Perspectives for Integrating Knowledge and Business Processes through Collaboration

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Abstract. Collaboration is now playing a greater role in business processes, where knowledge workers leverage knowledge to develop innovative products and services. Such business processes go beyond the goal of simply achieving a well defined outcome at minimum cost using well defined tasks. They place more emphasis on collaboration and knowledge sharing and ways to change processes as collaboration evolves. The paper calls for greater emphasis on perspectives other than process flow in process design. These are knowledge, social structure, business activity, organization and technology. The paper describes process design ways to combine these perspectives into a holistic model and converting the model a collaborative infrastructure that allows users to align collaborative technologies to their collaboration.

Keywords: Collaboration, Knowledge, business process, perspectives.

1 Introduction

Broad business strategies influence strategies followed in information system development. One common business strategy is to obtain competitive advantage by creating efficiencies through process automation. This strategy focuses on the process workflow perspective by automating the sequencing of process tasks. An increasingly evolving strategy is towards encouraging the collaboration that leads to obtaining competitive advantage through innovation. As a result processes are becoming more dynamic and emergent [1] to respond to any opportunities that arise through collaboration.

Such dynamic processes require different supporting technologies from those needed to support process flows. To design such processes and their supporting technologies requires design emphasis on additional perspectives than simply transaction efficiency. It requires greater emphasis on perspectives for leveraging knowledge into business processes. It is applicable to those processes that support the knowledge sharing and collaboration necessary for innovation. The importance of collaboration and social networking is further substantiated by Pralahad and Krishnan [2] who see an increasingly important role for collaboration in business networking. This is seen as part of a broader vision of business evolution known as Enterprise 2.0 [3]. The Enterprise 2.0 vision describes in relatively abstract terms what new businesses will look like. It sees collaboration growing between organizational units within and between organizations. At the same time collaboration changes as new opportunities

I. Bider et al. (Eds.): BPMDS 2010 and EMMSAD 2010, LNBIP 50, pp. 82–93, 2010.

arise. Enterprise 2.0 suggests that competitive advantage can be obtained by using new technologies such as those currently emerging through Web 2.0 to both support collaboration and its changing nature.

In summary, process design in this paper focuses on knowledge workers [4]. These workers must quickly assess complex business situations and respond to them. Efforts to reengineer the work of knowledge workers into prescribed forms have proven unworkable [4]. Studies have shown that knowledge workers are characterized by greater emphasis on continuously changing social connectivity and interactivity.

Rinkus [5] and others, for example, see social issues as primary in health systems and have developed the HCDID methodology that has user communication as a primary perspective in design. Hence perspectives that focus more on knowledge sharing and social structure are becoming more important in process design. Semantics of change can then be defined as driven by perspectives other than process efficiency. Change can be driven from the social perspective as for example creating a new team to make a proposal. The impact of this change on other perspectives can then be evaluated as for example providing the team with needed knowledge. Alternative an emerging knowledge requirement may be converted to its impact on process and social structure, as for example what expertise is needed to create the knowledge.

The paper first proposes a choice of perspectives. It shows how the perspectives can be integrated into a methodology and defines a design process based on the perspectives. The perspectives proposed are knowledge, social structure, organizational structure, business activity and process sequence. Increasing emphasis on achieving competitive advantage is resulting in more attention to create innovative organizational structures by facilitating collaboration and knowledge sharing. The goal is to develop an infrastructure that provides the commands for knowledge workers to align collaborative technology to changing collaborative processes.

2 Choice of Perspectives

The choice of perspectives is governed by the emerging enterprise trends. These include:

- The emergence of process ecosystems [6], where links between the different processes are continually changing and awareness must be maintained between process participants to keep track of outcomes in distant units that may impact on their own work,
- The trend to a more service oriented environment where systems must continually respond to changing customer needs requiring the continuous sharing of knowledge across units through collaboration and socialization in the business processes,
- Greater client involvement in product design [7] where solutions are created through collaboration between supplier network and the customer network. Often there is a major supplier who originated a project and who then builds and coordinates a network of providers and customers to develop solutions that can provide continually evolving services and co-created services to customer
- Greater emphasis on getting expert advice through business networking,

- Providing the ability to learn to achieve social capital [8] that is considered as essential in innovative learning organizations, and
- Greater collaboration and emphasis on authentic team work [9] where team members collaborate by sharing their expertise towards common goals to create jointly owned artefact.

These trends result in greater emphasis on collaboration and knowledge sharing within the business process. Hence it is crucial to include social networking as a significant part if process designs are to cater for knowledge workers, who as a rule do not follow prescribed processes. On the other hand, knowledge workers require support to enable them to quickly change their social work connections to meet new and often unanticipated business opportunities and quickly adapt to changing situations. They should be able to do so in a way that they can quickly comprehend how to adopt any new technology, and assimilate it in their work.

Knowledge is a primary perspective as it often determines innovation capabilities. Hence social structures and leadership become important in business processes to nurture knowledge sharing through team structures. In summary, the perspectives proposed here are:

- The **business activities** and their actions and outcomes,
- The **process workflow** or sequence of activities and the interdependence between activities,
- The **social structure** that describes roles and their responsibilities and the assignment of roles to individuals and the relationships between them. This is critical in the design of the collaborative infrastructure as it defines the specific collaboration
- The **knowledge** created and used during the activities,
- The **organizational perspective** in the kinds of teams support or leadership provided to support collaboration and innovation,
- The **technology** to support the collaboration, which is needed to share and create knowledge.

The paper considers how to integrate the perspectives by defining semantics that are meaningful to process participants. These both introduce a language and structure that enables meaningful communication that integrates the concepts into a holistic system.

2.1 Integrating the Perspectives

The objective is to provide integrate the perspectives into a holistic model. This requires:

- The development of the criteria to be used in the integration,
- The creation of an architecture that is implementable, and
- Defining the concepts for each perspective and their integration.

Figure 1 defines the main perspectives and criteria for linking them. The criteria are shown on the links between the perspectives. For example, business activities are related to the social structure through responsibilities allocated to roles in the activity.

They are related to knowledge as they both need knowledge and use it to create new knowledge. Social structures are related to knowledge as knowledge is created through social interactions in the business activities supported by technology. The business process organizes the activities into a process.

The next is to define an architecture that combines these dimensions. This is called a blueprint based on design science ideas.

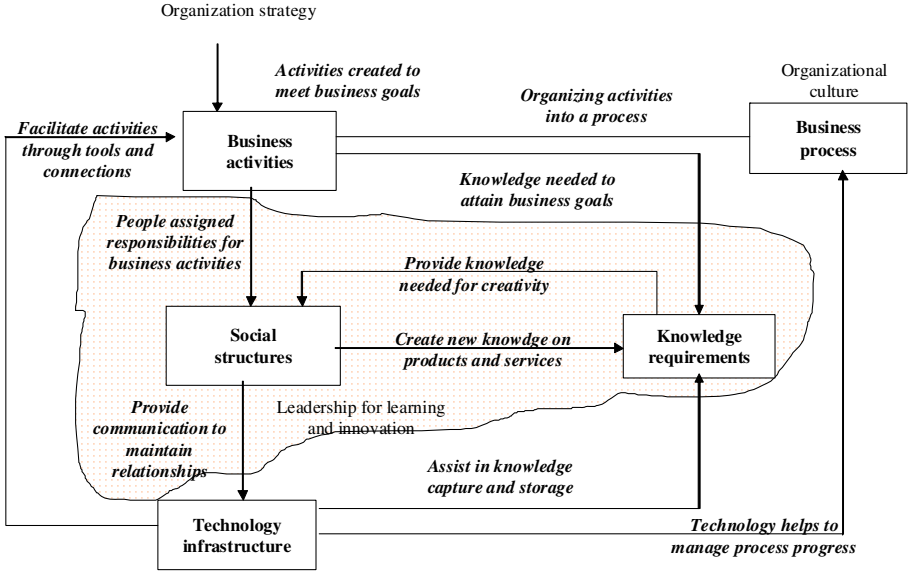

Fig. 1. Criteria Combining the Perspectives

3 An Architectural Blueprint for Design

Collaboration support must go beyond many current informal approaches of encouraging meetings and e-mail communication. These often focus on making collaborative technologies available but leaving it up to users to identify where to use the technologies, without identifying any particular long-term business benefit. Such uncoordinated use can be counterproductive as suggested by Hansen [12] as people may spend considerable time communicating without attaining a useful outcome.

The design blueprint proposed here follows the suggestion by Pisano and Verganti [11], who define a number of different strategies for collaboration support. They propose the idea of creating a *collaborative architecture* that customizes collaboration for a given network. The business value of the collaborative architecture is clearly identified by the kind of knowledge created during the collaboration.

The paper addresses ways to create such collaborative infrastructures focusing on the evolving service environment [7]. The paper distinguishes between business architecture, collaborative architecture and collaboration infrastructure. In this terminology:

- Business architecture are the way work is organized within business activities to achieve a particular objective. This can focus on delivering new products or services or in the collaboration needed to form business networks to deliver innovative services,
- The collaborative architecture is the ways that business entities collaborate within the business architecture to achieve their business goals, and
- The collaboration infrastructure that supports the collaboration including technology support through social or other software.

4 Design Process

The method proposed here focuses on defining the requirements for collaborative business activities, including their collaborative architecture. The paper describes a method that follows this structure to support business collaboration focusing on ways to support service industries. In selecting such a method a criterion is to decide on a driving perspective. It differs from many of the current design methodologies as it places greater emphasis on social structures early in the design. A further difference is that the emergent nature of collaborative processes is not easily modelled using the more structured modelling tools found in most methodologies. The collaborative nature of the target systems requires greater emphasis on knowledge sharing and the way collaborators can use and create knowledge in their business.

Figure 2 illustrates a simple form design process that commences with business activities and knowledge. More details can be found in [12]. The design steps in the design process include all the perspectives. The design process is not necessarily sequential although the number in each step indicates a possible sequence. Each design step uses some guidelines and produces an outcome.

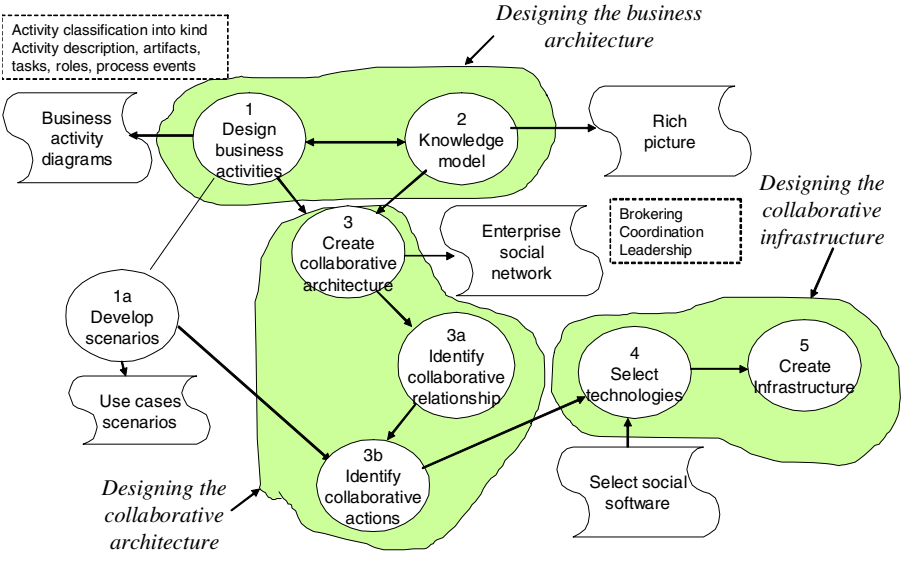

Fig. 2. Design process

The process begins with defining the business activities (step 1 i9n Figure 2) and their knowledge requirements (step 2). Scenarios (step 1a) can be developed as part of the business activities. Next we the collaborative architecture is defined (step 3). The collaborative architecture defines the roles, their responsibilities and the relationships between them.

The next sections describe the modelling concepts for the various concepts and their integration.

4.1 Modeling the Business Activity Perspective

The concepts for business activities can be used to define business activity diagrams. This can both serve as a specification or as a cognitive view of the business system. Figure 3 illustrates a business activity diagram. Here the clouded shapes represent activities, black dots represent roles, and disk shapes represent artefacts. Figure 3 is a model of a typical process of an organization responding to a tender. The main activities are:

- Developing a technical solution, which may be a building a road design,
- Developing the cost response part,
- Development of an implementation plan including fitting in with local factors such as construction rules and environmental standards.
- Assembly of the three parts and their combination with the personnel records of people who will be involved in the response, and the track of the responding organization.

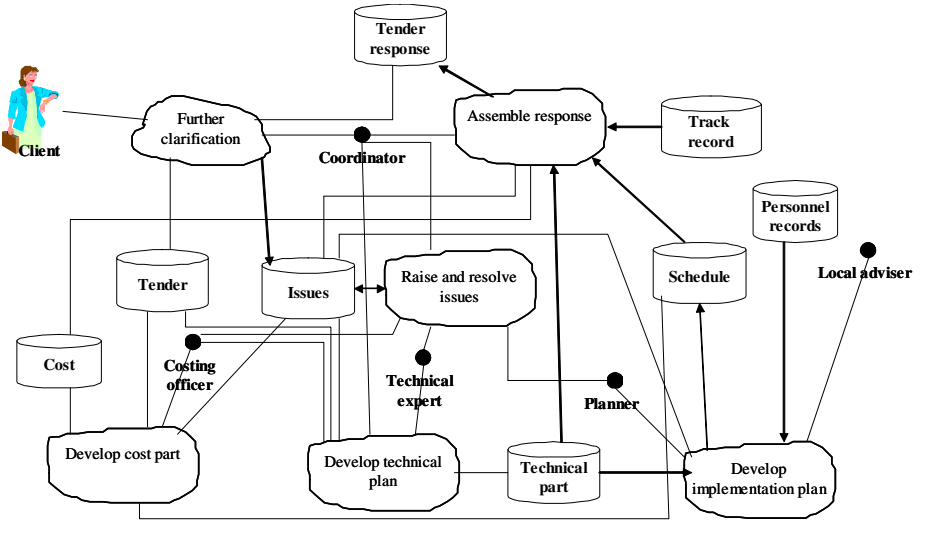

Fig. 3. Business activities in tender response

There are also formal collaborative activities such as resolving issues and ensuring consistency between the response parts. The degree of cooperation here is very high. Often there is need to get hold of experts in any of the three parts and to get clarifications from the client. The processes and activities can quickly change. There may suddenly be a need to make an environmental study or seek special approvals from local authorities.

Figure 3 shows part of the knowledge and social perspectives. It shows the artifacts or explicit knowledge that is available. This is the tender, various personnel records, track record of previous projects and so on. It also shows the roles needed in each activity to organize the activity and produce the necessary outputs.

4.2 The Knowledge Perspective

The knowledge perspective is generally not highly structured and rich pictures are proposed as the modeling tool to emphasize the tacit part of knowledge. Figure 4 gives an idea of the kinds of knowledge created and used by the different roles in the business activities. The kinds of knowledge created are possibilities through matching different kinds of existing knowledge through socialization and then externalizing it in codesign to create new knowledge, in terms of combining identified services. It shows in an informal manner the kind of interactions and the emergent activities that are often part of knowledge based enterprises. Thus for example the rich picture shows that ideas come up, they can result of suggestions for new initiates that are often further elaborated in meetings.

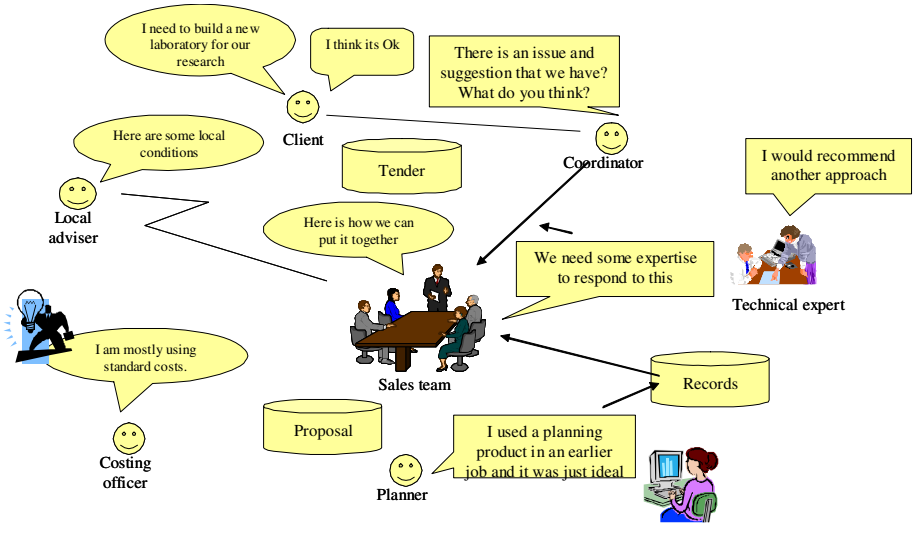

Fig. 4. A rich picture showing knowledge requirements

4.3 Concepts for the Social Perspective

Social network diagrams have been widely used to model relationships between people. These have been extended in a variety of ways to suit different purposes. Business

collaboration requires a clearer definition of what the people do and how they should collaborate in their work. At the same time, the chosen structures must naturally support the social acceptance of any new design. The extension is relatively simple. The link to business activities is through roles. The roles have defined responsibilities and the communication that forms part of these responsibilities is also included in the ESN.

Figure 5 shows the notation used in ESNs. Roles are shown by the black dots whereas individuals are shown as a face. The labels attached to each role show the role responsibilities and the labels attached to the lines joining the roles show the interactions between the roles. It is these interactions that often capture much of the knowledge needed in future decisions. Thus in Figure 5, X1 and X2 occupy roles A and B respectively and through their interaction create some knowledge. Often this created knowledge is based on interpretations by the individuals using their tacit knowledge. In implementation such created knowledge can be captured using the different Web 2.0 systems now becoming more commonly available. Dotted lines are sometimes used to show the informal relationships in the system.

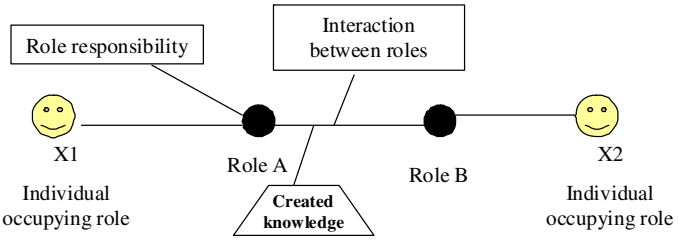

Fig. 5. ESN Notation

The ESN for tender evaluation is given in Figure 6. It shows the roles and their interactions and potential knowledge created during these interactions.

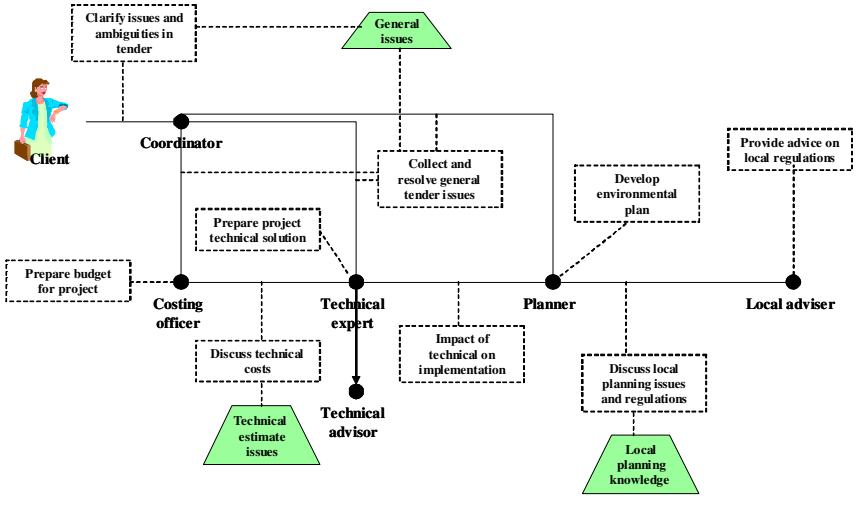

Fig. 6. ESN for tender evaluation

Completeness can be assured through checklists that ensure that all knowledge elements and roles are included in the ESN.

5 Conversion to the Collaborative Infrastructure

Technology requirements here are classified into the infrastructure and the interfaces provided to users. One requirement is a social database that stores the relationships illustrated in Figure 7. The requirements are:

- Ways to support the social network and capture the knowledge,
- Business activities and roles created in these activities
- Governance of assigning people to roles.

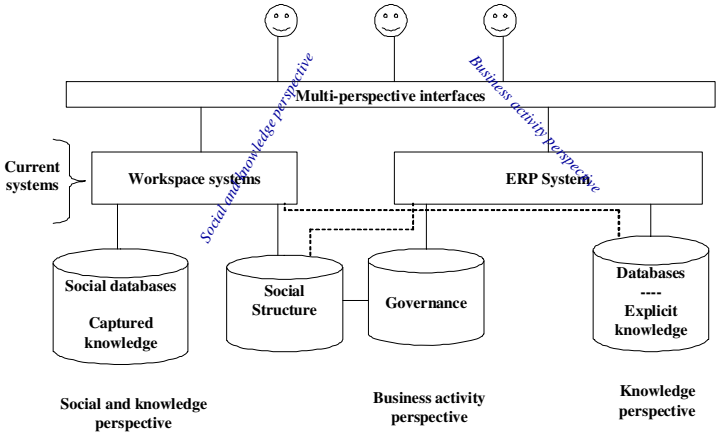

Fig. 7. Current technologies

A broad analysis of current technologies is illustrated Figure 7. There is usually a division between that part of a technology infrastructure that supports business activities and that which supports social structures with knowledge often shared between the two. Business activities are usually supported by ERP systems together with databases that hold the explicit knowledge. Social activities are usually supported by workspace systems of Web portals and often contain knowledge captured as part of social interactions. The challenge is to somehow combine the two parts into an integrated structure.

5.1 Combining the Perspectives to Create an Infrastructure That Integrates Knowledge, Social Structure and Activity

In this sense we look at each role from the knowledge perspective and decide on the support needed by the roles to support its activities. An enterprise social network (ESN) diagram is used for this purpose. The architecture here is to create the collaborative

infrastructure composed of the kind of services found in Web 2.0 or software services. The idea is shown in Figure 8.

Examples here include:

- A wiki is setup to construct the local environmental plan, with experts and internal staff contributing to it,
- A general issues discussion that involves most of the task leaders.

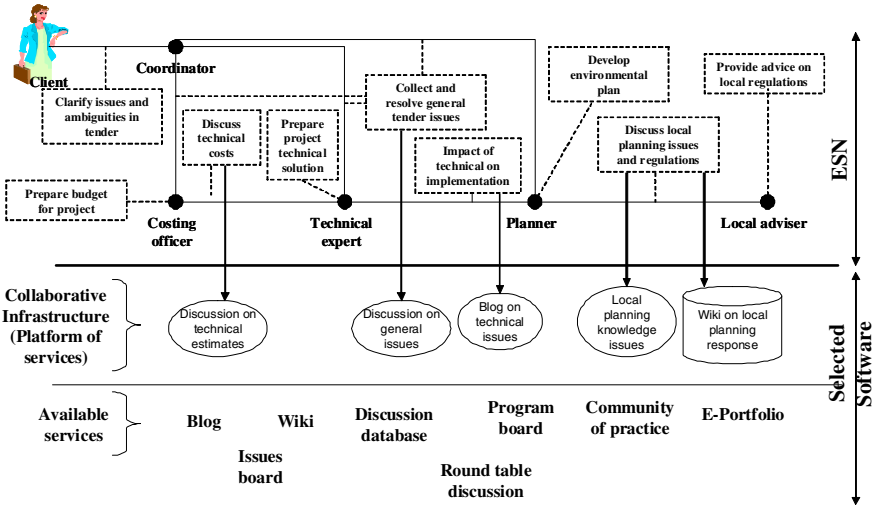

Fig. 8. Enterprise Social Network

6 Infrastructures for Supporting the Collaborative Architecture

Lightweight platforms that support adaptive systems and support user activated process realignment should include the concepts defined for the collaborative model while providing commands to easily create and change the structures of workspaces.

Commercial systems in this area focus on middleware software that provides the commands that allows users to use the middleware functionality to create workspaces. Furthermore, it should allow users to change the workspaces as work practices change. Many manufacturers are now providing ways to integrate the kind of software with enterprise applications. A typical example here is Websphere provided by IBM. The challenge in many such systems is to provide ways to share knowledge across activities. They provide access to corporate databases but often do not support the sharing of knowledge collected in the course of knowledge work in identifying and solving problems, and making decisions.

6.1 Groupware Platforms

One question is what kind of commands should be provided to knowledge workers to realign collaborative support to their changing collaborative activities. Our experimental

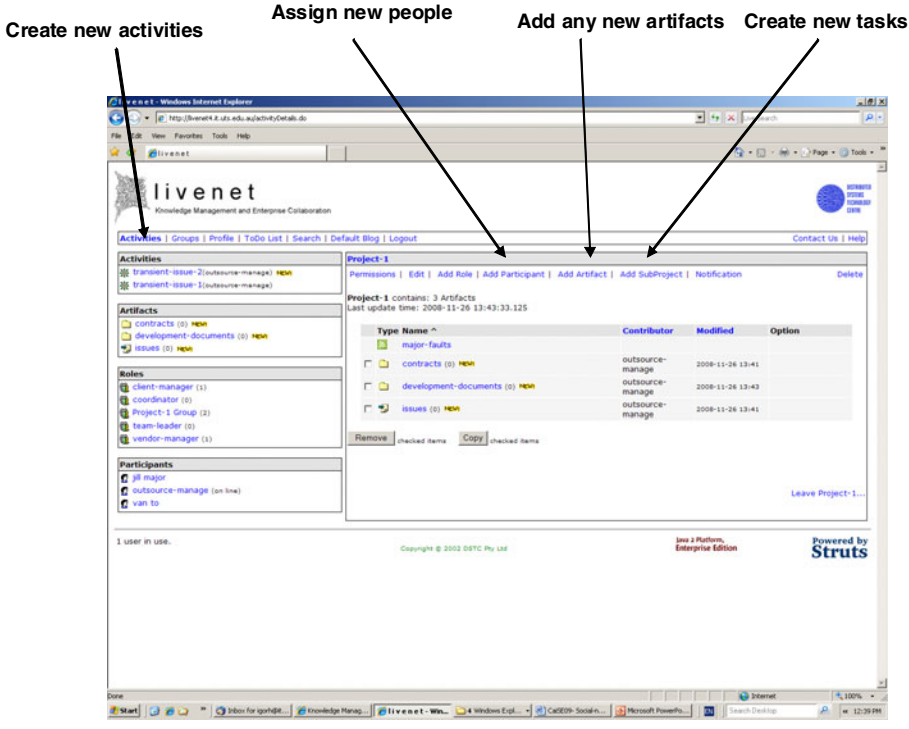

Fig. 9. A Demonstration Workspace

system, LiveNet, demonstrates the kind of support needed by workspace systems. Figure 9 shows the LiveNet interface and its typical commands.

It provides a menu that can be used to create new collaborative objects, including activities, roles, and artefacts. It also enables people to be assigned to the roles. Apart from these elementary operations the system includes ways to implement governance features as for example allowing roles limited abilities to documents. The system includes support for sharing artifacts across workspaces and a permissions structure to control such sharing. Social software such as blogs or discussion systems is supported and can be shared across workspaces.

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7 Summary

This paper focused on identifying perspectives for designing processes that focus on innovation within complex business environments. It introduced the idea of integrating social networking into the process and suggested collaborative infrastructure as a way to realize such processes. It then described the important factors in combing perspectives into a methodology. These included identifying the criteria for the links, links between the concepts in each perspective and an implementable architecture.

The next step is to add organizational structure and human relations factors as perspectives. This will extend the model to include organizational unit responsibilities and the governance structure. It will also enable the model to clearly show team structures and their organizational representations as well as the extent of knowledge sharing across the whole organization. The human relations factors will provide ways to match people to role in business activities.

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