Group Decis Negot (2011) 20:137–154
DOI 10.1007/s10726-010-9215-5

A Framework for Adopting Collaboration 2.0 Tools for Virtual Group Decision Making

Efraim Turban · Ting-Peng Liang · Shelly P. J. Wu

Published online: 15 October 2010

Abstract Decision making in virtual teams is gaining momentum due to globalization, mobility of employees, and the need for collective and rapid decision making by members who are in different locations. These factors resulted in a proliferation of virtual team software support tools for decision making, the latest of which is social software (also known as collaboration 2.0), which includes tools such as wikis, blogs, microblogs, discussion forums, and social networking platforms. This paper describes the potential use of collaboration 2.0 software for improving the process and the specific tasks in virtual group decision making. The paper proposes a framework for exploring the fitness between social software and the major activities in the group decision making process and how such tools can be successfully adopted. Specifically, we use a fit-viability model to help assessing whether social software fit a decision task and what organizational factors are important for such tools to be effective. Representative research issues related to the use of such tools are also presented.

Keywords Blogs · Collective intelligence · Collaborative decision making · Discussion forums · Enterprise 2.0 · Group support systems · Social networks · Social software Web 2.0 · Wikis · Virtual teams

E. Turban · T.-P. Liang (✉) · S. P. J. Wu
National Sun Yat-sen University, Kaohsiung, Taiwan
e-mail: tpliang@faculty.nsysu.edu.tw

E. Turban
e-mail: efraimtur@yahoo.com

T.-P. Liang
City University of Hong Kong, Kowloon, Hong Kong

1 Introduction

Changes in the business environment, such as increased globalization, offshore outsourcing, increase in travel costs, explosion of mobile work, and the need to collectively make rapid decisions have created changes in the manner in which groups work and make decisions. Notable is the growth of virtual teams working in different places and possibly times (e.g., see Brake 2009). Organizations are pursuing innovative collaborative relationships such as the worldwide network of firms, called relational capital, to drive a strategy of continuous innovations (Welbourne and Pardo-del-Val 2009). Managing and making use of virtual teams are not a simple task (e.g., see Siebdart et al. 2009) and they have been supported electronically for decades. A major activity of virtual teams is decision making. Team members work together to analyze and prioritize alternative solutions to problems and choose one alternative through extensive communication, analysis, deliberation, and negotiation. The decision making process used by groups has been researched for decades in attempts to improve it.

The use of computerized collaborative tools to support group decisions has gone through several stages of evolution. In the 1980's and 1990's, a popular research stream was to adopt a group decision support systems (GDSS) or group support systems (GSS) to enhance team productivity. Most studies at that time were conducted in a face-to-face setting (synchronous) with some same-place-different-time (asynchronous) settings (Thierauf 1989; Jessup and Valacich 1993). These studies were extended later on to remote settings (virtual teams). Collaboration tools such as emails, teleconferences, and shared screens became popular. However, in certain cases, the collaboration was still restricted to groups with members that knew each other; also, this style of collaboration has been found to be slow, difficult to manage, expensive and ineffective at times (e.g., see Socialtext 2009). Collaboration topics and related information were fragmented across many files, individual emails, and different versions of presentations. Excel files and Word documents were stored in different desktop applications, in shared computer drives, and in content management systems.

The Social text study cites surveys done by IDC Corp. and IBM that revealed waste of time, inefficiencies and poor utilization of existing knowledge. Furthermore, some of the collaborative software were too expensive for small and medium companies as well as too complex to install and use. The demand for improved collaborative team decision-making processes and tools encouraged a large number of vendors to create improved products and support technologies. A recent group of such technologies uses Web 2.0-based social software for such purposes. These tools (referred to as collaboration 2.0) attempt to solve some of the problems cited earlier and, in general, to improve the effectiveness and efficiency of the group decision-making process.

The special capabilities of collaboration 2.0 tools and procedures can result in considerable flexibility in operation and cost reduction in some companies (e.g., see Raman 2006; McAfee 2009; Coleman and Levine 2008; Kane and Fichman 2009). Alongside the many success stories of social software tools, there were reports of unsuccessful implementations and adoption problems, which range from employees wasting time to giving away corporate secrets. Furthermore, many are questioning the business value of social software. Therefore, the issue of how these new collaboration

tools can be used by organizations to create value without the potential risks and limitations is a challenging research topic. Unfortunately, there is little empirical scientific evidence regarding the usefulness and risks of social software especially with respect to their support of the decision-making process of virtual teams.

The purpose of this paper is to propose a framework that will facilitate the investigation of the issues related to the adoption of collaboration 2.0 tools in organizations to support decision making in virtual teams and to point to some potential future research issues derived from collaboration 2.0. The remainder of the paper is organized into the following parts:

- Section 2 provides a brief overview of the group decision making process, its major activities, as well as a brief overview of the characteristics, tools, environments and capabilities of Collaboration 2.0.
- Section 3 maps the potential fit of the major activities of the virtual group decision making process against the major social software tools. Special attention is given to information gathering and sharing, idea generation and selecting an appropriate solutions.
- Section 4 presents a proposed fit-viability framework to assess whether particular collaboration software fits the specific needs of virtual group decision making in an organization. It also includes representative research topics related to the fit-viability model.
- Section 5 outlines the contribution of the proposed framework and concludes the paper.

2 The Group Decision Making Process and Collaboration 2.0

In order to understand how collaboration tools can be used to support group decision making in virtual teams, we need to understand the group decision making process, the characteristics of collaboration 2.0 tools, and the relevant previous research in group support systems.

2.1 Group Decision Making Process

Group decision making is a collaborative effort. In a simplistic manner, collaboration is a process where two or more individuals, groups or organizations are working together, in order to accomplish a task or attain a goal. It involves series of interactions, communication, deliberation and other activities such as search for information, asking questions, collecting answers, generating ideas, and solving problems. People join forces and work collaboratively to design products and services, develop a strategy, innovate, work with business partners, solve problems and exploit opportunities. Note that the difference between collaboration and communication is ultra-thin because there are many forms and definitions of collaboration. (For several definitions of collaboration, see Coleman and Levine 2008, p. 17). Collaboration has been supported electronically by a large number of tools (see e.g., Kudaravalli and Faraj 2008 and en.wikipedia.org/wiki/collaborative_software).

Table 1 Major activities in the decision making process

Tuckman's model	Simion's model	Major tasks (Activities)	Process activities
Forming	Not applicable	Identify members	Search skills
		Know each other	Communication
		Build trust and collaborative culture	
Storming	Intelligence	Identify problems	Brainstorming
		Collect information	Nominal group techniques
		Information sharing	Voting
		Identify decision criteria	Ranking
		Prioritizing decision criteria	Deliberation negotiation
Norming	Design	Find alternatives	Brainstorming
		Evaluate alternatives	Delphi method
		Compare alternatives	Voting
		Prioritize alternatives	Ranking
Performing	Choice	Alternative selection	Choice models
		Sensitivity analysis	Decision analysis
		Implementation plan	Negotiation
	Implementation	Project management	Coordination Control
		Report writing	
		Education and training	

The process of decision making in groups has been investigated for decades. For example, Tuckman (1965) proposed a five-stage process that includes forming, storming, norming, performing, and adjourning. Fisher (1970) identified four major steps: orientation, conflict, emergence, and reinforcement. Tubbs (1995) renamed Fisher's model to include orientation, conflict, consensus and closure. In fact, these models are similar to the popular Simon's decision model of intelligence design and choice, which was used for both individual and group decision making. Each of the stages (or phases) in the above models includes certain tasks. Table 1 illustrates the major phases with their major tasks and activities.

As we can see in Table 1, different group decision process models tend to include similar activities. We consolidate the major steps in the process into the following: Information gathering and sharing for the purpose of problem identification and determining its importance; finding alternative solutions and analyzing them; selecting an affective course of action; and managing the process and implementing the solution.

2.2 Research in Group Support Systems

A substantial amount of research on applying software tools to support group decision making has been published in the area of group support systems (GSS) and computer supported cooperative work (CSCW). Research in GSS focuses on the use of electronic meeting systems (EMS) to support idea generation and decision making in small group settings (Nunamaker et al. 1991; Guerrero and Pino 2009). Earlier research has identified three levels of IT support. The first level intends to remove communication barriers; the second level provides decision modeling and group decision techniques aimed at reducing uncertainty in the group decision process; and the third level intends to improve group decision patterns through expert advice (DeSanctis and Gallupe 1987).

Four possible levels of modeling support were identified, including communication, modeling, negotiation, and intelligent support (Liang 1988). A broad range of issues has been covered, including computer-mediated group dynamics, design of group support systems, effect of group facilitation, behavioral and communication theories related to group decision support (see e.g., Jessup and Valacich 1993; Fjermestad and Hiltz 1998). However, this line of research is primarily oriented toward face-to-face discussions in a meeting room.

Instead of focusing on group decision making, CSCW and groupware technologies focus on cooperative work in distributed environments. The scope of coverage is quite broad, ranging from group editing, workflow, group scheduling and software design (see e.g., Coleman and Khanna 1995; Schmidt and Bannon 1992; Cohn et al. 2009). Research in these two areas has investigated many important issues in using IT to support group works, but they also encountered certain difficulties and were not very successful in investigating group decision making. For GSS, a major limitation is that most research targeted at the face-to-face setting and the major performance improvement is found in the process improvement and satisfaction but not in the decision quality (e.g., Dennis et al. 2001), while CSCW is basically technical oriented with a focus on system design. At the Internet age, a set of new tools and new thinking of applying such tools has emerged under the umbrella of Web 2.0.

2.3 Characteristics of Collaboration 2.0

Collaboration 2.0 refers to the deployment of Web 2.0-based social software tools and services, such as wikis, blogs, forums, RSS feeds, opinion polls, community chats and social networking, to facilitate enterprise collaboration. In fact, collaboration 2.0 includes large number of computerized tools, infrastructures, and service environments and it is frequently referred to as social software (see Lai and Turban 2008 and the list at en.wikipedia.org/wiki/social_software). Recognizing the potential of Web 2.0, researchers at the MIT Center for Digital Business (Brynjolfsson and McAfee 2007; Bernoff and Li 2008) and Harvard Business School (McAfee 2006) extended the Web 2.0 concept into Enterprise 2.0 (the use of Web 2.0 within the enterprise), asserting that the Web 2.0 tools create a collaborative platform that reflects the way knowledge work is really and naturally done. And indeed, a large number of companies successfully adopted Enterprise 2.0 for different collaborative activities (Shuen 2008; McAfee 2009).

Sari et al. (2008) used the term Enterprise Collaboration 2.0 to refer to how people use Web 2.0 technologies to improve the way they communicate in an enterprise setting. Collaboration 2.0 has unique characteristics being a social computing product and exhibits many of the characteristics of Web 2.0. These characteristics differentiate it from traditional computer-based collaboration tools in GSS and CSCW (referred to as collaboration 1.0). Web 2.0 provides a unique set of business value, as shown in Table 2. Despite the differences, collaboration 2.0 encompasses many of the outcomes, benefits and values of collaboration 1.0; however, it uses social software tools and it takes place in new settings such as social networks or virtual worlds.

Table 2 Comparing collaboration 1.0 and 2.0

Area	Collaboration 1.0	Collaboration 2.0
Context	Enterprise controlled	User generated, flexible, and dynamic
Ease of use	Can be complex	Very user friendly
Cost	Can be very high	Very low
Platform	Propriety	Open source, flexible
Focus	Transactions' support	Interactions—based
Interactivity level	Low	High
Collaboration nature	Structured, initiated by the company	Unstructured, initiated by users
Add-on application	Created by the enterprise	Can created easily by users
Channel for information push and sharing	E-mail, text messages	RSS feeds, Microblogging, (Twitter)
Flow of information	Structured, top down	Unstructured, bottom up
Context tagging for search	Usually not done, or done for search engine optimization	Done by users, Folksonomy
Combining applications	Require complex programming	Easily done with mashups
External expert contacts	E-mail, proprietary contacts	Social networks, mass collaboration, forums
Supporting environments and infrastructure	Extranet VANs, Intranets	Social networks, Intranet, virtual worlds
Flexibility	Low	High
Software for collaboration	Structured may not be modified; must be installed	Unstructured; often no need to install

2.4 Business Value of Collaboration 2.0

Collaboration 2.0 supplements and expends the capabilities of the traditional collaboration 1.0 tools by providing an inexpensive, flexible and user controlled computing environment and social software that allows for innovative collaboration activities, such as mass collaboration. Hence, the technologies are quickly finding a place in the corporate world by allowing for *unstructured collaboration* within an enterprise and with partners, suppliers and customers. These emerging technologies allow a manufacturer, for example, to go beyond mere transactions along its supply chain and share knowledge, learning, and best experiences amongst employees in specific departments, and with its suppliers, distributors and other business partners. This collaboration includes virtual group decision making as well.

To illustrate this further, look at designers and engineers that may be physically located across the globe, and how they can collaborate on building a new product through wikis, while extracting valuable customer preferences and feedback from self-organizing communities and their forums and blogs, and feeding these insights using RSS, into the product development process. Several decisions are made during this process.

Collaboration 2.0 applications already exhibited substantial benefits (e.g., Rutledge 2008; Ybarra 2008). In Intralink's webcast, the speakers cited the following benefits

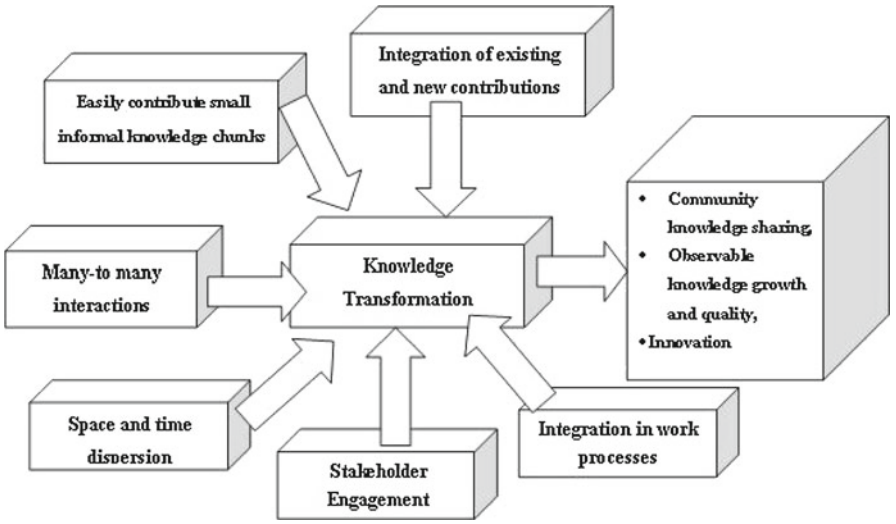

Fig. 1 The potential contribution of wikis and social interaction to knowledge sharing and innovations (*Source*: Majchrzak 2007)

of collaboration 2.0: *lower cost* (e.g., reduced document exchange costs by 30%), *increased efficiency*, *share mission-critical information with less risk*, *strengthen data security*, and *improved productivity* by 20% on document-intensive processes. Some additional benefits of collaboration 2.0 are associated with specific tools and it is important to choose suitable tools. For examples, Wagner and Majchrzak (2007) list the following five benefits as things that wikis has but other technologies do not have:

(1) Easily contribute small informal knowledge chunks;
(2) Support simple many to many interactions;
(3) Space and time dispersion can be overcome;
(4) Integration of existing and new contributions; and
(5) Integration of in-work processes.

Majchrzak also postulated that these capabilities can lead to knowledge transformation and eventually lead to innovations that can be used in solving problems and exploiting opportunities, as illustrated in Fig. 1.

In short, collaboration 2.0 has significant advantages over collaboration 1.0 in its low cost (some of the tools are free), its technological fitness with many computing systems (due to its open-source base), its unique participative framework (due to user generated content and user control and increased participation), the ability to easy and quickly add on unique and innovative applications, and the tapping of the power of the crowd in mass collaboration.

3 Supporting Group Decision Making with Collaboration 2.0 Tools

As shown in Table 1, the group decision making process involves many tasks and activities. If we adopt the broad definition of collaboration, which includes information

Table 3 Mapping collaboration 2.0 tools and group decision making tasks

	Group decision making process tasks	Collaboration 2.0 tools
Intelligence	Problem Identification	Blogs, IM, Polls (voting)
	Information finding/sharing	RSS feeds, blogs, Twitter
	Soliciting expert's opinion	Social networks answering function Enterprise social bookmarking
	Prioritize problems (importance)	Voting, blogs, IM, discussion groups (forums) chat room
Design	Search for alternative solutions	Search tools, expert/answering
	Idea generation—brainstorming	Discussion groups, blogs, IM, chat room
	Experts' opinions	Answer function, IM, Twitter
	Organize alternatives	Wiki
	Identify criteria of choice	Wiki, blog, IM, discussion groups
	Prioritize criteria of choice (importance)	Discussion groups, voting, IM chat room
Choice	Analysis (Forecasting, risk, comparisons)	Collaborative decision making (Social networking plus BI analysis)
	Selection of an alternative	Polling, discussion groups, IM
Implementation	Meeting management	Twitter, RSS feeds
	Project management	Presence awareness, Twitter, blog
	Report writing	Wiki
	Training (if needed)	Virtual worlds

gathering and sharing and communication, then most of the tasks in the process can be supported by collaboration 2.0 tools. Also computing environments and services such as social network services (LinkedIn, Facebook) and virtual worlds, (Second Life) provide the collaboration 2.0 tools and the infrastructure for their application. The issue of which tools, environment and services of social software can be used for which tasks or activity in the decision making process is complex, since it depends on many factors such as the size of the company and the deciding group, the locations of its members, the nature of the decisions they make, the urgency of the decision, the amount of money involved and who the members are, just to name a few. It also depends on the tools to tasks match and the viability of the social software and the decision situation.

A more intuitive approach is to match the capability of the tool with the nature of activities in various decision stages. Some of these tools are stand-alone and some may be incorporated in major collaboration software packages such as Microsoft's SharePoint and IBM's Sametime. In Table 3 we present the mapping between the most representative social software tools and the major tasks and activities listed in Table 1. The table is organized according to Simon's decision phases.

The matching suggested in Table 3 depends of course on many variables and constraints. What we provided is a representative and common matching for illustrative purposes and will be elaborated below.

3.1 Supporting the Intelligence Phase

The major role of the intelligence stage is to identify the problem and collect relevant information. While for many teams the problem (opportunity) is known and the mission then is to provide a solution, in other cases only the symptoms are known and

the team needs to identify and define the problem. This phase involves mainly finding, sharing and analyzing information. Once a problem is identified, the team needs to determine if it is important (or urgent) enough. As seen in Table 3, most social software tools can be useful here.

A most straightforward application for collaboration tools is to conduct searches and to help sharing information among participating group members. Applications in this category focus on efficient gathering of information and its dissemination in order to trigger new collaborations or foster existing ones. Corporations have been using RSS feeds, group chats, blogs' discussion forums, microblogs (mostly Twitter), and wikis for dissemination of briefs, queries, and finding best practices as an effective supplement or even as replacement of information dissemination via email. For example, listening to customers' thoughts on product functionality and usage in discussion forums and in blogs, has been a popular mechanism for obtaining valuable input and feedback for problem identification (and for evaluating alternative product improvements next phase), or for assessing the viability of suggested new products or services.

Some companies supplement or even replace focus groups by online forums. An interesting example of information sharing is the case of Johnson & Johnson Inc., in which information is shared via blogs and wikis for many purposes. In another example, Eastern Mountain Sports has been collaborating with its suppliers using blogs and wikis for several years for problem identification. Lately microblogging, and especially Twitter, has been recognized as effective information collection and disseminating tool (King 2008).

3.2 Supporting the Design Phase

Once a problem has been identified, the team needs to solve it. To do so, potential alternative courses of action need to be generated innovatively. One way to do it is to employ brainstorming. This is an area where prior research in group support systems has investigated thoroughly. In the Internet age, alternatives can be generated by virtual teams synchronously or at different times. It may involve small, internal only team members, or it may involve outsiders as well, sometimes in large numbers (see e.g., MacGregor and Torres-Coronas 2007). Social software can support the collection of experts opinions and suggestions (e.g.; via the answer function of Linkedln, by using Twitter or blogs to solicit help, or by using discussion forums, by using polling in social networks and by conducing live chats (e.g., IM). We note here briefly the use of large number of possible contributions, in what is referred to as the wisdom of the crowd, or the use of collective intelligence.

Collective intelligence occurs when a large group of people work independently on a single project. Such projects typically take place on the Internet using collaboration 2.0 tools such as wikis, polling opinions, and forums. The wisdom of the crowd refers to the consolidation of the collective opinion of a group of individuals, and it is used in the corporate world for idea generation and problem solving (see Surowiecki 2004 and Tedeschi 2008).

For example, IBM has been using social networking extensively for collaborative problem solving. One of their most known projects is called the *Innovation Jam*, an

online brainstorming session. In this community over 150,000 employees and business partners are trying to move IBM's latest technologies to the market. For example, in July 2006, IBM invited employees, partners and customers to contribute ideas about a certain new product. Within 72 hours more than 50,000 ideas were posted. These were winnowed down by using sophisticated analytical software, and, the selected ideas were analyzed and the best were implemented (see Bjelland and Wood 2008).

Idea generation is frequently enriched by knowledge management applications and the use of corporate knowledge bases. Several collaboration 2.0 tools can be applied to support knowledge management (Wagner and Bolloju 2005; Spinellis and Louridas 2008). Companies are creating, for example, *retiree corporate social networks* to keep retirees connected with each other and with the organization. These people possess huge amounts of knowledge that can be tapped for productivity increases and problem solving. Examples of KM applications can be found in Northwestern Mutual Life's internal social network, where over 7000 financial representatives share the captured knowledge, and in Caterpillar Inc. which created a knowledge network system for problem solving.

3.3 Supporting the Choice Phase

Making choices by groups usually requires some analysis, deliberation, discussion, voting and negotiation. Social software products can be an ideal support tool for all these activities, both when done synchronously or asynchronously (McAfee 2009). Facilitation of these activities can be enhanced by social software in a similar manner to the support of the intelligence phase. Groups may also need to conduct some analysis of the alternative courses of action. A recent development is the integration of social networking and business intelligence (BI), which appears under the name of "collaborative decision making" or "CDM" (see Schlegel et al. 2009).

CDM may dramatically improve the quality of decision making by directly linking the information contained in BI systems with collaborative input gleaned through the use of social software. This is especially true for non-routine, complex decisions that require iterative human interactions. Also, tying BI to decisions and outcomes that can be measured enables organizations to better demonstrate the business value of BI. Organizations already use collaborative social software to keep informed about where colleagues are and what they are doing and even thinking, and to mobilize them for urgent meetings to solve problems. Properly designing collaborative environments enable decision makers to discuss issues, brainstorm, evaluate their pros and cons, and agree on a final course of action using social software.

The implementation of collaboration 2.0 for virtual group decision support raises several interesting research issues. An important one is what factors a firm should consider in deciding whether to adopt such technologies in the organization. This is the topic for discussion in the next section.

4 The Fit-Viability Framework for Successful Adoption

While in theory social software can fit very nicely most of the activities in the group decision making process, in practice this may not be the case. In addition to a need for such tools, there are many factors that must be considered before an organization adopts this new technology. In order for an organization to utilize collaboration 2.0 properly, we propose a research model that can include the most relevant factors, and it has been proven useful in analyzing organizational adoption of electronic commerce initiatives and of mobile technologies (Tjan 2001; Liang et al. 2007).

4.1 Theories Related to Technology Adoption and Performance

A popular theory being used in assessing whether a particular technology can improve the performance of a task is called a *task-technology fit* (TTF) model which has been proposed by Goodhue and his colleague for explaining perceived individual performance due to the use of information technologies (Goodhue 1995; Goodhue and Thompson 1995) and Zigurs and Buckland (1998). The general concept is that, for a technology to be useful in enhancing performance, it must fit the nature of the tasks that the technology is designed to support. A good fit between task characteristics and technology characteristics will result in higher utilization and better performance.

In addition to the fit between task and technology, other theories exist (e.g., Li and Chau 2009). A popular one is the *organizational contingency theory* that argues that appropriate organizational settings are critical to the successful deployment of a technology. This has been supported by an analysis of a large amount of organizations that failed in benefiting from the adopted technologies due to inadequate organizational readiness or internal resistance. In the well-known Kmart case, rush deployment of the supply chain and warehousing system without considering its organizational and financial situations was one of the reasons that caused its bankruptcy (Konicki 2002). Many failed cases lack what is called "viability." Therefore it makes sense to combine the fit and viability concepts in what is known as *the fit-viability model*. Unfortunately, not much research has connected this theory to group decision making. One exception is the work of Dennis et al. (2001) who examined the effect of GSS from the *fit-appropriation perspective*.

4.2 The Fit-Viability Model

The fit-viability model was originally proposed by Tjan (2001) for evaluating organizational adoption of e-commerce initiatives. It includes two dimensions: *fit* and *viability*. The fit dimension measures the extent to which new applications are consistent with the firm's needs, core competency, structure, value and culture of organization. The viability dimension measures the extent to which value can be added by new applications. It also examines the requirements of human resource, capital needs and so on. This model was later adapted to assess the adoption of mobile commerce technologies (Liang et al. 2007; O'Donnel et al. 2007). In the revised model, the fit dimension measures the extent to which the feature of a technology matches the needs of the task.

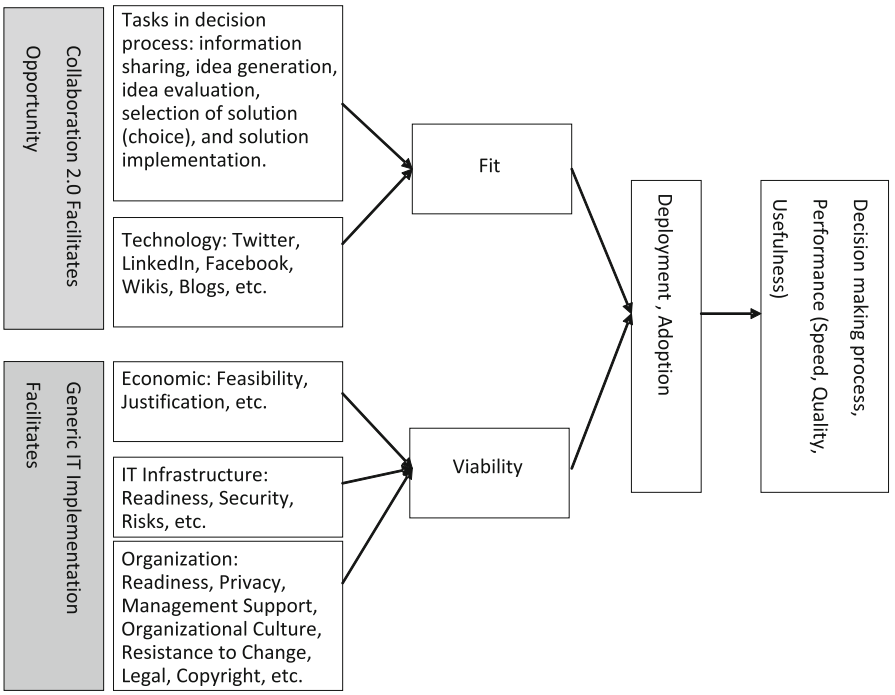

Fig. 2 A Framework for Adopting Social Networking Software for group decision support

Viability refers to the extent to which the infrastructure of the organization is ready for adopting a new technology. Adopters need to consider the economic feasibility, technical infrastructure and the social readiness of the organization.

We propose here a modified fit-viability-based framework regarding the adoption and use of social software for group decision support (shown in Fig. 2), and it is also based on adoption issues reported by practitioners (e.g., Rutledge 2008 and Shuen 2008).

The proposed framework includes two major components: (a) the opportunity that is driven by the fit between the intended decision making tasks and available social software tools; and (b) the implementation factors and the constraints that need to be considered to assess project viability. Enterprises should deploy those projects that are most fit and viable. For projects that are fit but not viable, the organization should prepare itself to increase the readiness before deploying the technology. The enterprise should not adopt a technology that does not fit the decision making process tasks. Once the fit and viability are satisfied, organization can deploy social software for group decision support with the expectation of improving collaboration, quality and speed of the decision process and eventually make better decisions.

Several other IT-generic factors may be critical for social software success and need to be researched. Nosek and McManus (2008) describe theoretical, conceptual and technical boundaries that limit development of innovative collaboration technology. Implementation strategies suggested by consultants and researchers range from

detailed practice-based approaches, such as the four-step approach POST (see Bernoff and Li 2008), to comprehensive strategy guidelines for businesses (Shuen 2008).

4.3 Procedures for Assessing a Collaboration 2.0 Tool

Imagine the following scenario: you are in a meeting in which a proposal is made to adopt IBM's Innovative Jam concept to decision making regarding new products in your company. With the fit-viability model in mind, an organization may use the following procedures to assess whether a particular collaboration tool is suitable for a group decision making in virtual teams.

4.3.1 Determine the Fit Between a Technology and a Decision Task

The first thing to do in finding whether a collaboration 2.0 tool is useful for improving the performance of virtual teams is to check the fit between the nature of the tool and the needs of the decision task. A convenient approach is to determine what would be the key aspects that can benefit a virtual team. A broad scope of new ideas is the main focus here. The information shown in Table 3 provides initial ideas. Collaboration tools, such as blogs and discussion forums, will fit well a situation, for example, where there is a need to solicit inputs from customers about the next generation notebooks. A practical approach is to identify major needs of the decision making tasks (such as information input, editing, voting) and the nature of the group (restricted to certain members only or open to the public) and then assess the fitness score of available tools. For example, if a task involves group editing function, wiki will be a useful tool, but blogs may not fit very well.

4.3.2 Analyze Economic Viability of the Technology

Once candidate tools are identified, the economic feasibility should be evaluated. For social software, many of them are free but some expensive ones offered by several vendors. It may be necessary to make tradeoffs between costs and functionality of the available tools. In addition to the acquisition cost, other related costs such as employee training, software maintenance, and compatibility with existing software packages need to be considered.

4.3.3 Identify Necessary IT Infrastructure

Since collaboration 2.0 tools take advantage of broader participation, the IT infrastructure necessary for running the software may be different from the existing one of the organization. For example, the server configuration and security protection may need to be upgraded. The organization will need to evaluate whether the current IT infrastructure is capable of supporting the intended collaboration 2.0 tools, and if not, what kind of improvement will be needed. The assessment needs to go beyond the infrastructure of the organization and include the infrastructure interoperability of all potential collaborative partners.

4.3.4 Examine human factors and organizational issues associated with the application

Another major issue in adopting the technology is whether the users would utilize the available collaboration 2.0 tools. Although the software may be useful from the organizational perspective, the user also needs to see the benefits. This is particularly important when the tool is intended for internal employees. For example, if a department does not see benefits for its employees to use online negotiation tools, or that the use of the new tool will dramatically change the current working mode, it is likely the adoption of such a tool will fail. The marketing department, for example, may reject the use of Facebook poll if there is no direct value to the department's employee. Education and user training can be useful in alleviating this kind of problems.

4.3.5 Choose a Deployment Strategy

Once collaboration software is assessed to fit the task and be viable for the organization, a proper deployment strategy needs to be determined. The issues at this stage include assessing organizational requirements, identifying champions, developing a feasible implementation plan, and defining performance measures. If a tool fits the need well but the organizational viability is low, it is recommended that the firm should take action to enhance its organizational readiness before adopting the tool. If the fit is low, the firm should search for alternative tools.

4.3.6 Measure Performance

It is also important to determine performance measures before the deployment and evaluate the outcome of adoption by the pre-defined measures. For group decision making, there are two kinds of performance measures: process and outcome. The process measure evaluates whether the group decision process is more efficient and whether the members are more satisfied with the process. The outcome criteria assess the effectiveness of a group decision making, which may include economic and other measures. For example, a company may use Facebook's Poll to gather user opinions (vizu.typepad.com/facebook-polls/) on introducing a new product. A process measure may be the number of relevant feedback messages received in the process, whereas an outcome measure is whether the new product decision results in a success.

4.4 Research Issues for Implementation

The fit-viability framework provides useful guidelines for deciding whether a collaboration 2.0 tool is suitable for a virtual team decision making. Since the framework also indicates many factors that must be taken into consideration for these tools to be effective, its implementation can be complex, and it provides a fertile research agenda (e.g., see Gibson 2009; Sangwan et al. 2009; Srinvas 2008). Potential research issues can be classified as technical, organizational, managerial and economical.

Table 4 Potential research issues in adopting collaboration 2.0 tools

1. Technical
• Integrating social software with existing platforms
• Identifying different tools to support different phases of group decision
• Reengineering group processes to allow easy use of 2.0 tools
• Developing friendly user interface for ease of use
• Assuring the quality of inputs, decision process, and decision outcome
2. Organizational
• Reducing employee resistance to change
• Assessing organizational impacts
• Fostering collaboration 2.0 culture
• Developing change management plans
• Implementing group decisions made by virtual teams
• Evaluating the role of leadership and senior management support
3. Managerial
• Identifying critical success factors for using Collaboration 2.0 tools
• Selecting useful tools for different activities in group decision making
• Allocating resources for implementation
• Providing incentives and building trusts in collaborative decision making
• Developing policies for security and privacy protection
• Assessing employee readiness for such a new technology
• Managing the misuse of time and computing resources in virtual teams
4. Economical
• Evaluating the cost/benefit of the technology and risk management
• Assessing the value of using collaboration 2.0 tools in group decisions
• Measuring the quality of decision outcomes

Technical issues are related to the nature of the collaboration 2.0 tools. For instance, the adoption of social software may need to integrate it with the existing platform and to re-engineer group processes. These issues can be handled by objective criteria. Organizational issues are related to the nature of the people who are going to use the technology. For example, reducing user resistance and assessing organizational impacts are two typical organizational issues. Managerial issues are those associated with the managerial activities for facilitating the use of these tools. Identifying critical success factors and allocating resources for implementation are two examples of the managerial issues. Economical issues target the financial aspects of adopting social software for collaboration. Examples include evaluation of cost-benefits of implementation and assessing the value of such tools in group decisions. Table 4 lists representative relevant issues.

5 Discussion and Conclusions

This paper presents a framework for adopting web 2.0 technology and especially social software tools to facilitate the group decision making process. More specifically, we have identified useful collaboration 2.0 tools for supporting different tasks in group decision making and proposed the fit-viability model for supporting the adoption of this technology. The contribution of the paper is two-fold. First, the fit-viability model helps in organizing various considerations in adopting social software for group

decision making. It is particularly useful for researchers in evaluating the critical success factors of using web 2.0 technology for group decision support. The fit-viability model and the deployment process also opens the door for a large number of challenging research issues for experiments, case studies, empirical surveys, and theoretical development.

For practitioners, the matching between collaboration 2.0 tools and group tasks provides useful guidelines for finding proper tools to enhance the process and outcome of group decision making. Many people believe that at the moment collaboration 2.0 has minimal business value, but this situation is changing with increased experiences and the evidence of successful applications. The major potential benefits for group decision making are in expediting and facilitating information sharing, the ability to solicit more opinions, expediting decision making activities such as prioritizing and analyzing alternative solutions, and encouragement of participation of people that otherwise may not collaborate.

Enterprises should check whether social software is viable economically, whether the organization has adequate technological capabilities to support social software, and whether the organization is ready for adopting and supporting it. Once social software is considered to fit and to be viable, the organization needs to develop a good deployment strategy and plans for adopting the technology. Using the fit-viability model may be a most useful approach for such a task.

Finally, some believe that the extension of Web 2.0 to Web 3.0 (semantic web, personalization, intelligent search, automated decision support, etc.) will increase the usefulness of social software as facilitator of group decision making. Moreover, social networking environments such as LinkedIn, Facebook and Second Life can provide significant value to activities such as idea generation, knowledge management, information sharing and collective intelligence. The framework and issues outlined in this paper may serve as useful guidelines for adopting collaboration 2.0.

Acknowledgements This research was funded by the Project for Universities to Pursue Academic Excellence to National Sun Yat-Sen University from the Ministry of Education, Taiwan, ROC.

References

Bernoff J, Li C (2008) Harnessing the power of the Oh-So-Social web. MIT Sloan manage Rev 49(3):36–42

Bjelland OM, Wood RC (2008) An inside view of IBM's innovation jam. MIT Sloan manage Rev 50(1):32–41

Brake T (2009) Where in the world is my team: making a success of your virtual global workplace. Wiley, Hoboken, NJ

Brynjolfsson E, McAfee AP (2007) Beyond enterprise 2.0. MIT sloan management review spring. pp 50–55

Cohn ML, Sim SE, Lee CP (2009) What counts as software process? Negotiating the boundary of software work through artifacts and conversation. Compt Support Coop Work 18:401–443

Coleman D, Levine S (2008) Collaboration 2.0: technology and best practices for successful collaboration in a Web 2.0 world. Happy about info publishing company

Coleman D, Khanna R (1995) Groupware technology and applications. Prentice Hall, Upper Saddle River, NJ

Dennis AR, Wixom BH, Vandenberg RJ (2001) Understanding fit and appropriation effects in group support systems via meta-analysis. MIS Q 25(2):167–193

DeSanctis G, Gallupe RB (1987) A foundation for the study of group decision support systems. Manage Sci 33(5):589–609

Fisher BA (1970) Decision emergence: phases in good decision making. Speech Monogr 37(1):53–66
Fjermestad J, Hiltz S (1998) An assessment of group support systems experimental research: methodology and results. J Manage Inf Syst 15(3):7–149
Gibson S (2009) Web 2.0 tools gain enterprise acceptance. eWeek, April 6
Goodhue DL (1995) Understanding user evaluations of information systems. Manage Sci 41(12): 1827–1844
Goodhue DL, Thompson RL (1995) Task-technology fit and individual performance. MIS Q 22(3): 231–236
Guerrero LA, Pino JA (2009) Supporting discussions for decision meetings. Group Decis Negot 18(6): 589–601
Jessup LM, Valacich JS (1993) Group support systems: new perspective. McMillan Publishing Company, New York, NY
Kane GC, Fichman RG (2009) The shoemaker's children: using wikis for information systems teaching, research, and publication. MIS Q 33(1):1–17
King R (2008) How companies use Twitter to bolster their brands. http://www.businessweek.com/technology/content/sep2008/tc2008095_320491.htm
Konicki S (2002) Now in bankruptcy, Kmart struggled with supply chain. Information week Jan 22
Kudaravalli S, Faraj S (2008) The structure of collaboration in electronic networks. J Assoc Inf Syst 9(10):706–726
Lai L, Turban E (2008) Group formation and operations in Web 2.0 environment and social networks. Group Decis Negot 17:387–402
Li D, Chau PYK (2009) Acceptance of internet-based services: a comparison of three models. Pac Asia J Assoc Inf Syst 1(3):1–24
Liang TP, Huang ZW, Yeh YH, Lin B (2007) Adoption of mobile technology in business: a fit-viability model. Indus Manage Data Syst 107(8):1154–1169
Liang TP (1988) Model management for group decision support. MIS Q 12(4):667–680
MacGregor SP, Torres-Coronas T (2007) Higher creativity for virtual teams. IGI Group, Hershey, PA
Majchrzak A (2007) The promise of passion of collective wisdom through wikis and the wiki way. Thinking Network, California 12–17
McAfee AP (2006) Enterprise 2.0: the dawn of emergent collaboration. MIT Sloan Manage Rev 47(3): 21–29
McAfee AP (2009) Enterprise 2.0: New collaborative tools for your organization's toughest challenges. Harvard Business School Press, Boston
Nosek JT, McManus M (2008) Collaboration challenges: bridging the IT support gap. Inf Syst Manage 25(1):3–7
Nunamaker JF Jr, Dennis AR, Valacich JS, Vogel DR, George JF (1991) Electronic meeting systems to support group work. Commun the ACM 34(7):40–61
O'Donnel J, Jackson M, Shelly M, Ligertwood J (2007) Australian case studies in mobile commerce. J Theo Appl Elec Commerce Res 2(2):1–18
Raman (2006) Wiki technology as a free collaborative tool within an organizational setting. Inf Syst Manage 23(4):59–66
Rutledge P (2008) The truth about profiting from social networking. FT Press, Upper Saddle River, NJ
Sangwan S, Guan C, Siguaw JA (2009) Virtual social networks: toward a research agenda. Intl J of Virtual Commun Soc Netw 1(1):1–13
Sari B, Schaffers H, Kristensen K, Loh H, Slagter R (2008) Collaborative knowledge workers: web tools and workplace paradigms enabling enterprise collaboration 2.0. http://www.cwe-projects.eu/pub/bscw.cgi/d1083684/Collaborative_Knowledge_Workers_eChallenges_Final.pdf
Schlegel et al (2009) The rise of collaborative decision making. Research note G00164718, Gartner Inc., http://www.gartner.com/technology/media-products/reprints/microsoft/vol6/article8/article8.html
Schmidt K, Bannon L. (1992) Taking CSCW seriously. Compt Support Collab Work 1(1):7–40
Shuen A (2008) Web 2.0: A strategy guide. O'Reilly Media Inc, Sebastopol, CA
Siebdart F, Hoegel M, Ernst H (2009) How to manage virtual teams. MIT Sloan Manage Rev Summer 2009:63–68
Socialtext (2009) Five biggest blunders to avoid with enterprise collaboration. http://www.socialtext.com/offers/wp_blunders_google.php?&utm_source=biz&utm_medium=cpc&utm_campaign=bsnetwork. Accessed Dec 2009.

Spinellis D, Louridas P (2008) The collaborative organization of knowledge. Commun of the ACM 51(8):68–73
Srinvas BG (2008) Collaboration 2.0: From execution to orchestration- –lessons for manufacturers from Davos. http://www.infosys.com/manufacturing/resource-center/Pages/collaboration.aspx
Surowiecki J (2004) The wisdom of crowds: Why the many are smarter than the few and how collective wisdom shapes business, economies, societies and nations. Doubleday Books, New York
Tedeschi B (2008) Putting innovation in the hands of a crowd. The New York Times. http://www.nytimes.com/2008/03/03/technology/03ecom.html.
Thierauf RJ (1989) Group decision support systems for effective decision making: a guide for MIS practitioners and end users. Wuorum Books, New York
Tjan AK (2001) Finally, a way to put your internet portfolio in order. Harvard Bus Rev 79(2):76–85
Tubbs S (1995) A systems approach to small group interaction. McGraw-Hill, New York
Tuckman B (1965) Developmental sequence in small groups. Psychol Bull 63:384–399
Wagner C, Bolloju N (2005) Supporting knowledge management in organizations with conversational technologies: discussion forums, weblogs and wikis. J Database Manage 16(2):i–viii
Wagner C, Majchrzak A (2007) Enabling customer-centricity using wikis and the wiki way. J Manage Inf Syst 23(3):17–43
Welbourne TM, Pardo-del-Val M (2009) Relational capital: strategic advantage for small and medium-size enterprises (SMEs) through negotiation and collaboration. Group Decis Negot 18:483–497
Ybarra M (2008) From LinkedIn to SharePoint, CIOs see Web 2.0 benefits. http://searchcio-midmarket.techtarget.com/tip/0,289483,sid183_gci1341716,00.html. Accessed Dec 2009
Zigurs L, Buckland BK (1998) A theory of task/technology fit and group support systems effectiveness. MIS Q 22(3):313–334