The Diffusion of Social Media and Knowledge Management – Towards an Integrative Typology

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Abstract. This paper introduces a first outline of a typology of distributed knowledge co-creation in virtual communities based on Porter's typology of virtual communities. The typology is based on empirical results from the analyses of social media, and a discussion of case study results from India proves the adaptability as well as usefulness of the typology. At the same time, the case study serves as an example to depict a socio-economic perspective on social media and knowledge management in Digital Ecosystems.

Keywords: Social media; web 2.0; typology; knowledge management; knowledge co-creation; produsage; presumption.

1 Introduction

Over the past years, researchers from the media and communications field as well as researchers from adjoining fields have observed that the traditional terminological and conceptual differentiation between mass media production on the one hand and their reception on the other hand is becoming increasingly blurred. The rapid diffusion of Internet technologies and the emergence of online communities--particularly online knowledge communities--have lead to the need for a theoretical re-conceptualisation. New terms such as 'produsage' and 'prosumption' [1] [2] describe emerging patterns of media production and consumption that blur the traditional role-division of producer and user, of sender and recipient. This change has far reaching consequences for the fields of economy and politics, and also for the traditional mass media sector.

So far marketing strategists as well as media and communication scholars often use the same terminology such as social media, web 2.0, social software, and online/virtual communities. However, communication scholars refer to broader trends of parallelised, decentralised content creation and distributed creativity regarding so- called *social*

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media products (e.g. YouTube, Facebook) that depict a post-industrial mode of socio-technical innovation. These innovations are built on iterative, evolutionary models and fluid, ad hoc processes that are not necessarily nor preliminary controlled by the hierarchies and laws of classical economics. The terminological aberrations that often describe similar, however not identical aspects of those processes (e.g. social media, social software, web 2.0, etc.) complicate the systematic study of respective innovations. In this respect, typologies are needed that allow the systematic classification of the various innovations observed.

Moreover, in the field of Digital Ecosystems research new paradigms such as Dynamic Service Composition etc. also focus on a flexible and interchangeable approach to software adoption and development, where the end-users are provided with the opportunity of easily adopting as well as adapting software (in a broad sense) for their own businesses, certain forms of produsage and prosumption can also be found. Given the importance of communities as a core factor in Digital Ecosystems, where knowledge (co-)creation and knowledge management represent the vital driving force as well as catalysts regarding a sustainable DE community, we argue that insights from the social sciences can contribute significantly to a structured approach and understanding of the social and technological (i.e. software applications) mechanisms as well as the connection of both in virtual knowledge communities.

In this paper we will therefore explore the modes of self-catalysed content co- creation as socio-economic innovation (produsage and prosumption) and propose a first outline of a typology on distributed knowledge co-creation.

2 Theoretical Background

Due to the increased number and complexity of products and services that compete with each other in a global knowledge economy [3] the importance of knowledge and its production as well as management has increased immensely. Accordingly, *knowledge management* (KM) has become a core issue in organisations in the last decades. The basic function of KM is the transformation of its employees' tacit knowledge into explicit knowledge and vice versa which is a circular process of socialisation, externalisation, combination, and internalisation [4]. The functions of KM can be summarised as (a) making existing knowledge transparent, (b) controlling of recently or prospectively needed knowledge, (c) supporting the exchange of knowledge, and (d) the interlinking and retrieval of information [5].

Recently KM has surpassed the organisational context towards more community-oriented ('gemeinschaftlich', see [6]) ways of knowledge production. In this respect the term of *communities of practice* (CoP) as introduced by Wenger seems to depict this shift best: According to Wenger "communities of practice are groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly" [7]. Hence, communities of practice are groups whose members participate in joint sharing and learning processes based on common interests. Members engage in discussions, help each other and share information [8].

According to Wenger the domain, community and practice together build a community of practice. The practice is developed through a variety of activities such as problem solving, requests for information, seeking experience, reusing assets, coordination and synergy, discussing developments, the documentation of projects, visits, and the mapping of knowledge and identification of gaps [7].

In recent years, ICT has facilitated the development of communities of practice whose members are locally dispersed and CoPs are being recognised as valuable organisational assets to "overcome the inherent problems of a slow-moving traditional hierarchy in a fast-moving virtual economy" [8].

It is possible to regard CoPs as a representation of the so-called *Mode 2 of knowledge production.* The traditional mode of knowledge production that used to be organised according to disciplinary boundaries is fundamentally changing [9]. More than 15 years ago, a new mode of knowledge production coined as 'Mode 2' has emerged. Not only the character of knowledge production but also knowledge validation and dissemination are transforming. Communities of practice produce their knowledge in the context of applications, across disciplinary borders, and the communities are composed of members with a huge variety of skills, professions, and scientific domains. Along these characteristics, flat hierarchies and transient organisational structures are preferred. Since the expertise of any community member is regarded as a potential asset, communities of practice need to ensure that contributions from any member can be taken up by the community--and this is the point where 'social' media come into play.

Certain technologies such as weblogs, folksonomies, and social networking sites have in common that communities make use of them to manage their own knowledge. Such media are usually coined as *social media* and are part of O'Reilly's notion of a *web 2.0* [10]. Lietsala & Sirkkunen [11] suggest to use the notion of social media as an umbrella term under which one "can find various and very different cultural practices related to the online content and people who are involved with that content" [11]. According to the authors, web 2.0 is not a synonym for social media as it represents an even looser concept referring to online services and technologies. What is important to keep in mind is that social media put an emphasis on the *content* whereas social software refers to the code, the technology, and software used for social media applications [11].

The most prominent example of a social medium is Wikipedia. Regarding Wikipedia, the differences between a classical encyclopaedia project and this new form of knowledge production are salient: In principle any web user can become a 'co-'author and add any entry to this encyclopaedia or is allowed to amend entries as editor. The same user can contribute with her knowledge and benefit from the knowledge of other users. "These produsers engage not in a traditional form of content production, but are instead involved in produsage - the collaborative and continuous building and extending of existing content in pursuit of further improvement." [1].

Another example are weblogs, which "could only be created by people who already knew how to make a website first. A weblog editor had either taught herself to code HTML for fun, or, after working all day creating commercial websites, spent several off-work hours every day surfing the web and posting to her site." [12]. However, since open source weblog software is not only available for free but also easy to use, the number of weblogs has increased enormously. Knowing HTML is no longer an obstacle which needs to be dealt with when sharing one's knowledge in the World Wide Web. Moreover, by means of using blogging services it is not even necessary anymore to own personal webspace. And given that many Web 2.0 applications had been and still are collaboratively developed in open source software communities, it is not only the *content* of weblogs and wikis which are 'prosumed', it is also the *software* itself. This again refers to the underlying paradigms and ideas of the Digital Ecosystems 'movement': Software applications are meant to be not only adoptable but also adaptable to the specific needs and services of the different DE community members (i.e. SMEs). Hence, with the dynamic contents that are to be managed by means of the software, the software itself is also changed (adapted).

So far, other formats than Wikipedia (such as Lycos IQ or Yahoo! Answers) have not found much attention from communication scholars albeit representing both knowledge-management systems and social media as the users generate the knowledge themselves. What constitutes most distinctively the usage of social media is that users generate their own content and that they are no longer relying on the content created in markets under economic and mass media logics. In this context KM is not only an issue of organisational success that huge corporations can afford. Resource weak actors are given new tools for managing their knowledge, individuals can profit from the participation in knowledge communities, be it for political participation, hobbyist activities, self-help, or other topics. In addition, SMEs may improve their position in the competition with corporations.

Nevertheless, the term social media remains somewhat vague describing phenomena like user-generated-content on the Internet in communities with the help of specific technologies and software. As media are used for communication which is a social process, media are also an integrative part of this process. This means that media are social phenomena and hence have immanent social characteristics. With regard to the various practices on the Internet, almost every website covers features usually described as social media. Even so called web 1.0 practices like personal homepages, IRC, and newsgroups could be considered as social media as they involve social processes as well. Accordingly the attribute 'social' is not specific enough, and the term *participatory media* would describe the concrete phenomenon more precisely [13].

However, we would argue that a typology helps to better understand and systemise the various phenomena of joint knowledge creation that were introduced above and that are usually also coined as social media. When it comes to the characterisation of social media we argue that it is appropriate to draw on dimensions that had already been used to categorise the phenomenon of online communities, a line of

research that gained academic interest before the emergence of the terms 'social media' or 'web 2.0'. One example was devised by Porter [14], who differentiated between the dimensions purpose, place, platform, population, and profit model when creating a typology of online communities.

3 Porter's Dimensions of Virtual Communities

According to Porter, "a virtual community is defined as an aggregation of individuals or business partners who interact around a shared interest, where the interaction is at least partially supported and/or mediated by technology and guided by some protocols or norms" [14]. As Porter notes, one advantage of her definition is the inclusion of business partners, acknowledging that communities can also operate in an economic system. Furthermore, Porter speaks of 'technology' in an abstract manner instead of focussing exclusively on Internet-based technologies and on the 'virtual' aspect of those communities. Community life can also take place in the 'real' world and not only in the virtual setting.

Porter's proposed typology differentiates two first-level categories. The first category deals with the establishment of virtual communities. They can be member-initiated or organisation-sponsored (for-profit or non-profit sector). The second category acknowledges the relationship-orientation: Member initiated communities can be social or professional. Organisation sponsored organisations can foster commercial, non-profit or governmental relationships.

The next step is to define the attributes of virtual communities. Porter proposes the following five attributes: *purpose* (content of interaction), *place* (extent of technology-mediation of interaction), *platform* (the technical design of interaction in the virtual community, where designs enable synchronous communication, asynchronous communication or both), *population interaction structure* (the pattern of interaction among community members as described by group and type of social ties), and *profit model* (return on interaction) [14]. With the help of those attributes, researchers should be provided with a consistent set to describe virtual communities. However, does this typology also cover all aspects of virtual knowledge communities?

4 Porter's Typology Assessed

On the basis of different social media (question-answer-communities*, Wikipedia*, blogs, etc.), a qualitative content analysis and structure analysis were conducted. The guiding research question was: How does Porter's typology of virtual communities fit to knowledge communities and social media? Is it sufficient or does it need adaptation according to empiric phenomena?

The results revealed that knowledge management can be regarded as the main *purpose* of the researched communities like Wikipedia, Yahoo! Answers or social media in general. The *profit models* can vary – Yahoo! makes revenues through

* If available, German editions were used for analysis.

advertisement, Wikipedia in turn is exclusively financed by donations. The *place* is almost exclusively virtual for all analysed communities even though local face-to-face meetings can be observed for Wikipedia as well. The platform is basically based on asynchronous interaction that can be explained through the complexity of the transformation from tacit to explicit knowledge and vice versa. The dimension of population resp. pattern of interaction needed further specification and hence should be described as the *role diversity* of community members. Generally it can be stated that any user can be both producer and recipient of content. But with respect to the functions of KM, when it comes to the controlling of recently or prospectively needed knowledge, each community has own rules and practices regarding the inclusion and exclusion of relevant or irrelevant content. Therefore Wikipedia developed a democratic hierarchy between 'conventional' users and elected administrators who for example have the authority to delete articles (Fig. 1).

In Yahoo! Answers the administrators (Fig. 2) are not elected by other users but nominated by Yahoo! instead. However the nomination procedure in Yahoo! Answers was not transparent and the moderators act on an anonymous basis. It is not clear whether a 'conventional' user can receive administrator privileges. However, it is evident that an administrator could also be a 'conventional' user by means of a second account. Even though the work of the administrators in both communities is dependent on input by other users who can indicate faulty or poor content, the power of the roles within these communities is not equally distributed. There are users with less and users with more power. The rules as to how to divide this power can either be transparent or vague.

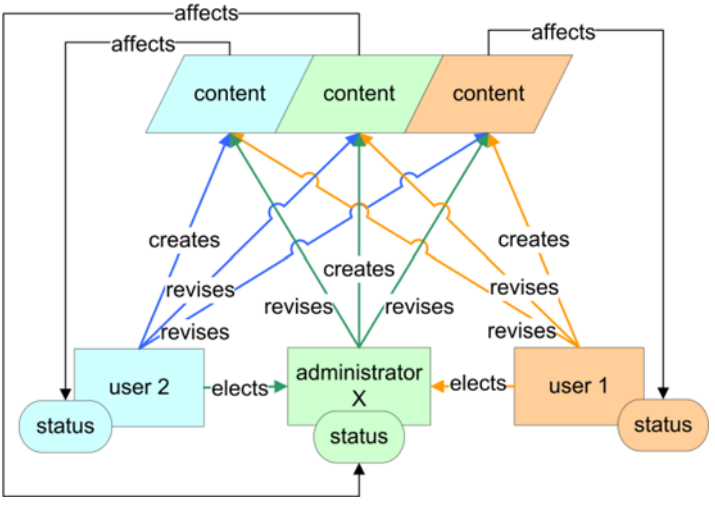

Fig. 1. Interaction pattern in Wikipedia

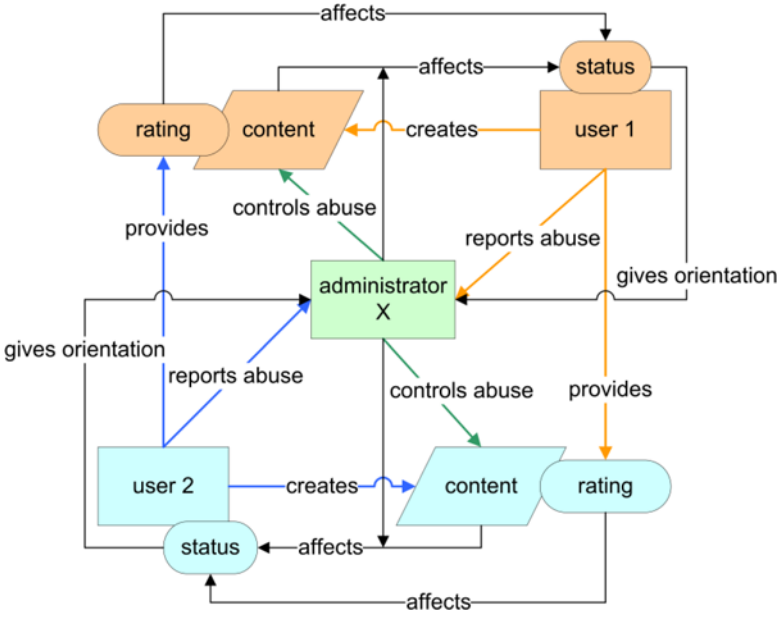

Fig. 2. Interaction pattern in Yahoo! Answers

In contrast to social media like YouTube, where spontaneous entertainment is a core purpose of the users, knowledge managing communities follow a long term approach. So it is of interest to ensure that the stored information can be transformed into knowledge through perception in future. Therefore, knowledge managing communities developed several *sustainability mechanisms*. These mechanisms are for example reputation systems, activity based credit systems, or rankings: users may be able to rate the content of others. The accumulation of all ratings of certain content can be compared to other evaluations of content and hence these ratings can be ranked. Additionally to simple statistics (e.g. number of content contributions, number of logins, and other activities), rating based statistics can be used for creating the reputation of each user in the community. On the one hand these mechanisms are meant for the motivation of the users to contribute regularly and on the other hand to provide indicators for the quality of the content.

The results of our research have lead to the integration of two further attributes to Porter's typology of virtual communities: *role diversity* and *sustainability mechanisms*.

With the help of these two new attributes we hope to initiate the further development towards a new typology for social media and knowledge management in Digital Ecosystems, allowing a distinct and clear categorisation of the various social and technological aspects. Whereas the notion of 'role diversity' refers to the concepts of produsage and prosumption, representing a central aim of Digital Ecosystems, 'sustainability mechanisms' are of equal importance to Digital Ecosystems' communities. The example of reputation and credit systems can also be integrated in a

discussion of trust regarding DE. Since the concept of 'trust' represents a major field in both computer science and social science oriented research of Digital Ecosystems, not only theoretical discussions but also practical applications and interpolations are needed. These practical applications can in turn be instilled by already existing virtual communities' practices, that cannot be applied as is, but by means of a structured approach in order to adapt the underlying mechanisms to the Digital Ecosystems context.

Table 1 summarises therefore Porter's features of virtual communities together with our proposed additional features regarding social media in Digital Ecosystems: role diversity and sustainability mechanisms. It goes without saying that these two new features also represent crucial attributes for communities that do not populate the Digital Ecosystems dimension, however particularly in this dimension they appear to be pivotal.

Table 1. Porter's Features of Virtual communities and additional features of social media

Porter's Teatures of Virtual Communities	Additional features of social media in Digital Ecosystems
Purpose	Role diversity
Place	Sustainability mechanisms
Platform	
Population interaction structure	
Profit model	

5 Social Media and Knowledge Management and a DEAL's Perspective

So far this paper has focussed on analysing the features of virtual communities with a clear theoretical focus. This section will provide insights drawn from a series of Digital Ecosystems pilot-projects in India in order to discuss the potential impact of the produsage and prosumption concepts on socio-economic growth.

The Digital Ecosystem pilot projects (DEAL-www.dealindia.org) for Indian Agricultural Extension Services (IAES) were analysed from a 'produsage' and 'prosumption' perspective. According to these analyses 'produsers' generate social capital that contributes towards 'self sustenance' of the ecosystem. According to our proposed typology from section 4, this analysis mainly focuses on the issues of role- diversity and sustainability mechanisms in a Digital Ecosystem.

IAES operates through KVKs--Krishi Vigyan Kndra (Agri-Science Centres), directed by the State Agricultural Universities (SAU), Indian Council of Agricultural Research (ICAR) Institutes or by the NGOs engaged in rural development (Non- Governmental Organizations). The projects focus on Northern India and

selected five KVKs for the longitudinal research. The projects attempted to create digital knowledge bases for fostering the process of creation and dissemination of new information and innovative knowledge among farmers (the tacit knowledge holder), KVK experts (the knowledge moderator) and scientists of the state agriculture universities and other institutions (the explicit knowledge holder).

In the pre DEAL framework, there were established and clearly defined formal relationships between different layers of actors—academic (Agricultural institutes, IITK), administrative (ICAR, ZCU-the Zonal Control Unit—the implementing and monitoring authority) and functional field units (KVKs), but very few ties among the members at the same layers. For example, ZCU in Kanpur had direct link with all five KVKs and farmers had close link with their respective local area KVKs but there were almost no direct links among the five KVKs or the farmers of different villages with each other before DEAL.

The OPAALS authors at IITK have incorporated some network diagrams which are drawn by using NetDraw, to give a clear idea about the effect of DEAL in the network structure. Their analysis shows that DEAL is able to boost the information flow by increasing the number of ties (from 77 to 183), and group reciprocity (from 0.3585 to 0.7745) of the existing network where all the existing nodes are present and IITK is the only new actor introduced.

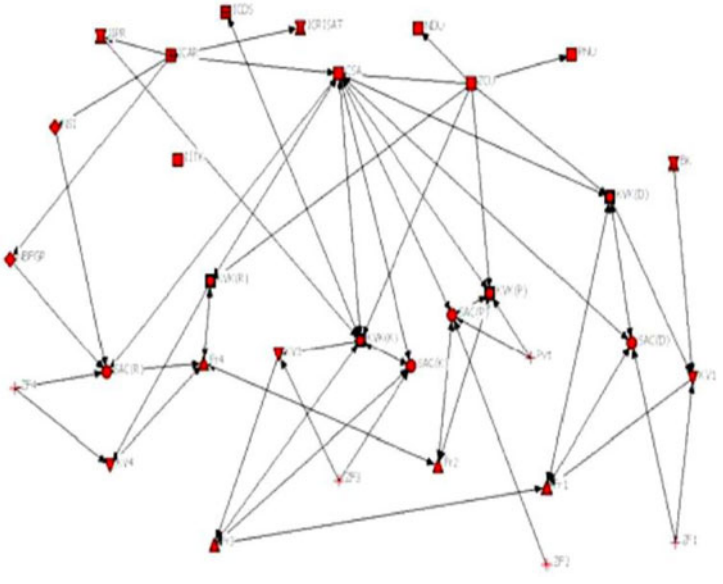

Fig. 3. Network ties before DEAL

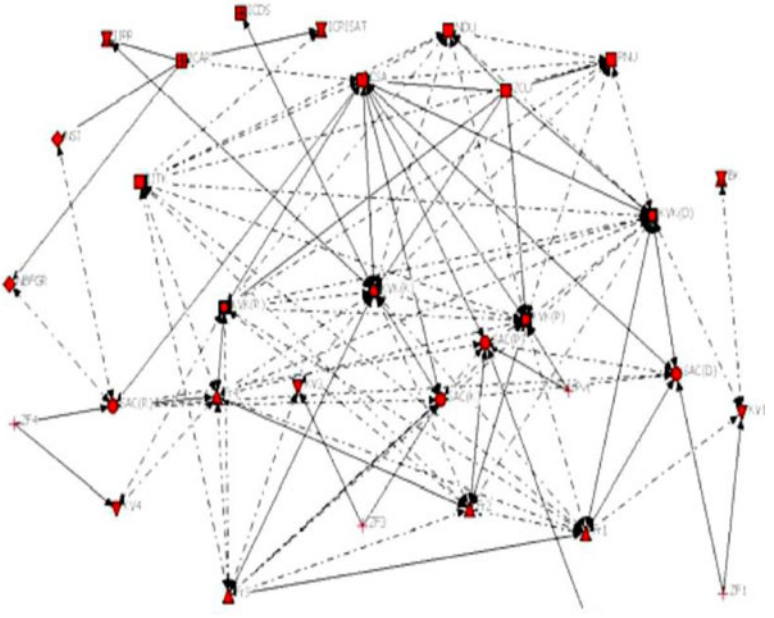

Fig. 4. Network ties after DEAL

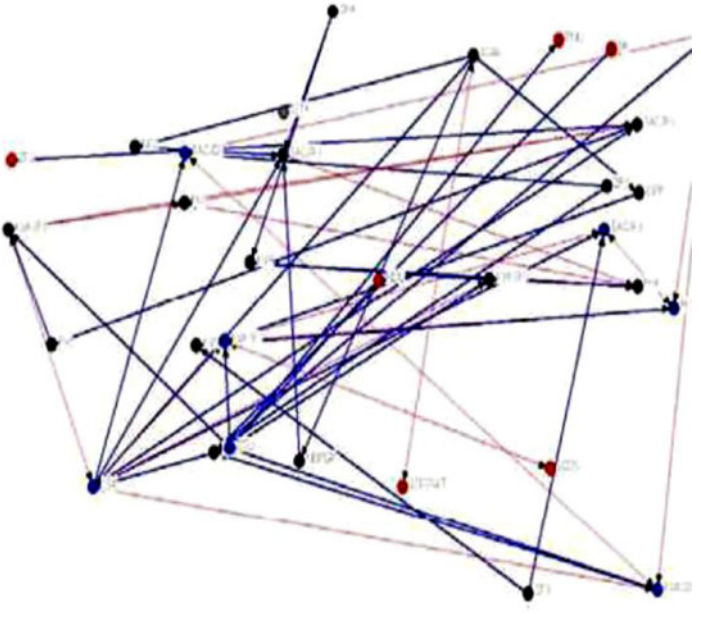

Fig. 5. Reciprocal ties before DEAL

The dotted lines, in figure 4, are the newly created links, where as the solid lines show the pre existing relationships among the actors. These ties are formed in the process of knowledge prosumption by the mutual engagement of the network members, facilitated by DEAL. Empirically, DEAL is able to generate weak ties within and between different groups of farmers, KVKs and different research institutes. These ties help to access the resources (information) associated with different nodes by reducing the network distance. So it helps in increasing the resource mobilisation in the network.

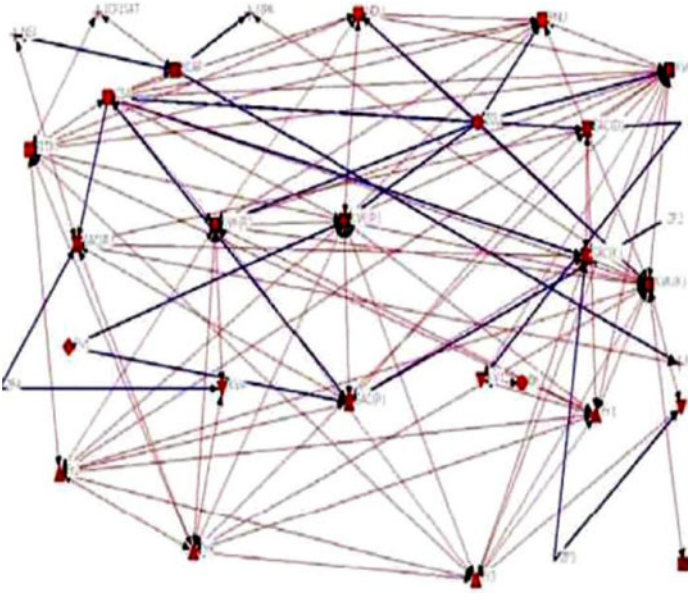

Fig. 6. Reciprocal ties after DEAL

Before DEAL, the reciprocity among ties was also low. Initially better reciprocity was observed only in the informal ties among the actors. But most of the ties within (e.g. between two academic institutions) and between (e.g. between a KVK and ZCU) layers were formal and there was low reciprocity. So the whole system was like a top- down push system. The implementation of DEAL helped in reducing the gap and increasing the group reciprocity which is an indicator of increased interactions among the members in the network. In figures 5 and 6, the light lines denote the reciprocal ties and the dark lines denote non-reciprocal ties. Increase in reciprocal ties has a positive impact on the collaborative knowledge co-creation process and increased 'prosumption' among members enhance the reciprocity. Thus there is a cyclical process in the network between content prosumption and increased interaction which also corresponds to the feature role diversity in our typology.

While responding to the question of 'self sustainability' of the community, the researchers proposed that the currency of reputation and trust generated through produsage and prosumption motivates further collaboration and community participation. Therefore, DEAL is able to enhance the social capital by increasing the mobilisation of resources in the network and also by enhancing the voluntary collaboration in the content creation process.

The DEAL example shows that this project can be described well with the help of Porter's features of virtual communities and the proposed additional features for social media in Digital Ecosystems (role diversity and sustainability mechanisms). An analysis focusing on the issue of role diversity and sustainability mechanisms seems to be capable of detecting important and potentially critical aspects of virtual knowledge communities. The results of such analyses may help to re-design such communities in order to facilitate their success.

6 Summary: Social Media and Knowledge Management and a Digital Ecosystem's Perspective

We have used approaches from the field of media and communication together with socio-economic discussions regarding the shift from traditional divisions between producer and recipient in virtual knowledge communities that use social media as interaction tools and environments. By means of this, we tried to:

- Develop a structured approach to the fuzzy term 'web 2.0' in order to arrive at an analytic environment for the deployment of social media in virtual communities. Contribute to the field of Digital Ecosystems by focussing on a driving factor of such environments, that is virtual knowledge communities.
- Using the concept of 'communities of practice' in order to introduce shifts in knowledge production and management (produsage and prosumption).
- Arrive at a typology of distributed knowledge co-creation (in Digital Ecosystems) by exploring the modes of self-catalysed content creation as socio-economic innovation (produsage and prosumption).

Regarding a Digital Ecosystem's perspective, the findings depicted in this article provide a small albeit significant field of work. Given the broad topic of knowledge production and management, together with discussions and theoretical explorations of the 'medium' (in our case 'social media'), we focused on the development an integrative typology of knowledge management in/with social media that should be used as a platform for further research (empirical and theoretical). The DEAL case shows that such research could provide promising results that can inform the designers and facilitators for knowledge communities and Digital Ecosystems. At the same time, we draw upon prior work [15, 16, 17, 18] conducted in the course of OPAALS and other work [19], in order to work with a sound theoretical and empirical basis.

Finally, based on our findings, we propose three main paths for further research that connect to existing research fields and results in Digital Ecosystems:

- *Modes of social media deployment in Digital Ecosystems*, including questions of accessibility and quality issues; social networks and applications; case studies and applications.
- *The integration of trust in Digital Ecosystems' knowledge communities*, including questions regarding knowledge verification; return of investment; identity; governance structures.
- *Knowledge modelling in Peer-to-Peer networks*, including questions as to the formalisation of knowledge and business modelling; knowledge visualisation; distributed knowledge production and management.

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