Structural Interventions in Electronic Networks of Practice: A Dynamic Grid/Group Model of Growth and Decline.

Peter Otto
Dowling College, School of Business
Oakdale, NY 11769
Tel: +1 (631) 244-3192
ottop@dowling.edu

Martin Simon
KSZ, School of Business
8002 Zurich, Switzerland
Tel: +41 (1) 919 08 34
sim@ken.ch

Abstract

Electronic networks of practice can help an organizations discover and share knowledge more effectively by facilitating learning both from within the organization as well as from entities outside the organization. In those instances where firms have linkages with outside organizations, however, the acquisition and sharing of knowledge takes place free from the constraints of hierarchy and local rules. These networks can be characterized as loosely structured, and generally self-organizing, which are made up of individuals who voluntarily participate in the creation and sharing of knowledge. Building networks without formal boundaries is a challenging task for any organization. This is because those responsible for building them must not only have to encourage the use of the new tools, but also refrain from intervening too often or with too heavy a hand. The objective of this paper is to conceptualize a simulation model, with which we can test the effects of structural interventions in electronic network of practice. The simulation model described in this paper is based on an explicit dynamic theory derived from the relevant literature. Simulation results indicate that: (a) too much structure (rules, regulations, and group commitment) can result in a decline of network attractiveness; (b) lack of structural interventions can lead to a network that only attracts those people who prefer an environment without any form of control.

Key words: Electronic network of practice, knowledge sharing, structural interventions.

Introduction

Given the growing complexity and dynamic nature of today's global markets, firms need to continuously innovate. To do this they need to learn faster than ever, certainly faster than their competitors. In order to facilitate this need for rapid learning firms must find ways to help their knowledge-based workforce discover and share knowledge. While practices designed to encourage learning within and across organizations have been in place for some time now, only recently have organizations become aware of the potential benefits that can accrue to the firm from practices designed to facilitate learning from entities outside the organization including even nominal competitors. Knowledge sharing within an organization is highly structured and well defined in terms of corporate policies that establish rules for sharing and retrieving knowledge from organizational stakeholders. In those instances where firms have linkages with outside organizations the acquisition and sharing of knowledge takes place free from the constraints of hierarchy and local rules. Professional associations often employ electronic networks as part of their membership benefits. Examples of successful networks include those engaged in open source software development where programmers voluntarily code software for the benefit of a broader community. The practice of establishing linkages with entities outside the organization recently gained attention when the CEO of Pfizer, Mr. Kindler, announced[1] that he wants his secretive researchers to open up and work more closely with outsiders. To encourage such collaboration Pfizer has decided to put the company's drugs pipeline on the Internet for all to see. His intention in doing this is to establish linkages to individuals and organizations outside Pfizer in order to leverage knowledge in hopes of improving the efficiency of Pfizer's R&D efforts.

Managing these loosely structured electronic networks, without formal boundaries, is a challenging task for an organization, echoing Andrew McAfee (2006) who stated the following: *"...leaders have to play a delicate role [to ensure the success of Online Communities], and one that changes over time, if they want to succeed. They have to at first encourage and stimulate use of the new tools, and then refrain from intervening too often or with too heavy a hand."* The main goal of an electronic network is to develop linkages with practitioners outside the boundary of the firm, while at the same time providing some structure so as help ease access, facilitate

[1] "Billion dollar pills" The Economist, Jan 25th 2007

collaboration and ensure quality of the knowledge being transferred. Thus, the main problem in building and sustaining electronic networks of practice is to balance a loosely structured environment with some control levers.

The concept of networks of practice (NoP) has lately achieved recognition within both academic and practitioner literature as a useful way not only to help facilitate learning, but also to help create identity, and even motivation within working groups. NoPs have been characterized as fluid social arrangements/relations, enacted among a self-selected group of participants (Lave and Wenger 1991). In contrast to communities of practice, where people may meet face-to-face, to coordinate activities and communicate with each other, networks of practice consist of a larger, loosely knit, geographically distributed group of individuals engaged in a shared practice without the need to meet face-to-face (Brown and Duguid 1991**).** With recent advances in computer mediated communication NoPs can extend the reach and social interactions needed to sustain the community**.**

Wasko and Faraj (2005) define an electronic network of practice as a self-organizing, open activity system focused on a shared practice that exists primarily through computer-mediated communication. Members of the network are willing to engage with one another to help solve problems or make contributions common to the practice. An important aspect of networks of practice is that members create, seek, and share knowledge and thus establish a community where new knowledge is acquired from the network and transferred among network members.

While previous studies on traditional communities of practice suggest that knowledge sharing is positively related to social factors such as strong ties (Wellman and Wortley 1990), co-location (Allen 1977; Kraut et al. 1990), demographic similarity (Pelled 1996), status similarity (Cohen and Zhou 1991), and a history of prior relationship (Krackhardt 1992), these factors have not been shown to positively influence knowledge sharing in electronic networks of practice (Wasko and Faraj 2005). In an analysis of data from a study of members of a national legal professional association in the United States, Wasko and Faraj (2005) found that network centrality is an important indicator of whether individuals choose to contribute knowledge; an actor with high degree centrality maintains contacts with numerous other network actors. Inkpen and Tsang (2005) argue that the concept of networks is one that suffers from being overstretched. They have shown that the extent and value of the knowledge transferred varies across network

types and contend that all networks are, at their core, about social relationships, and, therefore, social dimensions have applicability, regardless of the network type. While the literature is replete with contributions on knowledge transfer both within traditional and online communities, little is known about an organization's ability to actively intervene to encourage the growth of electronic networks of practice (e.g., Kunda 1992, Contu and Willmott 2003).

The goal of our research is to better understand the effects of interventions, in particular structural interventions when organizations establish an electronic network of practice. For example, ease of access or openness helps to grow the network at the beginning, while there is little control over who is gets into the network. As the network begins to grow, there is a need to have some rules and policies to maintain the quality of the content; this subsequently can affect the attractiveness of the network. To gain insights into the policy levers needed to build and nurture a network of practice, we propose a theoretical framework with which we can simulate the effects of structural interventions.

Our conceptual framework is based on the notion that at the core of a network of people is a social factors (Inkpen and Tsang 2005). Thus, we adopt the grid-group analysis, first proposed by social anthropologist Mary Douglas (1970, 1978) and later developed for application to political cultures by Thompson and Wildavsky (1986). Following a description of the grid-group analysis we present a conceptual framework of a network of practices, which we then translate into a simulation model. The paper concludes that to function effectively as a network of practice, groups need structural parameters to adhere to but if there is an imbalance in any one direction, i.e. too much or too little control, the network is likely to experience decay.

The Grid/Group Typology

The Douglas grid/group model (1970, 1978) proposes that an individual's behavior, perception, attitudes, beliefs, and values are shaped, regulated and controlled by constraints that can be grouped into two domains, labeled as: *group commitment* and *grid control*. Using the extremes measures of low and high for each domain variable yields four possible scenarios of social life: fatalism (high grid, low group), egalitarianism (low grid, high group), individualism (low grid, low group), and hierarchy (high grid, high group). This characterization of social life is supported a long and distinguished line of contributions(cf. Burns and Stakler 1961; Harrison 1972; Miles and Snow 1978; Mintzberg 1979; Handy 1986).

The following description of the grid/group typology is based upon the work of Douglas (1978), and Gross and Rayner (1985). The strength of the group ties (high or low) represents the extent to which people are driven by or restricted in thought and action by their commitment to a social group. High group strengths result when people devote considerable time, and attach great importance to interacting with other members of their unit. In general, the more things they do together and the longer they spend doing them, the higher the group strength. Group strength is low when people negotiate their way through life on their own behalf as individuals, neither constrained by, nor reliant upon, a single group of others.

Grid is the complementary bundle of constraints on social interaction – a composite index of the extent to which people's behavior is constrained by normative role differentiation. The strength of the Grid is high whenever roles are distributed on the basis of explicit public social classifications, such as sex, color, position in a hierarchy, office, descent (by clan or lineage) or point of progression through an age-grade system. A low-grid social environment is one in which access to roles depends upon personal abilities, skills, qualifications, etc. to compete or negotiate for them, or even of formal regulations for taking equal terms.

We contend that in an effort to develop a better understanding of the effects of structural interventions on NoPs the Douglas grid/group model has the following advantages over traditional approaches to help understand the effects of actively intervene to encourage the growth of electronic networks of practice. First the grid/group model more accurately captures the social relationships and characteristics of people within a network. Second, as Inkpen and Tsang (2005) conclude, the core of a network is people and as such the Douglas grid/group model helps to capture the important cultural biases that affect group behavior. However, a typical pitfall of all typologies is their limited power to explain change and transformation (Holland 1994). For our study we have attempted to minimize this limitation by using an aggregated view on the grid/group typology.

Electronic Networks of Practice

Thibaut and Kelley (1959) and Thorn and Connolly (1987) contend that person who shares their knowledge lose the unique value they once possessed, and that only the recipients of the shared knowledge really benefit. Assuming that those who have knowledge to share employ a rational calculus it thus seems irrational that individuals voluntarily contribute their time, efforts, and knowledge toward the collective benefit of others, rather than stay passive and use what others have contributed. However, if everyone stayed passive and waited for that other individual, an electronic network of practice would cease to exist.

Coleman (1990) and Putnam (1993, 1995) provide some theories of collective action to explain why individuals in a collective choose to make contributions. They argue that individuals contribute their knowledge because of the influence of social capital, which Lin (2001) defines as "resources embedded in a social structure that are accessed and/or mobilized in purposive action". While knowledge sharing is needed to sustain an electronic network of practice, Brown and Duguid (2000), and Nonaka (1994) contend that significant levels of social capital and knowledge exchange will not develop in electronic networks of practice. Studies have focused on group level social capital factors to explain the creation of intellectual capital within organizations (Nahapiet and Ghoshal 1998) and on individual relationships as primary source for the generation of social capital in electronic networks of practice (Wasko and Faraj 2005). However, it is suggested that different network types have distinct social capital dimensions. Inkpen and Tsang (2005) examined the boundary conditions of social capital among three network types, (Intra-corporate Network, Strategic Alliance, and Industrial District). Their study summarizes that the three network types involve different dynamics between organizational and individual capital, and conclude that when studying network (not an exhaustive list) behavior, it is important to first examine the nature of the network type concerned and how it differs from other types.

The network of practice we chose for our study is Wikipedia, more specifically the group of people who are contributing, administrating, and editing the collective knowledge of this online encyclopedia. Wikipedia is an international online project which attempts to create a free encyclopedia in multiple languages. Using Wiki software, thousands of volunteers have collaboratively and successfully edited articles. Within three years, the world's largest Open Content project has accumulated more than 1,500,000 articles in the English-language version

and more than half a million in the German-language version. There are 250 language editions of Wikipedia, and 18 of them have more than 50,000 articles each.

Wikipedia defines itself as *"a multilingual, Web-based free content encyclopedia project. The name is a portmanteau of the words wiki and encyclopedia."* The content of the Wikipedia encyclopedia is written collaboratively by volunteers, allowing most articles to be changed by almost anyone with access to the Web site. We have chosen Wikipedia for a number of reasons. First, it is an open source project with a dynamic environment where people join and leave the network and collaborate on making knowledge available to a larger audience. Wikipedia consists of a number of administrators, a small number of experts who oversee the content quality, and editors, people who contribute by editing existing articles or uploading new knowledge. Second, the structural dimension of social capital within Wikipedia involves the patterns of relationships between the network actors and thus, enables analysis of how structural interventions change networks ties, network configuration, and network stability.

Like many other open source project relying on collective knowledge creation or sharing by volunteers Wikipedia faces a number of challenges. For example, Wikipedia needs a lot of people to keep a project alive. Poor involvement of editors or even inactivity also challenges the sustainability of the project. Credibility of content is another issue, inexperienced editors need to build a certain level of credibility. If they fail to establish their credibility or take too long a time, the project might falter. Thus the success of an open network of practice, with its editors and administrators at the core, depends in part on how to encourage participation and to provide the structural dimension and ties as fundamental aspects of social capital. As described in the prior sections, the objective of this paper is to evaluate how structural interventions in networks of practice affect sustainability. To test our assumptions that interventions change the nature of the social capital dimension, we propose a set of conditions that facilitate the creation and sustainability of a network of practice.

Proposition 1. A loosely structured environment accelerates the growth of an electronic network of practice at the early stage

Proposition 2. As networks begin to grow, the structural environment needs to be increased to shape the value of the network

Proposition 3. Too much structure in established networks of practice is likely to result in a decline of users

These propositions will be examined using system dynamics Substantive interpretation of testing the structural policies with the simulation model will be discussed. In th.e next section we provide a framework and boundary of our model.

Contextual Framework

As stated earlier, our aim is to develop a theory of how networks of practice respond to structural interventions. While a simulation model should capture real-world behavior, it is at the same time a lens through which the modeler views the environment. Given the challenges of operating in a rather complex environment, we believe that the feedback structure shown in Figure 1 represents a high-level perspective of how the key variables in a network of practice are interconnected. The structure of this causal loop feedback diagram presented here can be expanded to divide the cultural bias into smaller segments. Such disaggregating can be useful to the discussion of motivation and knowledge sharing within a network of practice. In addition, one can extend the model to consider the effects of external perturbations, such as technology changes for example.

Modeling these details introduces additional model complexity without necessarily providing more insights. Moreover, there is little understanding about the interrelated nature among the cultural bias in the grid/group model. Thus adding complexity to the model may not provide more insights into the fundamental implication of structural interventions in a network of practice.

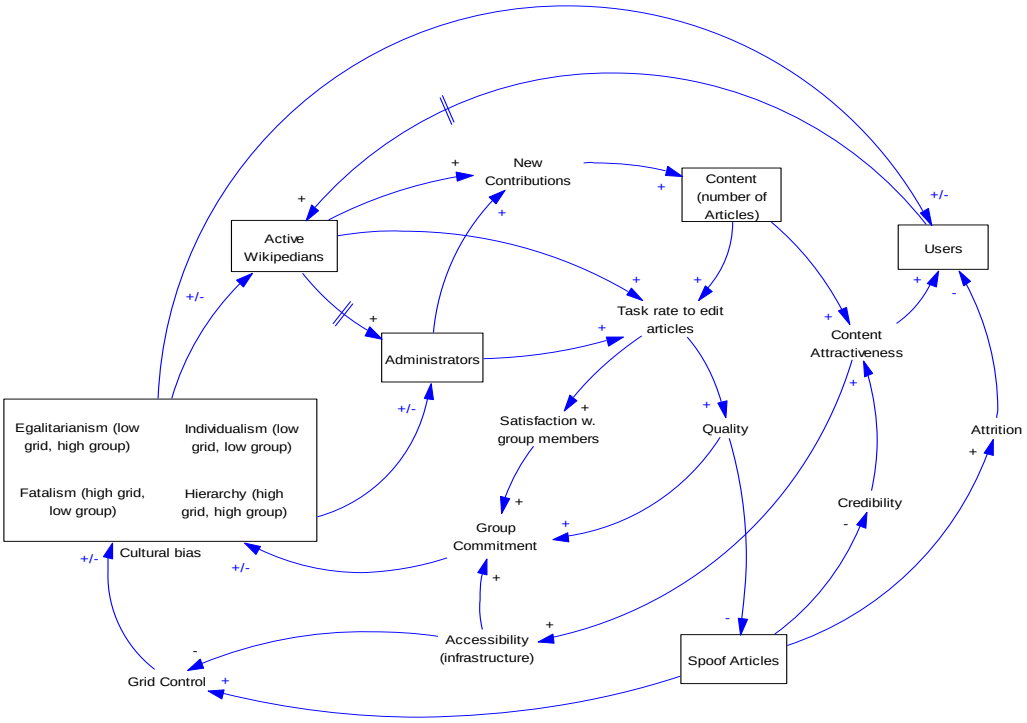

Figure 1: Causal feedback loop diagram for the network of practice

The focal point of our study is to simulate how structural interventions may change motivational factors to contribute, which in turn may increase or decrease the number of active Wikipedians (individuals who upload articles) and administrators (individuals who control the quality and also upload articles). As the number of individuals who contribute increases, content attractiveness increases and thus the network attracts more people (users) to use Wikipedia as online encyclopedia. The rationale for this feedback effect is based on data analysis from Wikipedia (http://commons.wikimedia.org/wiki/Category:Wikipedia_statistics). The data suggests a correlation of R=0.84 between the number of administrators and reach, (per million viewers) and R=0.95 between active Wikipedians and reach. In our model we use the term "user", which is the number of viewers going to the Wikipedia website.

Wikipedia's founder accepts that the site's open and egalitarian nature renders it vulnerable to attacks such as spoof articles. Where an increase of spoof articles increases, the credibility of Wikipedia decreases. The loss of credibility has caused commentators[2] to question

[2] Times Online December 15, 2005

whether Wikipedia is destined to follow the Wikitorial LA Times's doomed experiment in unrestricted internet comment, , which had to be closed down after just two days under a bombardment of pornographic postings. While the open and egalitarian nature of Wikipedia invites people to contribute, a network of practice cannot exist in the long run without structural components or boundary objects, such as documents, terms, policies, concepts, and other forms through which the network can organize the interactions (Wenger 1998). Wenger suggests that if boundary objects are an important structural dimension, it follows that there may be opportunities for organizations to encourage the growth of a network of practice by creating initial boundary objects in the form of monuments (symbols), instruments (infrastructure), and points of focus (focal concepts), around which it is hoped that future network members may congregate and interact. However, as stated earlier, too much structure are likely to result in the demise of a community.

We conceptualize the level of structural intervention in our model as feedback effect, where the number of spoof articles determines the grid control. The variable "grid control" is highly aggregated in our model which at the broader level acts to intervene with rules and regulations when the number of spoof articles increases. This feedback effect is intended to address the problem of observed in the LA Times NoP experiment where a lack of control mechanisms resulted in the loss of credibility and subsequently the demise of the network community. Grid control is linked to cultural bias and the four characteristic clusters of the Douglas grid/group model, which we explain briefly below.

> Egalitarianism (low grid, high group) is a social context in which the external group boundary is typically the consideration and the social experience of the individual and is shaped by the "we" versus "them" ethos. All other aspects of interpersonal relationships are ambiguous and open to negotiation, with emphasis on egalitarianism and active participation.
>
> Individualism (low grid, low group) represents a social context dominated by strongly competitive conditions, volatile circumstances and prescription for individual autonomy. This context allows the individual maximum options for negotiating contracts or choosing allies.
>
> Fatalism (high grid, low group) is a social context dominated by insulation. In its extremity, the sphere of individual autonomy is minimal with little scope for personal

transactions. The organizational correlate will be a hierarchical environment in which persons are classified according to well established and formalizes.

Hierarchy (high grid, high group) is a social context with individual behavior and group boundary controls.. Here everyone knows one's place, though that place might vary with time. Personal security is obtained at the expense of overt competition and social mobility.

The second variable, which influences cultural bias in our causal feedback model is group commitment. This variable is also highly aggregated since it only shapes the level of group commitment based on the notion that good contributions from the group may increase motivation and subsequently group ties.

Model Development

The success of Wikipedia stems from a certain seeding structure that provided a fertile environment for the cultivation of a vibrant online community. The seeding structure was a piece of software or Wiki, which is a collection of hypertext documents that be can directly edited by anyone. Every edit is recorded and thus can be retraced by any other user. Each version of a document is then available with its revision history and can be compared to other versions. After a surge in the number of spoof articles and vandal attacks, Wikipedia imposed a set of new rules or controlling structure to maintain its integrity. The simulation model we describe in this section is designed to help us to understand how structural interventions influence the growth or decline of a network of practice.

While previous research (cf. Kunda 1992, Contu and Willmott 2003, Thompson 2005) focused on the interrelationship between a network of practice and its host organization and the communicative interaction around these structures, we extend the boundary for our simulation model but at the same time use an aggregated perspective. We conceptualize a computer model to represent a network of practice but aggregate from an individual to a group level. Our model consists of the following clusters (or accumulation) of individuals: (1) Administrators (people who control the content of submitted articles and thus maintain the quality of the network), (2) Users (individuals who use the network), and (3) Wikipedians (people who contribute to build collective knowledge).

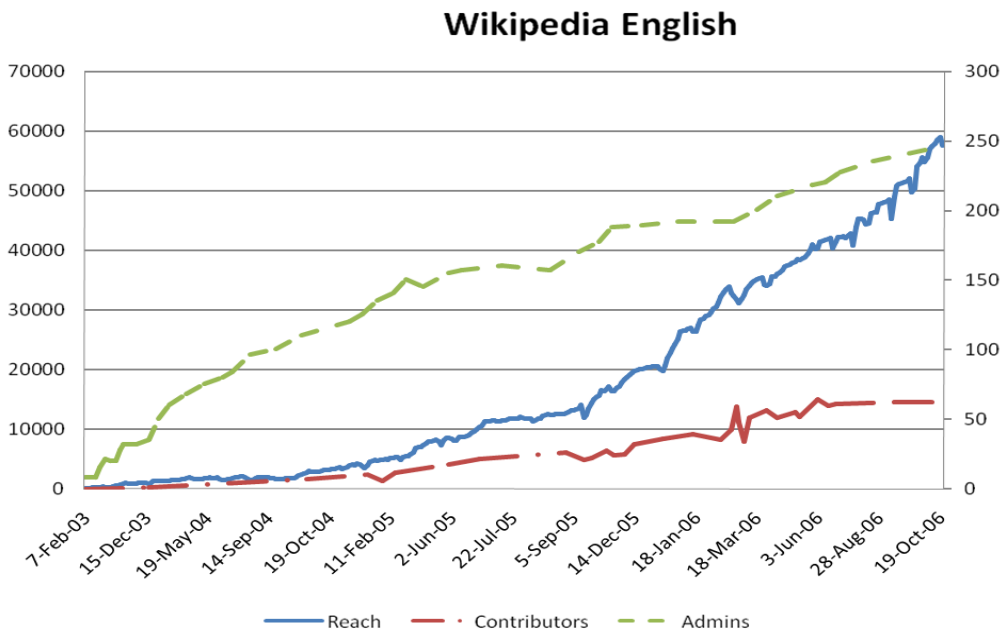

Figure 2: Time Series Data for the English Version of Wikipedia[3]

The graph in figure 2 shows how Wikipedia grew since its launch in early 2003. By end of October 2006, 14'600 Wikipedians (or active contributors) participated in building collective knowledge for the English version of Wikipedia, guided by 250 Administrators. Wikipedia's reach per million hit 56'000 in October 2006, which means that about 5.6 percent of Internet users were visiting Wikipedia each day[4]. We use the English version of Wikipedia as reference mode and to calibrate our model. However, because most of the variables used in the model are hard to measure, calibrating against real data does not mean the model is valid. Thus, testing the validity of the model is not an easy task.

Sterman (2000), Richardson and Pugh (1981), and Forrester (1961) have all argued that no model can ever truly be validated because every model represents a simplification of reality, not reality itself. The goal of model validation in system dynamics is to determine whether a model is appropriate for a given purpose and whether model users can have confidence in it. This is accomplished through testing and calibration. Sterman (2000) offers 12 tests, examining models on both structural and behavioral grounds. Other tests focus on collaborative model

[3] Source: http://commons.wikimedia.org/wiki/Category:Wikipedia_statistics

[4] Source: http://www.alexa.com

building projects that include both modelers and model users. Richardson and Pugh (1981) divide confidence-building tests into those that test for suitability and those that test for consistency. Suitability tests determine whether the model is appropriate for the problem it addresses, while consistency tests examine whether the model is consistent with the particular aspect of reality it attempts to capture. The time series data in figure 1 depicts the reference mode or base line for our model, against which we calibrate our model. It is suggested that one can have increased confidence in the insights that derive from the model if the reference environment can be replicated (Richardson and Pugh 1981).

Model Structure

One of the structural elements in our model is the representation of the grid/group framework. We use a two-dimensional matrix to capture the different characteristics of the Douglas analysis by positioning active Wikipedians and Administrators into the four clusters as shown in figure 3. Active Wikipedians are individuals who make regular contributions to build collective knowledge for the online encyclopedia, whereas administrators are individuals who control the quality of submitted articles and intervene when spoof is discovered.

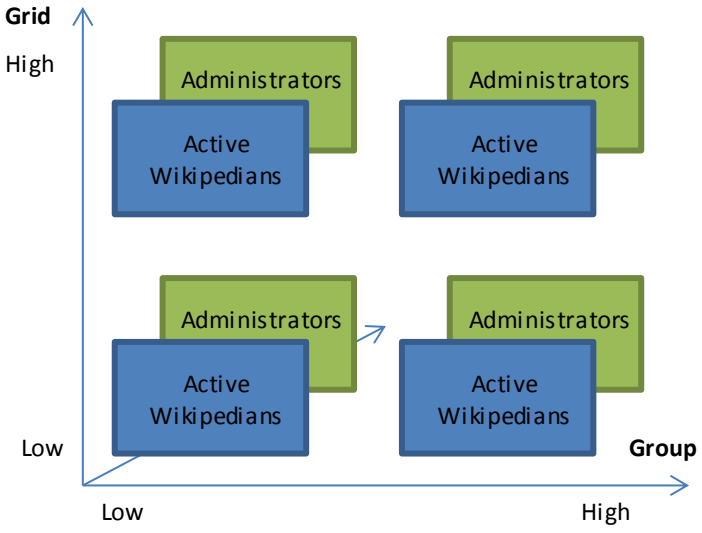

Figure 3: Grid/Group Framework for Model Conceptualization

For this study, we assume that there is no spatial transfer of individuals between the four clusters, thus inflow and outflow is limited to the individual clusters but not between. We operationalize

the two-dimensional matrix in our model with subscripts, separating the flow rates of every individual cluster depending on the control variable. The model structure, which translates the conceptual grid/group framework is shown in figure 4.

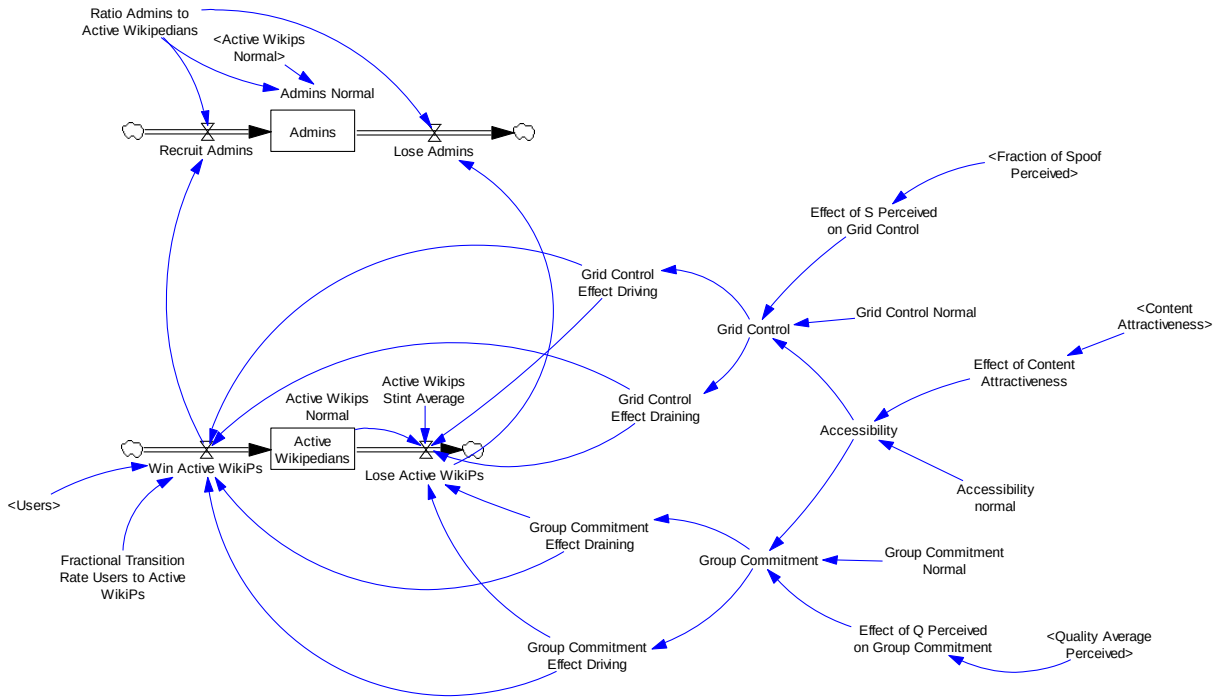

Figure 4: Grid/Group Model Structure with Subscripts

The two stocks in figure 4; Active Wikipedians and Admins, consist each of four subscripts ([high group, low grid], [low group, high grid], [high group, low grid], [high group, high grid]) to capture how grid control and group commitment affect the increase or decrease of individuals in the different clusters. It is suggested that the two groups, Active Wikipedians and Admins, have the same social characteristics and thus respond identical to structural interventions. We therefore have a symmetric structure in our model where grid control and group commitment determine the inflow and outflow from the two stocks. The policy levers to simulate structural interventions are: Grid control, group commitment, and accessibility. While feedback effects, e.g. fraction of spoof articles determine grid control, we can change the initial threshold of those parameters for policy tests. The ratio between active Wikipedians and administrators is determined by market data from Wikipedia and suggests that this value has not changed since interception.

Figure 5 presents the content sector. This sector keep track on the number of articles (Content Volume Q) and the spoof articles (Content Volume S). The stock "Content Volume Q" does not have an outflow for we assume submitted articles remain accessible for a longer period of time.

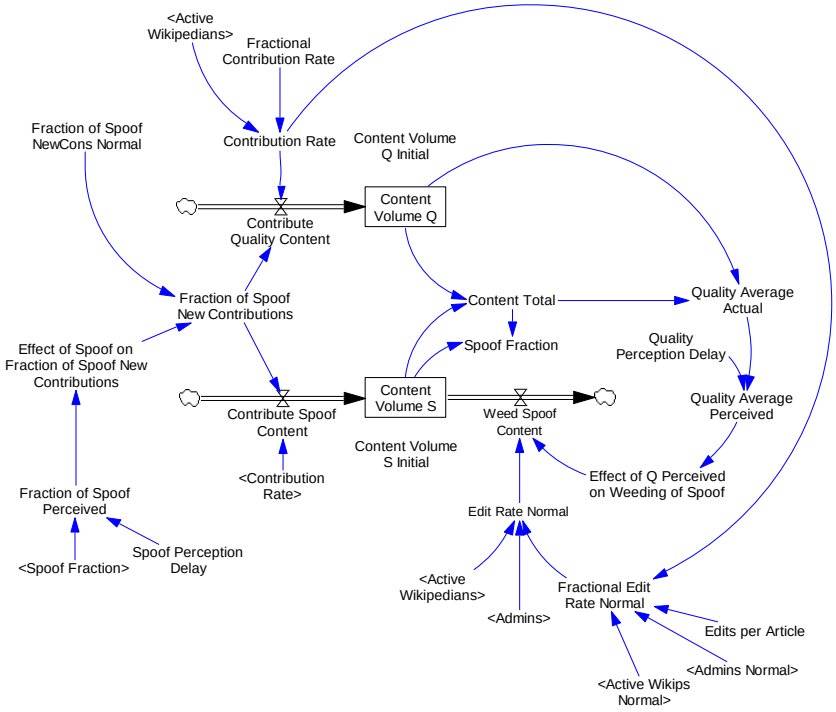

Figure 5: Content sector

As previously stated, Wikipedia experienced a surge in the number of spoof articles and vandal attacks for the open structure of the network and a lack of rules. To control the amount of spoof articles, we conceptualize a rate (Weed Spoof Content) which is a function of the edit rate based on resources and a perception ratio based on the amount of quality content and spoof. Other variables in this sector, which are not shown in the diagram figure 5 are "content attractiveness" (determined by total content, content normal, and attractiveness normal) and "credibility perceived" (determined by the spoof fraction and credibility normal).

The sector shown in figure 6 models the growth of users, operationlized as people who use the network as a numerical value of reach in millions (Internet users visiting Wikipedia each day). For users are not the focal point in our study, we simplified some of the structural elements in our model.

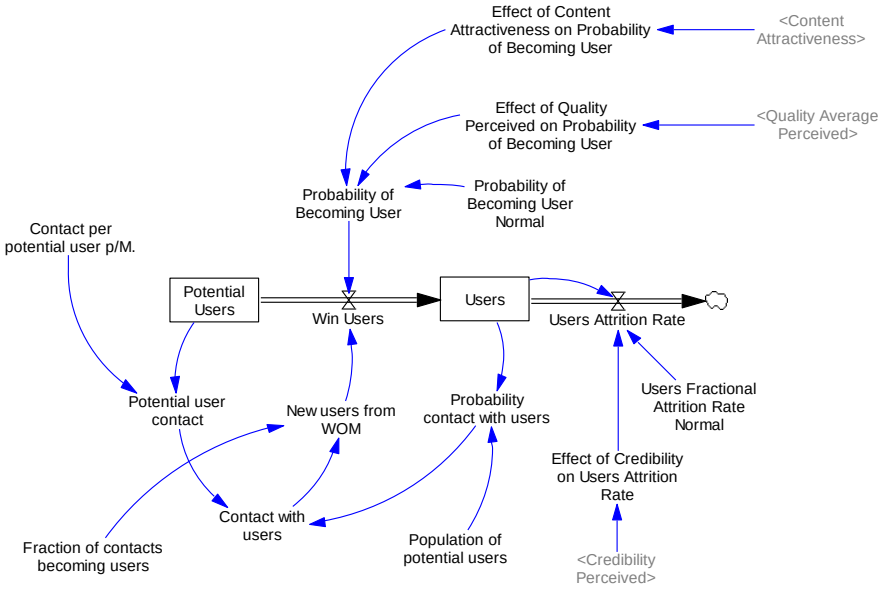

Figure 6: Model sector network users

Winning new users is modeled as a function of word-of-mouth (with a generic WOM structure) and effects from content attractiveness, and the perceived quality of the network, which increase the probability of becoming a user. Losing users, on the other hand, is determined by a fractional attrition rate and a perceived credibility.

Base Case Simulation

Figure 7 shows the number of active wikipedians, administrators, and the content volume of users in reach of millions (Internet users visiting Wikipedia each day). The model is fitted to the data from the English Wikipedia site, as shown in figure 2. We have set the model parameter values in the base case to control the structural environment of the network of practice (accessibility, group commitment, and grid control) to our best judgment rather than precise statistical estimates. The values for “accessibility normal” and “group commitment normal” are set to 0.5, assuming a moderate level of accessibility and group commitment at the interception of the network. Grid control normal is set to 0.2, which reflects an open environment with little control and rules of conduct.

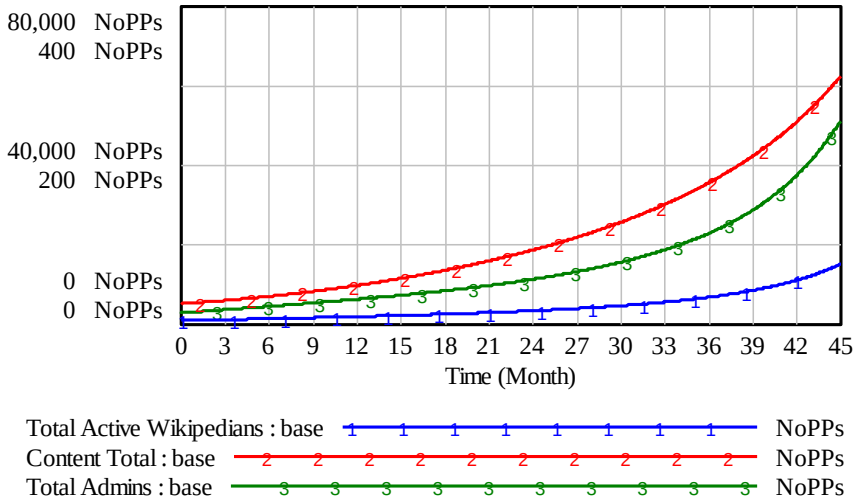

Figure 7: Base Case for Network of Practice

The initial values for the stock of active wikipedians is 200 people for each of the subscript clusters, assuming that at the time of interception the network already created interest to participate. Given the aggregated approach in our model and the lack of statistical estimates, we assumed that each of the four clusters will have the same initial value of 200 people. For the user group we chose an initial value of 1000 people, considering the buzz which was created before the network was launched.

The graph in figure 8 shows the base condition for the stock “Active Wikipedians” with its four subscripts from the grid/group framework (see figure 3). For the ratio of active wikipedians to administrators is a constant (a ratio which not changed since interception of the network) and the structural dimension between the two stocks is symmetric, we only show the graph of active wikipedians to capture how the network is populated.

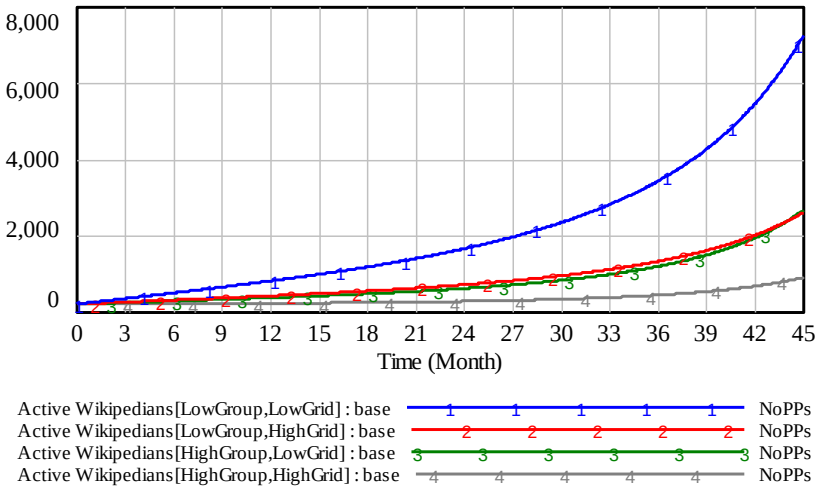

Figure 8: Grid/Group Dynamics for Base Condition

The highest growth among the four groups, following the Douglas grid/group framework, is for individuals, who are positioned in the low grid/low group cluster. We contribute this behavior in our model to the rather low initial value for grid control and a moderate level of group commitment. It is suggested (Altman and Baruch, 1998) that the characteristics of individuals in the low grid/low group cluster is determined by a high degree of self-responsibility and thus people in this cluster tend to be resistant to group commitments or rules and regulation interfering for individual autonomy. The group with the lowest growth is the high group/high grid cluster. In this cluster, we would find people who need clearly defined boundaries and a rather bureaucratic environment. For we have no data to calibrate the grid/group clusters, we tried to validate the model based on theoretical observations and our best judgment.

Policy Experiments

In this section we investigate how structural interventions may affect the growth or decline in a network of practice. The policy levers with which we test our assumptions are “group commitment” and “grid control”. We keep accessibility unchanged to assume a moderate level of access for users and those who want to contribute in the growth of the network. The graph in figure 9 shows how the system responds to an increase in grid control (from 0.2 to 0.9) and

group commitment (from 0.5 to 0.9), whereby zero means no control and one maximum possible intervention.

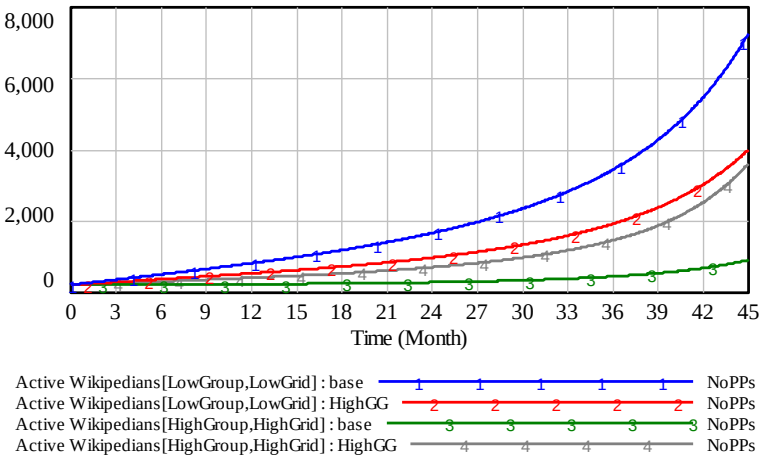

Figure 9: Policy Test High Grid/High Group

To have a better overview reading the graph, we only selected to compare the two clusters with either low or high grid/group characteristics. An increase in grid and group control results in losing people with high degree of self-responsibility, while gaining people who look for hierarchy and group commitment. While this policy is changing the composition of active wikipedians and administrators, it also results in a decline of users and an increase of spoof articles, as shown in figure 10 a&b.

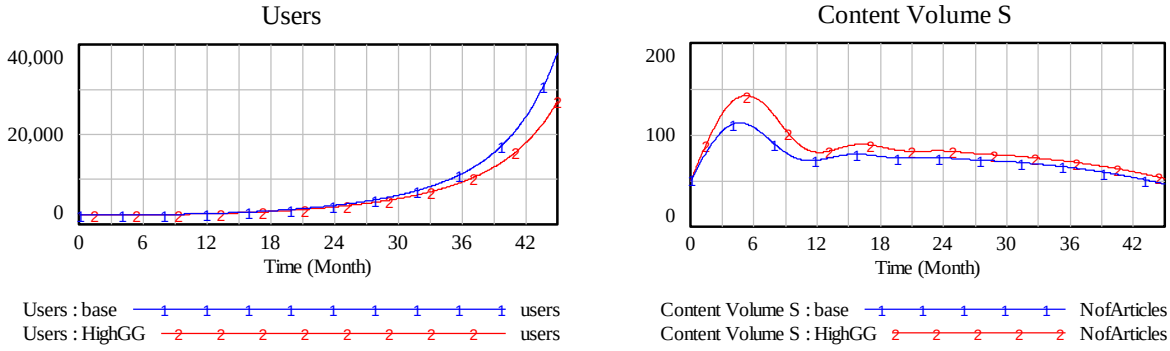

Figure 10 a&b: Number of users and Volume of Spoof Articles

The next policy test assumes no structural interventions at any point in time, which means all effects influencing either group or grid control are neutralized and the initial values for these two

policy levers are set to zero. However, we do not change the value for accessibility, simulating the same conditions as in the previous test.

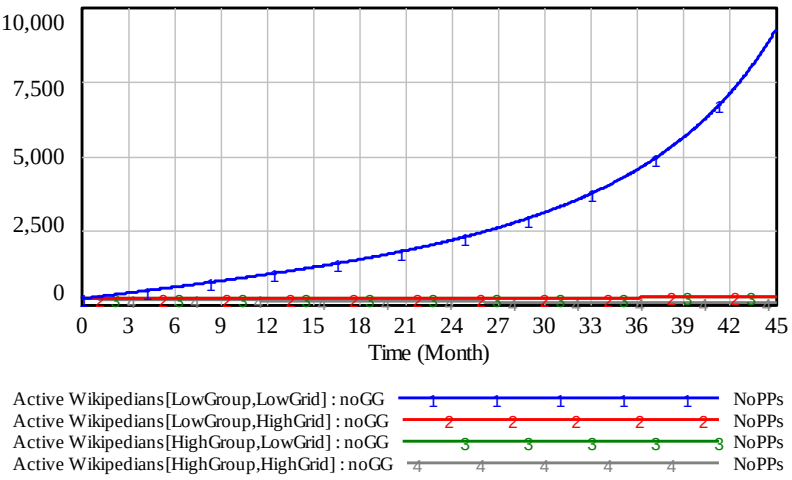

Figure 11: Result from Policy Test without Structural Interventions

As shown in figure 11, having no structural interventions in an online network of practice results in a strong growth of people who belong to the low group/low grid cluster but does not motivate others to join the network or to make contributions. The shape of the network is asymmetric for it only attracts those people who prefer an environment without any form of control. As a result, the attractiveness of the network is lower compared with the base conditions and subsequently the network attracts less users, as shown in figure 12 a&b.

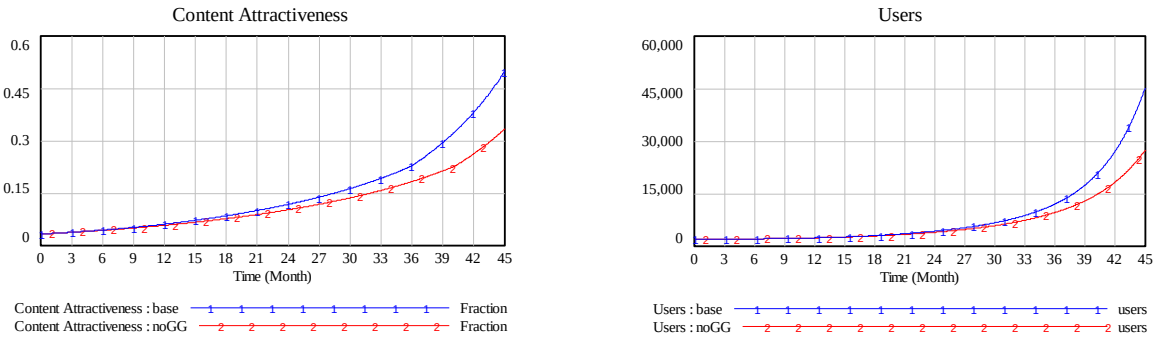

Figure 12 a&b: Effect of no Structural Interventions on Attractiveness and Users

Discussion

The model was exercised to determine the effects of structural interventions in an online network of practice. We were able to use the model and examine the propositions, which we stated in this paper. While many factors, internal as well as external, may contribute to the success of an open network of practice, our aim was to gain insights into how high-level interventions change the shape of the network. Despite some limitations, which we will address shortly, experiments with the simulation model provide useful insights to help manage an open network of practice more effectively. The model supported our proposition that a network of practice needs some structural control for having no control degreases attractiveness and subsequently the number of users. However, too much control, as stated in proposition 3, also results in having less users then in a network environment where some moderate control levers are in effect.

Another insight obtained from the simulation model is that even if we increase the number of people in one cluster, we do not make the network better. The simulation thus reveals counterintuitive behavior regarding a control action and its effect, resulting from our inability to understand how structural interventions effect the different social characteristics of the people who shape an open network of practice. Even though the simulation model is highly aggregated and simplified, it can be used to help develop a better understanding of the underlying non-linear dynamics in an open network of practice and to provide management support by enabling speculative analysis.

However, the simulation model presented in this paper has limitations and can be enhanced in several ways. First, the grid/group framework can be represented in more detail to capture how the different clusters may contribute to the collective knowledge creation. Second, some of the variables in the model should have a empirical base, rather than using judgment to increase the validity of simulation experiments.

While the simulation model presented in this paper is aimed at providing an effective tool to gain insights into the interrelated nature of key drivers affecting the success of an electronic network of practice, it is important to emphasize that such a model focuses on understanding the dynamics of complex systems and, thus, is a powerful methodology to complement quantitative research.

References

Allen, T. J. (1977). ***Managing the Flow of Technology***. Cambridge, MA: MIT Press.

Altman, Y., Y. Baruch (1998). Cultural Theory and Organizations: Analytical Method and Cases. *Organization Studies*, 19(50: 769-785

Brown, J. S., P. Duguid (1991). Organizational learning and communities of practice: Toward a unified view of working, learning, and innovation. ***Organizational Science***, 2(1): 40-57.

Brown, J. S., P. Duguid (2000). ***The Social Life of Information***. Boston, MA: Harvard Business Press.

Burns, T., G. M. Stalker (1961). ***The management of innovation***. London UK.: Tavistock.

Cohen, B. P., X. Zhou. (1991). Status Processes in Enduring Work Groups. ***American Sociological Review***, 56: 179-188.

Coleman, J. S. (1990). ***Foundations of Social Theory***. Cambridge, MA: Belknap Press.

Contu, A., H. Willmott. (2003). Re-embedding situations: The importance of power relations in learning theory. ***Organization Science***, 14(3): 283-296.

Douglas, M. (1970). ***Natural symbols: explorations in cosmology***. London, UK.: Barrie and Rockliff.

Douglas, M. (1978). ***Cultural bias***. London UK.

Forrester, J. W. (1961). ***Industrial Dynamics***. Boston, MA: MIT Press.

Gross, J. L., S. Rayner. (1985). ***Measuring culture***. New York, NY: Columbia University Press.

Handy, C. (1986). ***Understanding organizations***. London, UK.: Penguin.

Harrision, R. (1972). Understanding your organization's character. ***Harvard Business Review***, May-June: 119-128.

Holland, J. L. (1994). Separate but unequal better. In M. L. S. a. R. W. Lent (Ed.), ***Convergence in career development***. Palo Alto, CA.: CPP Books.

Inkpen, A. C., Eric W. K. Tsang. (2005). Social Capital, Networks, and Knowledge Transfer. ***Academy of Management Review***, 30(1): 146-165.

Krackhardt, D. (1992). The Strength of Strong Ties: The Importance of Philos in Organizations. In N. N. a. R. Eccles (Ed.), ***Organizations and Networks***: 216-239. Boston, MA: Harvard Business School Press.

Kraut, R. E., C. Egido, J. Galagher. (1990). Patterns of Contact and Communication in Scientific Research Collaboration. In R. E. Kraut, C. Egido, J. Galagher (Ed.), ***Intellectual Teamwork***. Hillsdale, NJ: Lawrence Erlbaum Associates Inc.,.

Kunda, G. (1992). ***Engineering Culture***. Philadelphia, PA.: Temple University Press.

Lave, J., E. Wenger. (1991). ***Situated Learning: Legitimate Peripheral Participation***. Cambridge, UK.: Cambridge University Press.

Lin, N. (2001). ***Social Capital***. Cambridge UK.: Cambridge University Press.

McAfee, A. (2006). Enterprise 2.0: The Dawn of Emergent Collaboration. ***Sloan Management Review***, Spring

Miles, R. E., C. C. Snow. (1978). ***Organiztional strategy, structure, and processes***. New York, USA.: McGraw-Hill.

Mintzberg, H. (1979). ***The structuring of organizations: A synthesis of the reserach***. Englewood Cliffs, NJ.: Prentice-Hall.

Nahapiet, J. S. G. (1998). Social Capital, Intellectual Capital and the Organizational Advantages. ***Academy of Management Review***, 23(2): 242-266.

Nonaka, L. (1994). A Dynamic Theory of Organizational Knowledge Creation. ***Organization Science***, 5(1): 14-35.

Pelled, L. H. (1996). Demographic Diversity, Conflict, and Work Group Outcomes: An Intervening Process Theory. ***Organization Science***, 7: 615-631.

Putnam, R. (1993). ***Making Democracy Work: Civic Traditions in Modern Italy***. Princeton, NJ.: Princeton University Press.

Putnam, R. (1995). Bowling Alone: America's Declining Social Capital. ***Journal of Democracy***, 6: 65-78.

Richardson, G. P., A.L. Pugh III. (1981). ***Introduction to system dynamics modeling with DYNAMO***. Cambridge, Mass.: MIT Press.

Sterman, J. D. (2000). ***Business Dynamics: System Thinking and Modeling for a Complex World.***: Irwin McGraw-Hill.

Thibaut, B. K., H. H. Kelly. (1959). ***The Social Psychology of Groups***. New York, NY: John Wiley.

Thompson, M., A. Wildavsky. (1986). A cultural theory of information bias in organizations. ***Journal of Management Studies***, 23(3): 273-286.

Thompson, M. (2005). Structural and Epistemic Parameters in Communities of Practice. ***Organization Science***, 16(2): 151-164.

Thorn, B. K., T. Connolly. (1987). Discretionary Data Bases. A Theory and Some Experimental Findings. ***Communication Research***, 14(5): 512-528.

Wasko, M. M., S. Faraj. (2005). Why should I share? Examining social capital and knowledge contribution in electronic networks of practice. ***MIS Quarterly***, 29(1): 35-57.

Wellman, B., S. Wortley. (1990). Different Strokes for Different Folks: Community Ties and Social Support. ***American Journal of Sociology***, 96: 558-588.

Wenger, E. (1998). ***Communities of Practice***. Cambridge UK.: Cambridge University Press.