# **Internet-Based Collaborative Tools for Small and Medium Enterprises**

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#### Abstract

Organizations that aim to achieve the agile manufacturing status must not only rely on the advancement of the production facilities, but also must strive to build the "soft technologies and tools" such as the applications of manufacturing information system, collaboration strategies, and Internet technology in order to improve productivity as well as creating fast response system to meet the customers demand. This paper reviews some of the Internet-based collaborative tools and products aimed at improving the SMEs competitiveness. It also presented a collaborative effort between three distributed business partners involving in designing and manufacturing of a product model utilizing the collaborative tool of Microsoft NetMeeting. This technology is readily available and SMEs are urged to use it to improve their competitiveness.

#### Keywords

Internet-based manufacturing, collaborative, small and medium enterprises, e-manufacturing, competitiveness

# **1. Introduction**

Traditionally, improvements on productivity were realized mainly by production technology upgrade, economies of scale, and the vertical integration of enterprise. Competitive edge is achieved by means of mass production, where maximum profit was generated by reducing the production cost of goods through specialization and division of labor. However, this strategy is no longer dominant in today's business world. The global manufacturing competitiveness of the twentyfirst century lies on the manipulation of a flexible, agile, high added value, and small batch production technology for mass customized products in a variety of less stable market [1]. Organizations that aim to achieve the agile manufacturing status must not only rely on the advancement of the production facilities, but also must strive to build the "soft technologies and tools" such as the applications of manufacturing information system, collaboration strategies, and Internet technology in order to improve productivity as well as creating fast response system to meet the customers demand. The strategy that embodies the usage of Internet technology to improve productivity is universally applicable even to small and medium enterprises (SMEs) and seems to be the only way to survive in today's intensively competitive era [2].

Despite the widespread publicity of information technology, the application of Internet technology to upgrade and enhance the product design and business operation for the SMEs is still at its infancy [3]. However, there has been a significant growth in collaborative products and services aimed for this category of industrial sector [4]. Aimed at small and mid-sized businesses, these products perform variety of tasks including scheduling, project management, Web-based video conferencing, data sharing, and supply chain management. This paper reviews some of these products and presented a collaborative effort between three distributed business partners involving in designing and manufacturing of a product model utilizing the collaborative tool of Microsoft NetMeeting.

# 2. Internet Technology and SMEs

Schlenker and Crocker [5] defined information technology as the use of management and processing of information through a system comprises of hardware, software and human-ware. Normally this system is confined within a specified organization. As there are needs to extend the information sharing with other organizations, the Internet technology emerges, where public and private telecommunications networks are utilized to establish the connections. These are known as Intranet for connection limited to only within the firm, the Extranet for connection between the firm and its trading associates, and the Internet for connections between the firm and the rest of the world. With Internet technology. the information system in a firm can be shared with clients, business partners and stakeholders that utilized the common information resources to establish business decisions and actions. The major hardwares needed are only telecommunication system and computers.

SMEs consider computers as important tool for processing information in their daily business activities especially in the function of spreadsheets, word processing [6], accounting and stock management [5]. In a study in Australia, 88.8 percent of the SMEs had Internet connection with vast majority of them utilize it for e-mail communications [6] either with clients, vendors or suppliers. Less than half of these SMEs had a web-page and even only small minority of them use the Internet for business transaction. It is very unfortunate that SMEs limit the usage of computer and Internet technology to merely in-house data processing and e-mail, whereas the larger corporations are benefiting a lot more from the similar technology. Some researchers proposed e-business adoption as a practical tool to maintain the competitiveness of SME in today's globalization era. ebusiness is defined as any business carried out over an electronic network [7]. This include exchanging data files, buying or selling goods on-line, having a website and using other companies websites in the firms activity. The concept of e-business enlightens the real potential benefits of Internet technology towards business enterprises.

Internet technology enables SMEs to collaborate with each other or even with large enterprises at faster speed and lower cost [8]. This can be achieved through connection with the companies manufacturing or supply chain system, which reduces coordination cost between the parties involved. On the other end, information can also be shared with customers either at the beginning of a design process or even at the middle of the production in order to keep the customers informed about the product status. Some researchers identify this benefit as a service that gives the impression of a large-scale enterprise to the SMEs [8]. Others identify the benefits of adoption to the internet technology as a means to achieve better relationships with customers and suppliers, increased information, increased visibility, competitive advantage, access to new markets, real time communication, increased knowledge, greater efficiency, cheaper promotional cost, more even playing field between small and large firms, new distribution and communication channels, and better targeting of customers [7]. Organizations that refuse to adopt this emerging technology will be lagging behind the market, missed opportunities, continued to reliance on traditional methods of business, bearing conservative image, lost customers and face new barriers to entry over time.

Even with all the benefits of the Internet technology well defined, there are clear documented evident that most SMEs are reluctant to venture into the proposed system [6]. The prominent reasons for not adopting the Internet technology system are issues relating to security and privacy of transactions, cost of consultants, lack of government incentives, and lack of expertise among staffs. For most SMEs, Internet technology system is too abstract for them to absorb. Nevertheless, they will be willing to adopt the technology if there are proofs showing the success of the system among SMEs at a reasonable cost. SMEs are normally very cautious about new capital expenditure for Internet technology. They will never venture into the system unless they are very sure that it will help them to generate more income or they will loose the business if they do not take up the system.

With proper deployment strategy, Internet technology can definitely add value to the firms' products and services [5]. The system allows the SMEs to understand their clients better, the needs of the supply chain, and the costs and benefits of their activities. The proposed system must be associated with ease of use, ability of the firms to understand and manage their daily processes or activities, improving relationship with customers, establishing business partners, and supporting organizational change within the firms and the supply chain.

### 3. Collaborative Computing Software

In supporting the collaborative effort between two or more geographically distributed parties, the tools that normally required are synchronous and asynchronous collaborative tools [9]. Synchronous tools are specifically meant for real time communications while, asynchronous tools are meant for non-real time communications. Some examples of synchronous tools are video conferencing, whiteboard, chat sessions, and sharing geometric models to provide a virtual meeting environment. The asynchronous tools are such as email and file upload or download from a database.

The collaborative tools or collaborative computing software have gained quite a substantial growth in recent years. These tools range from software for the purpose of conducting virtual meeting over the Internet to a lot more sophisticated products which allow on-line collaboration, managing projects and sharing of documents whether in synchronous or asynchronous mode. Some of these programs are available for free such as Microsoft's NetMeeting while some others are fairly expensive. All of these available collaborative computing software can be divided into seven major categories [4]:

(i) Virtual meeting. With this tool, employees at different geographical locations can attend meeting regularly without having to leave their offices. These meetings can be conducted either in synchronous mode such as with chat rooms or asynchronously, such as utilizing the message boards. Participants in the virtual meetings can perform various normal meeting functions including idea generation, brainstorming, group outlining and voting. They can even have a discussion in teleconferencing mode.

Table 1 illustrates some of the popular collaborative software programs belong to this category.

- (ii) Teamwork. Collaborative technology indeed provides a very substantial infrastructure when it comes to teamwork. A group of employees, customers, or suppliers from distributed geographical locations can assemble in cyberspace and use the web-based tools to accomplish and divide tasks. When the work is done, the electronic room is closed and the virtual team is dispersed.
- (iii) Project management. Project team can access a special web site specifically set up as a hub for the project. The web site contains all tasks and schedules for the projects which include engineering drawings, maps and other relevant documents. Project teams can simultaneously access schedules and reports, manipulate information and give instant feedback. Managers can delegate tasks, coordinate resources and receive updated information.
- (iv) Supply chain collaboration. This tool enhances buyer-seller relationship. The collaborative effort enables partners to work together to gain a better understanding of future product demand and allows all parties involved to establish more realistic plans to fulfil the customers requirement. The software can improve supply chain performance by allowing collaborative demand planning, logistics planning, scheduling, package design, synchronized production, and new product development.
- (v) Internal broadcast. This tool services can serve thousands of simultaneous users. They enable users to broadcast live and on-demand audio and video presentations over the web. They are suitable to be used for training sessions, product launches, technical briefings, trade shows, press conferences, earning announcements, distance learning and similar tasks.
- (vi) Information sharing. The software packages in this category include tools for storing, indexing, and retrieving documents and images which can be stored and retrieved via the web browsers. The SMEs can even use this software to manage the freely available file storage services provided by some web sites.
- (vii) Virtual jam. This tool is used by musicians to establish long-distance collaboration over the internet. Musicians can share files and can jam with likeminded musicians around the world. Artists may even be called for song recording while they are on tour. With this software, collaborating composers can send draft scores to each other for fine-tuning, rather than doing the process in a more costly studio setting with live musicians.

#### 4. Implementation and Application

Based on the literature review, a conceptual approach to implement and apply the collaborative tools is developed. Microsoft NetMeeting 3.0 was selected for this

implementation because of its freely available and comes with variety of collaborative tools. As illustrated in Figure 1. designers, customers, and production expert whom are all located at different locations can simultaneously be involved in a design review in real time. Upon completion of the first round components design, the designers initiate a virtual meeting via Microsoft NetMeeting with both customers and production representative for preliminary product review. CAD drawing or 3D virtual solid model can be simultaneously visualized by all parties involved. The customers can give comment on end-users and marketing perspective while the production representative can give input pertaining to the manufacturability of the product. These simultaneous discussions and feedback are materialized via the chatting medium or by using the whiteboard. Minor alterations recommended by any of the participants, can immediately be implemented on the CAD drawing or the 3D solid model for further evaluations and discussions.

Table 1: Collaborative Software Programs for Virtual Meeting (Attaran and Attaran, 2002)

Meeting (Attaian and Attaian, 2002)	
Name/Company	Features
eRoom/Instinctive Technology	Offers a virtual workspace on the web for multi-threaded and multi- topic discussions, real time messaging, polling, and data retrieval. Designed for servers. Single-user versions are also available.
WebEx Meeting Center/ActiveTouch	Offers a wide range of functions, such as message services, conference setup, tele- conferences, document sharing, and meet-me-services. The software can be installed at the user site or hosted as an outsource service by Active Touch for a monthly service charge.
Group Systems/ Ventana	This software suite offers ranges of meeting functions, including electronic brain-storming, ideas generating, and voting.
Netscape Virtual Office/Netopia	Originally designed for helping users to create a web site, but it also offers meeting functions, including chat rooms, screen sharing, and file and information exchange.
NetMeeting 3.0/ Microsoft	This Internet conferencing tool enables up to 30 users to connect on a corporate intranet. It offers a wide range of conferencing tools including chat, virtual whiteboard, document sharing, audio, video, and file transfer



Customers at Location B

1. Callabaration American b Car Dealart

### Figure 1: Collaborative Approach for Product Visualization at Design Stage

Upon agreement by all three parties involved in the virtual meeting, the designers can finalize the design. They can then use the CAM software to generate the tool path for the CNC machining requirements. Appropriate post-processor is then used to generate the proper CNC program. This CNC program is then sent to the production office via the file transfer function within the NetMeeting software. Upon receiving the CNC program, the production representative can verify the program by simulating it on the CNC machine. Minor adjustment to the program may be necessary especially in selection of tools and cutting parameters.

The above illustration and description of the collaborative effort has been applied in a process of designing and manufacturing a prototype model of a roof tile. Figure 2 illustrates a virtual meeting initiated by a designer via Microsoft NetMeeting with two other parties involved whom are the customer and production representative. All the three parties are operating at different locations. The designer activated the NetMeeting first at his Internet-enabled workstation and selects to conduct a host meeting. He also has to allow the desktop sharing so that what ever appears on his computer screen

can be visualized by the other participants. The other participants are connected to the virtual meeting by dialling the IP address of the designer's workstation through NetMeeting software. As all the meeting participants are viewing the same object on their computer screens, the meeting discussion are started utilizing chat session as a medium of verbal communication.

After noting all comments regarding the top face of the product, the designer then rotated the object to visualize the bottom face of the product. All participants will visualize the same object almost in real time and resumed their discussions. Figure 3 shows the comments made by the production representative regarding the interlock system of the roof tile. The sketches on the virtual meeting screen and text comment are made by utilizing white board medium. Finally when all comments have been adhered to, the related post-processed CNC programs which consist of both top and bottom face machining are sent to the production representative for the machining purposes.

### 5. Conclusion

The paper has discussed the application of Internet in conducting manufacturing collaborations. The example provided concerning collaborative design using Microsoft NetMeeting illustrated that such technology can be made available to SMEs at minimal and economical cost. The Internet technology is readily available and has already been a part of the SMEs tool in their day-to-day operations. Expanding the application of the Internet will not be difficult but its effect in terms of competitiveness improvement is tremendous. SMEs are urged to utilize this technology for their own future growth and survival.



Figure 2: Virtual meeting discussion over the top face of a roof tile 3D model utilizing chat session



Figure 3: Sketches and comment made by virtual meeting participant utilizing white board medium

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