# An organizational information network for corporate responsiveness and enhanced performance

*Gülçin Büyüközkan*

**The author**

**Gülçin Büyüközkan** is an Assistant Professor at Galatasaray University, Industrial Engineering Department, Istanbul, Turkey.

**Keywords**

Information networks, Information systems, Organizational change, Corporate strategy

**Abstract**

Today, companies are confronting a changing environment, which has never been faced before. It has been well accepted that with recent technological advances, barriers are eliminated and a new global market has been established. In order to obtain better results and customer satisfaction, the companies have to listen the voice of the customer and to produce value added products and services by reducing the cycle time. This requires an active and an effective management of operational functions and customer/supplier relationship. Information systems and technologies are the most important strategic tools supporting information and knowledge management in order to increase corporate responsiveness and enhanced performance. The objective of this study is to suggest an information-based responsive organizational network framework supporting efficient management of company-wide functions and customer/supplier relationships.

**Electronic access**

The Emerald Research Register for this journal is available at
**www.emeraldinsight.com/researchregister**

The current issue and full text archive of this journal is available at
**www.emeraldinsight.com/1741-038X.htm**

Journal of Manufacturing Technology Management
Volume 15 · Number 1 · 2004 · pp. 57-67

· ISSN 1741-038X
DOI 10.1108/09576060410512310

## Introduction

Today, companies are confronting a changing environment, which has never been faced before. It has been well accepted that with recent technological advances, barriers are eliminated and a new global market has been established. This globalization process brought common economic policies and competition as well. The competition takes place not only between local companies but also between corporations spread all over the world. Corporations, which had no difficulty in selling their products or tried to stand firm against the competition in the past, find themselves in an uncertain and a highly competitive environment. In order to obtain better results and customer satisfaction, companies have to listen the voice of the customer and produce value added products and services by reducing the cycle time. This requires an active and an effective management of operational functions and customer/supplier relationship. Information systems (IS) and information technologies (IT) are the most important strategic tools supporting information management (IM) in order to increase corporate responsiveness and enhanced performance (Goldman *et al.*, 1995; Kalakota and Whinston, 1997; Gunasekaran, 1998; Jagdev and Browne, 1998; Coronado *et al.*, 2002; Gunasekaran and McGaughey, 2002).

Managing information well needs adequate and effective flow ordering. After this rearrangement, information validity and reliability should be monitored by well-defined control points. The aim of IM is to get rid of the unnecessary information in order to process and collect the appropriate ones. This is because the redundant information mass seriously decreases the speed of the information flow and reduces productivity. What lies in the very heart of the information management is to transmit the right information to the right person at the right time (Davenport, 1997). For this reason, we need a well-designed and a well-managed information flow structure, which assures improved organizational

Received September 2002
Revised April 2003
Accepted Jnue 2003

Journal of Manufacturing Technology Management
Volume 15 · Number 1 · 2004 · 57-67

responsiveness. Organizational information network is about applying both IS/IT and network infrastructure to enhance the effectiveness of all areas of business on the process, system, enterprise and supply chain levels. A responsive enterprise information system should accordingly require an appropriate and interactive structure to be compatible with today's complicated market situations (Shaw, 2001). With information (used in this study by means of data, information and knowledge trilogy) being considered as an integral part of the organizational network, such ISs should also be regarded as an essential ingredient to provide the customer and supply chain partners with the ability to observe, recognize, plan, model, join and exchange available resources (Lau and Lee, 2000).

The objective of this study is then to provide a conceptual framework, which is a business rather than a technical context, for information based responsive organizational network to support efficient management of company-wide functions and customer/supplier relationships.

The remainder of this article is organized as follows. Next section presents briefly the concept of corporate responsiveness. The following sections are concentrated on the description of some specifications of organizational network and information-based network respectively. The next section details the proposed organizational information network framework. In the last section, some concluding remarks and possible extensions are given.

## Corporate responsiveness

In a changing competitive environment, there is a need to develop organizations and facilities significantly more flexible and responsive than current existing ones (Booth, 1996; Gunasekaran, 1998). Agility requires the capability to survive and prosper in a competitive environment of continuous and unpredictable change by reacting quickly and effectively to changing markets, driven by customer-designed products and services (Cho *et al.*. 1996). Over the past decade, there have been a large number of papers concerning the strategic importance of agility, especially for manufacturing (for example Youssef, 1992; Cho *et al.*, 1996; Gunasekaran and Yusuf, 2002; Sharifi and Zhang, 1999; Yusuf *et al.*, 1999). Agile production is characterized by: customer integrated processes for designing, manufacturing, marketing, and support for all products and services; decision making at functional knowledge points; stable unit costs; flexible manufacturing; easy access to integrated data; and modular production facilities (Abair, 1997).

The focus is on the integration of critical functional areas with the help of advanced technologies and alignment between strategies (Gunasekaran and Yusuf, 2002).

According to Sharifi and Zhang (1999), the capabilities that an agile organization necessitate to respond better to changes taking place in its business environment, are basically divided into four major categories: responsiveness, competency, flexibility and quickness. In reality, all these categories are also inter-related. Responsiveness, which is our key subject, is the ability of a company to gather information from its commercial environment, to identify changes and respond quickly to them, reactively or proactively, and recover from them (Sharifi and Zhang, 1999). In this sense, "zero waste total cycle time" and "zero waste information flow" are the prerequisites that enable responsiveness (Mason-Jones and Towill, 1999).

Corporate responsiveness imposes special requirements on the IS used to run an enterprise. In addition to satisfying the traditional requirements, a responsive organizational IS should be able to reconfigure in a very short time and include parts of IS from other companies. Given the importance of IT/IS to support the concept of responsiveness, Huang and Nof (1999) classied the impact of modern IT in three categories:

(1) speeding up activities;
(2) providing intelligent and autonomous decision-making processes; and
(3) enabling distributing operations with collaboration.

We integrate all these issues in our proposed organizational information network framework

Journal of Manufacturing Technology Management
Volume 15 · Number 1 · 2004 · 57-67

as it will be given in detail in the following sections.

## Organizational network

Network is not a new idea, but has become increasingly sophisticated with the understanding of virtual relationship and teaming processes.

As an organizational structure, the network may be conceived as a set of nodes and links, where each link carries flow and represents a relation. In an industrial context, a node points out an economic unit, which may be, depending on the perspective and scale of the analysis, an individual, equipment, a service, a department, an enterprise, or even a group of enterprises. The flow of a link corresponds to a flow of materials between two nodes where these materials represent tangible products or services as far as intangible ones (Poulin *et al.*, 1999). A relation shown as a link describes the management style applied on flow transit and references particularly to common objectives, to a type of partnership and to the rules of the network function. In the field of our concern, we utilize the term of organizational network to reference three perspectives: people, processes, and technologies:

(1) People network is essential to the concept of teams. Network means communicating, coordinating and cooperating, and teams do their work largely through information sharing.
(2) Equally important are process networks: the designed use of information sharing mechanisms and applications to facilitate the accomplishment of work.
(3) The technical network is required to exchange and share data, information and expertise between local networks, in which the nodes are positioned inside a building or a group of buildings (LAN: local area networks; MAN: metropolitan area networks) or extended network, from which the nodes are physically removed (WAN: wide area networks) (Reix, 1995).

Table I shows the organizational network characteristics for the development of a product specification (Metes *et al.*, 1998).

Organizational network then, in the sense that we use it here, is a structured work model that supports distributed nodes using information technologies to accomplish information and knowledge-based work.

## Information-based network

The purpose of an appropriately designed enterprise system can be classified into two categories: better information management and operations improvement (Kang *et al.*, 2001). Information plays several supporting roles in efforts to make processes more efficient and effective, while IM itself sometimes leads to radical performance improvement. In this context, IS have become the nerve center of most systems (Shaw, 2001). It enables the enterprise infrastructure to integrate operations with related business processes, such as filling orders or product development for manufacturing.

Because of the rapid advancement of IT in recent years, it has become increasingly important to consider the effects of the function and performance of systems on the enterprise as well on inner organizational levels. As operations become increasingly global, proper coordination between the business and manufacturing units in the value-adding chain needs special attention. IS can help to provide that coordination. The key components of information-based network may be proposed as shown in Figure 1.

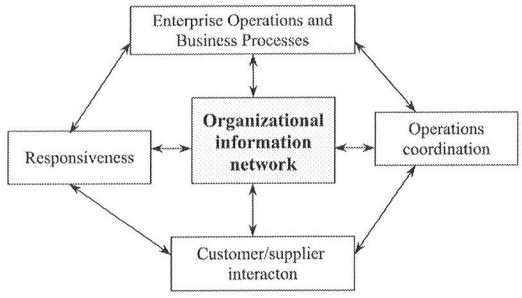
Information-based operations is characterized not only by the ready availability of information but also by the focus on connectivity. Furthermore, the IS and IT can be used to foster the necessary integration and coordination.

IS may be more, or less IT-based. IT is taken to refer to the hardware, software and communication technologies – essentially equipments – and attendant techniques, whereas IS represent a wider concept referring to how designed information flows attempt to meet the information needs of the organizations (Willcocks, 1994). In this study, IT covers all the equipment required to run the business while IS is the application responsible for managing the information flow through the

**Table I** Organizational network structure for development of a product specification (Metes *et al.*, 1998)

| | People network | Process network | Technological network |
|---|---|---|---|
| **Nodes** | Participants from different companies | Products, information objects, documents | PCs, e-mail, shared computer aided design (CAD), video conferencing equipment |
| **Links** | Relationships, trust, knowledge sharing, expectations | Time, information and knowledge flow | LANs, WANs, etc. |
| **Objective** | Drawn together to develop specification | Tasks, timescales | Configuration of the network |

**Figure 1** Basic components of organizational information network




elements that constitute IT. The set of IS/IT proficiency characteristics that supports the corporate responsiveness is defined by Coronado *et al.* (2002) and summarized as the following:

(1) Proactive proficiency characteristics (Coronado *et al.*, 2002):
- *Creation*: designing an infrastructure of global interaction standards that permits local solutions.
- *Augmentations*: improving the standards without impacting operational applications.
- *Comparison*: watching developments in information technology applications.
- *Migration*: anticipating future electronic interactions with customers and suppliers.
- *Modification*: adding new standards to the infrastructure without wreaking havoc on existing unique implementations.

(2) Reactive proficiency characteristics (Coronado *et al.*, 2002):
- *Correction*: fixing an infrastructure that is overly restrictive.
- *Variation*: accommodating variations to the infrastructure standards for unique requirements.
- *Expansion*: expanding the internal user community and the number of supported business units.
- *Reconfiguration*: moving unique solutions from one business unit to another.

Based on the study of Applegate *et al.* (1999), we summarize the possible benefits of organizational information network for both organization and market/industry as shown in Table II.

## A framework for organizational information network

In order to improve corporate responsiveness and enhanced business performance, an organizational information network is needed. Figure 2 shows such a framework in a business context.

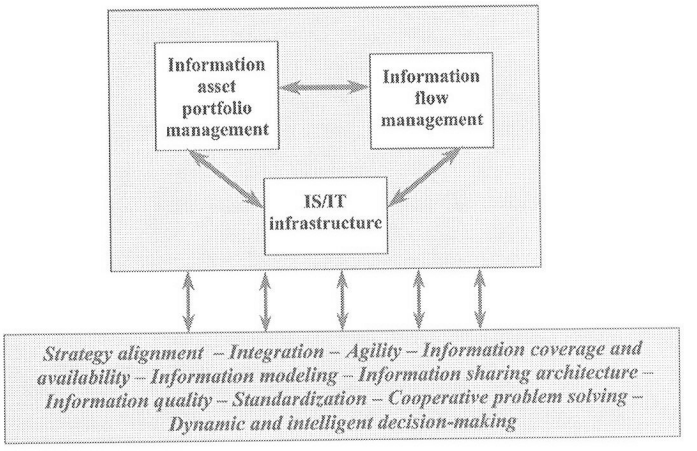
Key characteristics of proposed framework can be summarized as follows (Korhonen *et al.*, 1998; Prasad, 2000; Lee, 2003):
- *Strategy alignment*: strategic direction and focus need to be derived from and guided by business strategy and key business process requirements.
- *Integration*: key aspects of integration that need to be covered are business process integration including customers and suppliers, end-to-end demand and availability information integration.
- *Agility*: flexibility and adaptability are of strategic importance: market and industry changes are today faster than ever, and being able to change and adapt IT solutions to new requirements rapidly is very important.
- *Information coverage and availability*: access to real time information of all operations and sharing them between all parties in the

**Table II** Possible benefits from organizational information network structure

| Organizational benefits | Market/industry benefits |
|---|---|
| Improve ability to share information; communicate, coordinate, and control activities inside the organization | Improve ability to share information; communicate, coordinate, and control activities with customers, suppliers, and business partners |
| Increase the functionality and flexibility of the internal IT infrastructure | Increase the functionality and flexibility of the industry IT infrastructure |
| Improve core operating activities inside the organization (e.g. procurement, sales, customer service) | Improve existing supply/distribution channels that link the organization to customers, suppliers, and business partners or create new ones |
| Improve decision making and enhance organizational learning | Exploit the economic value of information by adding value to existing products and services and creating new ones |
| Enhance collaboration and coordination of work and commitment and loyalty of individuals and teams | Establish a position at the center of an electronic market and maintain that position by ensuring loyalty of all members |

**Source:** Based on Applegate *et al.* (1999)

**Figure 2** A framework for organizational information network




network including internal and external customers and suppliers.

- *Information modeling*: it entails the use of various models that electronically represent, in convenient forms, information (knowledge, methods and data) about the product, process, and the environment in which it is expected to perform.
- *Information quality*: the quality of the end results of organizational information network depends on the quality of the information. Information quality can be described by the following characteristics: relevance, timeliness, flow continuity, validity, accuracy, intelligibility, accessibility and visibility.
- *Standardization*: standard means of exchange for information is accomplished by a slew of standardized support systems (computers, networks, tools, database, applications, procedures, etc.) to encourage the sharing of information among and between organization members.
- *Information sharing architecture*: this includes enabling technologies for CE ± multimedia communication, framework integration, enterprise integration and coordination in a distributed synchronous setting. Standardized means of information sharing foster effective communication among the many different personnel teams of the organizations
- *Cooperative problem solving*: it includes seven Cs such as collaboration, commitment, communication, compromise, consensus, continuous improvement, and coordination. It means sharing problem solving insight or deep information, so that instead of a single individual, the whole team can make joint decisions.
- *Dynamic and intelligent decision-making support*: decision making can be viewed as a process of creating an artifact that performs what is expected (specified as requirements) in the presence of all sorts of constraints and operating environment that governs its behavior. An IS should be capable of identifying exceptions in order to guide management attention and decisions to these critical areas. This is particularly important when the number of transactions, customers and products is large, and there exists a massive amount of information.

Farbey *et al.* (1995) and Hipkin (2001) categorize the benefits of IS applications in eight classification levels as follows:

Journal of Manufacturing Technology Management
Volume 15 · Number 1 · 2004 · 57-67

(1) Mandatory changes, introduced to ensure organizational survival.
(2) Automation, consisting of technologies for replacing existing systems.
(3) Direct value added systems, whereby effectiveness is improved through IT.
(4) Management information (MIS) and decision support systems (DSS), which improve management decision making.
(5) Infrastructure, which improves general capability through IT.
(6) Inter-organizational systems, catering for common usage of a system in a number of locations.
(7) Strategic systems, which directly impact on strategic direction.
(8) Business transformation brought about through IT.

This classification can be adapted directly for proposed organizational information network framework. We can then indicate that the network is generally introduced to achieve direct value-added benefits (level 3), MIS and DSS benefits (level 4), infrastructural benefits (level 5) and also inter-organizational benefits (level 6) through supply chain management and customer relationship management.

Our proposed framework includes then three approaches such as:
(1) Information asset portfolio management (static view).
(2) Information flow management (dynamic view).
(3) IS/IT infrastructure (technological view).

**Information asset portfolio management**

In order to create a documented information asset from the information inventory produced or used in the organization, we suggest following up a methodological approach, which is conceptualized in four steps:
(1) *Analyze the work*: all the works (or tasks) in the organization should be represented through a process charts.
(2) *Analyze existing processes, information flows and mapping*: the existing and necessary information sources and flows within the current processes should be determined.
(3) *Characterization of information*: the current organizational information sources and flows should be analyzed and the characteristics should be determined.
(4) *Creation of organizational information representation process chart*: the first process representation chart should be completed and improved by the integration of necessary contents.

This methodological proposition benefits from three theoretical bases. These are process view, information mapping and information characterization. At the same time, to support these approaches and to ensure organizational information representation quality, systematic questionnaire-guided interviews are utilized. Organizational information is then analyzed and defined by using structured questionnaires, open-ended questions and one-to-one interviews.

*Process view*: Lorino (1991) defines a process as a "sequence of activities executed to achieve an objective". With the system approach, this process model connects the activities and their relationships and it defines standards for flowchart, which are easily understood. In other words, process models are used to facilitate an organization's understanding of "how" it currently operates and "what" it actually does (Childe *et al.*, 1996). For a detailed analysis, the process can be deployed in sub-processes and activities. Therefore, we can state that the process view supports general and detailed views of an organization. It enables also managers and organizational analysts to analyze an organization consistently and in an integrated way with a top-down and bottom-up approach (Takahashi, 1999).

By looking at the company with the modeling approach, the departments of the company, the actors in the departments, the job descriptions of the actors, the activities the actors perform, the existing relationship between actors and all related information about current situation of the company have to be explained by a flow chart created in full detail.

*Information mapping*: in a business process, information exists in the form of data and in combination with experience, communication, reflection, expertise, techniques and cognitive abilities (Karagiannis and Telesko, 2000). The aim is to make the most detailed analysis of this organizational information under the possible

Journal of Manufacturing Technology Management
Volume 15 · Number 1 · 2004 · 57-67

conditions (cost, time, etc.). Starting from the modeled business processes of selected cases, information sources, information flows and information contents have to be identified.

*Information characterization*: from the information perspective, it is not only important to map information sources and information relations between different activities, but it is also important to qualify these relations. In other words, we want to evaluate the information process by its frequency, density, importance, direction of relation, types, etc.

A questionnaire that will be used as a tool to help the study of the organizational information characterization may include the following questions:

(1) In the analyzed process activity, with whom does the actor work or have an existing relationship with (inside and/or outside the company)?
(2) From this person (or group), what kind of information is attained?
(3) What is the input of this activity?
(4) What is the output of this activity?
(5) Is the information flow between the input and output processes unidirectional or bi-directional or multidirectional?
(6) With what frequency is the information is required?

The qualitative properties of the information assets can be determined from the answers of these and similar questions.

**Information flow management**

Information flow is accepted as the bloodline (Gates, 1999). The quality of information flows has an influence on the quality of the material flows. If the information does not arrive on time or is not valid, then it causes an incapable material flow. This will end with the dissatisfaction of the customer from the process. The role of the information flow can be defined as (Davis *et al.*, 1993):

- It carries out the treatment of the process in connection with the organizational deals.
- It supports the communication and the relation in each stage of the process.
- It supports the process activities' information as a resultant of analyses, plans and controls.
- It incorporates the customer data acquired from the environment or the resources into the process for the treatment and the delivery of a product or service.

The information flows should have the qualities mentioned before to improve the process.

There are several models to manage better information flows. Between these models, those that are developed actually are generally very complicated and often unusable by organizations. For this reason, we propose a simple generic model based on four steps:

(1) Identify the critical processes of the enterprise.
(2) Determine the types of information flows.
(3) Characterize the various aspects of the information.
(4) Measure the value of information flows.

By following these stages, the information flow of a critical process may be formalized to manage it better.

Information flows of an organization may be classified in relation to their direction (Forza and Salvador, 2001):

- vertical information flows are communications which take place along command chains, both downwards and upwards;
- horizontal information flows are communications which do not pass through the command chain inside the company (they mainly cross the same hierarchy levels); and
- external information flows are communications which link the company with other channel actors (mainly suppliers and customers).

The first two directions are arising from the internal organizational network view. The third direction is added to take into consideration the external organizational network with the growing importance of coordination for reaching higher performances. The information flows can be also classified in connection with their direction according to three manners: unidirectional, bi-directional and also multidirectional (Perry *et al.*, 1999).

The value of information flows may be also measured from different point of view (static, dynamic and context of information, etc.) with

Journal of Manufacturing Technology Management
Volume 15 · Number 1 · 2004 · 57-67

different approaches as proposed in Büyüközkan (2002) and Davis *et al.* (2001).

**IS/IT infrastructure**

The effect of the use of IT manifest itself primarily by making available the information required for the coordination, decision and negotiating processes within and between organizations. The logistical flow of information within an organization and also between organizations is optimized through the support and design of powerful IT systems to make the right information available at the right time in the right place and in the required format.

IT infrastructure is defined as the extent to which information and applications through communication networks can be shared and accessed for organizational use (Wyse and Higgins, 1993; Broadbent *et al.*, 1999). The main purpose of IT infrastructure is to provide consistent and quick information support throughout the organization to respond to dynamic challenges in the markets. Broadbent *et al.* (1999) argued that IT infrastructure consists of a portfolio of IT resources that are shared and used by firms. It consists of both technical and organizational capabilities to provide the opportunities to share IT resources within and across the firms (Broadbent *et al.*, 1999). Based on the study of Bhatt (2000), we used the following four dimensions of IT infrastructure:

(1) extent of intrafirm infrastructure;
(2) extent of interfirm infrastructure;
(3) extent of infrastructure flexibility; and
(4) extent of information integration.

The first three dimensions are also used by Broadbent *et al.* (1999) in their study of IT infrastructure and the fourth dimension is adapted from Mudie and Schafer (1985).

Theoretically, intrafirm infrastructure refers to the scope of communication networks within an individual organization, and interfirm infrastructure refers to the scope of communication networks beyond an individual organization. Infrastructure flexibility refers to the extent to which compatible standards and protocols exist to allow heterogeneous hardware and software to communicate and meet present and future business computing environments.

In sum, infrastructure capability captures the extent to which an organization's units and their respective information bases are made accessible internally and externally via electronic linkages.

All these dimensions may not separate, rather they are highly correlated to each other. Therefore, we combined and conceptualized them as organizational information network infrastructure.

Several technologies may be used, owing to their ability to facilitate the information flow through this network. We summarize them as follows:

- Electronic (e-) commerce is the term used to describe the wide range of tools and techniques utilized to conduct business in a paperless environment. It includes electronic data interchange (EDI), e-mail, electronic funds transfers, electronic publishing, image processing, shared databases, the Internet, etc. With the rise of Internet and the ability to transfer information cheaply and effectively over the whole world, e-commerce is becoming a major focus for many organizations and represents a significant opportunity for integrated information network structure.
- EDI refers to a computer-to-computer exchange of business documents in a standard format. It describes both the capability and practice of communicating information between two organizations electronically instead of the traditional forms. Quick access to information, better operational and customer service, better communication, reduced paperwork, increased productivity, cost efficiency, competitive advantage are some of the EDI benefits. It improves productivity through faster information transmission as well as information entry redundancy.
- Data warehouse is generally thought of as a decision support tool for collecting information from multiple sources and making that information available to end users in a consolidated and consistent manner. Rather than trying to develop one unified system or linking all systems in terms of processing, a data warehouse provides a means to combine the data in

Journal of Manufacturing Technology Management
Volume 15 · Number 1 · 2004 · 57-67

one place and make it available to all of the systems.

- Internet, at the most basic level, provides instant and global access to a large number of organizations, individuals and information sources. The Internet offers tremendous potential for organization members to share information in a timely and cost effective manner, with relative ease.
- Intranets are networks internal to an organization that use the same technology as the foundation of the global Internet. Intranet can easily be extended to include customers and suppliers, forming a supply chain "extranet" at far less cost than a proprietary network.

In conclusion, we may note that, the strategic applications of IS/IT infrastructure in the organizational network promotes cross-functional, intra- and inter-organizational communication. It enables also decentralized decision making and the creation of autonomous process teams. IT must therefore be deployed in conjunction with the processes rather than conventional functional organizations. Formal description of business processes as proposed is needed to determine specific information requirements. After defining the processes and corresponding information requirements, IT can be employed in a manner which supports effective organizational network.

## Concluding remarks

The sharing of information among organizational members is a fundamental requirement for effective responsiveness. At the ultimate level of integration, decision makers at all levels within and between of the network member organizations are provided with the information they need, in yhe desired format, when they need it, regardless of where within the network this information originates.

For this reason, the work presented in this paper addresses the importance of an organizational information network to support the concept of corporate responsiveness. The proposed framework may be applicable both manufacturing and service industries.

It is important to note also that the range of technologies available to support organizational network structure is vast and ever changing. Unfortunately, there is not a single right solution for an organizational network. Various options should need to be explored to arrive at a solution that provides the functionality required for their specific network initiatives. Toward this end, benchmarking other organizations involved in integrated networks to identify best practices is important.

We would like to remark also the use of the workflow system to possible future research directions. The recent trends in the development of advanced workflow management systems and technologies seem to be of crucial importance for supporting the organizational information network which has to provide consistent information flow between the participants in the process, the smooth integration of the work flow, the timely sharing and harmonious support of the collaborative aspects of work.

## References

Abair, R.A. (1997), "Agile manufacturing: successful implementation strategies", *Annual International Conference Proceedings, American Production and Inventory Control Society*, pp. 218-19.

Applegate, L.M., McFarlan, F.W. and McKenney, J.L. (1999), *Corporate Information Systems Management*, 5th ed., Irwin/McGraw-Hill, Homewood, IL.

Bhatt, G.D. (2000), "Exploring the relationship between information technology, infrastructure and business process re-engineering", *Business Process Management Journal*, Vol. 6 No. 2, pp. 139-63.

Booth, R. (1996), "Agile manufacturing", *Engineering Management Journal*, Vol. 6 No. 2, pp. 105-12.

Broadbent, M., Weill, P. and St Clair, D. (1999), "The implications of information technology infrastructure for business process redesign", *MIS Quarterly*, Vol. 23 No. 2, pp. 159-82.

Büyüközkan, G. (2002), "Bilgi akislarinin yönetilmesi için formel bir yaklasim", technical paper, Galatasaray University, Galatasaray, p. 15.

Cho, H., Jung, M. and Kim, M. (1996), "Enabling technologies of agile manufacturing and its related activities in Korea", *Computers and Industrial Engineering*, Vol. 30 No. 3, pp. 323-34.

Childe, S.J., Smart, P.A. and Weaver, A.M. (1996), "The use of generic process models for process

transformation", *Proceeding of International Workshop on Modeling Techniques, Business Process Reengineering and Benchmarking, Bordeaux, France, 18-19 April*, pp. 1-10.

Coronado, A.E., Sarhadi, M. and Millar, C. (2002), "Defining a framework for information systems requirements for agile manufacturing", *International Journal of Production Economics*, Vol. 75, pp. 57-68.

Davenport, T.H. (1997), *Information Ecology*, Oxford University Press, New York, NY.

Davis, G.B., Hamilton, S. and Hoffman, T.R. (1993), *Managing Information: How Information Systems Impact Organizational Strategy*, Irwin Professional, Burr Ridge, IL.

Davis, J.G., Subrahmanian, E., Konda, S., Granger, H., Collins, M. and Westerberg, A.W. (2001), "Creating shared information spaces to support collaborative design work", *Information Systems Frontiers*, Vol. 3 No. 3, pp. 377-92.

Farbey, B., Land, F.F. and Targett, D. (1995), "A taxonomy of information systems applications: the benefits' evaluation ladder", *European Journal of Information Systems*, Vol. 4, pp. 41-50.

Forza, C. and Salvador, F. (2001), "Information flows for high-performance manufacturing", *International Journal of Production Economics*, Vol. 70 No. 1, pp. 21-36.

Gates, B. (1999), *Business @ the Speed of Thought – Using a Digital Nervous System*, Warner Books, New York, NY.

Goldman, S., Nagel, R. and Preiss, K. (1995), *Agile Competitors and Virtual Organizations, Strategies for Enriching the Customer*, Van Nostrand Reinhold, New York, NY.

Gunasekaran, A. (1998), "Agile manufacturing: enablers and an implementation framework", *International Journal of Production Research*, Vol. 36 No. 5, pp. 1223-47.

Gunasekaran, A. and McGaughey, R. (2002), "Information technology/information systems in 21st century manufacturing", *International Journal of Production Economics*, Vol. 75 No. 1/2, pp. 1-6.

Gunasekaran, A. and Yusuf, Y.Y. (2002), "Agile manufacturing: a taxonomy of strategic and technological imperatives", *International Journal of Production Research*, Vol. 40 No. 6, pp. 1357-85.

Hipkin, I. (2001), "Knowledge and IS implementation: case studies in physical asset management", *International Journal of Operations & Production Management*, Vol. 21 No. 10, pp. 1358-80.

Huang, C.Y. and Nof, S. (1999), "Enterprise agility: a view from the PRISM lab", *International Journal of Agile Management Systems*, Vol. 1 No. 1, pp. 51-61.

Jagdev, H.S. and Browne, J. (1998), "The extended enterprise – a context for manufacturing", *Production Planning and Control*, Vol. 9 No. 3, pp. 216-29.

Kalakota, R. and Whinston, A. (1997), *Electronic Commerce: A Manager's Guide*, Addison-Wesley, Reading, MA.

Kang, H.W., Kim, J.W. and Park, S.J. (2001), "Integrated modeling framework for manufacturing systems: a unified representation of the physical process and information system", in Shaw, M.S. (Ed.), *Information-Based Manufacturing: Technology, Strategy and Industrial Applications*, Kluwer Academic, Boston, MA.

Karagiannis, D. and Telesko, R. (2000), "PROMOTE: a process-oriented approach for knowledge management", *Proceeding of Third International Conference on Practical Aspects of Knowledge Management, Basel, Switzerland, 30 November-1 October.*

Korhonen, P., Huttunen, K. and Eloranta, E. (1998), "Demand chain management in a global enterprise-information management view", *Production Planning and Control*, Vol. 9 No. 6, pp. 526-31.

Lau, H.C.W. and Lee, W.B. (2000), "On a responsive supply chain information system", *International Journal of Physical Distribution & Logistic Management*, Vol. 30 No. 7/8, pp. 598-610.

Lee, C.Y. (2003), "Total manufacturing information system: a conceptual model of a strategic tool for competitive advantage", *Integrated Manufacturing Systems*, Vol. 14 No. 2, pp. 114-22.

Lorino, P. (1991), *Le Contrôle de Gestion Stratégique: La Gestion par des Activités*, Editions Dunod, Paris.

Mason-Jones, R. and Towill D.R. (1999), "Total cycle time compression and the agile supply chain", *International Journal of Production Economics*, Vol. 62 No. 1/2, pp. 61-73.

Metes, G., Gundry, J. and Bradish, P. (1998), *Agile Networking*, Prentice-Hall, Upper Saddle River, NJ.

Mudie, M.W. and Schafer, D.J. (1985), "An information technology architecture for change", *IBM Systems Journal*, Vol. 24 No. 3/4, pp. 307-15.

Perry, M., Sohal, A.S. and Rumpf, P. (1999), "Quick response supply chain alliances in the Australian textiles, clothing and footwear industry", *International Journal of Production Economics*, Vol. 62 No. 1/2, pp. 119-32.

Poulin, D., Montreuil, B. and Gauvin, S. (1999), *L'entreprise Réseau: Bâtir Aujourd'hui l'organisation de Demain*, Publi-Relais, Montréal.

Prasad, B. (2000), "Converting computer-integrated manufacturing into an intelligent information system by combining CIM with concurrent engineering and knowledge management", *Industrial Management & Data Systems*, Vol. 100 No. 7, pp. 301-16.

Reix, R. (1995), *Systèmes d'information et Management des Organisations*, Librairie Vuibert, Paris.

Sharifi, H. and Zhang, Z. (1999), "A methodology for achieving agility in manufacturing organisations:

an introduction", *International Journal of Production Economics*, Vol. 62, pp. 7-22.

Shaw, M.S. (2001), *Information-Based Manufacturing: Technology, Strategy and Industrial Applications*, Kluwer Academic, Boston, MA.

Takahashi, S. (1999), "Knowledge integrated management", *Proceedings of Portland International Conference on Management of Engineering and Technology*, Portland State University, OR, 10 July.

Willcocks, L. (1994), *Information Management, The Evaluation of information Systems: Evaluation and Management*, Chapman & Hall, London.

Wyse, J.E. and Higgins, C.A. (1993), "MIS integration: a framework for management", *Journal of Systems Management*, February, pp. 32-7.

Youssef, M.A. (1992), "Agile manufacturing: a necessary condition for competing in global markets", *Industrial Engineering*, Vol. 24 No. 12, pp. 18-20.

Yusuf, Y.Y., Sarhadi, M.S. and Gunasekaran, A. (1999), "Agile manufacturing: the drivers, concepts and attributes", *International Journal of Production Economics*, Vol. 62 No. 1/2, pp. 23-32.

## Further reading

Gunasekaran, A. (1999), "Design and implementation of agile manufacturing systems", *International Journal of Production Economics*, Vol. 62 No. 1/2, pp. 1-6.

Gunasekaran, A. (1999), "Agile manufacturing: a framework for research and development", *International Journal of Production Economics*, Vol. 62 No. 1/2, pp. 87-106.