

Defining Practice, Power and Relationships in Virtual Communities of Practice

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Abstract

This paper has two objectives. The first is to report on a pilot study of knowledge sharing in what was described a global on-line Community of Practice, however in order to do so, it will also need to address some of the conceptual issues associated with the study of Communities of Practice in general and on-line Communities of Practice in particular. This forms the second objective.

The Community of Practice in our study was intentionally created to share knowledge between product engineers and marketing managers in a large multinational organization. Most of the members of this community have only ever met in 'virtual meetings' co-ordinated from the company's HQ in France. Although the focus of their practice (a sub-set of the products of the company) is firmly part of the physical world, the Community itself exists almost entirely on-line. Our goal was to improve our understanding of this community in order to be able to undertake more focused studies in the future.

Although we had the full support of the company, the response to our request for interview was poor. The results section of this paper is therefore somewhat general in nature. The conclusions focus on a set of questions that could form the basis for a further study of this community or to inform studies of similar communities.

1 Introduction

Much of the literature concerning knowledge sharing in on-line Communities of Practice is written from the viewpoint that they provide an effective means to share or exchange knowledge between geographically distributed groups in an organization. The broad argument is that technology can create links between groups and that through this a company will gain access to 'global best practices', which can then be incorporated into more 'local' groups (Vaast 2004).

The idea has some obvious attractions for organizations. Communities of Practice have been portrayed as playing a role in ameliorating the problems associated with the rigid, compartmentalised structures of the traditional bureaucracy (Brown and Duguid 1991; Snyder et al. 2003). In terms of knowledge sharing, they have long been the focus of interest among sections of the Knowledge Management community (Lesser and Storck

2001; Nonaka 1994). However, the idea of using a Community of Practice as a way of sharing knowledge, particularly when doing so on-line, is not without its problems - conceptual as well as practical.

Firstly, a considerable degree of ambiguity has developed around the whole notion of a Community of Practice. Several authors (Cox 2005; Roberts 2006) have dissected the changes that have taken place in the concept between Wenger's early work with Lave (Lave and Wenger 1991) and his later works with McDermott and Snyder (Snyder et al. 2003; Wenger et al. 2002; Wenger and Snyder 2000). This ambiguity is heightened further when the notion of a Community of Practice is extended to include groups that only exist on-line. Exactly what do we mean when we talk about a Community of Practice?

Communities of Practice are often described as groups driven by a sense of mutual obligations and common passion for a particular topic. What might be termed the strong ties of Communities of Practice is often at odds with the weak ties seen as characterizing on-line communities (Teigland and Wasko 2004). In addition, on-line communication lacks the richness of face-to-face interaction; consequently, relying solely on on-line communication will also tend to inhibit strong ties (Kimble and Hildreth 2005). Given this, is it possible for a Community of Practice to exist on-line?

Similarly, Communities of Practice are sometimes described as being self-directed or autonomous. This does not pose a problem when a Community of Practice simply 'exists' in its own right but when looking at knowledge sharing in Communities of Practice that form part of a larger 'host' organization this autonomy can be problematical (Thompson 2005). Attempts to 'steer' the direction of the Community of Practice which are too heavy handed can either stop the Community of Practice from functioning or drive it underground (Gongla and Rizzuto 2004). Is the notion of a Community of Practice really compatible with the type of group in our study?

In terms of knowledge sharing in a large dispersed organization, Communities of Practice are sometimes singled out for criticism as being epistemologically unsuited for this task. One of the most frequent criticisms made of what is sometimes call CoP theory is that it fails to address the issues of the power differentials that exist in groups and organizations (Contu and Willmott 2003; Fox 2000). Others (Swan et al. 2002; Teigland and Wasko 2003) suggest that very nature of Communities of Practice will

make them more inclined to keep certain types of knowledge within the group rather than sharing it with outsiders. Are Communities of Practice really the answer to knowledge sharing in large multi site organizations?

Finally, this type of study also poses problems in practical terms. Because of the situated nature of what happens inside Communities of Practice, most studies have taken a broadly ethnographic approach (Lave and Wenger 1991; Orr 1990; Wenger 1998b). Beyond the normal challenges of ethnographic work, this poses few problems when the groups are co-located, but when groups go on-line, new problems can arise. The idea of virtual ethnography itself is not particularly new (Hine 2000), however when groups are on-line, globally distributed and embedded in a larger organization detailed ethnographic approaches may not be practically or economically feasible.

If, for whatever reason, it is impossible to take an ethnographic approach, the rich understanding of the context of a particular phenomenon will be lost and it will become impossible to produce the 'thick description' of its characteristics and complexities that comes about through the immersion of the researcher in the lives of their subjects. In these circumstances, how do you deal with, for example, the issue of 'lurkers' (Nonnecke and Preece 2001) who do not actively participate? Even if somebody does participate, without 'being there', how can you tell if they are simply 'going through the motions' (Handley et al. 2006)? In short, even if you can produce an adequate conceptual representation of the phenomenon you are studying, methodologically, what is the best way to approach the problem?

2 Communities of Practice - a concept without frontiers?

The notion of a Community of Practice as expressed in the literature is confusing and sometimes contradictory. Perhaps, as with many contested ideas, the degree to which "community" and "practice" can be stretched and moulded to fit the exigencies of any particular situation are part of the explanation of both the value and the enduring interest in this topic.

Several authors (Cox 2005; Roberts 2006) have chronicled the changes that have taken place in the concept highlighting in particular the distinction between the more conceptual early works (Brown and Duguid 1991; Lave and Wenger 1991) and the later managerial or performative accounts (Snyder et al. 2003; Wenger et al. 2002; Wenger and Snyder 2000). The term is stretched still further when the notion of a Community

of Practice is extended to include so called virtual and intentional Communities of Practice (Dubé et al. 2005; Wenger et al. 2005).

The aim of this section of the paper is not to provide 'the one true definition' of Communities of Practice; to do this would risk falling into the trap of what Mutch (2003) describes as "textual exegesis". Rather our aim is to delineate the scope of the term in order to better frame some of the material that follows.

2.1 The original view of Communities of Practice

The term Community of Practice originated with Lave and Wenger (1991), and in much of the early work the notion of practice was left largely undefined beyond noting that the concept of practice was socially constructed and intimately connected to learning. Probably the most frequently cited description of a Community of Practice to come from this particular work describes a Community of Practice as:

"... a set of relations among persons, activity, and world, over time and in relation with other tangential and overlapping Communities of Practice".
(Lave and Wenger 1991, p98)

and continues

"A Community of Practice is an intrinsic condition for the existence of knowledge, not least because it provides the intrinsic support necessary for making sense of its heritage ... the social structure of this practice, its power relations, and its conditions for legitimacy define possibilities for learning."
(Lave and Wenger 1991, p 98)

A Community of Practice does not imply "... co-presence, a well-defined, identifiable group, or socially visible boundaries" (Lave and Wenger 1991, p 98), but it does imply participation in an activity that has meaning for the participants.

"Participation in an activity system about which participants share understandings concerning what they are doing and what that means for their lives and for their communities" (Lave and Wenger 1991, p 98)

Thus, for the alcoholics who attend the Alcoholics Anonymous meetings (Lave and Wenger 1991, pp 79 - 84), participation is an attempt to learn how to become a "non-drinking alcoholic". Vann and Bowker (2001) describe this early view of a Community

of Practice as stemming from "*an epistemology of practice that entails a set of claims about how people learn and how knowledge is shared among social actors*".

The concept was quickly adopted by other authors such as Brown and Duguid (1991) who were more concerned with the role that Communities of Practice can play in the workplace. For them

"... practice is central to understanding work. Abstractions detached from practice distort or obscure intricacies of that practice. Without a clear understanding of those intricacies and the role they play, the practice itself cannot be well understood, engendered (through training), or enhanced (through innovation)." (Brown and Duguid 1991, p 40)

Brown and Duguid use Orr's (1990) ethnographic study of photocopier repairers as a basis for their work and describe Communities of Practice as "*interstitial communities*" that exist in the 'gaps' between work as defined by the organization, and the everyday tasks that needed to be done. They argue that most management theory:

"... focuses on groups as canonical, bounded entities that lie within an organization and that are organized or at least sanctioned by that organization and its view of tasks. The communities that we discern are, by contrast, often non-canonical and not recognized by the organization." (Brown and Duguid 1991, p 49)

Thus, in this early view, communities are small informal and quite possibly invisible to the outsider. The relationships within the community and between the community and the outside are not necessarily harmonious and, where they exist in the workplace, they do so in spite of, rather than because of, management's actions. The notion of practice is less clearly defined but is closely tied to learning and the structuring of relations in the everyday life. It is about:

"... what they are doing, what that means for their lives and for their communities" (Lave and Wenger 1991, p 98).

2.2 The analytical view of Communities of Practice

In his later works Wenger makes it clear that he wishes to establish an intellectual foundation for his work (Wenger 1998b, p 11). The result is, in many ways, closer to Brown and Duguid than it is to his earlier collaboration with Lave.

Like Brown and Duguid, the source material for his book is derived from on a detailed ethnographic study; this time of clerks in a medical insurance claims processing office. As in his earlier collaboration with Lave (Lave and Wenger 1991), Wenger argues that Communities of Practice are part of our everyday lives. However, unlike his earlier work, here Wenger is very much more concerned with Communities of Practice in the context of the formal organization:

"Communities of Practice are not a new kind of organizational unit; rather, they are a different cut on the organization's structure - one that emphasizes the learning that people have done together rather than the unit they report to, the project they are working on, or the people they know." (Wenger 1998a)

In essence, Wenger argues that Communities of Practice arise out of a need to accomplish particular tasks in an organization and provide learning avenues within that organization.

"From this perspective, an effective organization comprises a constellation of interconnected Communities of Practice, each dealing with specific aspects of the company's competency" (Wenger 1998a)

Wenger also develops the connection between practice and meaning, arguing that:

"Communities of Practice are not just places where local activities are organized, but also where the meaning of belonging to broader organizations is negotiated and experienced." (Wenger 1996)

As with his earlier work, Wenger is still concerned with a social theory of learning (Wenger 1998b, p 15), but in contrast to his earlier, more 'intuitive' definitions of a Community of Practice, Wenger now offers a more concise definition consisting of just three interrelated terms (Wenger 1998b, p 72 - 73). A Community of Practice now becomes defined in terms of:

- What it is about. The particular area of activity/body of knowledge around which it has organized itself. It is a *joint enterprise* in as much as it is understood and continually renegotiated by its members.

- How it functions. People become members of a Community of Practice through shared practices; they are there through their involvement in common activities. This *mutual engagement* binds its members together in a single social entity.
- What it produces. The members of a Community of Practice build up a *shared repertoire* of communal resources over time. Written files are a more explicit aspect of this although less tangible aspects such as rituals and idioms can also be included.

As might be expected from this more analytical phase in the development of the concept of Communities of Practice, there is also a move towards the operationalisation of the concept. For example, in the work from this period we have the "Seven Principles of a Learning Organization" (Wenger 1996), the "Five Stages in the Development of a Community" (Wenger 1998a) and the "Key Characteristics of a Community of Practice" (Wenger 1998b, 125 - 126). The work from this period has been used by researchers to such an extent that Murillo (2008) argues that it has become the de facto standard for a Community of Practice.

Thus in this later phase, the notion of a Community of Practice, although still based on ethnographic data, has expanded to a point where the community might (potentially) encompass the entire organization and the notion of practice has expanded from something that gives sense to one's own existence to something that exists to make sense of somebody else's world. Communities of Practice are still outside of the formal structure of an organization but have now simply become a "different cut"; the treatment of conflict and issues of power, which were explicit, although not to the forefront of the earlier works, now take even more of a back seat.

2.3 The business centred view of Communities of Practice

Wenger's more recent work (Snyder et al. 2003; Wenger et al. 2002; Wenger and Snyder 2000; Wenger et al. 2005) has been the subject of much criticism, for example, for being "*a popularization and a simplification but also a commodification of the idea of community of practice*" (Cox 2005, p 533).

Based on their experience as consultants rather than ethnographic analyses, Wenger, McDermott and Snyder claim that Communities of Practice, "... *all share a basic structure ... a unique combination of three fundamental elements*" (Wenger et al. 2002, p 27). These three fundamental elements are a domain of knowledge, a notion of community and the practice.

- **Domain.** This is the activity that forms the basis of the shared of interest(s) of the community. It focuses the community's members on an area of common concern, creating a shared identity, motivating existing members and attracting new ones.
- **Community.** This is formed through the interaction members and creates the environment where they can learn from each other through engagement in a joint enterprise. It allows the members reinforce the social bond between them and helps develop trust, respect and identity.
- **Practice.** This represents the shared knowledge of the community. It consists of the ideas, terminology, tools and artefacts created within the community as result of their shared activities. It is the outward expression of the community's accumulated and shared experience.

Beyond the structural re-definition of a Community of Practice, Wenger, McDermott and Snyder give still more prominence to the role that Communities of Practice can play in a business. For example, Wenger and Snyder describe Communities of Practice as:

"... groups of people informally bound together by shared expertise and passion for a joint enterprise [which can] drive strategy, generate new lines of business, solve problems, promote the spread of best practices, develop professional skills, and help companies to recruit and retain talent".
(Wenger and Snyder 2000 - 140)

The scope of a Community of Practice has increased again. In the broader sense, Communities of Practice are now seen as a way of "Reweaving the World" (Wenger et al. 2002, ch 10). In the preface to the book they say *"We share a vision that communities of practice will help shape society [and] provide new points of stability and connection in an increasingly mobile, global and changing world"* (Wenger et al. 2002, p xii). The final chapter of the book deals with that shared vision:

"The world itself has become the ultimate organization and the challenges it faces are increasingly related to knowledge. The principles that apply to our businesses ... also apply to the challenges faced by our society. The socioeconomic requirements for sustained prosperity ... demand that we apply these principles beyond the private sector." (Wenger et al. 2002, p 224)

Thus in the most recent version of the notion, the scope of the community has expanded to encompass entire organizations, if not the whole world, and the notion of practice has expanded to include to almost any activity that can be thought of as similar and shared. To use Cox's analogy (Cox 2005, p 538), it has moved from 'a group of people working together to build a boat' to 'anybody who engaged in an activity related to boat building'. Perhaps more importantly, Communities of Practice have made an epistemological *volte face* and have moved from something that exists in spite of the efforts of management to something that can be cultivated, if not actually created, by management. In this sense, a Community of Practice has become anything that a management of an organization chooses to support as a Community of Practice and any notion of conflict or contested vision has all but disappeared.

2.4 The disembodied view of Communities of Practice

We have seen that the term Community of Practice has been used to cover groups that range in size from a few people to whole organizations and that practice has been stretched to cover activities that are highly personal and individual to almost any activity that is seen to have some components that are both shared and similar. There is a second area where the definition of what can represent a Community of Practice has changed: Communities of Practice are now talked of in terms of Virtual Communities of Practice.

From the earliest work, the possibility that Communities of Practice could be non-collocated has been recognised (e.g. Lave and Wenger 1991, p 98). A whole section of Wenger et al (2002) is dedicated to the problems of distributed communities while Wenger et al (2005) focus almost exclusively of the 'cultivation' of virtual communities. However, this is not the same as saying that virtual or on-line Communities of Practice exist. As with the notion of a Community of Practice, what is meant by a virtual or on-line Community of Practice is not always clear. For example, sometimes a Community of Practice that is simply *distributed* in the geographical sense, (i.e. not concentrated in a single place but spread between several locations) is described as virtual simply because its members sometimes communicate using computer technology.

Truly virtual Communities of Practice, in the sense of something that only exists through the mediation of computers and electronic networks, are comparatively rare. Esteves et al (2008) gives an example of groups of students who learn programming in a

second life world while Smeds (2003) describes the simulation of a business process using a group of people spread across several countries. In both cases, both the community and the practice have no physical existence beyond that provided by computers. In a similar vein, Jacobson (2008) argues that an Adult Literacy Education Wiki represents a virtual Community of Practice as both the wiki and the community only exist thanks to computer technology. Finally, using Wenger's work, Murillo (2008) has developed a model of what he claims to be a virtual Community of Practice which he uses to identify four such communities that have emerged spontaneously in 'social areas' of the Internet.

Lueg (2000) bases his distinction between virtual and distributed Communities of Practice on 'where the action takes place'. In his study of on-line groups such as de.rec.bodyart he argues that although these on-line groups correspond to some definitions of a Community of Practice, it is what participants do in terms of piercing and tattooing their bodies in the physical world that creates a Community of Practice rather than the fact that they share these experiences on-line. Given that there appears to be so few examples of virtual Communities of Practice that are clearly and unambiguously 'virtual', how should we interpret this term, particularly when it is associated with the already ambiguous term 'Community of Practice'? What is it that the phrase 'virtual Community of Practice' connotes?

3 The search for alternatives

3.1 Communities of Practice and Business

Brown and Duguid's (1991) described Communities of Practice as a "deviant", "self-constituting", "maverick", "semi-autonomous" and "frame breaking" groups (Brown and Duguid 1991, pp 42, 50 & 54) and note that attempts to control or organize them may only succeed in disrupting them (Brown and Duguid 1991, p 49). The sensitivity of Communities of Practice to interventions from outside is also recognised, to some extent, in Wenger's earlier work. For example,

"They self-organize, but they flourish when their learning fits with their organizational environment. The art is to help such communities find resources and connections without overwhelming them with organizational meddling." (Wenger 1998a)

Examples of this phenomenon can also be found in the literature. Thus, in their study of "Communities of Practice that disappear", Gongla and Rizzuto (2004) note that if an organization 'spotlights' a Community of Practice,

"... the community may remove itself completely from the organizational radar screen ... pretending to disperse, but in reality continuing to function outside of the organizations purview." (Gongla and Rizzuto 2004, p 299)

Thompson (2005) provides a similar example from a company called World Systems. He describes how a Community of Practice called "E-Future" was 'spotlighted' by the parent organization who tried to 'clone' it and spread its 'best practices' throughout the organization. As with Gongla and Rizzuto's example, in the end, the members of the group withdrew into themselves and World Systems only succeeded in stifling what it sought to nurture.

Similarly, much play is also made of Wenger's (1998b) view of a business being a constellation of interrelated Communities of Practice. Again, while it is undoubtedly true that Communities of Practice can allow the sharing of knowledge between different groups, the capricious nature of Communities of Practice means that this particular outcome that can not be guaranteed. For example, Hislop (2004) examined three case studies of Communities of Practice in large European organizations and concluded that only one was successful in sharing knowledge. He argues that because of a strong internal sense of identity, Communities of Practice actually lead to less knowledge sharing between communities rather than more.

Most organizations tend to view groups - perhaps even Communities of Practice - as collections of 'human resources' that can be brought together and directed towards a task that will benefit of the larger organization. Perhaps we should look for alternative ways to describe what we find instead of continuing to stretch the notion of a Community of Practice.

Lindkvist (2005) suggests that dominance of the term Community of Practice in the literature has led to a neglect of other constructs, such as task groups or teams. In contrast to Communities of Practice, which he sees as stable and tightly-knit groups with dense reciprocal relationships (Lindkvist 2005, p 1194) he argues that much of the activity in organizations takes place in temporary project based teams that consist of a

diverse collection of individuals with little in the way of overlapping knowledge but with clear targets and a strong goal orientation (Lindkvist 2005, p 1198).

He describes such groups as knowledge collectives and sees them as being composed of individuals with different competencies and experience that are formed through participation in independent projects. In these knowledge collectives, knowledge is distributed and the members act as 'external memories' for each other. Individuals engage in goal directed searches for solutions within a knowledge network and knowledge is seen as something fluid and dynamic with empirical 'facts' being favoured over the development of an established practice.

3.2 Communities of Practice and Power

Although it is a criticism that is often made in passing it seems that little has been written that directly addresses the issue of power relations and Communities of Practice: either within the community or, in the case of a community that exists inside a 'host' organization, the community and the wider organization.

Contu and Willmott (2003) provide one of the most widely cited critiques of the way in which power within the community is dealt with. They are primarily concerned with the nature of situated learning and focus particularly on what they term the popularisation of Lave and Wenger's (1991) work by Brown and Duguid (1991) and on the way that certain themes in Lave and Wenger's original work were underdeveloped in order to be able to present a more conventional portrayal of its adoption. Fox (2000) is similarly concerned with situated learning and uses Actor Network Theory to provide insights into the phenomenon of legitimation in organizational learning, stressing the complementarities between the theory underlying Communities of Practice and Actor Network Theory.

In a similar way we argue that complementarities between the French sociology of "analyse stratégique" (Crozier and Friedberg 1977) and Brown and Duguid's analysis (1991) of Communities of Practice, mean that this could provide an alternative route for understanding the power relationships in Communities of Practice. We will deal with the theory behind Crozier and Friedberg's ideas in section 4.1. For the moment, we will simply outline the points of similarity and points of difference.

The first area of similarity is that both are concerned with what happens in the 'gaps' in the formal structure of organizations. For Crozier and Friedberg (1977), organizations

try to plan for every contingency in advance. Over time, they develop a set of abstract impersonal rules to cover all foreseeable events. They argue that in such circumstances, opportunities for individuals to exercise their own discretion become a political resource and the object of strategic power games. For Brown and Duguid (1991) the gap is between the way an organization specifies what a person's work should be and the way the work is actually carried out: what they term the gap between canonical and non-canonical practice. In a similar way to Wenger's (1998b) analysis of the work of insurance clerks, Brown and Duguid (1991) argue that one of the functions the CoP fulfils is to come to terms with a particular set of externally imposed canonical constraints

The second area of similarity is that, despite the recognition the existence of exogenous sets of rules and regulations to exist to govern behaviour, both approaches acknowledge the socially constructed nature of the organization. Crozier and Friedberg (1977) argue the way an organization actually works is an outcome of a set of ongoing local strategic games. Brown and Duguid (1991) argue that the reality of the organization is not to be found in the rules and regulations but in the relationships and meanings created within the Communities of Practice that constitute it. In both cases, organizational structures are (re)produced through the actions of actors who are simultaneously constructing their own reality and acting within it.

The key difference in the two approaches lies with the way in which the collective is viewed. Communities of Practice, particularly in the early works of Lave and Wenger (1991) and Brown and Duguid (1991), are seen as differentiated groups, which, although there may be internal disagreements, move broadly based on consent if not consensus. As indicated in the subtitle of their book - "The constraints of collective action" - Crozier and Friedberg (1977) take a rather different view. For Crozier and Friedberg, there is no notion of community, at best there is a group solidarity enforced by the fear of exclusion. In this world, it is conflict rather than consent that characterises collective action and it is the self-created strategies of the players that place a limit on their capacity for acting collectively.

3.3 Communities of Practice and the virtual world

Finally, we turn to so-called Virtual Communities of Practice. In reality, most of these groups actually deal with practices that are located in the physical world in a community

that mix of face-to-face meetings and communication by other means. Even Line Dubé, an advocate of intentional Virtual Communities of Practice, while listing all of the reasons why Virtual Communities of Practice should be developed, concedes that most Virtual Communities of Practice also use face-to-face meetings on a more or less regular basis (Dubé et al. 2005). On-line communication lacks the richness of face-to-face interaction; thus, relying solely on on-line communication tends to inhibit participation and the creation of strong ties that characterize Communities of Practice. Consequently, for many such communities, the 'boost' provided by face to face meetings continues to sustain the community through extended periods of on-line interaction (Kimble and Hildreth 2005).

As with the previous discussion of what is really meant by a Community of Practice, the scope for interpretation provided by the term 'virtual' tends to mean you will be able to find an example to fit a particular situation. Perhaps then the question here should also be can we find a more useful or appropriate description for a virtual Community of Practice?

Brown and Duguid (2000) provide one such alternative with the notion of "Networks of Practice". Networks of Practice are groups of people who are geographically separate but who share similar work or interests. Networks of Practice have similarities to Communities of Practice but may consist of members from several organizations and have weaker social ties. As Networks of Practice are organized at a more individual level than Communities of Practice and are based on personal rather than communal social networks. Networks of Practice may be a more appropriate model to use than a virtual Communities of Practice in certain circumstances. For example, Andriessen et al (2001) note that Networks of Practice are more comparable to the 'occupational groups' than virtual Communities of Practice.

Using this view, Communities of Practice are seen as providing a hub around which a wider network can form. Communities of Practice act as bridges or brokers, drawing together different groups and combining knowledge in new ways. They can provide the access points for individuals to engage with the wider network and to establish a local identity within the larger organization. Thus Vaast (2004) showed how the use of intranets helped to improve the interconnections between local communities which lead to the emergence of a Network of Practice. These did not replace these local communities but strengthened them.

4 Background to the case study

4.1 Crozier and Friedberg

In section 3.2 we indicated that Crozier and Friedberg's (1977) "analyse stratégique" framework could be useful to examine the power relationships within a Community of Practice and its relationship to the host organization. This is not an altogether novel idea. For example, Ducheneaut (2002) used Crozier and Friedberg's ideas to study a situation not that far removed from our own: the effect that the use of e-mail as a medium for communication has on organizational structure and power relationships.

The strategic analysis model developed by Crozier and Friedberg revolves around the analysis of relationships between interdependent actors rather than groups per se. Their work is based on four fundamental concepts:

- the concept of an actor who acts in his own interests and who interacts with other actors
- the concept of a concrete system which is formed by the interactions with social actor
- the concept of a strategic game in which the actors seek to exploit 'zones of uncertainty'
- the concept of power itself, which is viewed as a set of relations between actors

We will briefly examine each of these.

The definition of what represents an actor is flexible, for example, a Community of Practice could constitute the actor or it could be a set of individual actors. Ducheneaut (2002) for example, notes that actors, technology and context are not distinct entities but rather elements constantly interacting inside the boundaries of a game. The actor is a social entity in the sense that actors enter into relationships with other actors and have objectives, which may or may not be the same as the objectives of the organization. The behaviour of the actor is always the result of a choice, even if this choice is passivity, that is, 'to do nothing'. The actor has a bounded rationality in the sense of March and Simon (1958) and the actor always has some space for freedom of choice, no matter how limited this may be.

According to Crozier and Friedberg (1977), an organization is a set of "systèmes d'action concret" (concrete action systems) that are created by the players themselves. These systems consist of a web of relationships where players exchange, negotiate, make decisions, haggle and bargain. Players organize themselves either formally or informally, and arrangements between actors can vary depending on the stakes and their objectives, which are usually a compromise between the formal objectives of the organization and those of the actor themselves.

The strategic game is the method used by the actor for the regulation of these systems. The game is both about freedom and constraint. The actor has to accept the rules of the game, and at the same time, an actor has to develop a strategy in order to achieve their own objectives. The organizational forms that result from this are a series of interconnected games where the formal and informal rules define the strategies that could best serve the personal goals of the actor.

Power is defined in terms of a set of relations and the outcome of a permanent negotiation between actors to implement their strategies. Crozier and Friedberg (1977) explain that in any given situation, an actor will act in such a way as to maximize their own power. The degree of discretion an individual has within an organization is usually prescribed by formal rules and regulations however, there are some situations where this is not the case, e.g. where an individual has developed specific skills and expertise. In these situations, power is informal and can generate what Crozier and Friedberg call a 'zone d'incertitude' (zone of uncertainty).

The zone of uncertainty represents an area of freedom outside of the normal organizational rules where a player can act to increase their own power or limit the power of others. Consequently, these zones of uncertainty become the focus of strategic power games where the goal is to either enlarge the span of control or to preserve existing power relations and limit the freedom of others to encroach upon them. These games are often played out in situations such as those where there is a scarcity of resources, a lack of, or simply unclear, objectives or instability in the external environment (Miles 1980).

Crozier and Friedberg provide a useful grid with which to understand a situation and to analyse the game between the actors more precisely. This grid includes the actors themselves, their mission, the formal and informal set of relations of the actors, their

resources and weaknesses and the 'stake' of the actors and the strategies in terms of costs and benefits that come from a particular form of organization.

4.2 Description of the case study

The case study is of what was introduced to us as an on-line Community of Practice. It is run from the HQ of a unit of a large multi-national engineering company based in France. The company has been in existence for more than 150 years; in recent years, it has grown by acquisition and now has a presence in over 130 countries. The community was intentionally created in 2006 with the goal of improving knowledge sharing; it is organized centrally by a community leader who is based in France.

The specific focus is on bridging the informational lacunae that exist between the technical and commercial functions in the organization. The community leader explained,

"The community is a place where firm's employees share technical best practices, build application / solution approaches for the market and inform about competition and show our advantages".

He says that the objective of the community is,

"... to contribute to improving firm's knowledge and business, to interact with colleagues all around the world, to make feedback and share success with the whole community"

Examples of how it does this might be through highlighting specific technical requirements for local markets, identifying the strengths and weaknesses of competitors or simply finding that a particular problem has already been solved elsewhere. For him,

"... during the monthly meetings, application, technical, marketing and sales knowledge are shared between members from country and department".

The community has a high degree of official recognition and a reasonably formal structure. There is a steering committee consisting of eight core members and a points-based system that is used to measure member's participation (see Table 1).

The community is large, international and growing. In 2008, there were 370 members in 62 countries; the community grew by 180% between 2006 and 2007. The members mostly come from Europe (51%, Russia included) and North America (23%); Asia and

Oceania accounting for only 16%. The membership is mainly product engineers, design engineers, marketing and sales executives; although a number of technical support staff are also members. Product engineers and marketing managers represent 48% of member's positions but account for about 62% of total community activity.

The community uses three types of tool: a community web site, monthly web meetings and community management tool, all of which are managed by the community leader in France. The technology used for the meetings is a web-based platform with an audio link that allows the participants to view and control a shared desktop; there is also an asynchronous chat window that can be used for private conversations.

Each meeting consists of presentations by members on subjects such as technical best practices, applications / solutions, market conditions or 'tricks of the trade'; the latter is often in the form of 'success stories'. There are also presentations of new products or advanced features; the meetings end with information about community life.

The meetings are based on time zones: one for America and Europe, the other for Asia, Oceania and Europe. In 2007, each meeting had an average of 41 participants, although only a small proportion of these participants actually made presentations. If any specific items of information need to be transmitted from one time zone to another, this is usually done by the 'animator' of the meeting who is based in France.

Action	Points
Best knowledge transfer of the year	40
Knowledge transferred during web meeting	30
Presentation during a web meeting	20
Answer on the community website	15
Knowledge transferred on website	15
Participation to a web meeting	10
Document posted on the community website	5
Request for help on the community website	5

Table 1 Number of points awarded by type of activity

The membership of the community is actively managed using a systems based on a points awarded for degrees of participation. Points are given when a member takes one

of eight types of actions in the community. Every 6 Months, the eight most active members are nominated as "Core Members" and the accounts of members who have not participated at all are suspended. Suspended accounts can be reinstated on request but if the member continues not to participate, the account is deleted after a further six months. Beyond the management of the community, the points do not play any formal role in remuneration or promotion, however core members are given a replica of the product that the company produces which they can put on their desk to advertise their status.

5 Description of the methods

As we have seen, much of the previous work in this area has been based on ethnographic studies. While it is possible to study this kind of virtual community ethnographically, it is complex and expensive. For example, the study reported by Kimble and Hildreth (2005) dealt with a distributed Community of Practice that was based in three countries: the UK, the US and Japan. Their study was based on non-participant observation of members in the UK and US as well as accompanying members from the UK on their visit to the US. Even in that case, the member of the Community based in Japan was only even dealt with by video conference or e-mail.

An ethnographic study that (potentially) involves a large number of members in several countries would have been complex and difficult to realize. In addition, there were a considerable number of unknowns, including the true nature of the community in question. Given this, we decided that our first approach should be to conduct some form of pilot study in order to obtain a better understanding of our virtual Community of Practice, the relationships within it and the relationships between it and the 'host' organization.

To do this we needed to design a methodology that would be both practical in terms of time and cost and which would meet our objectives. The goal of the pilot study was to examine the question of knowledge sharing in Communities of Practice as this was given as the *raison d'être* for this community and to look more closely at issues of power, as a failure to do so has been singled out as a criticism of previous work.

These issues are very difficult to observe directly, particularly when situated in a large community. Our approach was broadly inductive and could be characterized as an exploratory case study (Yin 1994). The aim was to reduce the scope of the study and

the issues. Consequently, we viewed this work simply as a pilot project that would allow us to develop a more sophisticated set of protocols for studying how the dynamics of power relations in Communities of Practice in the future.

5.1 Data-gathering method

Our main data collection instrument was semi-structured interviews by telephone augmented with additional data from documentation supplied by the company. The data collection method used was dictated primarily by geographically distributed nature of the community. We selected this instrument because it is seen as being flexible and capable of generating a wealth of information (Miles and Huberman 1994). We tried not to be overly directive in our interviews, which lasted between 30 minutes and 1 hour. In addition, we had the opportunity to 'observe' two meetings, one physically from the 'control room' where the meetings are run from the HQ in France and one virtually as an on-line participant.

We used two grids to structure to the interviews. The first was based on the 'de facto standard' (Murillo 2008) criteria for a Community of Practice (Wenger 1998b, pp 125 - 126); this was aimed at trying to characterise the actual nature of the community. The second was based on ideas from Crozier and Friedberg's (1977) work and was used as framework to analyse the behaviours, attitudes and interpersonal relations within and beyond the community. The interview guide listed the main themes and sub-themes to be covered in the interview and was drafted beforehand to find out the views of the community member who were interviewed.

Specifically, the guide was designed to elicit individual views on:

1. The activities of respondent (job and Community)
2. Their level of involvement in the community
3. Issues related to joint enterprise and concrete systems of action
4. The perceived value of the community
5. Issues related to management support for the community within the organization
6. The culture of sharing within the organization
7. Conflict and issues of power within the community / organization
8. The evolution of the community
9. Various personal and professional characteristics of the respondents

5.2 Description of the sample

Our original goal was to interview all of the eight core members in the community, and to use these core members as a way to develop a 'snowball sample' of about 30 respondents. We drew up detailed lists based on data provided by the company that we hoped we could use keep this snowball sample broadly representative of the community as a whole. Our ideal representative sample is shown in Table 2 below

Zone / Function	Product Application	Marketing	Sales and Support	Total by zone
Americas	3	3	4	10
Asia	1	2	1	4
Europe	6	4	4	14
Total by function	10	9	9	

Table 2 Target sample

Despite the project being introduced to both time zones by the community leader, we had a very high non-response rate; when we did get a response, arranging a time for the interviews themselves sometimes proved impossible. In the end, we were only able to interview six of the eight core members and one non-core member; we also interviewed one ex-core member. The community leader has been interviewed twice (once in a telephone interview and once in a face-to-face interview).

The Table 3 below shows the actual characteristics of our sample. New core member indicates that the person has not been a core member previously.

Zone	Status	New core member?	Title	Position
Oceania	Core	X	Senior marketing engineer	Marketing
Europe	Core	X	Product marketing manager	Marketing
Europe	Core	X	Manager application centre	Product Application

Zone	Status	New core member?	Title	Position
Americas	Core		Senior applications specialist	Product Application
Europe	Core		Product application engineer	Product Application
Europe	Core		Technical support and methods	Support
Asia	Non-core	-	Technical support for sales	Support
Asia	Ex-core	-	Product marketing manager	Marketing
France	Leader	-		

Table 3 Sample used in the study

5.3 Data analysis method

The data produced by the interview was recorded, transcribed, processed and analyzed in order to identify any significant results. For the analysis and interpretation of data, we chose the thematic content analysis method (Berelson 1952) which is based on a system of extracting themes and sub-themes. We made a two-step qualitative analysis of what had been said: (1) content analysis of the transcribed interviews involved analyzing them one by one, and then (2) analyzing them all together by themes. The sequential analyses of each interview helped to identify the range of themes discussed by the interviewees; the thematic analysis of all the interviews led us to realize a specific thematic dictionary. The results of this analysis appear in section 6.

6 The results of our pilot study

Following the methods outlined above, we were able to produce results that gave us some insights into the nature of our virtual Community of Practice, the relationships within it and the relationships between it and the organization that created it. For convenience, we have divided the results into three sections.

6.1 The members

6.1.1 Reasons for participation

In our sample, two main reasons for participating in the community were identified.

Firstly there are individuals who seem to have an instinctive moral reflex to help because it is 'the right thing to do' (Wasko and Faraj 2000). These people are already members of others communities and have integrated the 'community' principle in their job. They often devote a lot of time, even time outside of normal working hours, to participation in the community.

"When I have to solve a problem, I like to be able to pass on that knowledge because I am sure other people will have the same problem and it will save them time. I don't expect a pat on the back for doing it; it is something I like doing" (Applications specialist, Americas)

Secondly, there are individuals who seem to have a more focused interest, such as a specific type of information. Inside this group, it is possible to discern several attitudes.

1. Those who really want to find a benchmark and to benefit from others experiences: time in the community varies according to their interests and what they find. If they find something of interest, they could spend time a lot of time in the community.

"I'm only engage with the site if there is a topic of interest in the newsletter" (Technical support, Europe)

2. People who see the community in terms of an "exchange" or "market" even if the knowledge and information available are for free. Those who fit in this sub-group try to have a regular time when they use the community.

"If you give some, you will have some - and it's for free" (Product Application Engineering, Europe)

3. For one person, membership of the community is simply an opportunity to find the right information at the right time. Each day he spends a little time looking for good information he can use. It is different with the previous sub-group because he often takes information but not always give back in exchange.

In Table 4 below, we can see how many people in our sample fit in each group and sub-group.

Groups	The "reflex"	The more "opportunist"		
Sub groups	none	Looking for benchmark	Exchange / give and take	Looking for a specific answer
Number of individuals	3	2	2	1

Table 4 Division of the sample per group

6.1.2 A profile of members

From our analysis of the results, four different profiles of users were identified:

1. The "searchers" (four respondents)

These people are looking for information that could be used in their job or more that could serve business. Their objective is rather clear and opportunist but they integrate culture of sharing. They have objectives that are more personal than the "sharer". They believe in sharing but at the same time have more specific and functional goals. They are aware of the constraints of a situation and probably use strategies such as compromise, negotiation or even passivity, to get around them.

2. The "sharers" (two respondents)

This profile is typically of somebody who thinks that knowledge sharing is a necessity. They integrate the culture of sharing in their everyday life. They have very positive attitudes towards the community. Their source of satisfaction is to learn from others. However, we do not have enough from this study on how they use this knowledge and whether they transfer it or not. As social actor, they certainly look for more resources and relationships and use a strategy of alliance to incite others to have this culture of sharing.

3. The "networker" (one respondent)

These are simply individuals who want to know other people, not only to develop networks and share knowledge but also to share and develop personal interests. The main stake here is to develop relationships with the experts on a topic. The community is a way to improve their network. The strategy might be at the beginning to make attempt and after it might be alliance.

4. The defeatist (one respondent)

In our sample, we could identify only one individual (who was a non-core member and was told to join the community) who fitted this category. He underlined the difficult relationships between France and the others areas. He did not seem to feel a culture of sharing because according to him, the real decision-makers are the people in France. Maybe this attitude could lead to achieve more personal objective and not sharing the community objectives. According to Crozier and Friedberg, the strategies he might follow would be to try to increase his own resources, according to the constraint that France is the decision-maker, by adopting a strategy of passivity.

6.2 Relationships within the community

6.2.1 The community as a strategic game

In the community, it seems that several types of social actors have grown up.

Among members, some draw a distinction between active and inactive members. This type of distinction was often made in relation to the different ways that the technical and the sales team used the community. One respondent underlines the differences between technical support and marketing.

"Problems of misunderstandings between technical and marketing are a frequent theme" (Marketing, Europe)

Thus, we can draw the attention to two social actors in reference to Crozier and Friedberg: the sales team and the technical team could have different objectives and it is possible to find a strategic game in the space of the community between those teams. We could argue that depending on they are looking for; they play a game to achieve their objective: bargain, exchange, negotiate.

The community was set up because this gap between technical and sales / marketing. However, we could wonder if the community is successful in reducing this gap or if the creation of the community has simply created a new space, where the two functions can engage in a strategic game.

A further result that highlights the Crozier and Friedberg model is the members' perception of the objective of the organization. For one respondent the company culture

is about knowledge sharing and entrepreneurship. Another member underlines that nothing is done locally and that all comes from France.

"People from France decide how we should develop the community and a couple of countries disagree with that and request different things"
(Marketing, Asia)

When we asked respondents to tell us about the conflicts in the community: five of them answered that there were not any conflicts or problems. However, later, three of these five respondents moderated their opinions. Some underlined the conflict between France and others countries.

"No conflict but debate ... we can only say our opinion, but in the end the decision comes from the top management ... so sometimes it's doesn't always end up happy" (Sales, Asia)

Maybe there is a power game between people who are in France and the rest of the world. According to all members, there are differences between areas and between countries. Europe seems to be favoured, while for Asia it seems to be very difficult.

The community is 'animated' from France and the European area is favoured because of this. From the viewpoint of Crozier and Friedberg (1977), we could argue that people who are in France and Europe benefit from more resources and information than members in others areas and so members from France have more power. Thus, the stake between the European area and the rest of world area might be different. If this were the case then people would implement strategies (such as passivity, compromise or alliance) to deal with this situation.

"... others countries do have others expectations of what they get out of the community - some participate to share and others participate to complain"
(Product Application Engineering, Europe)

"I can imagine that people in France that also need the community are in a quite difficult position since they sometimes know a little bit more some confidential stuff and they may not talk about it" (Marketing, Europe)

Consistent with Crozier and Friedberg's analysis of this example, when the information allows a group to improve or maintain power members they keep it, when this information is not useful anymore they share it. Finally, we might wonder if in fact the

community will simply exacerbate problems that may already exist in the host organization e.g. the relationship between the countries.

6.2.2 The community as a way to gain resources

All of the individuals in our sample agreed that they gained something from participating in the community: benchmark, knowledge or just information. Some (the "reflex" group) mention that the community is more than just a 'gain' it is part of their everyday job / life. Their motivation is a desire to learn, a challenge:

"It's not like you ask questions and you definitively get the answer. Sometimes the answer comes out that way and sometimes you know you get challenged ... you know it's not always successful" (Marketing, Asia)

For almost all members the main link is the product: the reason the community was formed in the first place. However, some mention the fact that the community also provides the chance to get to know others people and learn from them. Thus for some, the community is also a way to make relationships.

"You get to know other people, not only from the web meetings, you know the people behind them, it's important to share also personal things" (Product Application Engineering, Europe)

For some building relationships could be of interest for two reasons. First, it may be a way to respond to a personal need for social relationships e.g. a more altruistic position but this is moderated by the fact that the community is virtual and we assume in the first part that the feeling of affiliation is stronger in the day-to-day meeting. Second, people in the community could benefit from knowing others, and this attitude is more opportunist and consistent with the work of Crozier and Friedberg.

Hence, the members of the community can share the same objective about sharing knowledge of the product, but they also have objectives that are more personal. For example, one core member explained how the link between members could serve the interest of his local team and its performance. For him the community can help to anticipate on solutions because it gives information about the future, so in that way, the community is an opportunity him to increase his local resources.

Consequently, we can observe that, via the community, individuals are able to increase their ability to control resources. In the Crozier and Friedberg's view, the stake for all

individuals is to gain more resources; this could be different according to the needs of each actor.

6.3 Relationships between the community and the company

6.3.1 Creativity and innovation

One of the respondent said that when you want a solution you could either create it or find somebody else who has already solved it. The theme of 'not reinventing the wheel' featured in several interviews. This does not seem to fit well with the idea of the community as being a source of innovation. If all the community does is to help people to find solutions provided by others, then perhaps it could actually limit creativity.

With regard to the suggestion that such communities limit the sharing of proprietary knowledge (Swan et al. 2002; Teigland and Wasko 2003), only one respondent mentioned the possibility of not sharing knowledge that could lead to an innovation because it weakens one's own position in the organization.

6.3.2 A greater influence for members but no management involvement

Concerning influence, most respondents answered that the community gives them additional influence in one form or another. For example, it enables communication with people in France (which may have strategic implications - see section 6.1). Some of the members' use the community as a route to personal recognition from local peers and for some it is a route to recognition from members in other countries.

"No influence from membership but I may have more influence with others outside my own country" (Marketing, Europe)

As before, the initial response to questions on this topic was negative, but later respondents modified or moderated their view. The main point was that being core member gave them influence over the way things evolved inside the community rather than outside. It does not give influence for career growth or with management. However, we can assume that inside the community there are games between members according to their status, and that core members have an influence - for example on the topic for a web meeting.

As regard to the level of management involvement, all respondents said that management does not give any support for the community but that managers agree on the principle and accept it.

"My manager knows that I am in the core team, the only thing he said is "good job" but that's it" (Marketing, Europe)

An example of this is that two respondents tell us that they participate in the community during their own personal time.

7 Conclusions

In terms of empirical research, the focus of the paper is a study of knowledge sharing in a global, on-line Community of Practice that was intentionally created to improve the sharing of product related knowledge between product engineers and marketing managers in a large multinational organization. Most of the members of this community only ever meet in 'virtual meetings', which were 'animated' from the French HQ of a product division of this company. Practically and conceptually, this study posed a number of problems.

In the introductory section of this paper (section 2), we explored the scope of the term Communities of Practice and asked:

1. What do we mean when we talk about a Community of Practice?
2. Is it possible for a Community of Practice to exist on-line?
3. Is the notion of a Community of Practice compatible with the type of group in our study?
4. Are Communities of Practice really the answer to knowledge sharing in large multi site organizations?
5. Methodologically, what is the best way to study this type of group?

Later (in section 3), we outlined some alternatives notions that might be considered for the type of community in our study. Finally, in our methodology section (section 5), we stated that our objectives were:

1. To conduct a pilot study to examine the question of knowledge sharing in Communities of Practice using criteria for a Community of Practice (Wenger 1998b, pp 125 - 126)
2. To look more closely at issues of power using Crozier and Friedberg's (1977) "analyse stratégique" framework

The results of the work have been reported in section 6 above, here we will restrict ourselves to answering the question "what conclusions we can draw from this work?"

7.1 What has this study told us about the community?

The principal conclusion is that, even from the limited insights we have, this type of community is not as clear-cut as we might have expected. An intentionally created, global, on-line Community of Practice for sharing product related knowledge between product engineers and marketing managers in a multinational organisation, does not sound much like the Communities of Practice described by Lave and Wenger (1991) or Brown and Duguid (1991). It may fit into the description provided in Wenger's later works (Wenger et al. 2002); it may have more in common with Lindkvist's notion of a Knowledge Collective (Lindkvist 2005) or Brown and Duguid's notion of Networks of Practice (Brown and Duguid 2000) might be applicable. In this study, it seemed that they were all applicable.

By looking at the results, it is possible to find evidence of people motivated by a deeply personal concern about a practice that was also part of their working lives; similarly, there is evidence of people who view the community in much more instrumental way. There is evidence of groups within a larger network and there is evidence of people using the rest of the group as an external memory rather than the focus of a situated practice. This may be an artefact of our methodology (interviewing core members and snowball sampling) or it may simply be associated with our low response rate (i.e. an unrepresentative sample that happened to hold strong and divergent views).

Beyond this, there were some interesting indications that using Crozier and Friedberg's (1977) "analyse stratégique" framework could help highlight some of the strategic games that can be played in such communities, although the limited response rate means that these indications remain mainly speculative.

We return to these points again in section 7.3.

Finally, although not all of the details are reported in this paper, it was also interesting to note the limitations of the 'on-line' community. We saw in section 6.1.1 that some members saw the community more in social / networking terms than as a forum for knowledge sharing / exchange. There were a number of additional comments that are not reported here, which indicate that the desire for face-to-face meetings reported elsewhere was also present here.

7.2 What has this study told us about methods we used?

The answer to this question is to some extent tied up with conceptual issues about exactly what our unit of analysis is. We noted above that, even from a small sample of telephone interviews, it appears that our 'community' is t simultaneously several different things. It is also tied to the more practical issues of what is methodologically / ethically / commercially / economically feasible in this type of group.

The main problem for an assessment of our methodology has been the poor response rate. In terms of research design we felt that we had done all that we could to protect ourselves from this. The community we studied was recommended by a consultant who is recognised and somebody who has considerable expertise in this area. We had the full co-operation of the company that 'hosted' the community and we were introduced to members in both time zones by the community leader in a monthly 'virtual meeting' run from the French HQ. We had full access to member's company e-mail addresses and were able to contact them directly. However, in the end, we were unable to convert many of these contacts into interviews.

We are in a 'catch 22' situation. Without knowing more about the reasons the community did not respond in the way we expected we are unable to say if the method we used would have been appropriate, but because people have not responded, we do not know if it is the community or the method that is at the root of this problem.

7.3 What are the implications for future research?

This work was intended to be a pilot study. The aim was to reduce the scope of future studies and highlight pertinent issues; we remain in contact with the company and we are exploring ways in which we might improve our response rate. We still feel that our initial research design has the potential to highlight relevant issues, but that it has not yet been fully tested.

There are some indications from the current work that perhaps we underestimated the complexity of this type of community and one area for future work would be to develop better conceptual models of how the different types of groups we describe in section 3 relate to each other. We might also look more closely at the dynamics of group membership. It is clear that at least some the people we interviewed are members of multiple groups and people may play several different roles in the same group. While

Wenger does discuss multi-membership (Wenger et al. 2002; Wenger et al. 2005) this area has not been the focus of much attention elsewhere.

Similarly, there are some indications from the current work that Crozier and Friedberg's (1977) "analyse stratégique" framework could help to highlight the way in which power relationships help to shape the evolution of such communities. Again, this area has tended to be under-explored in recent work. However, it also needs to be noted that in order to be able to exploit this framework, we need to be able to identify "systèmes d'action concret" - something that we hoped to do with our original methodology but did not prove possible.

In the end, the ultimate conclusion of our work must echo the refrain of so many other researchers through the ages "more work is needed".

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