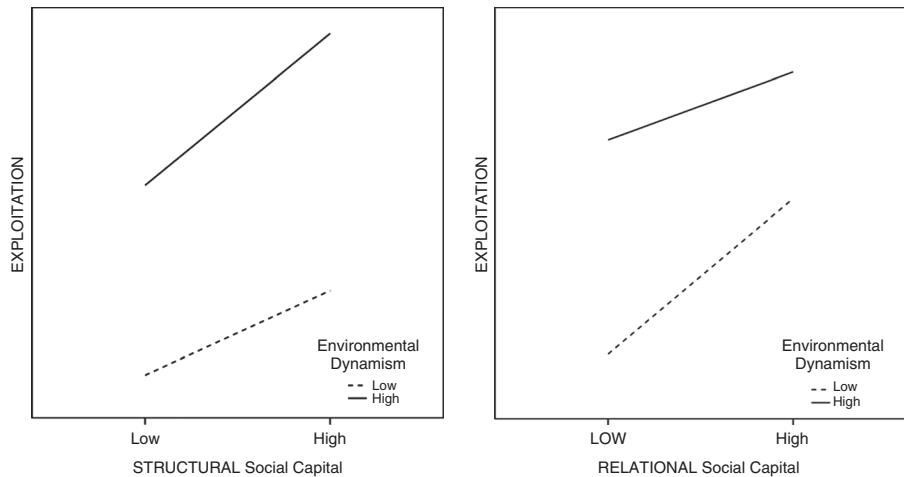


Figure 2.
Moderating effect of
environmental dynamism
between social capital
and exploration

In the case of knowledge exploitation, structural social capital plays a significantly larger role than relational and cognitive social capitals. This result is consistent with research on the “strength of weak ties” which indicates that individuals, groups and organizations are more likely to finding new stimuli and non-redundant knowledge in weak ties as they would be connected to structural holes (Granovetter, 1973, 1983; Burt, 1992). Likewise, we can contend that the possibility to scrutinize a larger and denser network of acquaintances supported wards in their search for and exploitation of non-redundant knowledge. Dense ties provide more opportunities to individuals in a ward to access the resources made available by everybody else, and this increases the possibility to identify and connect structural holes within (and by means of) the ward. Relational and cognitive dimensions of social capital also increase such possibility arguably because they make it easier to scrutinize the network. Strong ties provide trust and interpersonal dynamics that help individuals to dedicate more time and to have more assistance when trying to identify and combine internal knowledge. On the other hand, cognitive assonance allow individuals to scrutinize and exploit the internal

Figure 3.
Moderating effect of environmental dynamism between social capital and exploitation



network more effectively as individuals share notions of “what is important to look for” and “for what.”

The same result could be expected for knowledge exploration, and perhaps even more significantly, since wards would be in greater need to identify structural holes to explore external knowledge. Instead, the results show that relational social capital plays a significantly larger role than structural and cognitive social capital. Structural social capital, in particular, is almost non-significant ($\beta = 0.157$, $p < 0.10$). This result might be understood interpreting knowledge exploration as a risky behavior, i.e. individuals embedded in wards are exposed to the risk of misunderstanding the external knowledge. As the network gets bigger and denser, individuals receive a larger number of different inputs that they might struggle to make sense of, and translate into action (Gilsing and Duysters, 2008). Accordingly, individuals in a ward are more likely to concentrate on strong ties which embody less risks of misunderstanding, since the individual: first, would have more time and interpersonal support to interpret and align the resource available; and second, would be less exposed to threats since the interpersonal relationships are regulated by trust.

Noticeably, environmental dynamism “restores” the original dynamic: as environmental dynamism becomes higher, in fact, structural social capital becomes more important, and relational and cognitive social capital become less important. This result can be explained as follows. When the environment is more turbulent, the search for new knowledge is more urgent and wards are more exposed to the risk of not finding any relevant knowledge that could address the threats of competition and precipitating jolts. This risk might become so relevant that it offsets the risks associated with misunderstanding knowledge – arguably because it challenges the ward as a whole and not just its interpersonal dynamics. Individuals embedded in the ward, then, will pay less attention to the strength of ties, and scrutinize more the whole network to increase the possibility to access and use external knowledge. The same effect can be appreciated in the case of knowledge exploitation, where again structural social capital becomes more relevant, and relational social capital less relevant – thus suggesting that individuals in the ward might pay less attention to the relational nature of the tie, and dedicate more effort to scrutinize the entire network.

Taken together, these results indicate that environmental dynamism plays an important moderating role, and affects how the collective unit (e.g. ward) accesses its social capital. Higher environmental dynamism, we argue, generates a sense of urgency that pushes ward to wholly scrutinize its network, paying less attention to the role of relational and cognitive assonance.

Finally, our results indicate that environmental dynamism directly increases both knowledge exploration and knowledge exploitation. Differently from past research that questioned whether environmental dynamism had bigger effects on exploration or exploitation (Ahuja, 2000; Yli-Renko *et al.*, 2001; McEvily and Marcus, 2005; Posen and Levinthal, 2012), we found comparable effects which, most importantly, are both positive and significant. These results suggest that, in contexts of environmental dynamics, collective units do not necessarily choose to concentrate on one strategy at the expense of the other – rather they can pursue both knowledge exploration and exploitation. This is consistent with the notion that a turbulent environment would push organizational collectives to find new ways of working, and these new ways of working might come from a recombination of internal practices, as well as the translation of external practices. Since both options are relevant, both knowledge exploitation and exploration are relevant as well, and would be actively pursued. Conversely, the results also suggest that some degree of environmental dynamism is needed to stimulate knowledge exploration and exploitation. In situations of environmental stability, organizational collectives might not be stimulated to engage in knowledge exploration and exploitation because of a natural tendency to preserve the routine (Becker, 2004).

6. Conclusions

This research adds to our understanding of the antecedents of exploitation and exploration by providing evidence of the role played by the structural, relational and cognitive dimensions of social capital. The findings of this study fill a gap in extant literature in the field which has thus far concentrated on contextual factors (e.g. culture, organizational identity) and on units' properties (e.g. size, functions). Social capital emerges as highly instrumental for units in gaining access to external knowledge assets and to stimuli to recombine the knowledge already available within the unit.

Furthermore, the results also provide further evidence on environmental dynamism – an antecedent which has catalyzed conflicting results in the literature. Our results indicate that environmental dynamism exerts a direct positive impact on exploitation and exploration; and it also represents a relevant moderator in the relationship between social capital and knowledge exploration. In terms of practical implications, we believe that our study can support hospital managers or head physicians (i.e. ward leaders) in designing initiatives that could recognize the centrality of network ties – in terms of density, strength and cohesiveness – for strategies aimed at continuously improving hospital performances. The internal social network represents one locus in which hospital units can identify and acquire knowledge from outside (supporting an explorative capability) as well as the locus in which knowledge can be shared, recombined and turned into novel solutions (supporting an exploitative capability). Our findings primarily imply that managers should encourage initiatives that support systematic connections among units and facilitate knowledge exchange – and diverse interventions can be put in place, from systematic plenary meetings to more sophisticated ones such as “boundary spanning” tools (e.g. ICT solutions) and

roles (e.g. knowledge brokers). Future research, in this regard, is encouraged to dedicate specific attention to understand which initiatives are most suited to build “high” social capital. The establishment of network closure and strong ties in professional contexts is in fact, often elusive to top and middle managers – especially considering how employees protect themselves from top-down sight.

This study presents three limitations that future research could consider to advance our results. The first element concerns our conceptualization of the structural dimension of social capital. Different conceptualizations of structural social capital exist in the literature, at times leading to divergent results. Following Payne *et al.* (2011), we looked at the resources embedded in the network, rather than the structural features of the network (e.g. number of ties or their hierarchy as in Nahapiet and Ghoshal, 1998). While our results are consistent with this choice, future research could complement it with an assessment of the strictly structural features of the network – to identify, for instance, which structure is suited for this purpose – as well as more objective, non-perceptual, measure of the resources accessed by units – to identify, for instance, which resources are relevant and sought after. The second element concerns our choice of hospital wards as our research locus. Hospitals are not dissimilar to many other professionalized and service organizations, such as consulting companies, non-profit organization, law firms, universities, etc. As such, we believe that our results can be generalized in professionalized contexts in both private and public sectors. At the same time, the generalizability of our findings to non-professionalized contexts settings remains in question – and thus we recommend dedicating specific attention to replicate results in these settings before coming to conclusive results. Finally, our results rely on a single-survey and single-respondent design. Although evidence of relevant CMV effect was not present, we encourage future research to enrich the methodological approach triangulating multiple respondents’ perspectives and coupling surveys with non-perceptual measures.

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Appendix. Survey questionnaire

We asked respondents whether they agreed or disagreed with the following statements.

Structural social capital

1. Our employees usually collaborate with each other in order to identify and resolve problems.
2. Our employees frequently interact with colleagues within the same ward.
3. Our employees usually exchange information with colleagues on their specific area of expertise
4. Our employees learn from mutual interaction.

Relational social capital

1. In this ward employees trust one another.
2. Our employees develop strong relationships based on trust with specific employees within this ward or outside.
3. Our employees exchange their own ideas with numerous colleagues within this ward.

Cognitive social capital

1. Numerous valuable ideas and important work processes belong to "the way we do things" in this ward.
2. "The way we do things" in this ward provides a support and guideline to our employees.

Exploitation

1. Our employees share their expertise in order to develop new services.
2. Our employees are skilled in translating new knowledge into new services.
3. Our employees constantly consider new ways of better exploiting our internal knowledge.
4. Our employees clearly know who can better exploit new knowledge or technologies within our ward.
5. Our employees are very good in exploiting new knowledge or new technologies.

Exploration

1. Our employees quickly grasp new opportunities to better serve our patients.
2. Our employees quickly analyze and interpret changing market demand.
3. In this ward we often acquire new technologies or follow new processes from the outside.
4. Our employees always catch changes that occur in our area of expertise in terms of new services provided to patients.
5. Our employees quickly catch the benefits that new knowledge coming from outside the ward can give to our current stock of knowledge.

Environmental dynamism

We asked respondents how often the following practices have occurred in their area of expertise in the last five years:

1. Frequent technological changes.
2. Increase in the number of services offered.
3. Frequent changes in the type of services offered.
4. Frequent changes in market regulation.