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ABSTRACT

The present study describes an Integrated Methodology developed combining Social Network and Content Analysis approaches, to investigate the organizational mechanisms responsible for the creation of Social Capital within Communities. The methodological integration is proposed to overcome one of the main limitations of Social Network Analysis (SNA): the analysis of the content of the information flows and the organizational and cultural aspects of their exchanges.

The methodological framework was able to differentiate the "ties" among community members on the basis of the subject matter of the information flows. It showed its reliability for Project-oriented Virtual Communities to discover and draw the development path of their projects, from the new idea generation to the project outcome delivery, through the content "tagging" of the information flows. It is suitable to describe the main characteristics of a project-oriented community, useful and effective to monitor the processes developed within the community.

Keywords (Required)

Social Capital, Communities of Practice, Virtual Communities, Social Network Analysis, Content Analysis.

INTRODUCTION

During the last decades an increasing number of knowledge-based theories on organizational development arose, pointing different perspectives on the paradigms of "knowledge management" and "organizational learning" (Senge, 1994;Von Krogh et al, 1996), and their integrative features (Pawlowsky, 1999).

They were employed as a framework for the analysis of strategic organizational processes (Mintzberg et al, 1999), allowing to focus the individual and collective dimension of the organizational dynamics, identifying knowledge workers and knowledge communities as interest groups, "critical sources of knowledge and information as well as enablers of knowledge diffusion processes that might be of major concern for the development pattern of an organization" (Wilkens et al, 2004).

Many industrial and commercial organizations sensitive to these issues, while facing the threats and challenges of the knowledge-intensive business environment (Probst et al, 1997) developed, supported and sometimes institutionalized new forms of interactions among workers, internally and externally to the organizational boundaries (Enkel et al, 2000), that assumed the shape of communities, able to activate processes of generation of knowledge through the socialization processes (Nonaka and Takeuchi, 1995).

These new organizational forms were labelled "Communities of Practice" (Lave and Wenger, 1991) to identify unequivocally groups behaving as integrated networks, gathered in an open and flexible interaction, inside and outside the company boundaries, that made organizations able to respond to diverse external stimuli, spanning from market trends to technological change and competitive initiatives (Ghoshal and Bartlett, 1997).

The diffusion of Internet allowed communities to benefit from virtual networking,and delocalization (Cothrel and Williams, 1999), and to become more capable to afford the challenges of the new business environment increasing complexity (Hildreth

et al. 2000). The effectiveness of these new forms of collaboration and knowledge exchange provided wide attention to the managerial issues connected with their creation and support (Schultz et al, 2003; Mitchell, 2002); and a growing interest by scholars and managers in understanding how they work, how they organize internally, how they produce such value that is known as "social capital" (Burt, 2000).

THE SOCIAL NETWORK ANALYSIS: AN ANALYTICAL APPROACH TO INVESTIGATE SOCIAL CAPITAL CREATION

Social Network Analysis can be considered "the disciplined inquiry into the patterning of relations among social actors, as well as the patterning of relationships among actors at different levels of analysis" (Breiger, 2004). This methodology was widely employed since the 60s to highlight the link between the network structure of communities and the creation of social capital, represented by organizations' competitive advantage.

According to Burt, *closure* and *brokerage* are the foundation of the Social Capital research,and the starting point for every empirical research on the organizational mechanisms responsible for Social Capital creation (Burt, 2000).

Closure, represented by network density, is a source of Social Capital for the benefit of avoiding the risks associated with incomplete information; and because it facilitates sanctions, that allow people in a network to build trust relationships with the other. *Brokerage* is a concept connected with the advantage provided by the holes in social structures, the so called "*Structural Holes*" (Coleman, 1988): structural holes are an opportunity to broker the flow of information between people, and control the project that brings together people from the opposite sides of the hole" (Burt, 2000).

So both information access and control advantage represent the major advantages of a network structure, or a Social Capital. The approach, that focuses the Network Structure of Social Capital (Burt, 2000), brings the investigation about Social Capital creation on the identification of the organizational mechanisms responsible for the creation of social capital, mainly the two leading complementary mechanisms considered in this work, Closure, or Density, and Structural Holes, or Hierarchies.

The great contribution given by Burt (2000) is in that his work points of the correlation between network measures and performance: although several contingency factors usually affect the network evolution and behaviour and the organizational performance, his study was able to outline the main network conditions that explain a positive performance.

THE LIMITATIONS OF SOCIAL NETWORK ANALYSIS: THE NEED OF AN INTEGRATED METHODOLOGY

Relevant contributions (Naphiet and Ghoshal, 1998; 1993; Putnam, 1995) pointed the centrality to the Social Capital theory of the networks of relationships considered as a valuable resource to support social business, able to build for the community members "the collectivity, owned capital, a credential which entitles them to credit, in the various senses of the word" (Bourdieu, 1986, p.249). The *three-dimensions model* of social capital was considered as composed by the Structural Capital, representing the connections among members, the Relational one, embracing cultural aspect and motivation of the relationships, and the Cognitive one, regarding the content of the information flows (Naphiet and Ghoshal, 1998).

As Goodwin and Emirbayer (1994) pointed, Social Network Analysis is a framework devoted to the investigation of the information structure of groups, intending for it only the "structural dimension" of social capital or the connections, disregarding the content of relationships, that is the content of ties, in such a way neglecting the other dimensions of social capital. It considers all the ties in a network as comparable, indistinguishable and homogeneous in content. Applied to a large CoP, with a relevant size, observed for a long period, people performing different activities, or involved in different projects, interested in different topics or active in solving a specific problem, are detected simply as interacting members, with none distinction among categories of subgroups or changing in domain over time.

Stinchcombe (1990) expressed the need to articulate a systematic theory of social network coming from the dynamic an causal dimensions of the relationships, able to investigate ties among community members not only under the quantitative aspect related to the SNA metrics, like density and centrality, but also under the qualitative aspect related to the content of the ties, intended as the discussion topic, the phase of advancement in discussion or in collaborative work, that give meaning to the "relational" and "cognitive" dimensions of the social capital. He claims for the improvement of the investigation of the actual information, knowledge or message that flows across the links, explaining what people are doing, what they are working for, how much they are involved in a specific activity, who decides for what, who proposes a new idea and so on.

THE RESEARCH FOCUS

In this theoretical frame, the proposal of a methodological combination of two different approaches aims at carrying on further step in the study of the relation between communities implementation and organizational performance, by detecting the organizational behaviour of community members with regard to the "argument" of the ties among them.

The present work describes the application of such an integrated methodology based on the combination of two analytical approaches, the Social Network Analysis and the Content Analysis, useful to help Project-oriented Communities, Communities of Practice, Collaborative Innovation or Knowledge Networks to discover and draw the development path of each project, from the new idea generation to the project outcome delivery, through the content "tagging" of the information flows. It could enable the analysis of their overall composition, evolution and social structure, but also the characteristics and organizational behaviour of each project related sub-community, with the identification of the individual role of members and their contribution to the development of each task.

The achievement of the presented goal has been conducted under the guide of the following question: *How in a dispersed project-oriented community a new idea is driven through the development of the project until the delivery of the project outcome, given the information structure of the community and the organizational behaviour of its members?*

To answer the question above, a case study analysis was conducted on a large Virtual Community developed at a global scale, involving a huge number of members and a wide range of different organizations sited all over the world.

THE COMBINATION OF CONTENT AND THE SOCIAL NETWORK ANALYSIS

Content Analysis

Content Analysis (CA) is "a research technique for making replicable and valid inferences from texts or other meaningful matter to the context of their use" (Krippendorff, 2004).

Highly flexible methodology diffused in library and information science, it is conceived for identifying the presence of certain words or concepts within texts or group of texts, following the basic communication model of sender/message/receiver. "Inference" is a fundamental component of the methodology: the researcher uses analytical constructs or rule of inference to move from the text to the answer to the research question. (Marsh, 2006).

Different classification of CA typologies are available in literature; a research developed within the project of the Writing Center at Colorado State University, available on the website http://writing.colostate.edu, clarifies the differences between two fundamental categories of CA, the Conceptual and the Relational Analysis. Both kinds of research start with the identification of concepts present in a text or a set of texts; the fundamental difference is that Relational CA, also known as Semantic Analysis, focuses on the semantic, meaningful relationships between concepts: concepts individually are considered without any inherent meaning. Indeed Conceptual Analysis, also known as Thematic Analysis, is designed to determine the existence and frequency of concepts, generally represented by single words: a concept is chosen and the analysis is articulated on quantifying and tallying its presence.

The goal of the present work, that is to differentiate ties on the basis of their discussion topic, the phase of advancement in discussion or in collaborative work, that give meaning to the "relational" and "cognitive" dimensions of the social capital, brought us to chose for a Conceptual Analysis, focused on the Manifest Content, that resides on the surface of the communication. The CA applied to Manifest Content presents some advantages: it is easily observable, sufficiently formalized to be operationalized in an automatic way, and needs few interpretative efforts from coders (Rourke et al., 2000). "The requirements of scientific objectivity dictate that coding be restricted to manifest content" (Holsti, 1969).

Social Network Analysis

In 1979 Tichy, Tushman and Fombrun stated that Network Analysis represents an underutilized framework for analysing and conceptualizing organizations. Since then an increasing interest towards application of SNA application to study inter and intra organizational relationships appeared to follow the identification of the community dimension of actors working in a collaborative way for reaching common goals, pointing the facilitation in learning and knowledge sharing among individuals (Wenger and Snyder, 2000; Gloor, 2005).

Some important measures at a Group level like distance, reachability and density (Wassermann and Faust, 1994), as Betweeness, Closeness and Degree Centrality (Borgatti and Everett, 1999) give a quantitative description of the social network structure, while the same measures of centrality at the Individual level identify the most prominent actors,

extensively involved in relationships with other network members. Using these measures and a network representation, (Krackhardt, 1994) is a reliable way to obtain the identification of the network structure. As for the representation, a direct approach to the shape of Social Networks is ensured by the application of the Graph Theory, a complex framework able to translate in formal language the characteristics, dimensions and peculiarities of a network. The main elements that form a graph are points, representing the agents, and the lines, or edges, representing their relations; the sociogram, or the graph of networks, describes the qualitative patterns of connections among actors as a translation of the data contained in a matrix, drawing a representation of each row or column in a visually simple and intuitive way.

The investigation about the individual roles of strategic members within communities saw recently the important contribution of Gloor (2005) who identified four different role patterns inside the networks: creators, in apposition that allows them to see the entire knowledge flows; communicators, whose network role is to link to external members of other groups; collaborators, who have the task to coordinate others' activities; and knowledge experts, usually the subject matter experts in certain domains, all detectable though the Contribution Index (Gloor, 2005).

Recently the concept of Density has been often associated to that of cohesion (White, Harary, 2001): a group is intended to be cohesive "to the extent that the members are pulled together when confronted with disruptive forces" (Kadushin, 2004). To evaluate the level of cohesiveness of a network it is sufficient to remove one or more members and to report the emerging dynamics in terms of disconnectedness.

Density is a core concept and measure of the present study. Following the findings of Burt research (2000), the identification of the clear negative correlation between density and performance makes its evolution a relevant indicator of the performance evolution of the network (Burt, 2000).

In the present analysis we referred to the trend in density evolution to discover the organizational behaviour change in the community as related to the most evident change in density value. The assumption that as density decreases the community performance is improved could drive the observation of the periods in which the network assumes a clear and effective organizational structure, providing the benefits of the social capital exploitation for the overall community.

The methodological integration

The proposed methodology is articulated in three main phases,

1. *Initial Audit*. It is aimed at acquiring information about the Case object of the study, and about the Organization that created and lead the community. It may consist of an interview to a member of the community, better if he is in a strategic position in the network to behave as a key informant for the research. The information gained must be integrated with documents and data collected through publications, web sites, interviewee notes, to guarantee the differentiation in sources of evidence, to support the validity of the study.

2. *Content analysis*. The Content Analysis to be applied to the texts of the exchanged messages within the community, has the general goal to divide large communities in sub-groups, differentiated on the basis of the project they are developing. Its application consists of processing the overall messages database to find for each project a word, or a set of words, clearly and unequivocally representative of the project itself, to "tag" for each project the related communication flows.

3. *Social Network Analysis*. Starting from the results of the Content Analysis, each project related sub-community can be observed under a Social Network Analysis view, applying its main parameters and measures. It allows to obtain

a. *the Sub-community overall identification*, by investigating the Network Structure (network size, number of organizations involved, overall density/cohesiveness, Core-Periphery Structure); the Project Initiative features (Project Idea appearing date, Promoters, Project development temporal length); the emerging Characters and Positions for each Project, mainly through the application of the Actors Contribution Index.

b. *the Sub-community evolution time by time*, choosing a time unit, based on both the Quantitative Evidence (network growth by month, number of organizations involved by month; density/cohesiveness monthly evolution) and the Qualitative Visualization (actors positions, centrality and eccentricity; emerging roles and hierarchies; organizational dynamics)

The application of both Content and Social Network Analysis required the support of an automated system. For the purpose of the study we adopted the Condor software, formerly known as TeCFlow, a tool developed over the last 5 years at the MIT Center for Collective Intelligence and the Dartmouth Tuck Center for Digital Strategies (Gloor & Zhao, 2004).

THE CASE STUDY

The described methodology was applied to a large virtual Community, shaped as a Collaborative Knowledge Network (Gloor, 2006), created in 2001 by a Global Consulting.

From the *First Audit* it emerged that the role of the organization that created the community was relevant for its development. Such company is composed of 70 firms distributed in 140 Countries all over the world providing professional services in several areas of expertise, like accounting, consulting and other professional services; with a strong culture of cooperation, today it employs about 95,000 people, has customers in about 150 Countries, and a large number of partners.

Company cultural factors are the care to the customers, the centrality of people, the strength of cultural diversity. These ones, together with the principles of trust and commitment to each other and the sense of integrity, represent the common vision and the set of believes of the group.

The availability of a whole email database of the community recorded during the years 2001 – 2002 was the base for the application of both the Content and the Social Network Analysis.

The community was an ideal setting for testing the methodology for the following features:

- the actual amount of messages: 5431,
- the size of the community: 1141 actors,
- the variety of the involved organizations: 85,
- the wide geographical distribution: 100 different countries,
- the length of the period of observation: 19 months.
- the availability of a key informant to test step by step the reliability of the research findings.

The Content Analysis Phase was articulated as follows:

1. *Direct observation of the sample messages*: 30 messages over 5431 were read to understand the main characteristics of the language used in the email exchange, and to facilitate the developing of "inference rules" aimed at identify project-representative words.

2. *Development of "Inference Rules":* the draw of the logic of the "coding schema" generalizing the evidences coming from the direct observation of the texts. They derived from the recognition that in the exchanged messages the projects were identified always by their proper names or titles; and by the recurrent common features of these terms: never common words; always expressed in English independently from the conversation language, English or German; generally composed by two terms merged; sometimes composed by a letter (Ex. "e") and a common word (Ex. "ehome").

3. *Coding process*. It was the result of a semi-automated process, based on the computer aided system support, the "Condor" software, and the human involvement. It consisted of two phases:

    a.   Data collection and refining through the Condor software
    b.   "Preview terms" selection through the human involvement

The use of the two "stopword lists" in the automated data processing let us to extract from 5135 messages 3807 words to be analyzed. The analysis was conducted "by hand" on the basis of the developed Inference Rules, and articulated in an iterative process. Five iterations were made, with a continuous further selection, obtaining a gradual reduction from 3807 to 652, 141, 62, 27, 11 words.

The extracted 11 words were supposed to be the "topics" representative of the projects, products, services, methodologies or practices, that the community had developed during the period of observation. From a second interview it resulted that 9 of the 11 terms were the searched projects, showing a range of error of the kind of CA applied to the case of about 18%.

The Social Network Analysis Phase was aimed to analyze the large community as composed of 9 sub-communities, each one related to one of the topics extracted through the CA. These topics were employed as "tags" to differentiate in the software aided analysis the community in subgroups.

The Condor software was able to select the communication flows related to each topic, to highlight the network nodes "talking about" the chosen project. To each of these subgroups the intended set of measurements and visualizations of the analytic approach were applied, on a monthly scale, to give an approximation of the development of each project developed by the community.

While the application of the sole Social Network Analysis would have provided the picture of evolution the Community and its network structure as a whole, the integrated methodology let us discover the 9 subcommunities by which it was composed, and to analyse each one separately and in comparison with the others.

The analysis of each project related subcommunity, and the comparison among them in a "cross-project" analysis, was able to depict the overall community evolution and features, that were visualized and summarized in :

    a.   *Size*: the overall community of 1141 actors developed 9 projects over a period of 19 months. The 9 project-related subcommunities varied from 16 to 605 in size. Project 3 with 605 actors makes it the most participated, involving more than half of the overall community. By far the most complex and important one. The monthly distribution of actors per project was summarized in a "Actor – Projects Table".

Months	Project 1	Project 2	Project 3	Project 4	Project 5	Project 6	Project 7	Project 8	Project 9
1	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0
3	5	8	4	5	0	0	0	0	0
4	2	4	8	6	0	0	0	0	0
5	26	2	50	24	12	0	0	0	0
6	8	4	36	16	9	0	0	0	0
7	23	10	116	31	7	28	21	0	0
8	11	13	95	83	41	32	25	6	0
9	19	11	91	99	24	34	24	18	0
10	151	25	86	97	33	171	194	12	3
11	13	9	102	78	21	57	50	15	2
12	14	17	85	189	28	77	34	5	12
13	4	13	218	111	184	96	26	9	9
14	3	36	135	119	58	116	20	18	2
15	0	3	146	127	55	102	13	19	0
16	0	0	52	23	31	20	0	24	0
17	0	0	0	8	4	0	0	0	0
18	0	0	3	0	4	0	0	0	0
19	0	0	19	19	0	0	0	0	0

Table 1: Monthly distribution of Actors per Project (Actor-Projects Table)

b.   *Organizational Chart:* while the application of the SNA could have provided only the identification of the most central actors, the application of the Betweenness Centrality measure and of the Contribution Index (Gloor, 2006) with the segmentation of the community in 9 project sub-communities allowed the definition of the "organizational chart" of the community, that is the hidden organizational structure of the Collaborative Knowledge Network, with the distinction of the actors present and central in all the projects, and those distributed per project. It defined a five levels organizational structure, as represented in figure 1.

Figure 1: The hidden organizational structure of the CKN.

c.   *Project initiative*: the first 5 projects were the most important ones, and also the most successful, as showed by the density trend of the study. They were developed under the proposal of the 2 leading coordinators, probably because of their relevance for the leading organization, and the temporal distribution of the proposals. The first four are to be attributed to the same month, August 2001, the fifth one to October, two months later. The others came out from the contribution of other actors but always within the 10 most central ones.

Cross Projects Analysis		Project 1	Project 2	Project 3	Project 4	Project 5	Project 6	Project 7	Project 8	Project 9
Network Structure	Size	206	86	605	437	295	281	268	71	16
	Organizations	4	2	18	9	11	6	9	4	1
	Density	0,01	0,05	0,01	0,01	0,01	0,02	0,01	0,05	0,22
	Core-Periphery	N	N	N	N	N	N	N	N	N
Project Initiative	Project idea starting date	Aug 2001	Aug 2001	Aug 2001	Aug 2001	Oct 2001	Dec 2001	Dec 2001	Jan 2002	Marc 2002
	Project idea promoters	Char 1 Char 2	Char 1 Char 2	Char 1 Char 2	Char 1 Char 2	Char 1 Char 2	Char 2	Char 5	Char 1 Char 5	Char 1 Char 2 Char 3
	Project length	12 months	13 months	17 months	17 months	14 months	10 months	10 months	9 months	5 months
Network evolution and behaviour	Not operative months	1,2 15,16,17,18, 19	1,2 16,17,18,19	1,2 17	1,2 18	1, 2, 3, 4 19	1,2,3,4,5,6 17,18,19	1,2,3,4,5,6 16,17,18,19	1,2,3,4,5,6,7 17,18,19	1 – 9 15 – 19
	Max centralization months	5, 9, 10, 12	8, 10, 14	From 5 To 16	From 8 To 15	8, 13, 14, 15	From 10 To 15	10	9, 14,15,16	12,13
	Average actors	11	10	45	48	25	44	26	14	2
	Max actors	151	36	218	189	184	171	194	24	12
	Subgroups	2	0	5	2	2	1	1	0	0
	Central secondary organizations	N	N	Y	N	Y	Y	N	N	N

Table 2: Cross Project Analysis Matrix

d. *Organizational dynamics*: the community showed a clear trend in maintaining a fixed core group of actors, that coordinated and administrated the CKN, and a wide variety of consultants, engineers, researchers, marketing experts that contributed in different ways to the development of different projects, justifying the high *rate of turnover* of the different groups. When the goal was clear and the project activities started, the involvement of new resources was generally concentrated in few months, detectable by the trend in *size* and *density* value, analyzing in depth for each project the months in which it decreased under the value of 0,1.
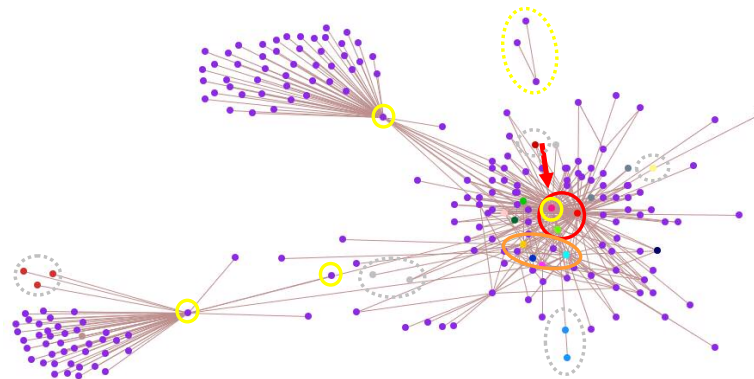

Figure 2: Project 2 Community Sociogram (Month 13). An example of organizational dynamics in a low density month.

MAIN MANAGERIAL IMPLICATIONS AND LIMITATIONS OF THE RESEARCH

The contemporary application of the experimented "tagging" system and of the Social Network Analysis allowed the study of the Community as composed of 9 sub-communities, each one involved in the development of one project.

The main limitation of the Social Network Analysis, that is to treat all the connections in the same way, without differentiating their arguments, being them referred to friendly personal communications or projects-related ones, revealed to be an obstacle in the analysis of large communities, like in the case of the study, performing different practices, preventing the development of a clear picture of the community, making it difficult to disentangle the web of many interactions, 5431 in our case, that present no meaning.

While SNA was able to point the "who" and the "how" of the social capital structural dimension, the integration with the Content Analysis revealed the "who", "how" and "what" of the social capital overall dimensions, structural, cognitive and relational, to provide a clear picture of the Community, useful to improve the understanding and the monitoring of such "hidden organizations", and to provide useful insights in their management.

The main managerial implications of the research findings regard the organizations' capability to

a.   *Understand:* the application of the presented methodology showed its suitability to describe the main characteristics of a project-oriented community, about

▪   the role of the original core group in guiding all the projects with a simple but tight organization;

▪   the impact of a strong leadership, becoming the centre of mass of the whole network.

b.   *Analyze and Monitoring:* the use of the applied methodology as a monitor for the processes developed to identify:

▪   the most involved actors, the way in which interact with the others and the spontaneous emerging of unpredicted roles;

▪   the trend in organizational behaviour, in density level, and centralization dynamics and the involvement of task-related subgroups, in the "operative" phase of the lifecycle.

c.   *Manage:* the application of the integrated methodology and the use of the presented frames, like the Cross-Projects Analysis Matrix could be useful as a managerial tool for

▪   identifying step by step the zones of intervention of each project, preventing the failure of project development activities;

▪   supporting the activity of all the community organization, identifying the best contributions to be rewarded;

▪   identifying the knowledge experts that play a crucial role in gathering competences needed by the company.

The main critical points of the research derive from the application of the Content Analysis. It is a very flexible and inferential approach: the *direct observation* of the sample messages could be affected by some degree of subjectivity. For this reason it is recommended for this phase of the analysis to be performed by more than one researcher. Moreover, the analysis of the social capital of a community requires attention to the cultural, relational and organizational context, that need the involvement of one internal actor, preferably one of the central ones, in the analysis of the overall community.

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