Paper B50

Study of New Technologies of Information and Communication (TIC) in Tanning industry

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Introduction

Technological innovation has been a vital factor in stimulating economic growth and makes a very significant contribution to the growing prosperity of the industrialized world. Major critical or new technologies are: Computers, Internet, Automation technologies, Biotechnology, New materials technology and Renewable energy technologies. These technologies can be distinguished from the others by the speed at which their applications are increasing and by their impact on industry, economy, society, employment and international commerce.

Leather Industry has undergone notable technological transformation[1] since the beginning of twentieth century. The invention and introduction of the drums for wet processing of leather by Durio(Italy) in 1904 heralded a new technological era in leather processing. The drum has withstood the test of the time of by retaining its basics features even today despite mechanical improvements, electronic sophistication, size enlargements and add-on auxiliary facilities. The technological developments made during last century have thrown up following challenges for the sustainable growth of the leather industry. They are:

- Environmental pollution control
- Total quality management
- Process controls and automation for wet processing of leather
- Environmental friendly leather processing chemicals and techniques

Usage of Computer assisted designs (CAD), Computer assisted manufacturing (CAM) and Flexible Manufacturing (FM) in leather manufacturing have reduced the labour and process material costs and brought in:

- Reduction in waste
- Effective treatment of waste water discharges and byproduct utilization
- Higher productivity to cover the enhanced overheads caused by environmental pollution control measures
- Predictability of leather quality, grade and delivery.

Microprocessor based systems[4] offer several new avenues for modernization of leather sector. Computer hardware is being integrated with electrical, mechanical and electronic controls to achieve accurate control of temperature, processing time, quantity and concentration of chemicals in various operations involved in leather making.

Driving forces of modernization:

Technology up gradation has several ramifications and they could very well act as driving forces for modernization as listed below:

Commercial - eCommerce:

- Better International Image
- Higher profitability and returns
- Enhanced competitiveness

- Business models, standards and norms, marketing issues, promotion of network practices, International marketing
- Enhancing Export Competitiveness of Indian SMEs through ICT [2]

Environmental – Green Chemistry

- Pollution minimization and waste reduction through recycles
- Better material management
- Cleaner and safer inplant ecology
- Inprocess techniques to control BOD,COD,TDS level incorporating the Green Chemistry concepts

Quality Control- eGovernance

- More consistent material quality
- Easier to implement inplant/on line controls
- Easier to adopt ISO standard and work practices

Human Resource Development – eLearning, Video conferencing, etannery, Inter, Intranet techniques, HR portals

- Enhanced skills
- Better working environment
- Higher productivity

Technological-Robotics, Smart computers, Smart leathers

- Competitive edge due to adoption of environmentally friendly and internationally competitive technologies
- Efficient material movement through improved layouts and scientifically designed work places
- Efficient chemical, water and energy management
- Usage of Robotics for accuracy and mass production

MODERNISATION using New Technologies of Information and Communication

SOFTWARE	HARDWARE	IT
•New organizational concepts •Modern Process techniques •Low waste technologies •Simulation and modelling •Image processing •Artificial Intellegence •Neural network •Expert systems •Pattern Recognition •Robotics •Process recipes •Business Process Reengineering	•Plant and Machinery Upgradation •Instrumentation and controls •Temperature,Pressure,Ph controls •Inprocess systems for BOD,COD , TDS control •Smart sensors •Embedded systems for specific purposes like leather defects analysis,Calibration systems	•eMail •Internet and Intranet Applications •Web services •Video conferencing •OLTP •ERP •Datawarehousing •DataMining •eCommerce,mCommerce •eLearning •Workflow •eProcurement •eTannery •Virtual laboratory •Data centre •Cloud computing

Study on ERP solutions for Tanneries

Enterprise Resource Planning (ERP) is one of the solutions to improve productivity and overall business performance in order to face the global challenges.

ERP is an acronym for Enterprise Resource Planning, and signifies the techniques and concepts employed for integrated management of business as a whole from the viewpoint of the effective use of management resources to improve the efficiency of an enterprise.

The direct benefits of ERP system include[3]

BUSINESS	MANUFACTURING
•Business integeration •Flexibility •Better analysis •Planning capabilities •Use of the latest ICT technology •eGovernanace •Internet security •Cyber Law	• Reduction of lead-time • On-time shipment • Reduction in cycle time • Better customer satisfaction • Improved supplier performance • Increased flexibility • Reduction in quality costs • Improved resource utility • Improved information accuracy and decision-making capability

It facilitates grasping business details in real time, and carries out the various types of management decisions in a timely manner, based on that information. ERP package handles the entire range of main business functions necessary for the company's operations. They are targeted at everything from small business to the largest organizations and they are composed of a highly centralized database and an information system cluster linked by a network. The ERP systems should mirror the business processes. A business model is not a mathematical model but it is a representation of the business as one large system showing the interconnections and interdependencies of the various subsystems and business processes. One of the most critical steps in the ERP implementation is the creation of an Integrated Data Model.

The ERP systems also have simulation capabilities that help the capacity and resource planners to simulate the various capacity and resource utilization scenarios and choose the best option. The efficient functioning of the different modules in the ERP system such as Manufacturing, Materials management, Quality Management, Strategic and operational planning, Finance, Human resources, Logistic maintenance, Maintenance management, Sales and Distribution ensures that the inventory is kept to a minimum level, the machine down time is minimum, the goods are produced only as per the demand and the finished goods are delivered to the customer in the most efficient way. The ERP system helps the organization in drastically improving the capacity and resource utilization. It provides better customer satisfaction. With the use of web enabled ERP systems, the customers can place the order, track the status of the order and make the payment sitting at technical support knowledge base. It facilitates an improved supplier performance. ERP systems provide vendor management and procurement support tolls designed to coordinate all aspects of the procurement process. The Quality Management systems in ERP packages support the benchmarking and use of optimal product design, process engineering and quality assurance data by all functional departments within the manufacturing enterprise, thereby facilitating definition of repeatable processes, root cause analysis, and the continuous improvement of manufacturing methods. The supply chain management is the process of acquiring needed materials and services from vendors, coordinating deliveries,

assuring quality, and trying to minimize costs. One way to better manage the supply chain is to provide vendors with information rather than just orders for goods.

This section lists the inputs required for creating ERP model for a Tannery:

Description of the tannery	Quality control
Machinery involved	Marketing
Process carried out	Human Resources
Supply chain management	Maintenance Management
Manpower/machinery management	End products

The picture (Fig 1) below describes the Information on integration through ERP systems.

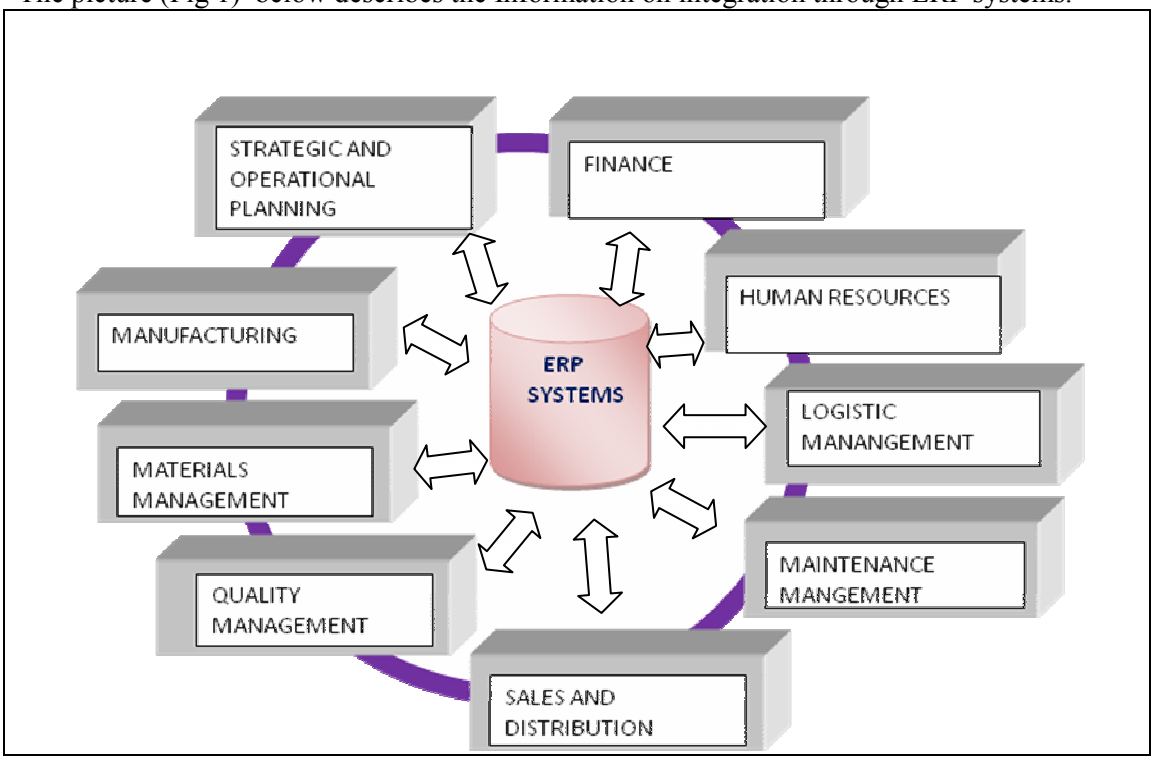


Fig 1. Information Integration through ERP systems

Data Warehouse and Data Mining

A Data warehouse is a collection of computer_ based information that is critical to the successful execution of enterprise initiatives. A Data ware house is subject oriented repository, designed with enterprise wide access in mind. It collects and stores integrated sets of historical data from multiple operational systems and feeds them to one or more data marts. It may also provide end-user access to support enterprise views of data. Some of the applications data warehousing can be used for are: Decision support, Trend analysis, Financial forecasting .One strategy adopted by companies in which many users primarily want to access data on corporate files is to create a user database. The data warehouse contains data of interest to users in a format that is easily accessible to them. The success of the data utility depends on choosing the right information from the main corporate database and making it available on the user's computer. This approach can be used for Digital library Information system on Leather products, "**Who and Where**" information linking with National and global census data.

Data Mining

It is the extraction of hidden predictive information from large databases. Data Mining can predict future trends and behaviors allowing businesses to make proactive, knowledge-driven business decision. Data warehousing added on-line analytical processing for dynamic data delivery. With Data mining, one gets predictive, proactive information delivery. Cleaning data is the process of minimizing errors in the dataset. Data transformation creates a consistent format for data .Feature selection narrows down the number of variables – useful for very large data sets with large numbers of irrelevant variables. Exploratory Data Analysis is a graphics based statistical process that helps pre-analyze data by examining things like variable distributions. The model building phase uses three major techniques. They include: Decision trees, Clustering, Association Rules.

eCommerce

Electronic commerce, commonly known as **e-commerce**, consists of the buying and selling of products or services over electronic systems such as the Internet and other computer networks. It is more than just buying and selling products online. It also includes the entire online process of developing, marketing, selling, delivering, servicing and paying for products and services. The amount of trade conducted electronically has grown extraordinarily with widespread Internet usage. The use of commerce is conducted in this way (Fig 2), spurring and drawing on innovations in electronic funds transfer, supply chain management, Internet marketing, online transaction processing, electronic data interchange (EDI), inventory management systems, and automated data collection systems. Modern electronic commerce typically uses the World Wide Web at least at some point in the transaction's lifecycle (Fig 3), although it can encompass a wider range of technologies such as e-mail, mobile devices and telephones as well. Electronic commerce is generally considered to be the sales aspect of e-business. It also consists of the exchange of data to facilitate the financing and payment aspects of the business transactions.

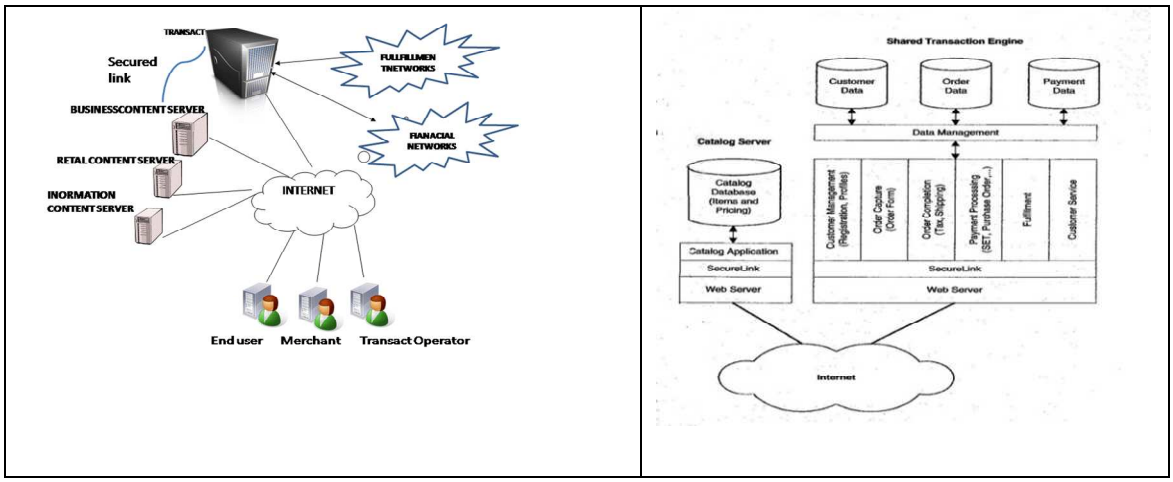


Fig 2. eCommerce Architecture :Logical View

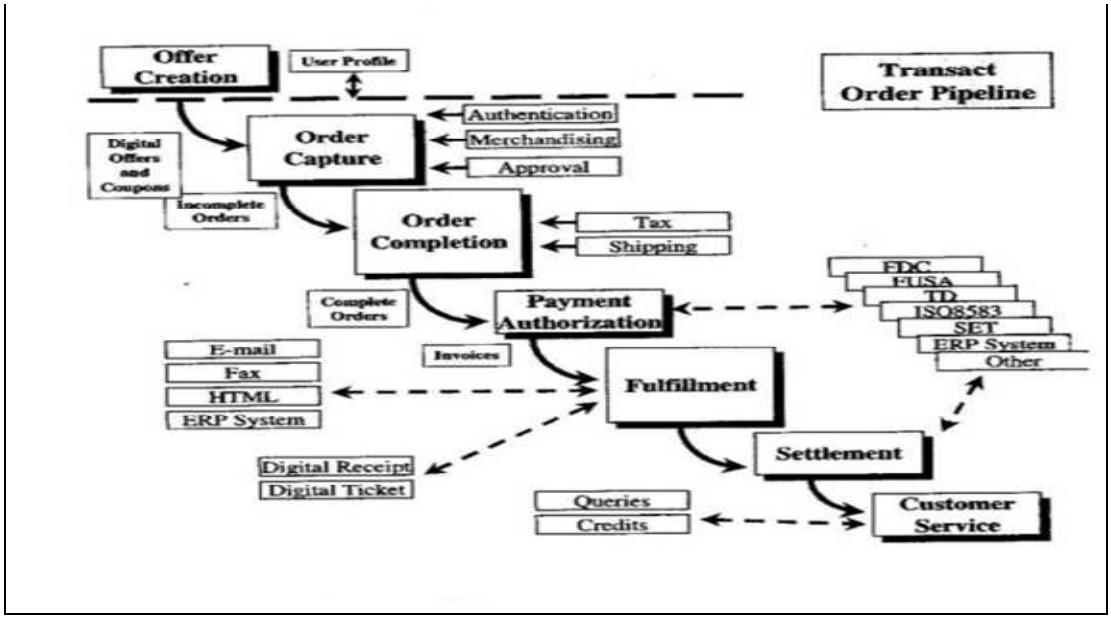


Fig 3. Transact Pipeline Diagram

GIS and Risk Analysis

An environmental impact assessment is an assessment of the possible positive or negative impact that a proposed project may have on the environment, together consisting of the natural, social and economic aspects. The purpose of the assessment is to ensure that decision makers consider the ensuing environmental impacts when deciding whether to proceed with a project. The International Association for Impact Assessment (IAIA) defines an environmental impact assessment as "the process of identifying, predicting, evaluating and mitigating the biophysical, social, and other relevant effects of development proposals prior to major decisions being taken and commitments made. They do not require adherence to a predetermined environmental outcome, but rather they require decision makers to account for environmental values in their decisions and to justify those decisions in light of detailed environmental studies and public comments on the potential environmental impacts of the proposal. A Geographic Information System (GIS) is a computer-based tool for mapping and analyzing things that exist and events that happen on Earth. GIS technology integrates common database operations such as query and statistical analysis with the unique visualization and geographic analysis benefits offered by maps. These abilities distinguish GIS from other information systems and make it valuable to a wide range of public and private enterprises for explaining events, predicting outcomes and planning strategies GIS incorporates software, hardware, and data for collecting, managing, analyzing, and portraying geographically referenced information. It allows the user to view, understand, manipulate, and visualize data to reveal relationships and patterns that solve problems. The user can then present the data in easily understood and disseminated forms, such as maps, reports, or charts.

Real time analysis for pollution prevention in Leather Processing

Material and energy in our economy flows in one direction only – from raw materials towards final disposal as industrial or municipal waste. Sustainable development requires a change in these flow patterns. Cyclic flows of material needs to be established. The focus is on the efficient use of materials and energy, reduction of waste toxicity, and reuse and recycling of materials. Applying fundamental knowledge of chemical processes and products to achieve elegant solutions with the

ultimate goal of hazard-free, waste-free, energy efficient synthesis of non-toxic products without sacrificing efficacy of function forms the basis of green chemistry.

An application on concept of green chemistry and technology for leather processing can be considered through real time analyses for pollution prevention. An expert system (KMS) integrated with the inline process analysis will help to implement this application. A knowledgebase on the processing of leather starting from pre tan to finished leather forms an input to this inline process analysis system to control the Toxicity levels.

Robotics and Embedded systems

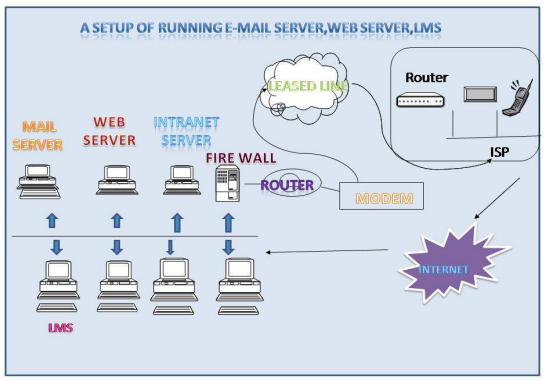
Robotic is a field of engineering that deals with design and application of robot and the use of computer for their manipulation and processing. Robots are used in industries for speeding up the manufacturing process. Robotics require the application of computer integrated manufacturing, mechanical engineering, electrical engineering, biological mechanics, software engineering and the like. ROBOTICS is the science of using a machine (a robot) to perform manual functions without human intervention. It is one branch of artificial intelligence. Robotics finds a wider application in Leather garment industry and Footwear Industry. Knowledge based systems for leather defects diagnostics, pattern recognition etc., can form an embedded system that can reside in a computer to assist online detection of defects. Operational research techniques for optimum strategy of scheduling and sequencing of multiproduct tannery operations increases productivity, plans for efficient use of equipments and hence raises profit [5].

Human Resource Development- ICT in Training [8]:Web enabled training

Human resources development in the leather sector is assuming a wider and greater emphasis and importance to meet the rising needs of the industry [6]. Technical education and training are not merely development of skills. The education and training, knowledge skills and commitment, should be targeted to meet the needs of the manufacturing industry at full level-operations. Online training, eLearning will prove to be very powerful tools in imparting training in the leather sector and help building a knowledge society.

DATA CENTRE CONCEPT

IT operations are a crucial aspect of most organizational operations. One of the main concerns is business continuity; companies rely on their information systems to run their operations. If a system becomes unavailable, company operations may be impaired or stopped completely. It is necessary to provide a reliable infrastructure (Fig 4) for IT operations, in order to minimize any chance of disruption. Information security is also a concern, and for this reason a data center has to offer a secure environment which minimizes the chances of a security breach. A data center must therefore keep high standards for assuring the integrity and functionality of its hosted computer environment. This is accomplished through **redundancy of both fiber optic cables and power, which includes emergency backup power generation.**



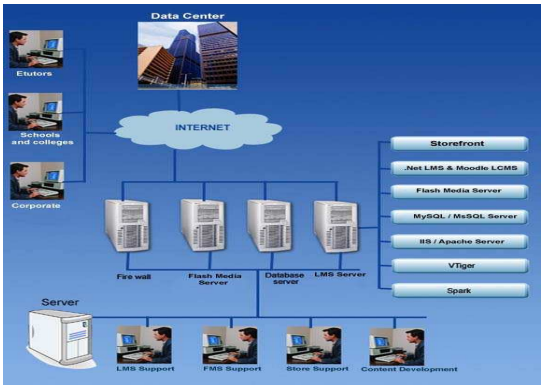


Fig 4. Infrastructure setup for Web enabled services and Industry,Academic partnership

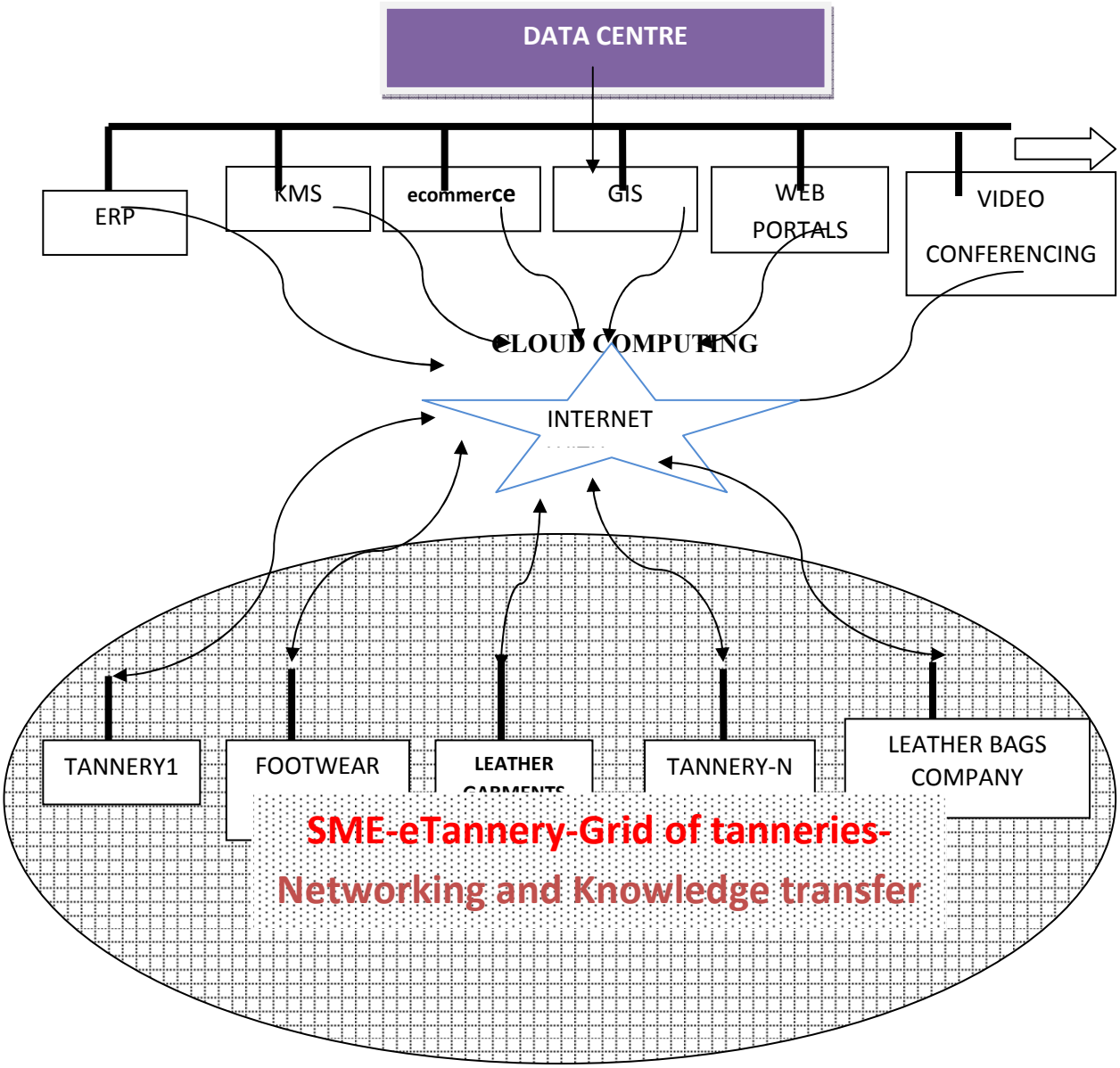


Fig 5. Visualisation of eTannery

ICT Adoption in Indian SMEs [2]

In recent years, organizations have implemented thousands of large and small innovations in software applications, work process, business organization, enterprise resource planning & management, supply chain management, customer relationship management and business intelligence & agility.

ICT adoption in the Indian SME sector can be evaluated by using, a 4 stage model. These stages are:

- Basic ICT Infrastructure
- Functional Automation
- Business Automation
- Business Integration

This model can also be used for benchmarking ICT adoption among different industry sectors.

- Computerization in selective roles, Basic level computerization and LAN for Office Automation, Communication/Promotion purposes
  (e.g. Word Processing, Spread Sheets, Database, Drafting, Graphics, Intranet, Email, Web site, Product Catalogues, etc.)
- Computerization in selective functions
  (e.g. Financial Accounting in Accounts, Material Accounting in Stores, Payroll in HR, Invoicing in Sales) - Mainly non cross functional.
- Computerization in core business processes, process automation &integration (DSS+ERP)
- Computerization in business networks (DSS+ERP+E-Commerce)

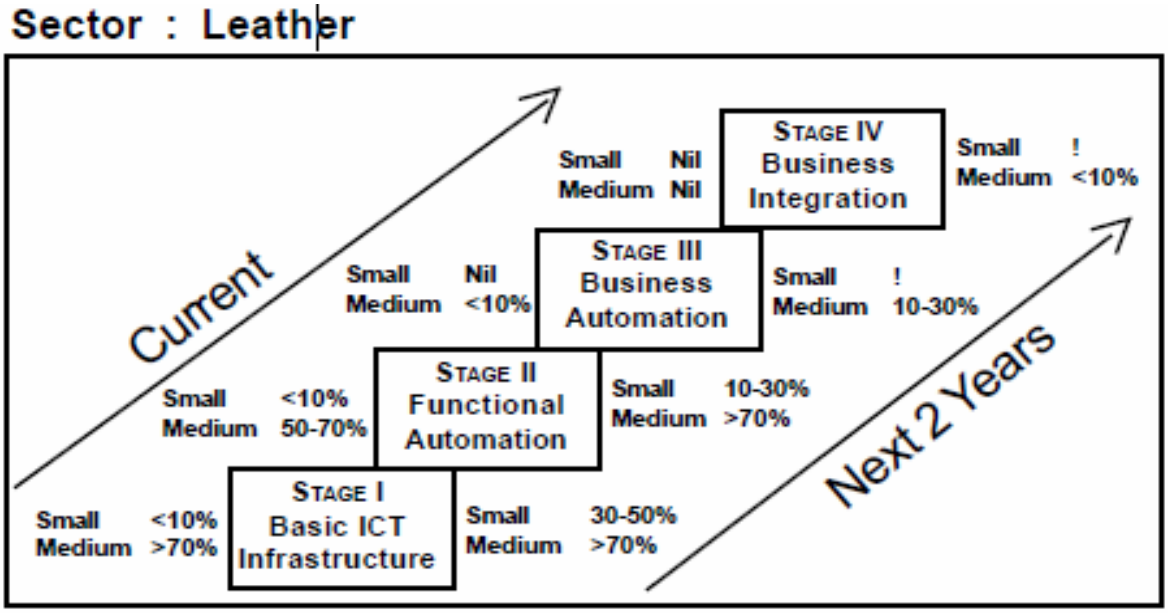


Fig 6. Deployment of ICT in Leather Sector (Year 2005 Report)

Medium and large companies in this sector are mainly engaged in branding, design & development, and export activities.

Above snapshots (Fig 6) indicate that there is tremendous scope within Indian SMEs for strategically deploying ICT and get transformed to take global leadership position. With ICT tools, SME sector can improve upon the way it is doing business currently and become more vigilant to the finer details in its day to day operations and their implications on international competitiveness. This will help SME

businesses, not only to sustain the present competition but will also provide them a platform to grow in future.

It is therefore essential for Indian SMEs to absorb appropriate Information & Communication Technology. (ICT) tools to leverage business advantage. Effective utilization of an information and decision support system will provide SMEs a disciplined business environment to operate in, where decisions concerning supply and demand are fully supported by facts. This approach would also help in maximizing business value and enhancing growth and competitiveness.

Conclusions

ICT has an immense potential [7] to modernize a traditional industry provided the interventions are conceptualized by experts and has a good understanding of the customer needs.Web-based marketing increases the reach & building newer marketing channels. CAD-CAM technologies enhance the Design Capabilities & product range building. Networking & knowledge transfer enables the credit and competence building in actions. Training and skill up-gradation of the actions enhance the quality of leather products. Upgrading of leather production process improves the productivity. Capturing traditional knowledge and integrating it with new knowledge (TIC) will take the leather industry to the position of global leader.

ICT facilitate a closer interaction of leather industries with research and educational institutes through Internet, Intranet facility. A Visualisation of an eTannery is given in Fig 5.Usage of Cloud computing which is system infrastructure dependent will enable companies (SME), to be infrastructure-less. By using the Cloud infrastructure on "pay as used and on demand", one can save in capital and operational investment and reap the benefit offered by ICT. Innovation in the field of Robotics to suit Leather Industry will provide a very high standard and eco friendly leather products. Storage and Retrieval of digital collection in the leather and allied field will open up a gateway for new findings and new branches of science. ICT enabled learning can introduce Leather and Allied science at the school curriculum to help build a knowledge society.

References

1. Tannery Modernization, April 1995
2. Technology Exports –VOL VII NO. 3,2005 , Hemant Verma,World Wide Web
3. ERP Demystified , Alexis Leon
4. Computer based technology for vegetable tannin extraction – V.S.Sundar Rao,K V Ragahavan,P G Rao, M M Gurumoorthy, P.Latha,Journal of the Society of Leather Technologists and Chemists, Vol 78,p 178
5. Scheduling and Sequence of Leather processing for optimum utilization of resources- A computer aided approach,Panda R C,P.Latha and P G Rao, XXIII IULTCS CONGRESS,FRIEDRICHSHAFEN May 15-20,1995
6. INDIAN LEATHER 2010- A Technology, Industry and Trade forecast , G Thygarajan,Chairman, TAFIL, CLRI
7. Evolving an ICT Platform for a Traditional Industry: Transforming Artisans into Entrepreneurs,B. Bowonder, S. Sadhulla and Akshay Jain
8. Human Resource Driven-ICT in education, AICLST2010, P.Latha

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