Practice of information systems

Evidence from select Indian SMEs

Milind Kumar Sharma and Rajat Bhagwat
J.N.V. University, Jodhpur, India

Received January 2005
Revised April 2005
Accepted May 2005

Abstract

Purpose – To provide the outcome of information system (IS) related practice survey designed to identify current trends in Indian small and medium enterprises (SMEs).

Design/methodology/approach – This research is exploratory in nature, a survey methodology is used for study and the focus of study is cross-sectional. Two companies have been selected for detailed case studies. The objective of the study was to become more familiar through survey and information collected to one point in time. The methodology was based on a questionnaire survey and personal interviews.

Findings – The outcomes, based on a survey of 210 SMEs, reveal that though SMEs understand and acknowledge the importance of the IS in day-to-day operations management in the present dynamic and heterogeneous business environment but these are yet to implement, operate and exploit it fully in a formal and professional manner so as to enable them to derive maximum business gains out of it. SMEs are not found equipped adequately with the IS resources to suit their needs.

Research limitations/implications – The target of the study is the SMEs operational in the western part of India and hence it has the limitation in terms of the scope. However, the overall results are encouraging with 70 percent response rare in the survey and underline the need for more such studies. The results have implications for all managers responsible for IS, any SME in the era of globalization.

Originality/value – The paper presents IS-related practices going on in Indian SMEs. Findings reported in the paper provide SMEs operators the utility of IS in day-to-day business operations.

Keywords Information systems, Small to medium-sized enterprises, Globalization, India

Paper type Research paper

1. Introduction

Recent research reported in the literature suggests that information flow is the bloodline of any business-operating unit irrespective of its size and operations. In the present customized and globalized business environment, where geographical distances are of no importance for customer-supplier relationships, the organization's competency in information system (IS) has become one of the key measures for its survival. To operate small and medium enterprises (SMEs) in extremely volatile and unpredictable business environment, availability of right kind of information at right time has become a prerequisite for successful operations. With the advent of relatively inexpensive computer hardware and the availability of wide range of packaged software, many small firms now have some experience of the effects of computer-based IS (Martin, 1989). During the last decade many SMEs have tried to

The authors are thankful to All India Council for Technical Education, Ministry of Human Resources Development, Government of India for sponsoring research project for SMEs. The results reported in the paper are based on the outcome of this project. The authors also thank the anonymous referees for valuable comments.

Journal of Manufacturing Technology Management
Vol. 17 No. 2, 2006
pp. 199-223

1741-038X
DOI 10.1108/17410380610642278

adjust their business operations to cope with the increased demands for customized manufacturing. SMEs are now more and more taking active part in the global business network, participating in many interlinked supply chains. This makes IS one of the key issues for SMEs from their day-to-day functional point of view. A generic management IS is essential to a manufacturing company for effective implementation of a management IS (Niu and Feng, 1987). IS is an organized combination of people, hardware, software, communication networks and data resources that collects, transforms and disseminates information within and among organizations. IS function maintains a technology watch, looking for opportunities and threats from developing technology (Jordan, 1993). Blili and Raymonds (1993) show that planning IS in SMEs become more critical as technology becomes more central to the SMEs' products and processes, and that planning needs to be integrated with business strategy. Premkumar (1992) argues that firms should reflect on the role of IS and adjust there IS planning process to match. For successful planning and implantation of IS in SMEs it is important to study the present status of IS, its trend and practice. A formidable body of literature exists on the usage, adoption and implementation of IS. Most of the existing studies have focused on microcomputer usage and few has tackled the IS usage. Most of these studies were conducted in early-1980s in the western countries and in the United States in SMEs. Comparatively, very little has been researched in the fast developing countries like India and China. A survey-type study is needed on a larger scale in order to explore the effects of IS-related practices in day-to-day functioning of SMEs sector (Martin, 1989). In this paper role of IS-related practices from the view of supply chain and day-to-day operations management in SMEs are presented and discussed based on a survey conducted in western part of Indian SMEs. Western part of India has very large clusters of SMEs having international customers and engaged in manufacturing and supply of OEM products and other products such as machined components, designer fabric, handicraft items, electronic component design and assemblies, non-metallic components, etc.

A structured questionnaire was designed based on the initial feedback received against a pilot questionnaire and subsequently personal interview held with academicians, experts, consultants and major SMEs operational in the western region of the country. It is then administered to SMEs operational in this area for their feedbacks. Feedbacks received subsequently are discussed and findings are reported in this paper.

2. A review of literature

In this section a brief literature review on IS in SMEs is presented.

Information technology (IT) plays a vital role in the sustained growth of business organizations. The term IT is defined in broad sense as "technologies dedicated to information storage, processing and communication" (Ang and Koh, 1997). This notion of IT focuses on combination of hardware, software, telecommunications and office equipments that transform raw data into useful information for speedy retrieval (Seyal *et al.*, 2000). Increasing investments in IT and strategic role played by ISs make IT implementation as an important research issue within the MIS discipline (Bostrom and Heinen, 1977). Blili and Raymonds (1993) identified the need and usefulness of information systems strategies (ISS) in small and medium sized enterprises (SMEs). They propose an ISS methods for SMEs based on experiences from large enterprises

and focus on introduction of IT into SMEs to create strategic advantage. Levy and Powell (2000) reviewed ISS development in SMEs. They develop an approach that reflects the role of information as a strategic resource and argue that ISS recommendations in SMEs need to take account of organizational change issues as much as IS implementation. Love and Irani (2004) examined the approaches used in Australian construction small and medium sized enterprises to evaluate and justify IT investments for IS development. They conducted an exploratory study of IT evaluation and benefits management practices of SMEs in the construction industry. Palvia and Palvia (1999) stress on key areas of IT dissatisfactions that are: training and education, software maintenance, documentation and vendor support. According to them software vendors and consultants can appropriately address these deficiencies. Poon and Swatman (1999) reported on internet use in small business sector and find that although use of e-mail is very popular for business communication and documents transfer, there is almost no integration between the internet and internal applications. Small business has been recognized (Blili and Raymonds, 1997) as highly flexible and adaptable to change, be it environmental, operational or technological. These firms have been shown to penetrate wide-ranging markets, operate computer-based manufacturing systems and possesses sophisticated ISs. Being strategic allies of large companies, better utilization of electronic data interchange (EDI) in SMEs operations is proposed. The extent of use of IS is actually related to the computing environment. Computing environment is usually classified in two broad categories: the traditional data processing and end user computing (Seyal *et al.*, 2000). In the data processing environment users interacts with computers indirectly through professionally trained staff. On the other hand in end user computing, the users directly interact with the computers through application software (Palvi *et al.*, 1994). In this users are supported by professional consultants, a vendor support program or through education/training firms who act as intermediaries between users and computers. Burn (1990) studied the strategic use of IT in Hong Kong SMEs. She surveyed three medium sized companies and found that IT strategy is related to Porter and Miller (1985) model of competitive advantage. Sohal and Lionel (1993) studied the role and impact of IT in 530 Australian business companies and found IT usage was positively related to organization performance. Fink (1998) studied 280 Australian SMEs and found ten IT adoption factors in the business firms. The study of Seyal *et al.* (2000) identified and assessed the degree of use of IT among participating SMEs in Brunei Darussalam. It has further identified the factors that influenced the use of IT. Study recommended that chief executives not only should explore the ways to adopt the latest technology but also to encourage their functional and business managers to learn and use the various techniques of telemarketing to get the business gains and to built a real IT culture. In order to build an IT-based culture, IT should be used not only to support business functions but also to support the operational functions. It further leads to improved IS-related practices in the organization. The literature suggests that development and implementation of IS in SMEs is one of the key issues for their growth in the present competitive business environment, which requires a study of IS-related practices going in SMEs sector and identify the gaps to be filled for successful implementation of IS.

3. Motivation and research objective

SMEs cover a wide spectrum of industries and play an important role in both developed and developing economies. India is no exception and SMEs occupy a prominent position in planned development of Indian economy. The SME sector accounts for 40 percent of the industrial production, 35 percent of the total export and provides about 80 percent of employment in the industrial sector in the country. Over the years, SMEs have shown a consistent growth rate, both during protected economy and open economy (Ghose, 2001). The Indian SMEs have been consistently outperforming large industry on crucial parameters such as growth in production and growth in employment. As information flow is the lifeline of any organization, authors attempted to conduct a survey-based research to get insight of IS-related practices going on in SMEs sector, a progressive driver of Indian economy.

The objective of research is:

- to explore the extent to which SMEs are aware of the principles of IS;
- to understand the existing IS-related practices going on in SMEs;
- to identify and suggest potential alternatives of IS practices for SMEs to enable them to be more competitive in the present era of globalization; and
- by doing so, contribute to the body of knowledge regarding IS practices in SMEs from supply chain and operations management view.

4. Scope

The target of the study is the SMEs operational in western part of India that includes three states (out of which two are major contributors to the National economy in terms of various economic parameters and rest one is still in a growing stage but emerging very fast as strong SMEs base in the country). Two states selected for the study, are having very rich infrastructure in terms of road transport, power and labor and a large number of multi national companies are operational here successfully. However, the rest one is having moderate resources but progressing very fast and in times to come a lot of foreign direct investment is expected in the state. In the study it was a deliberate attempt to choose two states as developed and other one in developing stage so as to get better insight on IS-based practices and issues in two different working environments. It will not be out of place to mention here that no prominent IT company in SMEs sector found operational in these states selected for the survey. The target SMEs were selected from the following sources:

- Industrial directory (2002 and 2003),
- Directory of ISO 9000 certified companies.

5. Methodology

Since the research is exploratory in nature, a survey methodology is used for study and focus of study is cross-sectional. The objective of study is to become more familiar through survey and information is collected at one point in time. The methodology was based on a questionnaire survey and personal interviews. A structured questionnaire was designed based on the initial feedback received against a pilot questionnaire and subsequently personal interview held with academicians, experts, consultants and major SMEs operational in the western region of the country. It was done (dry run) so as to avoid any bias and ensure that no irrelevant question is present in the questionnaire

and hence to assess the content validity. It is then administered to 210 SMEs operational in this area for at least five years for their feedbacks deploying random stratified sampling, to ensure a wide geographical and industrial spread. The questionnaire (see Appendix) contained three sections, A, B and C. Section A contained ten questions pertaining to SMEs organization profile; section B contained 13 questions related to IS practices going on and section C contained six questions pertaining to respondent's profile. A database of 210 SMEs has been created based on SMEs operational in three western States of India. This contains name of company, location, main products, type of industry, postal and e-mail addresses. The SMEs surveyed covers manufacturing, high tech engineering, finance, packaging and distribution sector. Twenty percent of the total surveyed SMEs are exclusively export oriented units (EOUs). In addition to the standard administration of the questionnaires, periodic reminders to the SMEs on e-mails and through postal services were also made so as to motivate SMEs to respond quickly. Further, debriefing telephonic interview was also conducted with appropriate respondents, in which respondents were asked to explain the reasons why they gave the answer they did and wrote the comment they wrote. Also any note put up or any query made by the respondents in their feedback was clarified so as to avoid any sort of bias and confusion in the feedback. The questionnaire sought responses covering company profile, suppliers, customers, IS practices, IT facilities and general view of SMEs from IS view. There was a 70 percent response rate. The findings, therefore, should be considered as a substantive indication of the current practices.

6. Breakdown of the survey by industry

Table I provides the number and percentage of SMEs covered in the survey where $n = 210$ and those responding = 147 or 70 percent.

The response rate is 70 percent, which can be considered as good in Indian context.

7. General profile of the surveyed SMEs

The SMEs surveyed covers manufacturing, high tech engineering, finance, packaging and distribution sector. Figures 1-4 show the number of employees, average number of

Sector	Number of SMEs Surveyed	Number of SMEs Responded	Percentage Surveyed (210)	Percentage Responded (147)
Manufacturing	97	71	46.2	48.3
High tech engineering	58	42	27.7	28.6
Finance services	20	13	9.5	8.8
Packaging and distribution	15	7	7.1	4.8
Service utility	20	14	9.5	9.5

Table I.
Survey sectors and responses

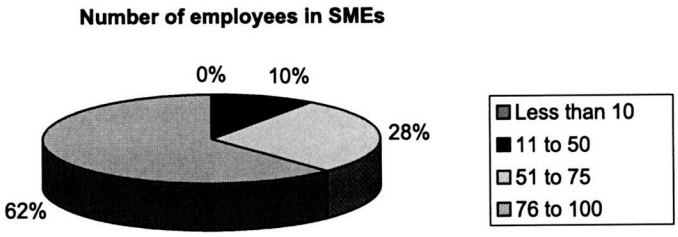

Figure 1.
Number of employees in SMEs

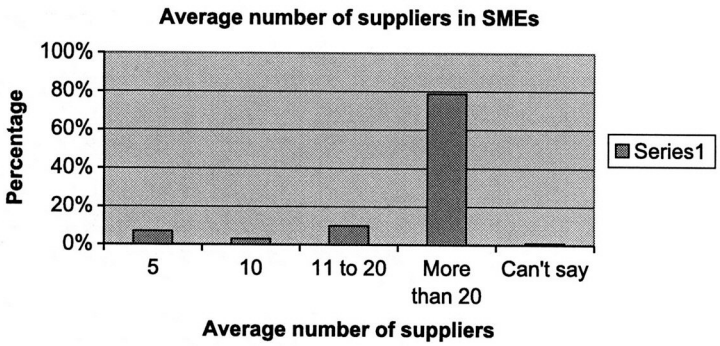

Figure 2.
Average number of suppliers in SMEs

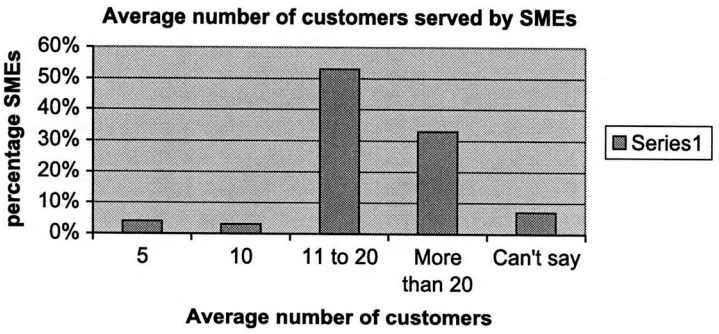

Figure 3.
Average number of customers served by SMEs

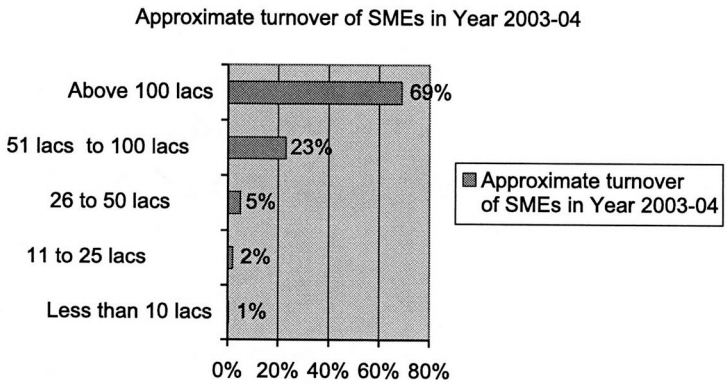

Figure 4.
Approximate turnover of SMEs in Year 2003-04

suppliers, average number of customers and approximate turn over of SMEs in year 2003-2004.

8. Result and discussion

The responses to the questionnaires have been analyzed and the results are presented in the following sections of the paper. The questions asked for two types of response. Some questions required an indication of agreement with a statement. In such cases the

percentage of companies that indicated agreement is given. The other type of question asked for a score (from 1 to 5) indicating the importance attached to a subject. For such cases the average score of those answering the question are presented.

8.1 Priorities attached to issues at site

In total, 15 issues were identified by the respondent SMEs.

Of the five issues attracting the highest priorities at site, these can be directly addressed by deploying effective IS in the organization. Given marks out of 5, these are connectivity (4.6), integration (4.5), information sharing (4.3), real time data transfer (4.1) and quick response technology (4.0).

Given highest priorities to these issues by SMEs further strengthen the view point of authors to carry out this study as all these issues are directly related to the IS-related practices.

Issues of medium importance are shown below:

- Flexibility (3.5),
- Responsiveness (3.5),
- Product customization (3.5),
- Cross functionality (3.5),
- Manufacturing strength (3.5).

It is noteworthy here that issues of highest importance for large and organized companies invite moderate attention by SMEs.

The issues of least importance given as under:

- Information technology (2.5),
- Bull whip effect of information (2.5),
- Electronic data interchange (2.5),
- Order tracking (2.5),
- ERP/ SCM Software (2.5).

Major surprises here are IT, EDI, ERP/SCM software not being considered a high priority. These issues are usually associated with innovation. A possible explanation is seen when considering and discussing the IS-related practices going on in SMEs.

8.2 Information system related practices in SMEs

Nowadays most manufacturing companies realize that a robust management is the key to success in unpredictable markets (Mc Leod, 1993). Reengineering of the business operations is the most important task in meeting the requirements of the market. These market requirements had originally been fulfilled by low prices. However, today's highly competitive market requires customer orientation products and fast delivery of quality products. Therefore, the focus of attention, which had previously been on high utilization of production lines, shifted to quick response to market and efficient information handling (Lau *et al.*, 2003). Majority of the SMEs acknowledge the importance of IS in today's globalize business scenario, however, only 43 percent SMEs respondents accepted the fact that there exists a formal IS in their organization. It will be interesting, here, to note the fact that all such firms are run by professionally

qualified owners or managers. A total of 53 percent SMEs operate in the presence of informal IS environment and rest of the respondents do not subscribe with the view that there should be any IS in place in any organization for its successful operation. These SMEs mindset of IS is limited to the extent of mode of correspondence and internal communication within the organization.

8.2.1 Mode of correspondence used. Mode of correspondence like post/courier and phone service are used by all the respondents, however, users of services of fax, e-mail, web sites, extranet and EDI are 95, 65, 23, 2 and 12 percent, respectively. In correspondence, it is interesting to note that maximum of surveyed SMEs use conventional methods of communication like fax. Whereas 65 percent of SMEs use e-mail as communication medium in terms of use of IS in organization. Very less SMEs are found to be using IS for network communication through extranet or EDI.

8.2.2 Computers and IT used by SMEs. Feedback about total number of computers used by respondents SMEs is quite encouraging as 72 percent SMEs are using more than 25 computers in their organization, while 18 and 7 percent SMEs use more than ten computers and more than five computers, respectively, in their operations. Three percent respondents SMEs accepted to use more than 50 computers in their business operations; these are high tech engineering and handicraft industries catering specifically to the overseas market. Here it is important to mention that use of computers in SMEs is only limited to top management and managerial/supervisory staff only.

Approximate percentage of employees using IT to perform their jobs in SMEs are found to be as per Figure 5.

Results in the figure indicate that IT in SMEs still takes a backseat despite of the fact that use of computers is continuously increasing in their operations.

8.2.3 Decision aid/support system. Decision aid/support system used by the SMEs shows that only 2 percent SMEs permit Individual PCs or terminal for staff at workplace as decision support system. Most of the SMEs surveyed belong to the manufacturing and engineering segment so this result does not surprise since their nature of operations do not demand individual terminal for employees. A total of 14 percent SMEs use online real time supplier information tracking and deploy mainframe-based purchase system for their business operations. Here, it is noteworthy that all these SMEs are exclusively export-oriented units and are profits making companies. E-mail facility and internet access for staff is allowed by 5 percent SMEs. It is observed that it is discouraged by SMEs in view of security concerns and for

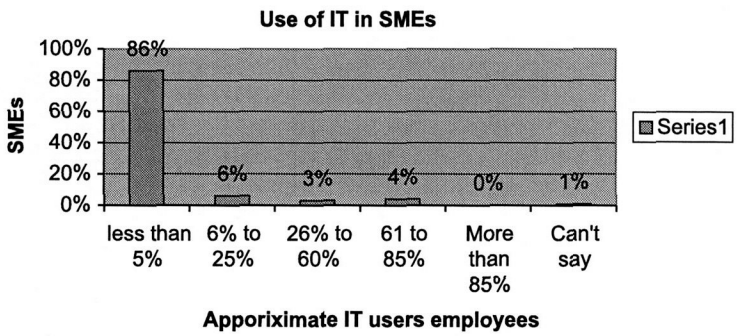

Figure 5.
Use of IT in SMEs

maintaining secrecy of their business information. Existence of decision aid/support system is not found as significant as expected in SMEs sector. This resource is limited in use by SMEs for merely communicating with suppliers and customers.

Results of SMEs pertaining to their use of IS for sharing information with suppliers and customers are as shown in the Table II.

Results in the table shows that majority of the SMEs use their IS to share information related to the purchase of raw material goods and supply of finished products with suppliers and customers, respectively. Sharing information of placement of purchase orders, shipping advices and payment invoices by e-mails with their suppliers and customers is being considered as the only use of IS by SMEs. Information sharing by SMEs on the activities like product development, sales forecasting, company's future plans and production cost invite very less attention where as in case of large companies these are considered as strong pillars of their competitive strength.

Following Table III indicates the various tools of IS used by the SMEs for their day-to-day operations.

No SME found to be using ERP/SCM Software and extranet in their business operations. Reason cited for this is mainly related to the cost factor and lack of awareness in SMEs sector. However, most of the EOUs are aware of the uses and benefits of ERP/SCM software and extranet and expected to use them in future as their diversity of business increases day by day. Use of internet and web sites is found to be quite encouraging in contrast of the Figure 5 results which shows IT as a least priority for SMEs.

Information sharing with suppliers and customers	SMEs (percent)
Related to purchasing and supplies	68
Order tracking	25
Inventory status	15
Product development	4
Sales forecasting	2
Marketing developments	11
Company's future plans	1
Company's production costs	1
Technology know-how	12
We do not share any information	Nil

Table II.

IS tool	SMEs (percent)
Bar-coding	14
EDI	3
Intranet	4
Extranet	Nil
Internet	49
Own web sites	23
ERP/ SCM software	Nil

Table III.

8.2.4 Use of information system. Results in following Table IV shows the use of IS in different activities of SMEs.

No SME uses IS for forecasting and planning as the volume of their business, they consider, is not very high and also most of them are having orders in advance. Accounts and finance still today demand maximum use of IS in SMEs operations. However, moderate use of IS is observed for day-to-day administrative affairs, sales and service, purchasing and collaborative information sharing among SMEs. Data sharing for design purposes invites least use of IS as most of the SMEs cater strictly to the specifications and designs given by the customers. Since supply chain of SMEs does not involve too many trading partners, a few SMEs make use of IS in inventory tracking at supply chain linkages.

8.2.5 Role of information system architect. Though respondent SMEs felt it necessary to have specialists in their companies to design and maintain IS according to their requirements. But no SME confirmed to employ full time IT professionals in-house for this very purpose. However, only 7 percent SMEs confirmed to take out side professional helps from IT consultants in case of their IS breakdown.

8.2.6 Reasons for adopting information system. SMEs cited reasons for adopting IS-related practices according to their preference as given below in the Table V.

Economic liberalization since 1991 has changed the face of Indian SMEs. It has altered the way Indian SMEs do business. Indian SMEs had to function in a protective environment for several decades. Until 1990, the Indian economy was inward looking

Activity	SMEs (percent)
Forecasting and planning	Nil
Sales and service	48
Data sharing for design purposes	3
Inventory tracking at supply chain linkages	7
Promotion campaign	18
Purchasing	41
Collaborative information sharing	33
Manufacturing scheduling	12
Administrative affairs	41
Accounts and finance	83
Logistics operations	11

Table IV.

Reasons	SMEs (percent)
Communication with the trading partners	53
To reduce inventory cost	11
Quick response to customers needs	42
Logistics costs	10
Improvement of overall efficiency	38
Quality and warranty of products	9
Forecasting uncertainties	2
Short product life cycles	42
Reduce throughput time	15

Table V.

and protected from internal and external environment (Bowonder, 1998). One fundamental change that the liberalization has brought about was the decontrol of the production. Earlier, Indian SMEs were in a very comfortable position, with demand exceeding supply. The companies had been thriving on outdated technologies, producing low quality products at high costs and were able to survive because of a protected market and hardly any competition (Rajgopal, 1999). Today SMEs in India, is facing competitions from imports and from multinational companies in the domestic markets. The new competition is in terms of reduced costs, improved quality, products with high performance, a wider range of products and better service, all delivered simultaneously to enhance value to customer (Dangayach and Deshmukh, 2000). To face these challenges and to survive in the globalized market results in the above table show that communication, quick response, compressed product development cycles and improvement in overall efficiency, all key factors, are the major reasons for practicing IS in SMEs.

8.2.7 Benefits of information system. SMEs are under increasingly diverse and mounting pressures due to more customized and sophisticated markets, changing customer choice and global competition. In such a competitive business scenario SMEs have to search for new processes, new materials, new suppliers, new plant and machinery, and new channels to deliver products and services at competitive price (Dangayach and Deshmukh, 2001). In this era, benefits observed/perceived by SMEs due to IS in organization are as shown in Table VI.

Responsiveness, better customer service, increase in turnover, better capacity utilization, edge over other competitors, reduction in inventory, and improved relations with supply chain partners are the major benefits perceived by the SMEs by following the proper IS-related practices in business operations. Results shows that use of IS increase the overall performance of the SMEs and lead them towards total customer satisfaction in the era of globalization.

8.2.8 Barriers in information system. However, a few factors are found as barriers in practicing IS in SMEs (Table VII).

Benefits	SMEs (percent)
Responsiveness	82
Better customer service	76
Increase in turnover	56
Better capacity utilization	49
An edge over new entrants in the industry	41
Product quality	39
Inventory reduction	38
Improved relations in the supply chain	33
Reduction in manpower	24
Reduction in unit cost of product/service	23
Order fulfillment time reduction	23
Reduction in suppliers base	21
Reduced product/material acquisition cost	20
Reduced transportation cost	11
Low working capital requirement	5
Accurate forecasting	1

Table VI.

Barriers	SMEs (percent)
Threats of information security	62
Resistance to change and to adopt innovations	52
Fear of supply chain breakdown	48
Fear of IS breakdown	43
Lack of funds	34
Lack of trust and faith in supply chain linkages	23
Poor infra-structural facilities like computers, etc.	13
Disparity in trading partners' capabilities	13
Low priority by the management	12
Lack of awareness about IT	12
Inability to negotiate online	Nil

Table VII.

Results are obvious as SMEs have their own constraints. The biggest is the lack of vision, as these companies do not want to change their working styles in view of security threats in business. Fear of IS breakdown always gives SMEs nightmare. SMEs do not appreciate the benefits drawn by following proper IS in a single instance and hence resist changing traditional working styles.

9. Case studies

Based on the exploratory survey, two cases of SMEs are present. Of these, one company A is leading small-scale company and other company B is a leading medium scale enterprise. We have adopted case study method for research, after exploratory survey, as survey research may have some errors in it (Malhotra and Grover, 1998).

Case studies are longitudinal in nature and one attribute is to be discussed with more than one person in the company for collection of data, therefore non-response bias is reduced to minimum. Various researchers used case study for their research (Shrivastav, 1995; Cheng and Musaphir, 1996; Menda and Dilts, 1997). The primary aim of this study is to gain in-depth understanding of IS-related practices in leading SMEs in the western states of India. The specific issues involved in the study are:

Understanding of the use of the IS in the organization.

IS-related practices going on in the company:

- How is IS implemented?
- How is IS related to day-to-day operations management?
- How is IS helpful for SMEs for their day-to-day functioning?
- Who is responsible for effective implementation if IS-related practices in the company?

Organization culture:

- Workforce involvement in IS-related activities,
- Supplier/customer orientation.

Competitive priorities of the SMEs.

- benefits observed/perceived by following IS-related practices; and
- barriers observed in implementing IS-related practices.

9.1 Company A

The setting. Company A is the oldest surgical disposable needles and syringes manufacturing company (established in 1981) and catering to the consumer goods market segment. It belongs to a medium scale industrial group and operating in a multi-plant environment (two factories). Both plants are located in the western part of India. The company produces all types of disposable needles and syringes. With 100 employees, it enjoys 15 percent market share in the disposable needles and syringes market. Presently company A is the third largest manufacturer of disposable needles and syringes in India and has 20 percent exports (mainly in USA market) of total sales. Plant and machinery together with the technology was brought from Korea. It is an ISO 9001 certified company.

Previous approach. During 1950-1990, an era of limited supply, the National industrial policy was restrictive and regulative, therefore the company's production was less than demand. Being the oldest disposable needles and syringes manufacturer, company enjoyed a monopoly status in India. Initially the company did not have a proper IS for manufacturing and other peripheral business activities like marketing and purchasing as demand outstripped capacity and it enjoyed a protected seller's market. Company had no proper IS in place till the year 1990. After relaxation in the industrial policy many new companies have entered in this sector with foreign collaboration.

Later the company had to face cut throat competition from local SMEs and large-scale manufacturers. It had to introspect its business activities from all angles to survive in the highly competitive market. In 1995 the company has grown explosively and its production volume has also increased. The company also started exports to Europe (12 countries) since the year 1998.

Present approach. Owing to increased competition the company adopted proper IS practices (in 1991) that focused on fast and accurate flow of information within and among all trading partners. The company decided to have faster flow of information by adopting more and more use of computers and various IT tools. It invested extensively in EDI, internet, extranet, intranet, web sites, bar-coding, fax, etc. and framed a proper IS strategy. Company also hired professional help outside from consultants and experts from time to time for proper implementation, use and maintenance of IS. It is also thinking to appoint at least three full time employees to look after the IS-related activities round the clock in the capacity of IS architects.

Vision. To become leading disposable needles and syringes manufacturer in India.

Mission. To supply superior quality, eco-friendly and low-cost disposable needles and syringes on time.

Elements of IS.

- Fast communication with the trading partners on real time basis.
- Increase responsiveness and cross-functionality.
- Online supplier information tracking.
- Automatic release of purchase orders (based on inventory level).
- Internet access to all employees on or above supervisory level.
- To provide managerial support to the suppliers, by giving them online instructions.

- Increase investment in computerization and IT implementation.
- To address competitor claim head on.

IS development methodology. After setting up of proper IS, the MD with key managers and supervisors framed a IS strategy. Essential features of IS strategy are:

- Speed up the flow of information by using electronic data interchange (EDI), internet, extranet, intranet, and web sites, etc.
- Online connectivity with the trading partners with minimum loss of information.
- Information sharing with suppliers and customers on real time basis.
- Matching competitors features by continuously improving products and services through smooth and accurate flow of information.
- Online information for internal functional control like work-in-process on shop floor, daily production target, daily, weekly and monthly production schedule, data related to quality control, all inventory control aspects, detailed health analysis of each equipment.

After implementation of IS strategy, the company computerized most of its business operations. It arranged to provide necessary training to its employees for using IS facilities in the company effectively. It helps employees to become more and more computer and IT friendly that led to improvement significantly in the productivity and efficiency of the company. The company had also computerized its purchase and distribution system with more than 50 percent of its vendors and customers connected through the network.

Competitive priorities. Rank-wise competitive priorities of the company are:

- Delivery speed (provide fast deliveries).
- Dependable deliveries (on time deliveries).
- Product reliability.
- Easy and eco-friendly disposal of the used products.
- Conformance quality.
- Quick response to customers.
- Competitive cost.

Benefits observed/perceived by following IS-related practices. Rank-wise benefits observed by following IS-related practices are:

- Better capacity utilization.
- Increase in turnover.
- Improved relations in the supply chain.
- Better customer service.
- Order fulfillment time reduction.
- Accurate forecasting.
- An edge over competitors in the industry.

Barriers observed in implementing IS-related practices. Rank-wise barriers observed in implementing IS-related practices are:

- Fear of IS breakdown.
- Lack of trust and faith in supply chain linkages.
- Lack of funds.
- Threats of information security.
- Poor infra-structural facilities like computers, generic software, consultancy for design of customized IS, lack of government policies and subsidy for IS development, etc.
- Lack of awareness about IT.

9.2 Company B

The setting. Company B is a small scale bearing balls manufacturing company. It produces bearing balls for all types of bearings. Its customer ranges from country's largest bearing manufacturing company to big multi national companies operational in India. It is an ISO 9002 certified company and operates in a multi plant environment (three factories) all located in the same vicinity in the western region of India. The company has technical links with a leading Japanese company. The company was established in 1985 and started production in 1986. It enjoys a 20 percent market share it supplies products to leading bearing manufacturing companies. It exports 15 percent of its total production to overseas market. Its MD is a graduate engineer in mechanical engineering and is a quality conscious person. The number of employees in the firm is ~100.

Previous approach. The company enjoyed and maintained its market share consistently with reasonably handsome profit margins. As the company's core competency lies in its quality, it invested extensively to establish and maintain world-class quality system in house, which further led to high manufacturing costs. Since company was getting sufficient economic returns from its customers, it hardly looked into its high production cost aspect. There were excessive inventory and waste (due to scrap and rework) in the work place. Company used to purchase its raw material from some selected local suppliers by paying hefty premium prices. There were hardly any interdepartmental coordination that led to delay and poor decision-making.

Post liberalization era allowed large MNCs to come in India and sell the bearings at much lower price than India's local bearing manufacturers. That forces local bearing manufacturers to negotiate their suppliers (bearing ball manufacturers) on cutting their prices drastically. Also in 1992 three new local manufactures in the same industrial region started and launched production of bearing balls and supplied at much lower prices than the company B. There was cutthroat competition in bearing market that led the bearing manufacturing companies to compromise on quality. No doubt, product quality of company B was much superior than that of new entrants in the market. Initially company B did not realize the degree of competition because of its high quality products but after loosing about 25 percent of its market share by such local companies, it decided to introspect its internal system. It also started to explore export opportunities but failed in the absence of proper IS.

Present approach. The company decided to reengineer its entire production system to cut down its manufacturing cost. It still does not compromise on quality. It formed a team to look into the aspect of entire operations. After a period of one month the team

recommended some suggestions to cut down the production cost. The team recommended strongly for a proper IS in place so as to improve interdepartmental coordination and cooperation. Shop floor supervisors are trained to identify bottlenecks and take corrective actions. Purchase section is fully computerized and entire process of purchase is streamlined so as to cut down the inventory levels and raw material costs. Online negotiation on internet with the suppliers is being followed to have raw material at competitive prices. Old machineries are also replaced with new more advanced machines.

For exports, company hired services of some export agents initially and then set up its own separate division with all modernize computer and IT tools facilities for it. Company launched its web site. Foreign buyers are approached in various international level trade fairs. Aggressive marketing strategies are implemented. Information connectivity at all levels is maintained with in the company so as to minimize through put time and fast deliveries with quick decision-making. Production cost has come down drastically with no compromise with the quality. Company managed to compensate its lost local market share due to entry of new local entrants, by exporting its products at very attractive profit margins. With investment on IS, the company is able to attract international customers and able to get much attractive international orders than what it has lost in local market and was able to economically justify the large investment on IS.

Vision. To become world-class quality supplier of bearing balls at competitive prices.

Mission. Be recognized as the best quality and timely supplier by the customers.

Information system development. Earlier, the company has no proper IS aligned with manufacturing and marketing function. A proper IS is now put in place that integrates all departments within the company and facilitates fast communication and decision-making with suppliers and customers. After taking measures to cut down its production cost, it decided to target foreign buyers. Its newly set up export division brought trade enquiries from overseas market from the customers who require top quality products and ready to pay premium prices in return. This newly set up division is equipped with latest EDI and computer technologies. That helps company to respond immediately to its foreign enquiries. It also took approval required for entry in Europe market and now having orders in advance till the next year.

For domestic market, by deploying proper IS, company's internal operations are fully computerized and connected well with its suppliers and customers. Online negotiation with more than one supplier helped to cut down its material cost. Recently due to availability of well connected IS in-place, the company imported one major raw material in bulk quantity from Italy at less than 50 percent prices. Customers are offered attractive quantity discounts for bulk orders and cash discounts for favorable term of payments time to time. All efforts are engineered to take the advantage of economies of scale and scope. Company is still the number one quality bearing ball manufacturer in India in small-scale sector.

Observation. Since the company has drastically cut down its production cost, once again it is not only able to get maximum share of business from its existing customers but fetched very attractive export orders also. The following points indicate this:

- It uses extensively electronic data interchange (EDI), internet, extranet, intranet, web sites, bar-coding, fax, etc.
- Cut down its selling price in the domestic market significantly.

- Better capacity utilization.
- The whole organization is networked through use of IT.
- Completely booked for its production till the next year, 20 percent of which is from export orders.
- Consistently being recognized by best quality producer at competitive prices.
- Won current year's National Productivity Council's award.

Competitive priorities. Rank-wise competitive priorities of the company are:

- Conformance quality.
- Product reliability.
- Product performance.
- Competitive price.
- Delivery speed (provide fast deliveries).
- Dependable deliveries (on time deliveries).

Benefits observed/perceived by following IS-related practices. Rank-wise benefits observed by following IS-related practices are:

- Elimination of waste.
- Reduction in inventory.
- Quick decision-making.
- Overall lead time reduction.
- Accurate forecasting.
- Low cost.
- Better capacity utilization.

Barriers observed in implementing IS-related practices. Rank-wise barriers observed in implementing IS-related practices are:

- Low priority by the management.
- Resistance to change and to adopt innovations.
- Poor infra-structural facilities like computers, etc.
- Lack of vision.
- Threats of information security.

10. Concluding observations

Existing literature suggests that SMEs may be differentiated from larger enterprises by a number of key characteristics, which are generally, described as follows (Addy *et al.*, 1994; Burns and Dewhurst, 1996; Ghobadian and Galliar, 1997; Appiah-Adu and Singh, 1998; Berry, 1998; Marri *et al.*, 1998; Haywood, 1999):

- Personalized management, with little devolution of authority.
- Severe resource limitations in terms of management and manpower, R&D, finance, marketing, etc.

- Reliance on small number of customers, and operating in limited markets.
- Flat and flexible structures.
- High innovatory potential.
- Reactive and fire fighting mentality.
- Informal and dynamic strategies.

Authors feel that in addition to above, the absence of proper and formal IS practices are also one of the major characteristics of SMEs that differentiate them from larger and organized companies. Traditional mindset does not allow SMEs to invest their resources much in IS. Findings reveal that though SMEs understand and acknowledge the importance of the IS in day-to-day operations management in the present dynamic and heterogeneous business environment but these are yet to implement, operate and exploit it fully in a formal and professional manner so as to enable them to derive maximum business gains out of it. SMEs do not deploy IT as intensively as large companies. Results of the study reveal that IT in SMEs still takes a backseat despite of the fact that use of computers is continuously increasing in their operations. Even in correspondence also, more and more use of computers is increasing in SMEs sector. Study shows that SMEs have applied IS mainly in the field of financial accounting (e.g. receivables) and for operational management such as sales order management or material requirement planning. IT for management information and decision support has low priority and SCM/ERP software have been used rarely in SMEs. However, use of decision aid/support system in EOUs is more prominently observed. Majority of the SMEs use their IS to share information related to the purchase of raw material goods and supply of finished products with suppliers and customers, respectively. Information sharing by SMEs on the activities likes product development, sales forecasting, company's future plans and production cost invite very less attention. Information sharing in these neglected areas can equip SMEs a competitive edge over organized sector by following proper IS practices. Also the role of a controller or an IS architect does not usually exist in SMEs. IS-related tasks are usually carried out by company-external people. In other words, SMEs suffer from a shortage of special IS skills that are needed to successfully manage day-to-day operations. SMEs do not deploy IS as intensively as large companies.

In the present era of globalization it is obvious that the survival of the SMEs will be determined first and foremost by their ability to manufacture/supply more, at competitive cost, in less delivery time, with minimum defects, using fewer resources. In order to face this challenge, with other important issues, the issue of IS needs to be addressed extensively. Accessibility to the right kind of information at right time is the need of the hour. Hence, research is needed to recognize and highlight the issue of IS prominently and more frequently in literature. The researchers while taking into account SMEs perspective have so far not addressed this issue at length. Further, research can be directed towards performance measures of IS also. That will be of great use for different companies to measure performance of their IS and compare with each other and adopt the best one that delivers optimum results and hence can lead towards better IS practices in the organization.

References

Addy, C., Pearce, J. and Bennet, J. (1994), "Performance measures in small manufacturing enterprises; are firms measuring what matters?", *10th National Conference on Manufacturing Research (Proceedings)*, Taylor & Francis Publishing, Loughborough, pp. 110-4.

Ang, J. and Koh, S. (1997), "Exploring the relationships between user information satisfaction", *International Journal of Information Management*, Vol. 17 No. 3, pp. 169-77.

Appiah-Adu, K. and Singh, S. (1998), "Computer orientation and performance: a study of SMEs", *Management Decision*, Vol. 36 No. 6, pp. 385-94.

Berry, M. (1998), "Strategic planning in small and high tech companies", *Long Range Planning*, Vol. 31 No. 3, pp. 455-66.

Blili, S. and Raymonds, L. (1993), "Information technology: opportunities and threats for small and medium sized enterprises", *International Journal of Information Management*, Vol. 13, pp. 439-48.

Blili, S. and Raymonds, L. (1997), "Adopting EDI in a network enterprise: the case of subcontracting SMEs", *European Journal of Purchasing & Supply Management*, Vol. 3 No. 3, pp. 165-75.

Bostrom, R. and Heinen, J. (1977), "MIS problems and failures: a sociotechnical perspective – Part 1. The causes", *MIS-Quarterly*, Vol. 1 No. 3, pp. 17-32.

Bowonder, B. (1998), "Industrialization and economic growth of India: interaction of indigenous and foreign technology", *International Journal of Technology Management*, Vol. 15 Nos 6/7, pp. 622-45.

Burn, J.M. (1990), "The strategic use of IT in Hong Kong organizations: an analysis of applications in small to medium sized organizations", *Proceedings of a International Conference on IT*.

Burns, P. and Dewhurst, J. (1996), *Small Business and Enterpreneurship*, 2nd ed., Macmillan Press, London.

Cheng, T.C.E. and Musaphir, S. (1996), "Theory and practice of manufacturing strategy", *Int. Journal of Production Research*, Vol. 34, pp. 1243-59.

Dangayach, G.S. and Deshmukh, S.G. (2000), "Manufacturing strategy: experiences from select Indian organizations", *Journal of Manufacturing Systems*, Vol. 19 No. 2, pp. 134-48.

Dangayach, G.S. and Deshmukh, S.G. (2001), "Practice of manufacturing strategy: evidence from select Indian automobile companies", *International Journal of Production Research*, Vol. 39 No. 11, pp. 2353-93.

Fink, D. (1998), "Guidelines for the successful adoption of IT in SMEs", *International Journal of Information Management*, Vol. 18 No. 4, pp. 243-53.

Ghobadian, A. and Galliar, D. (1997), "TQM and organizational size", *International Journal of Operations & Production Management*, Vol. 17 No. 2, pp. 121-63.

Ghose, A.K. (2001), "SMEs and environment protection", *Productivity*, Vol. 42 No. 2.

Haywood, M. (1999), "Software based supply chain links in SMEs in the North West", *Stimulating Manufacturing Excellence in SMEs (Conference Proceedings)*, University of Plymouth, Plymouth.

Jordan, E. (1993), "Executive information system for the chief information officer", *International Journal of Information Management*, Vol. 13 No. 4, pp. 249-59.

Lau, H., Choy, K. and Wong, C. (2003), "A generic management information system for small and medium enterprises", *International Journal of Manufacturing and Technology Management*, Vol. 5 Nos 1/2.

Levy, M. and Powell, P. (2000), "Information system strategy for small and medium sized enterprises: an organizational perspective", *Journal of Strategic Information System*, Vol. 9, pp. 63-84.

Love, P. and Irani, Z. (2004), "An exploratory study of IT evaluation and benefits management practices of SMEs in the construction industry", *Information & Management*, Vol. 42, pp. 227-42.

McLeod, P. Jr (1993), *Management Information Systems*, Macmillan Publishing Company, London.

Malhotra, M.K. and Grover, V. (1998), "An assessment of survey research in POM: from constructs to theory", *Journal of Operation Management*, Vol. 16, pp. 407-25.

Marri, H., Gunasekaran, A. and Grieve, R. (1998), "An investigation into the implementation of the computer integrated manufacturing in small and medium sized enterprises", *International Journal of Advanced Manufacturing Technology*, Vol. 14, pp. 935-42.

Martin, C.J. (1989), "Information management in the smaller business: the role of the top manager", *International Journal of Information Management*, Vol. 9, pp. 187-97.

Menda, R. and Dilts, D. (1997), "The manufacturing strategy formulation process: linking multifunctional viewpoints", *Journal of Operations Management*, Vol. 14, pp. 315-31.

Niu, M. and Feng, J. (1987), "Introduction to the project of computer aided production management of Shenyang No. 1 machine tool works", *Computers in Industry*, Vol. 8, pp. 173-80.

Palvi, P., Means, D.W. and Jackson, W.M. (1994), "Determinants of computing in very small business", *Information & Management*, Vol. 27, pp. 161-74.

Palvia, P. and Palvia, S. (1999), "An examination of the IT satisfaction of small users", *Information & Management*, Vol. 35, pp. 127-37.

Poon, S. and Swatman, P. (1999), "An exploratory study of small business internet commerce issues", *Information & Management*, Vol. 35, pp. 9-18.

Porter, M. and Miller, V.E. (1985), "How information gives you competitive advantage?", *Harvard Business Review*, Vol. 63 No. 4, pp. 149-60.

Premkumar, G. (1992), "An empirical study of IS planning characteristics at common industries", *OMEGA*, Vol. 20, pp. 611-29.

Rajgopal, J. (1999), "Challenges: then and now", *The Hindu Survey of Indian Industry*, pp. 39-41.

Seyal, A., Rahim, M. and Rahim, N. (2000), "An empirical investigation of the use of information technology among small and medium business organizations: a Bruneian scenario", *The Electronic Journal of Information Systems in Developing Countries*, Vol. 2 No. 7, pp. 1-17.

Sohal, A.S. and Lionel, N.G. (1993), "The role and impact of information technology on Australian business", *Journal of Information Technology*, Vol. 13, pp. 201-11.

Shrivastav, P. (1995), "Environmental technologies and competitive advantage", *Strategic Management Journal*, Vol. 16, pp. 183-200.

Appendix. Questionnaire

Section 1: Organization profile

1. Name of organization:
2. Type of business:

3. Please indicate the number of employees in your organization:
   (A) Less than 10
   (B) 11 to 50
   (C) 51 to 75
   (D) 76 to 100

4. Please indicate your main types of products/services:
   (A) Finished product
   (B) Raw material
   (C) Consumer goods
   (D) Others, please specify

5. Please indicate who are your main customer groups?
   (A) Consumer
   (B) Service industry
   (C) Others, please specify

6. Please indicate your organization's approximate annual turnover in Rs for year 2003-2004:
   (A) Less than 10 lacs
   (B) 11 to 25 lacs
   (C) 26 to 50 lacs
   (D) 51 to 100 lacs
   (E) Above 100 lacs

7. Please indicate the approximate trend of profits during the past 3-years:
   (A) Increased by 10 percent per year
   (B) Increased by more than 10 percent per year
   (C) Almost constant
   (D) Decreases
   (E) Cannot say

8. The average number of suppliers employed for a raw material/out-sourced component in the final product are:
   (A) 5
   (B) 10
   (C) 11 to 20
   (D) More than 20
   (E) Cannot say

9. The average number of customers you are catering to:
   (A) 5
   (B) 10
   (C) 11 to 20
   (D) More than 20
   (E) Cannot say

10. Please rank the competitive strengths of your organization (rank 1-5) (Table VIII).

Attributes	Very low 1	Low 2	Moderate 3	High 4	Very high 5
Quality					
Cost effectiveness					
Responsiveness					
Flexibility					
Information technology					
Product customization					
Cross-functionality					
Sales and marketing					
Manufacturing strength					
Innovativeness					

Table AI.

Section 2: Information system related practices

1. Do you have any formal IS being followed in your organization? (IS is an organized combination of people, hardware, software, communication networks and data resources that collects, transforms and disseminates information in an organization):

(A) Yes

(B) No

(C) Cannot say

2. Please indicate (tick mark) the mode of correspondence used by your organization with your suppliers and customers.

Post or courier

Phone

Fax

Extranet

E-mail

Web sites

Electronic data interchange (EDI)

3. Please indicate the approximate percentage of employees using IT to perform their jobs:

(A) Less than 5 percent

(B) 6-25 percent

(C) 26-60 percent

(D) 61-85 percent

(E) More than 85 percent

(F) Cannot say

4. Please indicate total number of computers used in your organization:

(A) Less than 5

(B) Less than 10

(C) Less than 25

(D) Or more

5. Your organization has following decision-aid/support system, please tick all that applies.
   - Individual PCs or terminal for staff
   - Mainframe-based purchase system
   - Online real time supplier information tracking
   - Purchasing performance evaluation system
   - E-mail facility for staff
   - Internet access
   - Automatic release of purchase orders (based on inventory level)
   - Vendor rating system

6. Please indicate the level of (rank 1-10) information sharing with your suppliers and customers.
   - Related to purchasing and supplies
   - Order tracking
   - Inventory status
   - Product development
   - Sales forecasting
   - Marketing developments
   - Company's future plans
   - Company's production costs
   - Technology know-how
   - We do not share any information

7. Rank (1-5) the areas where majority of delays take place in your organization.
   - Order finalization
   - Engineering/ planning
   - Material/service procurement
   - Manufacturing/operations
   - Delivery

8. Is your organization using following? (Y or N for Yes and No, respectively).
   - Bar-coding
   - EDI
   - Intranet
   - Extranet
   - Internet
   - Own web sites
   - ERP/ SCM software

9. Indicate the level (by ranking 1-5) of IT-based information/documents sharing with the followings.
   - Customers
   - Distributors
   - Suppliers
   - Warehouses and logistics service providers (transporters)

10. Use of IT in following activities in your organization (Y or N for Yes and No, respectively).
    - Forecasting and planning
    - Sales and service
    - Data sharing for design purposes
    - Inventory tracking at supply chain linkages
    - Promotion campaign
    - Purchasing
    - Collaborative information sharing
    - Manufacturing scheduling
    - Administrative affairs
    - Accounts and finance
    - Logistics operations

11. Reasons for adopting IT in the organization (Y or N).
    - Communication with the trading partners
    - To reduce inventory cost
    - Quick response to customers needs
    - Logistics costs
    - Improvement of overall efficiency
    - Quality and warranty of products
    - Forecasting uncertainties
    - Short product life cycles
    - Consolidation of market share
    - Reduce throughput time

12. Please rank (1-11) the barriers in the IT implementation of the organization.
    - Resistance to change and to adopt innovations
    - Low priority by the management
    - Poor infra-structural facilities like computers, etc.
    - Lack of funds
    - Lack of awareness about IT
    - Threats of information security
    - Inability to negotiate online
    - Lack of trust and faith in supply chain linkages
    - Disparity in trading partners' capabilities
    - Fear of IS breakdown
    - Fear of supply chain breakdown

13. Benefits observed/perceived due to IT-enabled organization (Y or N).
    - Accurate forecasting
    - Increase in turnover
    - Inventory reduction

Order fulfillment time reduction
Low working capital requirement
Product quality
Reduction in manpower
Reduced transportation cost
Improved relations in the supply chain
Better capacity utilization
Responsiveness
Reduction in suppliers base
Reduced product/material acquisition cost
Reduction in unit cost of product/service
Access o old class suppliers/service providers
An edge over new entrants in the industry
Better customer service

Section 3: Respondent profile

1. Name and qualification (optional):
2. Designation in the organization:
3. Your area of work in the organization (please tick):
   (A) Purchasing
   (B) Operations
   (C) IT/IS (information technology/information system)
   (D) Marketing
   (E) Technical
   (F) Any other (specify)
4. How long have you been with your current organization?
   (A) Less than 5 years
   (B) 5-10 years
   (C) More than 10 years
5. Would you like to share the findings of the survey?
   (A) Yes
   (B) No
6. Your e-mail address:

About the authors

Milind Kumar Sharma is working as Assistant Professor at M.B.M. Engineering College, Faculty of Engineering, J.N.V. University, Jodhpur, Rajasthan State, India, in the Department of Production and Industrial Engineering. He is the corresponding author and can be contacted at: milindksharma@rediffmail.com

Rajat Bhagwat is working as Associate Professor in the Department of Mechanical Engineering, Faculty of Engineering, at M.B.M. Engineering College, J.N.V. University, Jodhpur, Rajasthan State, India.