ENTERPRISE SOCIAL NETWORKS: APPLICATION TO OIL INDUSTRY

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We believe that Enterprise Social Networks (ESNs) will help improve communication among stakeholders within the created "virtual" communities and improve overall operational efficiency of the industry. Such a model requires the creation of "network externalities" through a large number of participants in the network. It is postulated, that the larger the membership in the community the greater the advantages of membership. The paper demonstrates how ESN would work for the oil industry and explains how various members could benefit from their participation in the network. The value chain of the oil industry and its various participants as well as the interaction and business value creation for each enterprise group are discussed.

Introduction

Online social networks are continuously changing the way we communicate and share information with one another in today's society. Various social networking websites focus on building online communities of people who share interests and activities, or who are interested in exploring the interests and activities of others. Many companies have already started to be part of the growing connectivity with their consumers and are continuously finding beneficial ways of interaction through blogs, wikis, forums, focus groups, etc.

Web 2.0 is a term describing the trend in the use of World Wide Web technology and web design that aims to enhance creativity, information sharing, and, most notably, collaboration among users.

The services provided for Web 2.0 communities consist in general of the following components: focus on content and services for collaborative creating, management, updating and sharing of content; services and automatic update procedures that evaluate each user input and create always a new common state of knowledge and content; and trust building services as ratings, voting and similar, which are also the foundation for the collective intelligence services. The services are offered furthermore in three different forms:

1. Platforms or tools for users to initiate communities. Examples of platforms or tools are the various blog or mobile blog platforms. Depending on the specific type of content that is supported by the platform two major groups can be distinguished: services which facilitate navigation tasks (directory services), and services that empower users to create their own content (technology centric services).

2. Online collaboration tools are offered as online applications (in contrast to local application) or in form of workflows that map a process to an online environment (e.g. time schedule).

3. Community services unify users through a common objective. The common goal can be something like "finding new contacts" or "finding relevant information". Community platforms offer complex services for social creation of content of various kinds.

The intrinsic value of Web 2.0 communities itself is very limited. The benefits for the users evolve over time and through the number of interactions. Content or value generated through the supporting community is highly dependent on the size of the supporting community. Commercialization has not been reached in the majority of Web 2.0 services. There are some commercially successful services, in particular in the area of social networking service such as LinkedIn or OpenBC. Currently, some even doubt, any Web 2.0 services will ever be transformed into commercial services [Hoegg, 2006].

On the other hand, the "groundswell" trend described by Li and Bernoff where customers interact with companies from the "bottom-up" seems inevitable and businesses will have to embrace some form of social networking technology sooner or later. Table 1 presents a summary of the existing social networking tools classified according to their use. The threats and benefits to a company are briefly described [Li & Bernoff, 2008].

Enterprise Social Networks and System Dynamics

Enterprise Social Networking (ESN) technology is penetrating enterprises and widespread adoption by enterprises of all types is expected. A study done by Wainhouse Research finds that even though the ESN market is in its infancy, it has already reached the $200 million mark. Furthermore, the market is expected to grow at a rate of 40% each year over the next five years to reach $2 billion by the year 2013. This forecast in market size and growth was achieved by analyzing the major enterprise software vendors and over 50 startup vendors using both primary and secondary research sources [Wainhouse Research, 2008].

Enterprise Social Networks connect people at little or no cost; which can be beneficial for entrepreneurs and small businesses looking to expand their contact base. These networks often act as a customer relationship management tool for companies selling products and services. Since businesses operate globally, social networks can make it easier to keep in touch with contacts around the world.

There is still a lot of skepticism about the organizational transformation ESNs will cause to businesses. Programmers are very reticent to commit to business applications built on social networks because of security and privacy concerns hounding social networks [Boulton, 2008]. While some have embraced such applications to enable collaboration and cut costs, others have shunned them as lacking security and reliability.

In this study, we postulate that ESNs will evolve from an "Initial Stage" of mainly individuals connecting to each other to a "Second Stage" where a company would start networking with another company and as the business to business interaction grows, we would reach a "Third Stage" of a multi-business interaction. Figure I shows a diagram of the foreseen stages.

Table 1 Benefits and potential threats of technology uses

Technology Classification According to Use	Tools	Threat to Institutional Power	Benefit
People Creating	blogs, user-generated content, and podcasts	Unregulated	Companies can "listen" to their customers. Instant interaction with customers.
People Connecting	social networks and virtual worlds (i.e. LinkedIn, MySpace)	Consumes a lot of time and may deter productivity.	Companies can create affinity groups to "test" new products or for improving existing products
People Collaborating	wikis and open source	Not coordinated. Content created may not necessarily be accurate and unbiased.	Content is created and monitored through collaborative efforts of participants. Can be useful for intra-company knowledge management.
People reacting to each other	forums, ratings and reviews	From a business standpoint, opinions and comments of non-experts can influence consumers in a detrimental way.	Allows the creation of rating systems that can potentially boost sales.
People organizing content	tags	Companies lose control in classifying their products.	Tags define individuals. Allows companies to monitor how they are viewed by their customers.
Accelerating consumption	RSS and widgets	Intensify threat to institutions.	Can be used as a marketing tool.

Source: Li, C. and Bernoff, J. Groundswell. 2008

A typical model focuses on building a community of individuals interested on a specific issue or industry. It is not a total bottom up type of approach but rather it is a shared value proposition in cyber space. ESNs are focused on an enterprise value creation with focus on a particular industry. One such a model has been built around International Business and Innovative Technology (IBTIX) platform. This platform focuses on bringing together organizations across globe innovative that are willing to share their information in a close community. However, the business model requires a fee for members to participate in the network. The initial support was provided by the Economic Development authorities of the city of Glasgow, and the New Hampshire International Trade Resource Center.

Dynamic Model of ESN

For a better understanding of the evolution of an ESN, we present a system dynamics model. This model was selected because of the particularities of a dynamic system, which allows for an analysis based on factors that easily change. Also, a dynamic system is the best way to model the network effects that are affecting ESNs.

Figure 2 shows the Systems Dynamics model that we created for presenting the evolution of an ESN. The model is centered on the element called ESN, which represents the network itself, or to be more precise, the number of companies in the network. The ESN grows due to the "Join Rate", and decreases because of the "Exit Rate". Because of the network externalities, we assume that the ESN can only hold a certain number of firms in order to be effective and in order for the firms to gain any advantage. This is defined by the "Carrying Capacity" element of the model. The "Join Rate" and "Exit Rate" are a based on the number of companies in the network as well as the possible number of companies in the network. Both the "Join Rate" and the "Exit Rate" follow a path defined by the ESN and the "Carrying Capacity". (For more details about the mathematics behind the model, please see Appendix A.)

Figure 3 shows the evolution of the ESN with fixed factors. We kept the "Carrying Capacity" of the ESN to 1000 and the initial number of companies in the ESN to 2. The "Join Rate" and "Exit Rate" are based on the "Carrying Capacity" and the number of firms in the network. This pattern was obtained by running the model with the constant factors.

Governance/Membership

Collective intelligence is considered to be a form of intelligence that is acquired from the collaboration and competition of a large number of individuals. The concept of maximizing the collective intelligence is reflected in Web 2.0 and is the basis of membership and evolution of any ESN. Hoegg describes the process of collective intelligence as the interactive exchange of information and the continuous development and maintenance of a group opinion. Maximizing this collective intelligence requires a self-regulating community. At this point of evolution there are few specific regulations regarding the selection of members for online communities. To solve this problem, the structure of Web 2.0 includes quality assurance mechanisms or formalized review processes. A comparison can be made when looking at the recommendation system of eBay or Amazon.com's reviewing process [Hoegg, 2008].

One other challenge that businesses could face is the trustworthiness of the information circulating in an ESN. Another characteristic of the process of collective intelligence is the transparency of the information creation and sharing process. This issue is related in part to the

As ESNs are part of the IT field, one important challenge that has to be looked at is the security of the network. This covers areas of content, structure and framework. Also, network security is strictly related to member participation. ESN managers have to create a viable framework for accepting members as well as a structure that can sustain the different systems of the participants. Because the information is going to be circulated in a virtual world, ESN will be connected to many different IT systems.

Figure 1 Diagram of social networks evolution into ESN

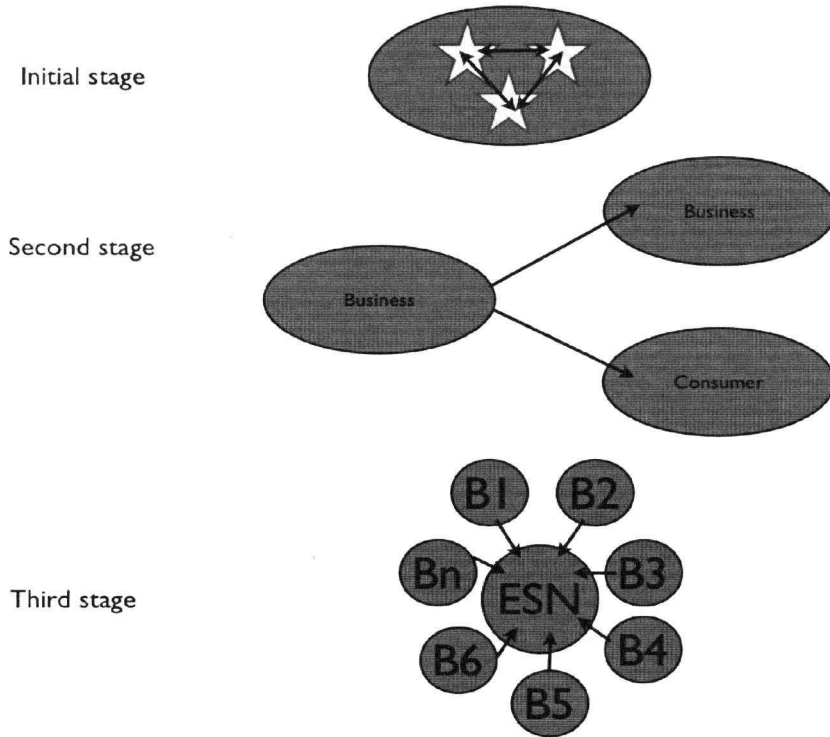Initial stage

Second stage

Third stage

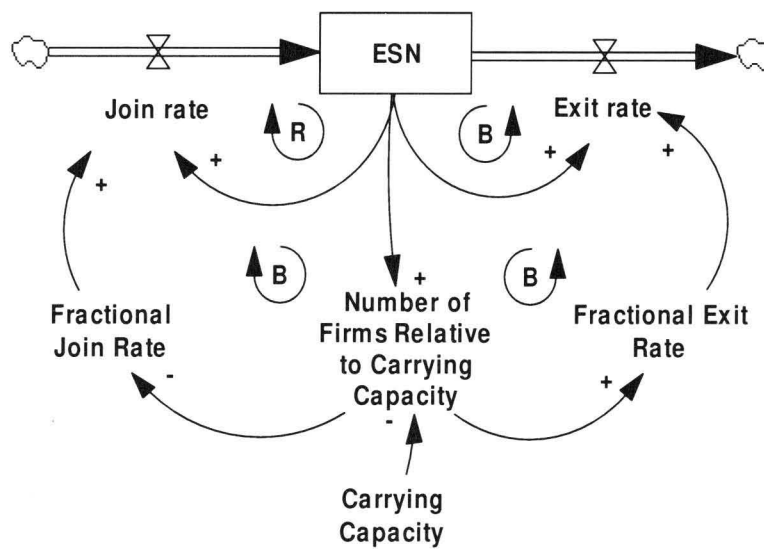## Figure 2 System Dynamic Model of the Evolution of ESNs

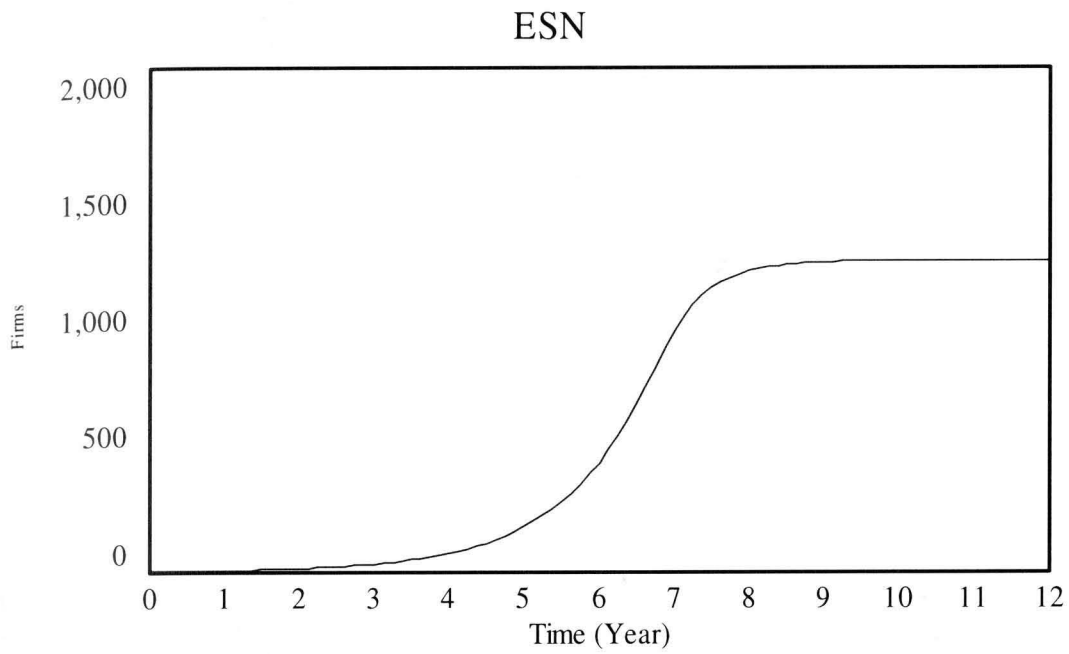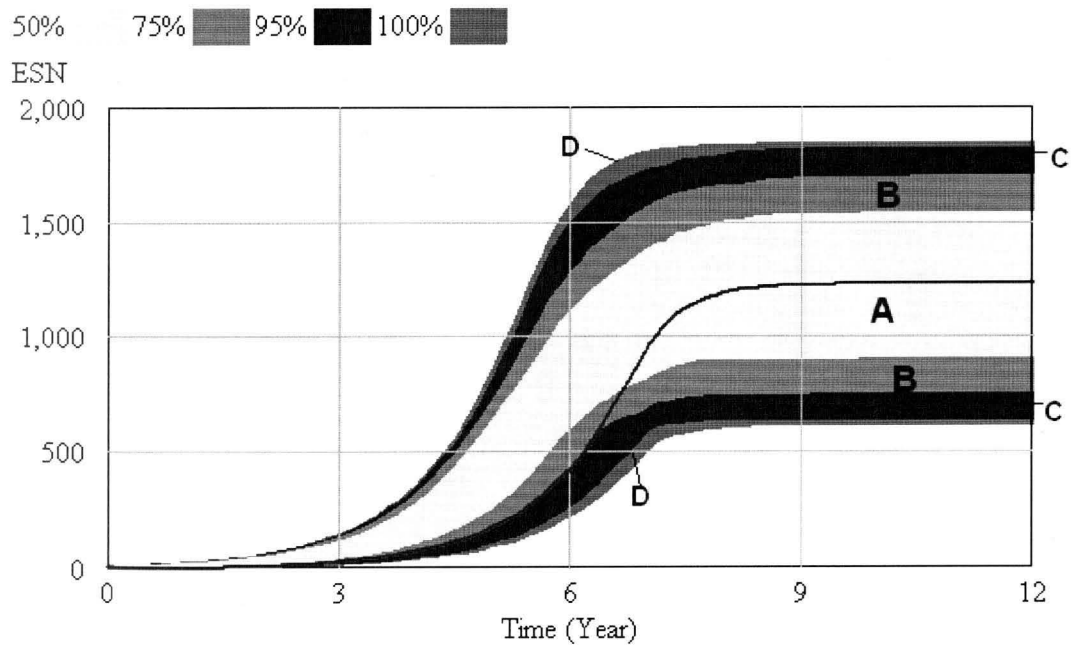**Figure 3 : Output of the Evolution of ESNs Model**

ESN

Figure 4 Output of the Evolution of ESNs Model – Sensitivity analysis

Although companies are trying to move towards a more standardized IT structure and systems, there is a need for a large investment in resources and time. A more standardized IT structure will not be available for a long time. Thus, currently there are many different systems being used around the world. These systems have different data and network security protocols, which could prove to be a high hurdle to jump for an ESN platform.

A good security implementation together with a carefully crafted screening process would cover the issue of information trustworthiness. Accepting members in the network has to be done very thoroughly. Membership should be obtained only through recommendation from current members. This would allow only trustworthy companies to get involved in the ESN, and would increase the credibility of the exchange of information.

As it is the case with many social networks, there are positive and negative network effects related to the evolution of ESNs. Positive network effects come from the increasing number of members: more members means more benefits, thus more information being exchanged. But there are also negative networks effects which appear when the network reaches a certain threshold limit. Even if the number of members in the network continues to slowly increase, the benefits start to decrease for each member. This is mostly due to the decrease in the number of participants in the information exchange.

Legal Aspects

Legal issues per se, include cybercrime, intellectual property rights, data protection, privacy rights, and consumer rights. The legal mechanisms for addressing Internet governance issues, including self-regulation, international treaties, and jurisdiction are constantly evolving.
Regarding ESN technology, we foresee that the main legal aspects to be concerned about are the following:

- Privacy issues (identify theft)
- Data Security (loss of confidential information, proprietary information, etc.)
- Company exposure to legal liabilities and financial penalties from compliance breaches (i.e. copy right infringement, defamation, sexual harassment)

In the United States, congress generally protects site vendors from legal liability for user-supplied content. Statute 17 USC §512(c) stipulates that a website isn't liable for hosting user copyright-infringing content unless the website receives a notice from the copyright owner and fails to promptly remove the content. Statute 47 USC §230(c) stipulates that "No provider or user of an interactive computer service shall be treated as the publisher or speaker of any information provided by another information content provider" [Goldman, 2007] In addition, the Federal Trade Commission (FTC) staff has proposed measures to address consumer privacy and security needs such as full disclosure of the purposes of where data is collected [Raysman & Brown, 2008].

At the international level, the borderless nature of the internet and its applications has created a unique set of questions and challenges for the field of international law commonly called Information and Communication Technology Law or more fashionable - Cyber Law. Practically

every country in the world has issued specific legislation or developed case law in this area. The domain has acquired sufficient stability to fit into a common structure.

Currently, the only convention that deals directly with Internet-related issues is the Council of Europe Cybercrime Convention. The Hague Convention on Jurisdiction and Judgments, rulings of the World Intellectual Property Organization deals with some cyberspace aspects such as human rights. The main corpus of existing instruments in the field of Internet governance is non-binding, and includes: the OECD Guidelines related to ICT and the Internet, the UNCITRAL Model Laws in E-Commerce, resolutions and declarations of the United Nations and other international organizations dealing with Internet governance related issues such as the United Nations General Assembly Resolutions on Internet Security [Kurbalija, 2005].

Based on the above issues, it would be highly recommended that organizations that use ESN technology create policies targeted at preventing defamation, sexual harassment, copyright infringement, cyber crime, and confidential information leaks.

Organizational re-structuring

The challenge of finding organizational structures that support and adapt to new technologies is daunting. We consider that the implementation and management of a functional ESN platform will require the commitment of the companies involved in finding the right mix of technical, innovative, creative, and business oriented staff as well as a structure that fits the company.

Companies will have to consider all possible options before making any decision about the corporate structure going forward. A cross-functional team could probably be a good start of a company that is new to the ESN technology.

The dynamics of ESN include new competition, advanced and changing technology, new services, and many other innovative strategies and actions that enhance the business environment. For a company to adjust to new technologies they must reengineer their business practice. Harper has several recommendations for companies that seek to implement new technology projects such as ESN:

- Designate a leader for managing and implementing a new technology.
- Perceive that the new technology will have a significant impact on the business.
- Have multiple dedicated teams and use at least 2% of total employees to those systems. (Harper, 2008)

We know that going through any major change is stressful on a company. Going through paradigm changes sometimes can be detrimental. Company culture plays a large role in whether a new technology can make it or not. Reengineering the thinking, the style, the atmosphere and the structure of a company must be a slow, but constant process that goes on as the market demands.

ESN Application to the Oil Industry

A number of companies, in the oil industry, have attempted to take advantage of social networks by setting up   blogs in order to interact with their customer communities and explain

their side of the story. However, blogs can be a double edged sword since positive comments as well as many critical opinions regarding the operations of multinationals are posted. For example, Exxon-Mobil's blog (http://www.exxonmobil.com/Corporate/Services/RSS/RSS_CS.xml) explains the activities of the company emphasizing their contribution to the community and their support for environmental activities. But, there is also a blog not sponsored by Exxon-Mobil that is highly critical of the company's activities particularly regarding its environmental policy (http://boycott-thieves.blogspot.com/). While these blogs provide "bottom up" information about the company, they have little commercial value. An oil industry community enterprise social network would provide interaction among various players and interest groups within the industry.

The value chain of oil industry consists of exploration, development, transportation, refining, wholesale distribution and retail sale through gas stations. This is an integrated operation process with participation of various players in this system both within the oil industry and outside the oil industry.

Figure 5: Oil Industry Value Chain
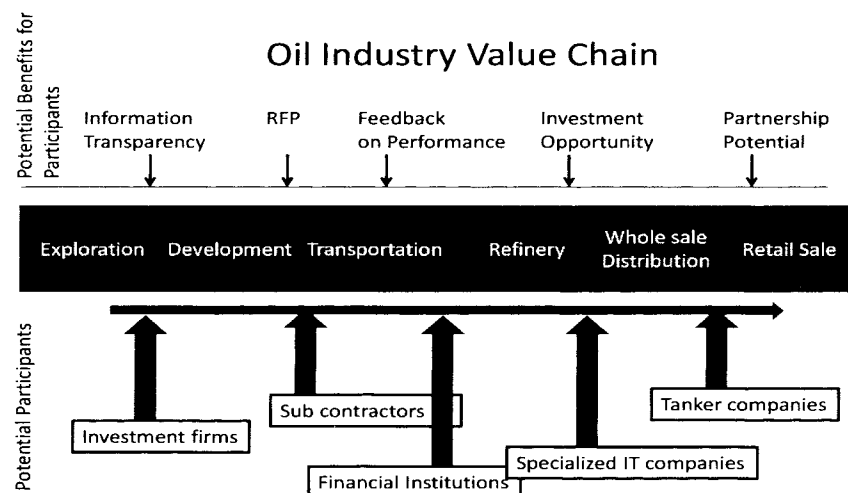
Oil companies, oil services companies, tanker and transportation companies, and gas stations are considered to be "within" the oil industry. Financial companies, subcontractors, construction companies; independent oil companies just to name a few are considered to be "outside" the industry. Other related groups are analyst, Information Technology companies, and environmental firms. Figure IV provides a diagram of the oil industry value chain.

The following table provides a summary of benefits that the ESN participants would obtain through joining and enterprise social network. While the list is not comprehensive regarding the benefits, it does provide some insight as to what each group could potentially gain.

In the oil industry, in particular, participating firms must be mindful of potential legal implications of discussions regarding future prices. Such discussions could be viewed as potential price fixing. Additionally, a number of activities could be considered confidential by

participants. For example, details of contract discussion, financing structure, and negotiation with sub-contractor require confidentiality. After passing the initial stage, the details can be worked out off line bilaterally between the parties involved outside the Enterprise Social Network.

Table 2. Summary of Oil Industry Value Chain Activities and corresponding ESN participants and benefits

Activities	Enterprise Social Network (ESN) Participants	Benefits of information sharing through ESN
Exploration	Governments, oil companies, contractors subcontractors, financial institutions	Contract Information on potential oil track lease, receiving bid, project planning , getting bid from sub-contractors, identifying sources of financing
Development	Infrastructure firms Investment Institutions, sub contractors Suppliers	Bringing contractors and subcontractors together, identifying potential investors, getting input from NGOs on environmental concern, identifying potential buyers of product
Transportation	Tanker companies, oil companies, shipyards	Potential tanker contract, ship availability, excess tanker capacity to be shared
Refining	Refineries, chemical companies oil companies	Availability of excess refinery capacity, planned shut down for maintenance, supply need
Whole sale distribution	Transportation firms, storage facilities owners, oil companies	Ability to directly interact with suppliers and their buyers, direct access to market information
Retail Distribution	Gas stations	Access to sources of supply
Others	Consultants, IT companies, NGOs, investment and lending institutions	Finding consultants on environment, legal specialist on contracts, investment firms to provide financing package and funding

Conclusions

Companies are realizing that social networking applications can support broader business initiatives. The underlying social networking applications provide the power to better connect people to information and to one another. Realizing the potential of these technologies, however, is not as simple as implementing Web 2.0 applications. The real questions are how the successful framework of online social networking could support the business goals of a company, how it would fit with the business culture, and how it can be used to share information and generate profits.

An Enterprise Social Network consists of an industry community that brings together various enterprises operating in the same industry in order to develop relationships, build commercial linkage, and provide information on potential business activities as well as feedback on the reliability of particular business partners. Such a platform could help eliminate soft trade barriers, such as language and cultural differences among companies. This network could also introduce small businesses to new markets and facilitate cross-border trade by eliminating geographic barriers. Joining a virtual community focused on the creation of value in a particular industry would benefit both small and large enterprises.

In the ESN environment the decisive factor is the disintegration of the value chain because the roles of owners and consumers are not clearly defined. In the ESN world the users cover both roles. (Hoegg et. al., 2006) A business to business platform could work in a similar fashion by allowing "companies" to create content as well consume the content. Just as it is done in the Web 2.0 environment the content should be continuously enriched and adapted to the changing environment.

Organizations will find that it's increasingly in their best interest to provide a centralized solution for informal flows of information. However, one challenge associated with these new communications tools is that while they effectively help create informal networks and information discovery, they also need to provide tools to add structure as connections evolve into ideas and projects. The lack of structure will limit the development of more directed communities with specific projects and schedules. (Happe, 2007)

Some of the foreseen benefits of a business to business platform are the following:
- Coordinate communications, accelerating cross-company performance
- Increase sales through real-time market intelligence and collaboration
- Encourage co-innovation to better serve joint customers and markets
- Create an interdependent ecosystem of partners that drives increased revenue for all participants (Happe, 2007)

A system dynamic model was developed to show how a virtual enterprise network expands over time by increase in membership as well as increase in internal participation of its members. A sensitivity analysis with respect to initial size of membership and rate growth was done. The results indicate that after the initial growth period of the network there will be a fast increase until a t limit is reached. After that, the growth of the ESN will flatten indicating that after the limit is reached the ESN is relatively stable in terms of the membership.

In this paper, we argue that there are legal and governance implication that must be considered in the establishment of Enterprise Social Network at an industry level. From the perspective of the firms the restructuring of IT activities would be critical so that it focuses on the strategic role of the new division responsible for the ESN in addition to the technical dimension of implementing such a platform.

Finally, the paper shows how the system can be applied to the oil industry. The value chain of the oil industry and various participants in this industry along the value chain are described. While the disaggregation of value chain and list of participants at various stages is partial, it nevertheless shows the great potential benefits for the industry if such a model is implemented.

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Appendix A – ESN Dynamic Model Equations

Carrying Capacity= 1000

> Units: Firms

> The carrying capacity defines the equilibrium or maximum sustainable number of firms in the ESN.

ESN= INTEG (Join rate-Exit rate, Initial Firms)

> Units: Firms

> The network is increased by joining firms and decreased by exiting firms.

Exit rate=Fractional Exit Rate*ESN

> Units: Firms/Year

> Exiting firms are proportional to the size of the network.

Fractional Exit Rate=0.05+0.05*Number of Firms Relative to Carrying Capacity^4

> Units: 1/Year

> The fractional exit rate is an increasing function of the ratio of firms in the network to carrying capacity. A power function is assumed.

Fractional Join Rate=1-(1/(1+exp(-7*(Number of Firms Relative to Carrying Capacity-1))))

> Units: 1/Year

> The fractional join rate is a declining function of the number of firms in the network relative to the carrying capacity. A logistic function is used.

Initial Firms=2

> Units: Firms

> The initial number of firms in the network.

Join rate=Fractional Join Rate*ESN

> Units: Firms/Year

> Join rate is proportional to the size of the ESN.

Net Fractional Join Rate=Fractional Join Rate-Fractional Exit Rate

> Units: 1/Year

> The net fractional join rate is fractional joining firms less fractional exiting firms.

Net Join Rate=Join rate-Exit rate

> Units: Firms/Year

> The net join rate is joins less exiting.

Number of Firms Relative to Carrying Capacity=ESN/Carrying Capacity

Units: Dimensionless

The ratio of number of companies in the network to carrying capacity determines the fractional join and exit rates