Impact of Web 2.0 /Web 3.0/ Social Networking Tools in the Research and Development Units within Organizations

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ABSTRACT

"Web 2.0" is the mixture of trends in Internet technology and business models. "Enterprise Web 2.0" is the application of these Web 2.0 practices, technologies, products and services by enterprises for their gain. Web 2.0 technologies or social networking tools offer a tremendous level of user-participation. Hence, the process and use of such technologies (EW 2.0) is unavoidable. Two major movements drive this inevitability:

1. **Demographics** involve the behaviors of "digital natives" who have grown up with the Web and with advanced digital technologies.

2. **Consumerization** is the phenomenon by which consumer technologies and behaviors drive innovation in IT products and practices. Recognizing what would be disruptive is an art. Companies are increasingly trying to take advantage of this fact before they miss the next wave of web innovation.

Moreover, the popularity of these Web 2.0/ Social networking tools is just not in the technologies that they use but rather that they enable end users to create, edit, and classify content and allow people to connect with others. **"Web Content Management" (WCM)** helps knowledge workers and Research & Development to gather information that sits outside the enterprise. This is very important to future design work since it tags this information to their own knowledgebase.

Thus, the path to Web 2.0 for enterprise offers big rewards, including committed customers, increasingly productive employees, and empowered communities that increase the rate of innovation around corporate assets like products and historical data.

INTRODUCTION

From time immemorial, we have seen how knowledge needed to compete and succeed in business was preserved locally within the boundaries of the office and worker groups. In today's business environment, the growth of an organization depends on globally dispersed customers and suppliers, in real time and on-demand.

To meet the challenges posed by competitors, organizations are pressed to be innovative which can only be accomplished by tapping into the knowledge and expertise of colleagues or co-workers. One of the most vexing problems is the huge gap between IT and the business, a problem that can hamper an organization's growth. This gap can be easily filled by sharing and strengthening organizational knowledge between IT and the business with the help of Web 2.0/Social networking tools, tools that can help companies foster innovation as it occurs when there is a successful diffusion between the Business and IT domains

WEB 2.0 – A STRATEGY

Web 2.0 is a broad set of concepts that can be segmented into three anchor points — technology, community and business — to help enterprises understand how they can benefit. The challenge is that Web 2.0 is not just a set of technologies, but also attributes that have a social dimension: new business models, user-contributed content and user-generated metadata, more open and transparent business processes, design and feature simplicity, and decentralized and participatory products and processes

Innovation – improves / degrades the strategic renewal competency?

A successful "Web innovation" occurs within established firms only when they start to discern the difference between their current business and innovation strategy in the immature market from the innovation occurring in mature markets. This would help firms to avoid creating a "costly old business" (New business + Old business). It is important that firms separate their new business from old business to avoid the threat of cannabilizing the old business. This separation also provides the focus to operate quickly and flexibly within this competitive world through innovation. Hence, with these

upcoming new businesses, “structure” should be following “strategy” instead of the reverse. Sometimes, innovation through the web also calls for reorganization, to ensure that the organizational structure fits a company as it grows and matures. Any market change by disruptive technologies cannot be avoided, and often results in a slow death as the company catches up with and adapts to the new circumstances. Finally, as the company matures, it loses its innovative spirit and thereby the strategic renewal competencies also die. Acknowledging this fact, the web of innovation should be the starting point, not the strategy or structure.

ATTRIBUTES ASSOCIATED WITH WEB 2.0

Below are few of the benefits that an organization can achieve by using any web 2.0 tools/technologies:

- **Enables a collective user experience –** *“Collective knowledge”* is something beyond our perception, it is not only held collectively but also generated and applied collectively within the pattern of social relationships. It fosters new learning through informal and self-organizing communities, which benefit from cultivation.

- **Fosters leadership –** Web 2.0 fosters leadership skills through collaboration with different groups both within and outside an organization, especially when the groups are distributed. Each team and sub-group attend to different functionalities and have different leaders. Distributed leadership is the coordination of these leaders.

- **Awareness and virtual space –** Web 2.0 knowledge management tools make users and seekers aware of their respective knowledge by providing the time and space to connect virtually.

- **Business Value –** by providing a larger umbrella of learning for customers, companies can attract loyal customers and create a healthy customer community. It is important to know buyers’ and users’ moods to drive more demand for a product and ultimately to foster organizational innovation.

ENTERPRISE WEB 2.0

Companies looking to implement an Enterprise Web 2.0 (EW2.0) strategy require a platform that provides standardization and simplification across different business applications and development technologies, while enabling the flexibility required for innovation within business units ("common flexibility"). The platform must provide Web 2.0 applications with a reliable and secure communication between client and server - whether online, offline or mobile - across any network. Finally, it needs to support Service-Oriented Architecture (SOA) initiatives by enabling the consumption of loosely coupled services that provide access to business functionality and data in real time, while leveraging existing code, development standards, tools, skills and infrastructure.

During the last 20 years, mainstream enterprise applications have swung back and forth between server- and client-centric architectures. Originally, mainframe architectures were server-based and sent the user interface (UI) to display terminals. In the 1990s, attracted by the power of graphical desktop environments like Microsoft Windows, the pendulum swung to the other end of the spectrum - client/server, which was entirely client-based except for server-side databases. In the late 1990s, the next pendulum swing was caused by the low-cost, global deployment model of the Web, leading to the development of browser-based HTML and J2EE applications, which were again entirely server-based with the UI running on the client-side browsers.

Today, the architectural flexibility of Web 2.0 offers developers the best of both worlds. By delivering the high performance and robust functionality of desktop or client/server - combined with the universal reinstall deployment and centralized management of browser-based applications, EW2.0 applications deliver a quantum operational efficiency and end-user productivity while decreasing IT costs. For the first time in 30 years of application development, EW2.0 enables application developers to partition client- and

server-side layers, using appropriate technologies to meet different business objectives and specific end-user requirements.

Although EW2.0 architectures combine the best qualities of their historic predecessors, there are some lingering challenges surrounding integration, security, UI development and performance. To overcome these challenges, enterprise IT organizations should consider implementing a “reference architecture" that provides these services consistently to all EW2.0 developers, regardless of their development technology and target deployment platforms.

BUSINESS MODEL BEHIND EW 2.0

As defined by Rappa, M. in “Managing the Digital Enterprise,” the business model "is the method of doing business by which a company can sustain itself – that is, generate revenue." A web business model provides an abstract pattern of mechanisms used to enhance and realize customer value, based on the technologies and processes of the Web. Web 2.0-style business models emphasize the role of community, recognize the power of networked collective intelligence, and the viral dissemination of important marketing information web business model.

Different business models:

Web 1.0 business models were primarily seen as affecting sales and marketing, with a limited impact on procurement operations within a limited number of industries. Just as concepts proposed during the era of Web 1.0 business models did not take effect until four or five years later, Web business models in the Web 2.0 era that are proposed today seem unrealistic, but may become a reality in the near future. These models may include the incorporation of peer-to-peer commerce outside of traditional online auction and content-sharing sites, to finance and insurance industries, the conglomeration of product information and procurement processes to build "virtual" real-time trading exchanges, and massive increases in products and services that can be sold via low-

transaction "micro-commerce" assisted by emerging bluetooth and other radio frequency identification networks.

Web 2.0 – its positive business aspect

The second wave of Web business innovation began a few years ago, during the advent of Web 2.0. It emphasized old and new technology adoption to increase user effectiveness, new forms of community collaboration and network-collected intelligence. New Web business models emphasize important community-based effects, such as the rapid "viral" dissemination of information by committed communities of Web users and great increases in collaborative information sharing made possible by new collaboration and content development tools, including enterprise Wikipedias and Web bookmark-sharing applications.

Enterprises must prepare for positive business model changes that will result in unexpected waves. In addition, powerhouse Web 2.0-style technologies based on new styles of Web platforms are emerging in both the business-to consumer space and in the emerging business-to-business (B2B) space, with all-important semantics in place for more-efficient cross-industry communication. This may impact the Web 2.0 movement.

CHANGING DEMOGRAPHICS

The most important aspect of Enterprise Web 2.0's success lies in effective community identification, cultivation and business value extraction. Web 2.0 systems have created a new discipline of "cultivating communities." When assessing the applicability of Web 2.0 technologies to an enterprise, an application manager should ask, "Is this population an organization of hidden communities?" If so, how can application managers unearth, cultivate and gain business value from those communities. A population is any large

number of people associated with a business relevant grouping, such as employees, customers, suppliers, shareholders and so on.

Demographics are a Main Driver

Demographics drive change. As the population in enterprises shifts, business and IT r must respond to those changes optimistically. Digital natives, individuals who have grown up using a wide array of personal technologies, have different preconceptions with regard to technology and its use. Others, who may not have grown up with the technology and may be technically part of another generation, often fit into this category.

Providing tools that align to skills enables an organization to get the most out of the digital native. Organizations that refuse to provide for the needs of digital natives will find themselves unable to attract the best talent. Enterprises that eschew new generation approaches risk losing out to those that do. When it comes to social software, it will eventually become essential to the economic structure of the organization. Digital natives form relationships online through virtual communities and other on-line interactions. As the force of demographics strengthens, the trend toward ad-supported software will increase. Ignoring demographics simply won't work. Although there are risks and benefits to leveraging ad-supported applications, the risks described are largely hypothetical at this point. The IT organization should be aware of the possibilities and take appropriate actions to mitigate the potential risks at any cost.

CONSUMERIZATION

The consumerization of IT focuses on how enterprises will be affected and can take advantage of new technologies and models that originate and develop in the consumer space, rather than in the enterprise IT sector. The consumerization of information technology and the technologies and processes associated with Web 2.0 are the most important developments that are transforming and affecting Web business models.

In addition, the consumerization of IT, the important process in which the nexus of IT focus shifts toward the consumer and away from business, continues to increase the importance of the Web business model for many enterprises. The non-sanctioned electronics and software that your employees carry around and download aren't just for play. Increasingly, companies are paying attention to how these consumer-oriented technologies can be used to empower their workforce to gain competitive advantage by fostering community and knowledge generation in an increasingly dispersed workforce. The combination of consumerization and the Web amplifies the individual effects. The consumerization of IT, which is the movement from business and military to products and processes geared to the consumer, affects business model planning from organizations that are producers and consumers of technology products. This is a key development that affects business model planning.

Summary:

- The community aspects of Web 2.0 affect organizational Web business model planning by exploiting the network's collective intelligence to refine customer product and service offerings and by exploiting viral marketing channels.

- The power of Web platforms as a place for organizations to put and use Web-based services, content and metadata will be a key factor in business model planning.

- The increasing transparency of the Web as a sales and marketing channel is another factor that organizations must consider when evolving their Web business models.

Social Software

Social software provides an open and free-form environment that stimulates participation and interaction, as well as aggregating these interactions into an emergent structure that reflects participants' collective attitudes, dispositions and knowledge. Enterprise social software provides persistence, structure and transparency to otherwise transient

informal interactions among workers in an organization. Valuable business information is created, shared and refined through self-selection, social incentives and decentralized control, rather than top-down resource allocation and mandates. Social software enables community involvement in locating expertise (social networking), sharing content (social publishing) and collaboration to build content (social collaboration).

Social Networking

This involves the business value of quickly locating and leveraging expertise and relationships spread across a large organization or community. Social networking includes social profile management Web sites and products, such as MySpace, Facebook, LinkedIn, Lotus Connections, Windows Live Spaces and Leverage Software. It also includes social networking analysis technologies, such as Visible Path and Tacit Software, which employ algorithms to understand and use human relationship information and enhance discovery of people and expertise.

Social Publishing

This is the community as a content generation engine. With social publishing, community members post, consume, share, reference and rate content. This category includes technologies such as social tagging, social book marking, social search, social filtering and social validation. Web sites and services such as YouTube, Flickr, Digg and del.icio.us fall into this category.

Social Collaboration

This involves direct community interaction and collaborative content creation. Social collaboration involves technologies, practices and products including wikis, blogs, IM, collaborative offices and virtual worlds.

BEST PRACTICES FOR WEB 2.0

The unique “feature of participation” in Web 2.0 is reflected in the emphasis on developing virtual communities and involving users in sharing knowledge. When assessing the applicability of Web 2.0 technologies to an enterprise, leaders should be aware of hidden communities with the organization. If so, ideas have to be cultivated to unearth, cultivate and gain value from these communities. Past research shows that this effort is more art than engineering, and, in most enterprises, it's nonexistent. Accordingly, much of our best-practice research will address how to identify, cultivate and monetize enterprise-relevant communities.

STRAGEGIC GROWTH – USING WEB 2.0

Here are a few important benefits of Web 2.0 and other related technologies:

1**.** Enterprise applications are strengthened by incorporating 2.0 technologies. The technologies might include mashups, Ajax interfaces and RSS feeds, in the realm of consumer-facing, non-enterprise-class applications accessed by consumers on the Web. It is not just these consumer-facing applications that will be transformed. It is always important to keep track of consumer behavior in the market by means of these Web 2.0 tools, so that organizations can enable customers and knowledge workers to handle the relationships of large amounts of information.

2. Web platforms can be useful in overall procurement, acquisition and building some sales strategies. Unlike current generation Web platform, the first-generation Web platforms did not concentrate on Business-to-Business presence. The concept of “Online communities” was not available in the first generation of Web platforms. It is a huge opportunity for organizations to take advantage of all the benefits that this current generation Web platform has to offer.

3. Organizations must keep employees aware of the Web technologies by looking at companies that have already kick-started their innovation with these online tools.

4. Semantic tagging technologies can greatly increase the navigation of internal and external information overload, and increase information-based product consumption and use. Use of tagging/bookmarking to enable communities of users to become more efficient at using the organization's information resources is particularly relevant in information-intensive industries such as research and academia.

5. Web 2.0 communities of interest virally share information about products and services. They provide rapid feedback at low cost. Instant online evaluation/feedback/market valuation might increase productivity and service also.

6. Online relationship management helps organizations to maintain/improve their brand image among customers and other influential users rapidly and economically.

WEB 2.0 – EMPOWERED COMMUNITIES

1. Community through knowledge sharing – "Collaboration"

- **Membership** – this allows users to get a sense of ownership in the digital world.
- **Friending** –users can invite other like-minded users or friends and share his/her profile.

2 .Adopting strategies for exponential growth – "Viral Marketing"

- **Products & Services** – viral marketing delivers brand-awareness through customers. The influence of certain customers' comments or views can be much more than you might think. Customers' feedback about any product is extremely important as it will influence their friends, families, and colleagues future purchasing decisions. This decreases a company's advertising cost, and improves e-commerce sales opportunities. Thus, adopting the concept of, "Give away something, and sell something".

- **Growth Rate** – the rapid "viral" dissemination of information by committed communities of Web users and great increases in collaborative information sharing made possible by new collaboration and content development tools, including enterprise Wikipedia/Media-wiki and Web bookmark-sharing applications, are essential for any organization's research and development. You must build scalability into your viral model.

- **Exploits common motivations and behaviors** – the resulting urge to communicate produces millions of websites and billions of e-mail messages. Viral marketing also adopts a design strategy that builds on common motivations and behaviors for its transmission. It ultimately helps providers by increasing their productivity and fame in the market.
- **Leveraging existing communication networks** – the research shows that each person has 8 to 12 people in their close network of friends, interest groups, and collaborators. Network marketers have long understood the power of these human networks, both the strong, close networks as well as the weaker networked relationships.
- **Takes advantage of others' resources** – the most creative viral marketing plans use others' resources to get the word out. Affiliate programs, for example, place text or graphic links on others' websites.

3. ***Non-stop Research & Development – "Innovation"***

- **Innovation** may depend heavily on knowledge held by the users of technology and those who have knowledge of complementary technologies. If so, information sharing of any sort may be critical to innovation, and policies should encourage this sharing.

- Free flow of content from another web into a site, and syndication of contents and brand through RSS, widgets, open APIs etc., is essential within any organization's Research and Development unit.

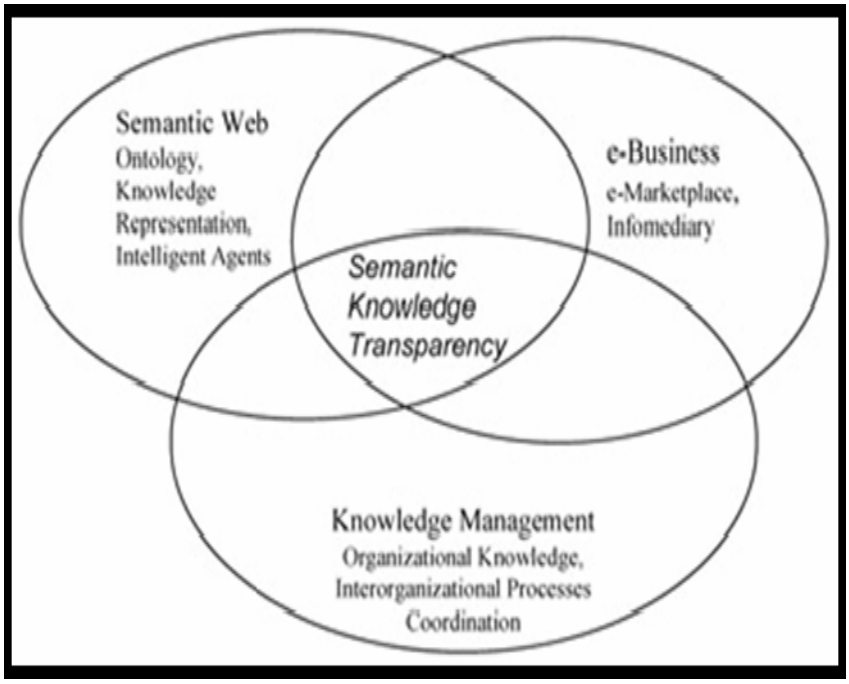
4. ***Let the outside in and the inside out – "Web Syndication"***

- Allowing people to access valuable data and content will not only help users but also increase the business- to-business side revenue stream.

5. *Business strategy – "Profitability"*

SEMANTIC WEB

The Semantic Web is a key component for realizing the vision of semantic knowledge transparency in e-business processes. The Semantic Web supports the transparent flow of semantic knowledge to automate, enhance, and coordinate collaborative inter-organizational e-business processes. The Semantic Web vision comprises ontologies for common semantics of representation and ways to interpret ontology; knowledge representation for structured collections of information and inference rules for automated reasoning in a single system; and an intelligent agent to collect content from diverse sources and exchange data enriched with semantics.



Conceptual representation of semantic knowledge transparency and integration

According to Berners-Lee, the Semantic Web comprises and requires knowledge representation, ontologies, and agents in order to function:

- **Knowledge representation:** Structured collections of information and sets of inference rules that can be used to conduct automated reasoning. Knowledge representations must be linked into a single system.
- **Ontologies:** Systems must have a way to discover common meanings for entity representations. In philosophy, ontology is a theory about the nature of existence; in systems, ontology is a document that formally describes classes of objects and defines their relationships. In addition, we need ways to interpret ontology.
- **Agents:** Programs that collect content from diverse sources and exchange the result with other programs. Agents exchange "data enriched with semantics." Intelligent software agents can reach a shared understanding by exchanging ontologies that provide the vocabulary needed for discussion. Agents can even "bootstrap" new reasoning capabilities when they discover new ontologies. Semantics make it easier to take advantage of a service that only partially matches a request.

KNOWLEDGE MANAGEMENT

Knowledge is a strategic resource that delivers a decisive competitive advantage. The vision of enterprise knowledge management lies in the definition of some global objectives for managing and optimizing this resource. The three main criteria for any enterprise knowledge management strategy can be categorized as:

- **Capitalize** – Understanding the role of our organization, what we are doing and where we are going
- **Share** – switch from individual intelligence to collective intelligence
- **Create** – create and innovate to survive

Knowledge Management involves strategy because it is a new type of management responding to a new socio-economic environment and a new vision of the organization. It involves organizational structure because the knowledge is created through complex networks, and connected to an environment that can challenge classic structures.

Strategic Entry Point to Knowledge Management – Virtual Communities

Risks of loss of knowledge and crucial know-how, and loss of development opportunities are increasingly considered *major risks* by companies, whose intangible capital represents a prime resource. Knowledge is often an individual, rather than organizational, resource residing within the minds of members of the organization. The critical success factors of organizational culture, trust, and reward systems aligned with the principles of knowledge management remain difficult to attain.

Organizations can expend significant resources to develop a culture, high levels of trust, and the reward systems necessary to enable effective knowledge management. In contrast, virtual communities seem to emerge fairly effortlessly on the Internet and inherently possess these critical success factors. Virtual communities are "social aggregations that emerge from the Net when enough people carry on public discussions long enough, with sufficient human feeling, to form webs of personal relationships in cyberspace." Based on this definition, knowledge sharing is the very essence of virtual communities. Thus, we can assume that a potent culture (with at least a minimum level of trust) and incentives for sharing knowledge have developed within virtual communities. Otherwise, sharing would not occur and virtual communities would cease to exist.

Role of Virtual Communities in Organizational Knowledge Management

In organizations, the goal of Knowledge Management is directly aligned to the purpose of Virtual communities — to get members of the organization to interact and share knowledge so it can be leveraged for organizational benefit. In addition to the fact that the primary purpose of Virtual communities is to share knowledge, several specific features of Virtual communities that lend themselves to knowledge management are discussed below. These features can be categorized as the Virtual community for people, communication within the Virtual community, and Virtual community technology.

1. COMMUNICATION:

- Social-ties always exist in a Virtual community, particularly through online forums. Hence, this form of communication facilitates knowledge creation and sharing.
- The knowledge sharing process is self-regulating. Users generate and share knowledge when it is most appropriate and efficient. There is no pressure to communicate.
- Although Virtual communities generate revenue in some way, either in the form of selling advertising, selling products to members, providing market research, collecting subscriptions, or customer support, the underlying function of the Virtual community is an online discussion forum.

2. ***PEOPLE:***

- Virtual communities are generally easy to use. Typically, individuals click on a link or enter a URL, and may register online. The infusion of people results in new ideas and expertise, which are in turn shared with members of the Virtual communities.
- Oversight and moderation of Virtual communities tends to be managed by individuals with some level of expertise in the domain area of the Virtual community. This enables moderators to oversee interaction on the site, and to provide knowledgeable responses. Moderators also allow other members of the Virtual community to provide answers. This facilitates the independence of the Virtual community. Allowing others to answer questions increases the number of "experts" in the community, which is important for overall community value.
- The ability to remain anonymous in a Virtual community has long been the focus of research on group decision-making. Virtual community members often feel more comfortable participating and sharing knowledge with others in a Virtual environment.
- Oversight and moderation of Virtual communities tends to be transparent to users.

3.*TECHNOLOGY:*

- The electronic nature of a Virtual community stores past discussions allowing members to search archives as needed.
- Communities are easily accessible anywhere in the world. This allows knowledge to reach the right people at the right time, an important part of knowledge management.

- The use of different technologies enables robust communication that is similar to face-to-face communication.

CONTENT MANAGEMENT USING THE WEB

Content management is *"a variety of tools and methods that are used together to collect, process, and deliver content of diverse types"*. There are at least three differing approaches to content management:

1) Web content management,
2) Document management
3) Utilization of structured documents

Companies struggle to manage the flood of information that is provided by electronic sources such as the World Wide Web. Although the Web has become widely used, it is still a complex platform for disseminating a portion of organizational content. The term "Web content management" took birth out of Web 2.0 world as a useful tool to collect, structure, and distribute information within a company. As a huge market of commercial Web content management systems currently exists, industries should design a system that includes the following functionalities:

- Collaboration through Virtual Communities
- Enterprise integration
- Personalization
- Strong sense of community – for new ideas and innovation

A typical design principle is to clearly distinguish the content, structure and layout. A brief description for these three terms follows (content, structure & layout):

CONTENT

Content can be either in the form of a document or attachment, or in the form of link/ URL. Integration of information sitting outside the company's portal/intranet is essential for any organization but particularly for the R&D units in order to cultivate innovative thinking. Information can be integrated/grouped in the following ways:

- By providing a link to another system stored in the Web content management system; the user is redirected to the main entry document of that system.
- Using a search option to interface another information system.

STRUCTURE

Users need a varity of means to view, modify and browse content using categories, search, and notification mechanisms. A categorization hierarchy allows users to classify content into various topics. This structure is built on top of the content to be accessed. In general, a categorization hierarchy is either built manually by providing links between the content and the categories, or automatically using learning algorithms.

LAYOUT

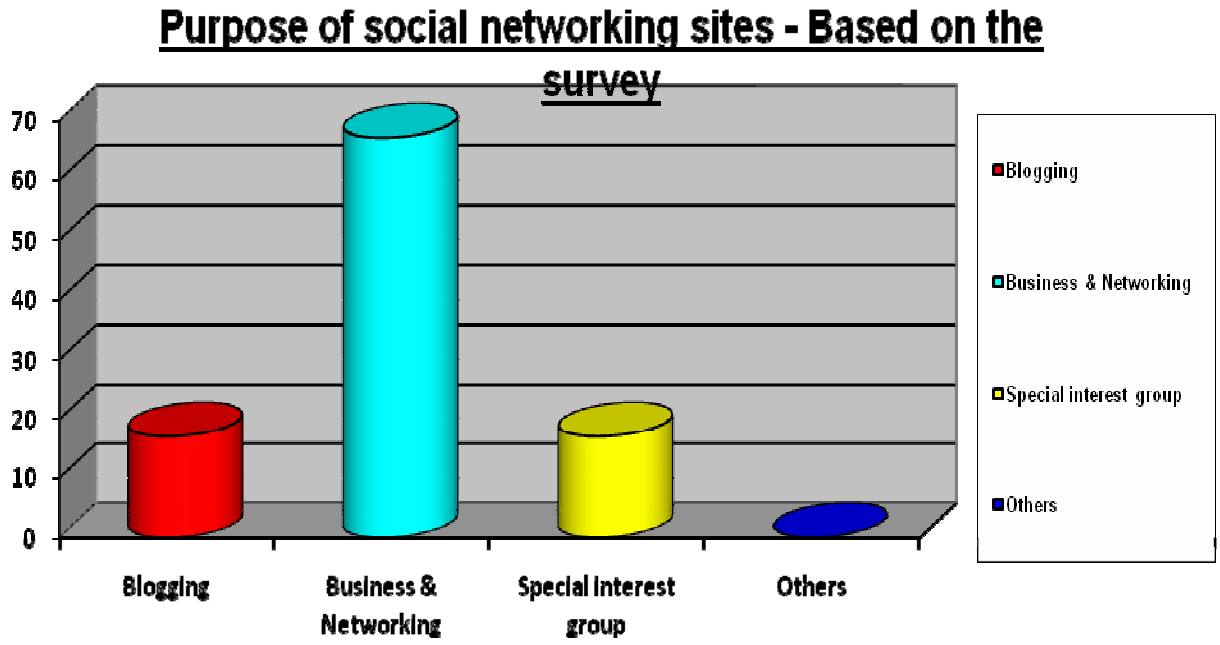
We should support users by creating and handling content through *easy-to-use, consistent* interfaces. The addition of new content should not be difficult, even for inexperienced users. Inconsistent content must be avoided; if several versions of a document exist, only the most recent should be shown. When designing these interfaces, it is important to consider basic consistency rules. Consistency in user interfaces mandates that the same navigational element (link, button, menu, etc.) should always behave in a similar way.

SURVEY ANALYSIS:

(The charts and results are based on a survey conducted within the EMC Innovation network group and other Research & Development units, with limited resource)

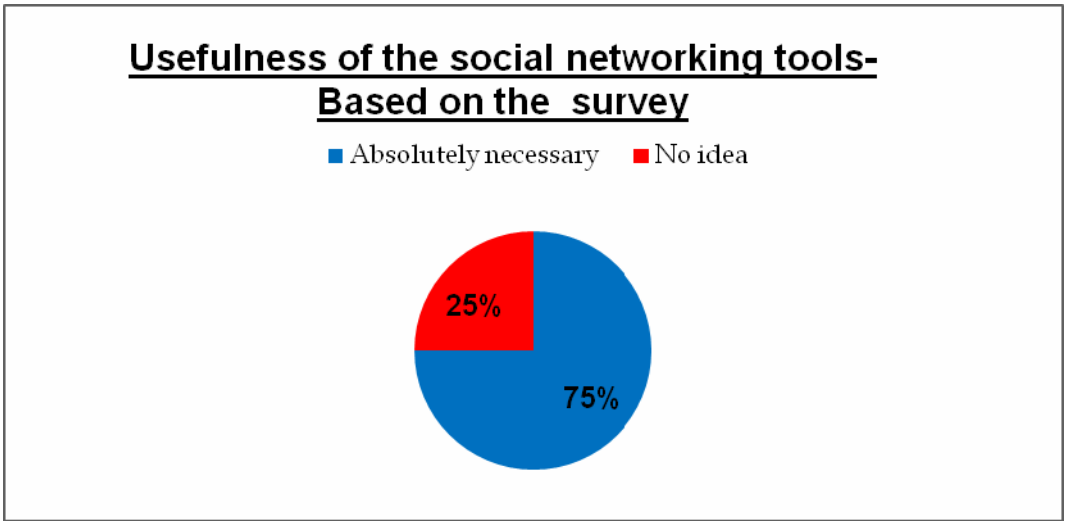
1. Purpose of using social networking sites:

Simplicity and convenience are driving the rapid adoption of Web 2.0. The CEO of Sun Microsystems, Jonathan Schwartz, recently stated that "simplicity changes the world. Convenience is a force multiplier." Virtual communities are the best means to increase and enhance business and networking.



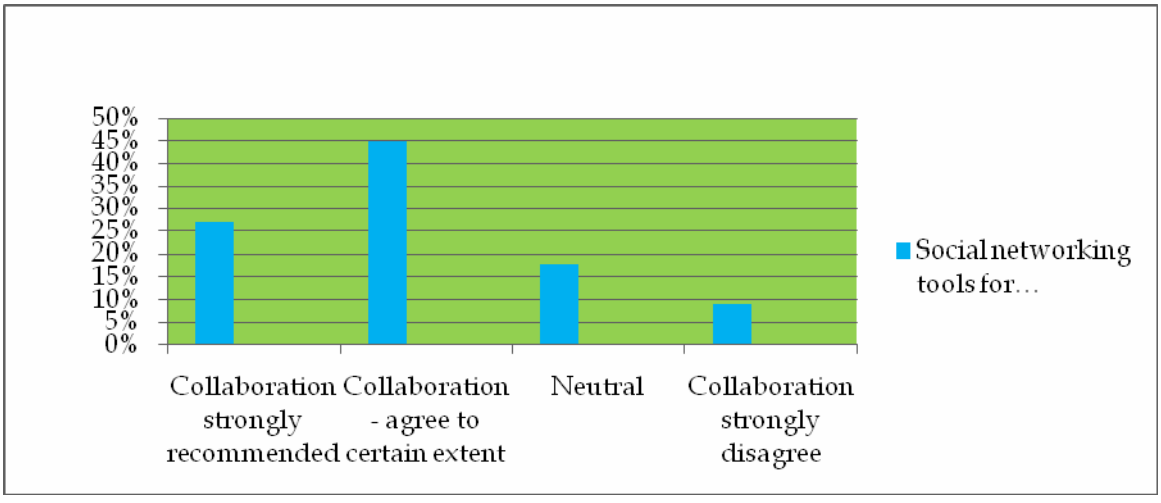
2. Tagging and bookmarking tools:

Tagging and bookmarking tools helps users to save, organize and search a link to web pages that users visit frequently. The classification of web-based resources is based on the content of the resource, thereby providing users with semantically categorized tags. Despite its usefulness, the benefits that these tagging and bookmarking tools are yet to be tapped by many organizations. The pie-chart below clearly shows the need for bookmarking tools within EMC's research and development unit.



3. Collaboration using social networking tools:

Although it is well-known that social networking tools are primarily used for knowledge sharing and collaboration purpose, the survey results shown below are quite interesting.



CONCLUSION

In sum, any distributed organization that wants to enable effective knowledge sharing is subject to a significant challenge. Virtual communities help individuals to identify experts, create virtual spaces for individuals to meet and share knowledge – thus allowing human knowledge to be available both globally and locally. To tap into this knowledge, virtual communities offer one means to encourage workers to participate in larger networks where new ideas and diversity can challenge and enrich communities, providing both an in-flow and out-flow of knowledge.

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