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Global Journal of Computer and Digital Techniques

Aims and Scope

Journal of Computer and Digital Techniques publishes technical papers describing recent research and development work in all aspects of digital system-on-chip design and test of electronic and embedded systems, including the development of design automation tools (methodologies, algorithms and architectures). Papers based on the problems associated with the scaling down of CMOS technology are particularly welcome. It is aimed at researchers, engineers and educators in the fields of computer and digital systems design and test.

Global Journal of Computer and Digital Techniques

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E- Kranti: The Beginning Of New Era In Delivery Of Services

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ABSTRACT

Digital India is an ambitious programme of the Government of India with a vision to transform India into a digitally empowered society. It is a mission to prepare India for a knowledge future by making technology central to enabling change. This mission rests on nine pillars: Broadband Highways, Universal Access to Mobile Connectivity, Public Internet Access Programme, e-Governance Reforming Government through Technology, e-Kranti Electronic Delivery of Services, Information for All, Electronics Manufacturing, IT for Jobs and Early Harvest Programmes. From enabling storage of legacy documents in digital format to providing a unified platform for all scholarships provided by the Government of India, from facilitating online registration and obtaining appointments in hospitals to propagating widespread use of digital signatures, from setting up of a National Centre for Flexible Electronics to creating an Electronic Development Fund as a Fund of Funds, from creating the fibre optics backbone infrastructure across the country to moving ahead with the Next-Generation Network that heralds the convergence of voice, data and multi-media services. Digital India is the most comprehensive programme under implementation, designed to harness the immense potential of Digital to propel India forward. This paper explores innovativeness of 'Digital India' programme. The Department of Electronics and Information Technology (DeitY) has started a National eGovernance Plan (NeGP) 2.0 for new electronic revolution, or eKranti. Provide us with an overview of the eKranti framework. The eKranti or NeGP 2.0 framework proposes new and substantially revised models of implementation and service delivery. NeGP 2.0 envisages government wide transformation by delivering all government services electronically to the citizens through integrated and interoperable systems via multiple modes. This transformation in eGovernance will be achieved through undertaking transformational BPR, adopting emerging technologies like cloud and mobile, providing integrated services via interoperable systems and building sustainable organisational and human resource capacities.

Keywords: - Digital India, Digital Infrastructure, Digital Enterprises, E-Kranti, , e-Taal, National e-Governance Plan 2.0.

1. INTRODUCTION

Technology transforms people's lives. It empowers and connects. From mitigating poverty to simplifying processes, ending corruption to providing better services, vitality of technology is everywhere. It is an important instrument of human progress.

Mr. Narendra Modi (Prime Minister)

E-Kranti or National e-Governance Plan 2.0 is an important pillar of the Digital India programme. The Vision of e-Kranti is "Transforming e-Governance for Transforming Governance". The Mission of e-Kranti is to ensure a Government wide transformation by delivering all Government services electronically to citizens through integrated and interoperable systems via multiple modes, while ensuring efficiency, transparency and reliability of such services at affordable costs.

The approach and methodology of e-Kranti are fully aligned with the Digital India programme. The programme management structure approved for Digital India programme would be used for monitoring the implementation of e-Kranti and also for providing a forum to ascertain views of all stakeholders, overseeing implementation, resolving inter-Ministerial issues and ensuring speedy sanction of projects. Key components of the management structure would consist of the Cabinet Committee on Economic Affairs (CCEA) for according approval to projects according to the financial provisions, a Monitoring Committee on Digital India headed by the Prime Minister, Digital India Advisory Group chaired by the Minister of Communications and IT, an Apex Committee chaired by the Cabinet Secretary and the Expenditure Finance Committee (EFC) / Committee on Non Plan Expenditure (CNE). The Apex Committee headed by the Cabinet Secretary would undertake addition / deletion of Mission Mode Projects (MMPs) which are considered to be appropriate and resolve inter-Ministerial issues.

Central Ministries/ Departments and State Governments concerned would have the overall responsibility for implementation of the MMPs. Considering the need for overall aggregation and integration at the national level, it is felt appropriate to implement e-Kranti as a programme, with well-defined roles and responsibilities of each agency involved. The thrust areas of the e-Kranti - electronic delivery of services under the Digital India programme are:-

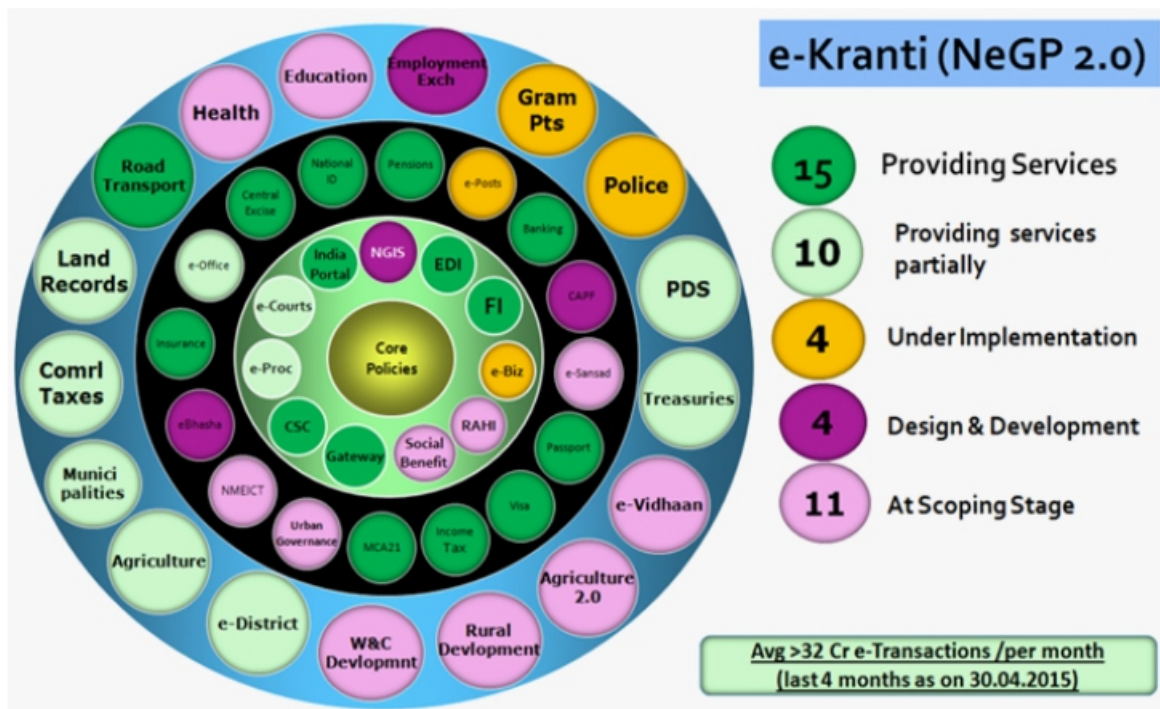
Technology for Education (e-Education), Health (e-Healthcare), Farmers, Financial Inclusion, Planning, Justice, Security, Planning and Cyber Security.

E-Governance - Reforming Government through Technology, a pivotal pillar of the Digital India programme, would also be implemented under e-Kranti by undertaking and strengthening Government Process Re-engineering, electronic databases, complete workflow automation and IT based Public Grievance Redressal in all Government Departments.

Considering the critical need of e-Governance, mobile Governance and Good Governance in the country, the approach and key components of e-Kranti have been approved by the Union Cabinet on 25.03.2015 with the vision of "Transforming e-Governance for Transforming Governance".

All new and on-going e-Governance projects as well as the existing projects, which are being revamped, should now follow the key principles of e-Kranti namely 'Transformation and not Translation', 'Integrated Services and not Individual Services', 'Government Process Reengineering (GPR) to be mandatory in every MMP', 'ICT Infrastructure on Demand', 'Cloud by Default', 'Mobile First', 'Fast Tracking Approvals', 'Mandating Standards and Protocols', 'Language Localization', 'National GIS (Geo-Spatial Information System)', 'Security and Electronic Data Preservation'.

There are 44 Mission Mode Projects under e-Kranti, which are at various stages of implementation.



2. E-KRANTI / NeGP VISION

NeGP makes all Government services accessible to the common man in his locality, Through Common Service Delivery Outlets and ensure efficiency, transparency & reliability of such services at affordable costs to realise the basic needs of the common man.

3. APPROACH AND KEY COMPONENTS OF E-KRANTI : NATIONAL E-GOVERNANCE PLAN 2.0

The Union Cabinet chaired by the Prime Minister, Shri Narendra Modi, today gave its approval for the Approach and Key Components of e-Kranti : National e-Governance Plan (NeGP) 2.0. This is a follow up to the key decisions taken in the first meeting of the Apex Committee on the Digital India programme

held in November 2014. This programme has been envisaged by the Department of Electronics and Information Technology (DeitY).

4. THE OBJECTIVES OF 'E-KRANTI' ARE AS FOLLOWS:

- i. To redefine NeGP with transformational and outcome oriented e-Governance initiatives.
- ii. To enhance the portfolio of citizen centric services.
- iii. To ensure optimum usage of core Information & Communication Technology (ICT).
- iv. To promote rapid replication and integration of e-Gov. applications.
- v. To leverage emerging technologies.
- vi. To make use of more agile implementation models.

5. THE KEY PRINCIPLES OF E-KRANTI

- i. Transformation and not Translation.
- ii. Integrated Services and not Individual Services.
- iii. Government Process Reengineering (GPR) to be mandatory in every MMP.
- iv. ICT Infrastructure on Demand.
- v. Cloud by Default.
- vi. Mobile First.
- vii. Fast Tracking Approvals.
- viii. Mandating Standards and Protocols.
- ix. Language Localization.
- x. National GIS (Geo-Spatial Information System).
- xi. Security and Electronic Data Preservation.

6. E-KRANTI IN SERVICES

In service sector, digitalization is playing a vital role by providing a valuable and fast service. That is easier to access and consumption. Some of them are as-

6.1 E-KRANTI FOR EDUCATION: E-EDUCATION

All Schools will be connected with broadband. Free wi - fi will be provided in all secondary and higher secondary schools (coverage would be around 250,000 schools). A programme on digital literacy would

be taken up at the national level. Massive Online Open Courses (MOOCs) shall be developed and leveraged for e-Education.

6.2 E-KRANTI FOR HEALTH: E-HEALTHCARE

E-Healthcare would cover online medical consultation, online medical records, online medicine supply, pan-India exchange for patient information, etc. Pilots shall be undertaken in 2015 and full coverage would be provided in 3 years.

6.3 E-KRANTI FOR FARMERS: E-FARMING

This would facilitate farmers to get real time price information, online ordering of inputs and online cash, loan, and relief payment with mobile banking.

6.4 E-KRANTI FOR SECURITY

Mobile based emergency services and disaster related services would be provided to citizens on real time basis so as to take precautionary measures well in time and minimize loss of lives and properties.

6.5 E-KRANTI FOR JUSTICE

Interoperable Criminal Justice System shall be strengthened by leveraging several related applications, i.e. e-Courts, e-Police, e-Jails and e-Prosecution.

6.6 E-KRANTI FOR FINANCIAL INCLUSION

Financial inclusion shall be strengthened using mobile banking, Micro-ATM program and CSCs/ Post Offices.

6.7 E-KRANTI FOR CYBER SECURITY

National Cyber Security Co-ordination Centre would be set up to ensure safe and secure cyber-space within the country.

6.8 E-KRANTI FOR JUSTICE: E-COURTS MISSION MODE PROJECT

The e-Courts Mission Mode Project is a national e-Governance project for ICT enablement of district/subordinate courts of the country. The objective of the project is to provide designated services to litigants, lawyers and the judiciary through ICT enablement of courts.

6.8.1 PHASE I OF E-COURTS MISSION MODE PROJECT

The Phase I covered the basic infrastructure for ICT enablement which consisted of various modules, primarily - such as computer hardware, Local Area Network (LAN), internet connectivity and installation of standard application software at each court complex and up gradation of ICT Infrastructure of Supreme Court and all High Courts / Benches. It also included provision of laptops, laser printers, broadband connectivity at home offices of judicial officers and imparting ICT training to them. Power back up was also provided at these court complexes for the ICT Infrastructure through Diesel Generator Sets (DG Sets) and Uninterrupted Power Supply (UPS).

Status of implementation as on 30th September, 2015, for main components of the project is given as under:

S. No.	Module	Status as on 30.09.2015	% Completion
1	Sites readiness	14249	100.00
2	Hardware installation	13436	94.29
3	LAN installation	13683	96.02
4	Software deployment	13672	95.95

In addition to above following activities also have been done.

- (i) ICT infrastructure of the Supreme Court and High Court has been upgraded.
- (ii) Laptops have been provided to 14,309 judicial officers.
- (iii) A Case Information System (CIS) software has been developed and made available for deployment at all computerised courts.
- (iv) Entry of case data has been initiated, and data in respect of over 4.5 crore pending and decided cases in more than 13,000 courts is available online.
- (v) Judicial Service Centre (JSC) has established at all computerised courts.
- (vi) Over 14,000 Judicial Officers have been trained in the use of UBUNTU-Linux OS and over 4000 court staff have been trained in CIS software.
- (vii) Process Re-engineering has been initiated in all High Courts to study and suggest simplification in existing rules, processes, procedures and forms.
- (viii) Video Conferencing between 500 courts and corresponding jails: Pilot launched in five districts has been completed and roll out in remaining locations across the country is under process.

(ix) **Service Delivery and National Judicial Data Grid:** The national e-Courts portal <http://www.ecourts.gov.in> has become operational. The portal provides online services to litigants such as details of case registration, cause list, case status, daily orders, and final judgments. Currently, litigants can access case status information in respect of over 5.5 crore pending and decided cases and more than 1.79 crore orders/judgments pertaining to district and subordinate Courts.

The portal has been linked to the e-Taal, a web portal for dissemination of e-Transaction statistics of Central and State level e-Governance Projects including Mission Mode Projects, and the portal has recorded 25.49 crore transactions so far, which is among top five if not the highest among all other e-Governance Projects.

6.8.2 PHASE II OF E-COURTS MISSION MODE PROJECT

Envisaging further ICT enhancement through universal computerisation of all the courts, use of cloud computing, digitization of case records of last 20 years and enhanced availability of e-services to lawyers and litigants through e-filing, e-payment gateways and mobile applications etc., the Phase II of the project has also been approved within the cost of Rs.1670 Crores in the duration of four years. The project would function in line with the Digital India program of the Government of India. The Phase II of the project would focus not only on the computerisation of courts across the country but also help in the automation of workflow management which would enable the courts to exercise greater control over the management of cases. The services envisaged to be taken up during Phase II, which would be at the disposal of the citizens, include installation of touch screen based Kiosks with printers in each Court Complex, fetching information through Mobile, facilitating improved performance of courts through change management and process re-engineering, installation of Video Conferencing facility at all Court Complexes and corresponding jails, use of e-filing, e-Payment and mobile applications and also for the composite set of services to be provided through the Judicial Service Centres. Further, the judiciary can also benefit from the project by provisioning of Hand held process service devices for process servers to ensure transparent and time bound delivery of court notices and summons, Digital Signature Certificates (DSCs) to Court officials to enable them to issue certified e-documents to lawyers and litigants, and provisioning of laptops and printers to Judicial Officers. The court management system would also be created under the project through digitisation, document management, Judicial Knowledge Management and Learning Tools Management. Also the use of solar energy has also been proposed at some court complexes enabling the courts to help the environment actively. In line with the Digital India Programme of the Government of India which emphasises on Citizen centric services, the project would also focus on Digital Infrastructure as a Core Utility to Every Citizen providing Governance and

Services on Demand subsequently digitally empowering the Citizens.

7. DIGITIZATION: EMPOWERING INDIAN ECONOMY

Digitization often enables a process to be fundamentally reconfigured; for example, combining automated decision making with self-service can eliminate manual processes. Successful digitization efforts start by designing the future state for each process without regard for current constraints—say. Digitizing information makes it easier to Data scientist, User-experience designer, Training a merchandising manager preserve and access the data. For example, an original historical document may only be accessible to people who visit its physical location, but if the document content is digitized, it can be made available to people worldwide. There is a growing trend towards digitization of historically and culturally significant data. As a result, attackers born in the digital age can swoop in and disrupt the market through rapid delivery of digital products and services combined with advanced algorithms and full access to information.

According to an article in The Guardian in March 2007, if all spoken language since the dawn of time were digitized, it would consume five Exabyte of storage space. Total digital information, in 2006 was estimated at 161 billion exabytes. Email alone made up six Exabyte's of that figure.

7.1 Accelerating The Digitization Of Business Processes

People want a quick and seamless digital experience, and they want it now. Companies such as Amazon and Apple have made every organization to deliver products and services swiftly, with a seamless user experience. All service providers need their customers to have automated access to all the data they provided earlier and not to ask the same questions over and over again.

The market through rapid delivery of digital products and services combined with advanced algorithms and full access to information. Intuitive interfaces, around-the-clock availability, real-time fulfilment, personalized treatment, global consistency, and zero errors—this is the world to which peoples have become increasingly accustomed. It's more than a superior user experience, however; when companies get it right, they can also offer more competitive prices because of lower costs, better operational controls, and less risk.

7.2 Delighting The People

To meet high people expectations, companies are accelerating the digitization of their business processes. The benefits are huge. By digitizing information-intensive processes, costs can be cut by up to 90 percent and turnaround times improved by several orders of magnitude. Examples span multiple

industries: one bank digitized its mortgage-application and decision process, cutting the cost per new mortgage by 70 percent and slashing time to preliminary approval from several days to just one minute. A telecommunications company created a self-serve, prepaid service where peoples could order and activate phones without back-office involvement. An insurance company built a digital process to automatically adjudicate a large share of its simple claims.

Real-time reports and dashboards on digital-process performance permit managers to address problems before they become critical. Instead, successful companies are reinventing processes, challenging everything related to an existing process and rebuilding it using cutting-edge digital technology. For example, rather than creating technology tools to help back-office employees type people complaints into their systems, leading organizations create self-serve options for peoples to type in their own complaints.

Digitization often enables a process to be fundamentally reconfigured; for example, combining automated decision making with self-service can eliminate manual processes. Successful digitization efforts start by designing the future state for each process without regard for current constraints—say, shortening a process turnaround time from days to minutes. Once a compelling future state has been described, constraints (for instance, legally required checks) can be reintroduced.

7.3 Build Capabilities

Digitization skills are in short supply, so successful programs emphasize building in-house capabilities. The goal is to create a centre of excellence with skilled staff that can be called upon to digitize processes quickly. Still, many times companies must search for talent externally to address the need for new skill sets and roles, such as data scientists or user-experience designers. It is also important that the team has the skills needed to build the required technology components.

8. ADVANTAGES OF E - KRANTI

- 5200 Co- Operative Credit Societies under one roof
- Direct reach to Co-operative Credit Society of Gujarat members which are more than 50 Lacs members
- Members can apply for interest free loan from their respective credit society for purchasing computer, Laptops, All In One, Tablet, Smart Phone, printers, UPS etc on 12 months installment base.
- Loan is available on easy equated monthly installments through Credit Cooperative societies.

- Bring cutting edge Revolution through eKranti.
- Transform the Gujarat State's youths, Farmers into a technology savvy generation.
- Offer computers, Laptop, All In One, Tablet, Smartphone at Zero Interest Loan.
- Help develop a completely new sustainable business model which will be helpful to societies.
- Offer a common product under a uniform scheme & strengthen the brand "Bring eKranti".
- Help Citizens to avail next generation needs.
- Improve Literacy by availing technology which in turn helps to grow GDP.

9. THE CHALLENGES FOR E – KRANTI

In India, ekranti has too many challenges to be successful. Let's have a look on those challenges.

9.1 Infrastructure

India will need massive Data Centres with mirroring i.e. all data will need to be backed up at an alternate site. This will require large investment to set up state-of-the-art data centres in various parts of India. These data centres will have to be provided fail proof physical and cyber security cover.

9.2 Security

Security is not an act but a process and a lifestyle. India is a nation where we neither understand security nor practice it, as part of our daily lifestyle. This has left our IT infrastructure vulnerable to security attack either through cyber space or through internal sabotage. While organizations like Computer Emergency Response Team (CERT) is trying to cope with the ever evolving cyber threats, India is still nowhere in establishing secure and impenetrable networks, as seen in various attacks on our critical sites of various government establishments, over the years. Government sites especially are vulnerable. Then there is the real possibility of internal sabotage that can result in stealing or damaging of data, at any given point. There is a real possibility of a disgruntled individual who is motivated by greed, revenge, political or religious affiliation may get access to the data to steal or damage it. The problem is that security has to be clearly understood by all and unless this is made part of our operational lifestyle, both at the individual and at the government level, securing vast and critical data, will always be a major hurdle. The biggest challenge to the success of the Digital India project is not on the delivery side but on the security side. Securing this data for all time is going to be the real challenge that the government has to address before embarking on this ambitious project.

9.3 Cyber Laws

When the government stores personal data of the citizens, the government becomes its custodian. This means that the government is responsible for securing the data and also preventing its misuse. The question is how is the government going to prevent litigation in cases of data misuse? For instance, what happens when one individual uses a government official to access another individual's medical records and then uses this information against that individual? Furthermore, India is a country with a VIP culture. What happens in a case of data pertaining to a VIP being accessed, lost or damaged by someone with vested interest?

In this scenario, the government becomes a party to the data breach. What happens if the data is damaged or the delay in verification causes the individual a financial loss or a loss of business opportunity? Will the government be liable for the loss? Do we have cyber laws that adequately address such scenarios? These will have to be looked at very closely by the government prior to launching the Digital India program.

9.4 Training

The Digital India program will have to simultaneously launch a training program to ensure all government officials understand the data that is available, its protocols of access and protocols of security, and also the legal ramifications of data breach. Given the large size of the government, it will take time and investment to train and cover all individuals, for successful delivery of the program.

10. SWOT ANALYSIS OF NEGP

STRENGTHS	WEAKNESSES
<ol style="list-style-type: none"> 1. There is a general awareness, both within & outside the government, of the importance of e-Governance 2. 24 out of 31 MMPs have gone live and produce over 11 Cr transactions p.m (TPM). 3. There is a significant increase in the number of professionals and experts working on e-Gov. both within government and in the industry. 4. Basic ICT infrastructure is available in all 	<ol style="list-style-type: none"> 1. NeGP has not become a national movement and could not produce the expected impact on the common man, especially in the rural areas. 2. There are significant time overruns. 3. Emphasis on Standards and interoperability is weak. 4. The degree of process-engineering is quite low

<p>States</p> <p>5. Significant funding has gone into e-Gov sector, both from GOI to States and by States themselves.</p> <p>6. There has been a significant increase in the political support for the e-Gov. program.</p> <p>7. NeGP has catalyzed the movement towards bringing in legislations on the citizen's right to time-bound delivery of public services.</p> <p>8. The environment created by NeGP has spawned a very large number of eGov projects, though outside NeGP, thus expanding the portfolio of services available online.</p>	<p>5. Mission-approach is lacking in implementation.</p> <p>6. Age-old approval procedures have hampered pace and stifled enthusiasm.</p> <p>7. There is a woeful lack of HR dedicated to e-Gov.</p> <p>8. Adoption of PPP model has not been adequate.</p> <p>9. Monitoring & Evaluation systems are weak.</p> <p>10. There is no accountability for timely implementation and for producing qualitative outcomes.</p> <p>11. Problems of connectivity in rural areas continue to plague the program.</p> <p>12. Sub-optimal use of the ICT infrastructure is a major concern.</p>
<p style="text-align: center;">OPPORTUNITIES</p> <p>1. The huge advancements in the Technology landscape during the last 7 years, enable more efficient, cost-effective and agile solutions to be designed now.</p> <p>2. The advent of the Cloud enjoins the agencies to embrace the concept of shared infrastructure, platforms & services.</p> <p>3. New business models that are based on OpEx rather than CapEx as in the past, are more feasible for adoption now.</p> <p>4. A great leap in quality of service delivery is now possible, through a radical process reengineering, breaking away from the conservative incremental approach that has so far been widely followed.</p> <p>5. With the acute need having been recognized for a large number of e-Gov. professionals for pursuing the on-going programs, and more importantly, to take the program to a new level, there is a huge opportunity to establish an institution of international stature, for Capacity Building in the area of e-Governance. With its</p>	<p style="text-align: center;">THREATS</p> <p>1. Allowing NeGP to proceed along the current direction and at the current pace may result in mass scale disillusion leading to e-Governance losing its appeal for transformation of the public sector.</p> <p>2. The existing e-Gov. projects would become obsolete or inefficient, if a fresh energy is not injected into them.</p> <p>3. A large number of islands of IT activity will be created, which do not admit either bridging or integration.</p> <p>4. Several countries competing with India on the software front can take a strong lead in implementing e-Gov. projects globally and capture the market share that India could otherwise get.</p> <p>5. India could lose the opportunity to leapfrog in the quality and nature of citizen services offered through e-Gov. if she does not take advantage of the new generation technologies like the cloud, the big data analytics, social media and mobile computing, besides In-Memory Databases,</p>

<p>inherent strengths in the software & ICT sector, and with a large number of Indian IT companies already having a strong international presence, e-Governance can be a strong vertical that can move the IT exports to a higher level & help the country achieve the target of \$ 300 billion of IT turnover by 2020</p>	<p>Software Defined Networks, 4G and LTE. A technology refresh is the need of the hour for NeGP.</p>
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A strength, weaknesses, opportunities and threats (SWOT) analysis of NeGP reveals several issues related to adopting new technologies, transforming processes and improving implementation that need to be addressed urgently. It derives from the reports of the Expert Groups and the experience of DeitY in working with various Ministries and Departments in implementing the 31 MMPs. It is evident that there is a need to make substantial improvements to the current framework of NeGP to bring about the desired transformation. It is also clear that the weaknesses and threats under the current framework adversely affect implementation of various MMPs, resulting in sub-optimal outcomes. On the other hand, the opportunities present a compelling case for a comprehensive revision of the entire e-Governance framework in the country, to achieve the full potential of e-Governance for improving delivery of Government services to citizens.

11. SUGGESTIONS FOR THE PROGRAM 'E – KRANTI'

The Digital India program is a great opportunity to develop the digital backbone in the country. If the government can extend the vision to include email messaging and cloud services on servers located in India, it will truly usher in a digital revolution in India, besides opening up massive business opportunities at home.

Today, most Indians hold email accounts with Gmail, Hotmail, and Yahoo etc along with using messaging services like WhatsApp and Viber, which all run on servers located outside India. This makes all individuals and by extension, the country, vulnerable to surveillance and privacy breach, as shown by snooping done by NSA, of the United States.

India must offer all the above services including cloud storage, to all Indians. Of course, this will entail massive investment in technology and infrastructure, but the Digital India program could well be extended in a phased manner to initiate the process of bringing all digital activity to India.

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IT In India: A Review Of IT Education And Employment Scenario Across Genders

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ABSTRACT

Past couple of decades has witnessed the rapid growth of professional and technical education predominantly in the private sector. Important segment of this was in the area of Information Technology, Computer Science and Computer engineering both at degree and diploma level. The present paper analyses the growth of educational facilities in IT & allied engineering disciplines, regional disparities, employment avenues, sector of employment, gender participation, comparison of IT & allied branches with other branches of engineering etc. The paper also takes stock of diploma-level IT education along with degree and tries to compare the scenario with all the factors concerned with education, employment etc. Particular information pertains to Growth of IT Education, Employment Status of IT Graduates, Gender distribution among paid employed, Participation of IT pass-outs in Skill Enhancement, Gender disparity in Pursuing Higher Education: Variation across disciplines, Quality of Employment among IT Employees – Comparison across all the Branches, and Education – Skill Match at the workplace.

1. GROWTH OF IT EDUCATION IN INDIA

Growth of Information Technology (IT) Education started with few seats in select universities two decades ago. Consequently, the field of study was introduced in almost all the government-run engineering colleges. For the past one-and-half decades, this subject has gained wide publicity with the growth of IT business, software development, business process organizations (BPO) in the name of call centers.

The past fifteen years also saw the emergence of liberalization in professional and technical education, growth of private engineering colleges has increased enormously in all the geographical regions of the country except North Eastern states. Every private college has started the specialized branches with names like Information Technology (IT), Computer science, computer engineering, computer science & engineering etc. Therefore, the consequent section deals with all these branches of IT with a nomenclature of “IT & allied engineering branches”.

All the colleges in government and private management have increased their existing intake capacity due to liberalized policy of regulators of technical education and to meet the growing demand of IT sector of India and other developed countries.

Table 1 shows the growth of intake in IT & allied branches of India in a span of one decade.

Figures in table one reveal that during the period 1997 to 2007, the IT education both at degree and diploma level increased many fold. In case of degree education, the intake capacity increased by 5 times, whereas in case of the diploma, size almost doubled. It is observed that the intake of diploma courses did not grow as much as intake of degree. As a result, in most of the states, the size of engineering colleges is outnumbering polytechnics. Earlier, the case was reverse. There are inter-regional variations in growth patterns. Even the growth patterns vary between degree and diploma intakes in a particular region. Only East indicates a positive increase on both fronts, otherwise, whereas there is negative relationships between engineering intakes with that of polytechnics. Moreover, the region having higher rise in engineering intakes have higher declines in diploma intakes and vice versa.

2. EMPLOYMENT STATUS OF IT GRADUATES

The following table (Table 2) gives the status of Degree and Diploma graduates of IT & related branches in India. Among degree holders, two-third were found to be settled in paid-employment, and nearly 29% were found to be unemployed. Only one among 16 graduates was pursuing higher studies in IT field. Among the diploma holders of IT, it was found less than twenty percent were in paid employment, and nearly half of them were unemployed. It was noteworthy to observe that nearly half of them were pursuing higher education i.e., graduation after their diploma. In both the cases utilization of apprentice scheme for enhancing their skills is almost absent with only a fraction of them enrolling for the scheme.

2.1 Gender disparity among paid employed

An attempt was made to classify the gender distribution among the paid employed both in case of employed in India and abroad and a comparison was made with other branches of study. Among the paid employed category, it was found that 68% were males, and in case of employment abroad, it was more than 84%. These figures are in sync with other branches though there is a slight variation among male and female employment in India. The details are given in Table-3

2.1.1 Unemployment and Gender variation:

Further analysis of unemployed engineering degree holders in IT & related fields in respect of different categories such as (i) looking for job, (ii) not looking for job, and (iii) interested in self-employment among male and female respondents revealed that almost 100 percent of male and female graduates were looking for a paid employment, and the enthusiasm towards self-employment is nil among male and female pass-outs.

2.1.2 Participation of IT pass-outs in Skill Enhancement .

Though it was revealed that the participation of IT graduates and diploma pass-outs is negligible in skill development schemes (Table 2) such as ATS, an attempt is made to assess the enthusiasm of male versus female graduates in their skill enhancement efforts.

It was found that male participation is more than double in their skill enhancement efforts compared to female counterparts. However, it was observed that the percentage is low compared to other branches of study. In case of diploma holders also, the respondents size is more than double compared to degree holders, which appears that the diploma pass-outs participation is more than double the degree holders in enrollment to Apprentices Training Schemes (ATS).

3. GENDER DISPARITY REFLECTING HIGHER PERCENTAGE IN IT PURSUING HIGHER EDUCATION DISCIPLINE WISE

An analysis indicating gender disparity was made from the available respondent across disciplines. It was observed that nearly 40 percent of the female graduates are pursuing higher education in IT, whereas, in other fields such as civil, mechanical, electrical engineering, the female participation in higher education is around ten percent. An average figure for all the branches of engineering reveals that nearly one-fourth of the female respondents are pursuing higher studies.

4. QUALITY OF EMPLOYMENT AMONG IT EMPLOYEES: COMPARISION ACROSS ALL THE BRANCHES

3.1 Change of Job & Job Satisfaction:

An attempt was made to study the extent of satisfaction in the present job by probing their options for a change of job and shift from the present job. It was found that across all the disciplines of study, the extent of satisfaction in the present job varies across all the branches and gender as referred in Table 4.

Further, comparison among gender in job satisfaction reveals that women employees are not opting for change of job. This implies that women employees are very much satisfied with the present job in all branches including IT etc. It was observed that the waiting period for IT degree holders is 3 years whereas for diploma holders it was found to be 6 years. There are inter-state variations in the waiting period ranging from one to 3 years for degree holders.

3.2 Emoluments of IT personnel

An attempt was made to capture the emoluments figures of fresh and experienced professionals of IT & related fields. There is a wide variation among the states. Contrary to the perception that IT industries offer more salaries, the data reveals that the average salary for IT graduates is less than other branches of study. However, the wages of fresh graduates is far more than other graduates. This is due to the fact that the IT field offers lucrative jobs in the beginning of their career and later on there is wage stagnation. In case of experienced IT professionals, their salaries are much higher than the all-India averages of other branches of engineering.

3.3 Education-Skill Match at the workplace

Table 5 describes the status of IT graduates and other graduates working in their own field as compared to other areas which are not concerned to their parent subject/degree obtained. It reveals that majority of IT graduates are working in their own field i.e., in the field directly related to their subject of study at graduation level. In other cases, i.e., graduates of other fields of engineering, the education-skill match at the work place varies from 50 to 90%. This data reveals that the non-IT professionals are also working in IT field, i.e., in establishments such as software, BPO, consultancy etc. where there is IT skills in demand.

Table 1. T Growth of Intake in IT & allied branches in India .

Region	Degree		Diploma		Degree Growth 1997-2007	Diploma Growth 1997-2007
	1997	2007	1997	2007		
South	9445	40135	5500	11300	224.93	5.45
West	3745	20150	2150	3225	438.05	-50.00
North	2450	15900	1850	2475	548.98	-66.22
East	1105	11365	1045	2218	928.51	12.25
Total	16745	87550	10545	19218	422.84	-17.75

Table 2. Activity Status of IT Graduates.

Activity Status	Degree		Diploma	
	Respondents	percentage	Respondents	Percentage
Paid employment	34363	63.9	3731	19.4
Self-employed	152	0.28	129	0.067
Apprentices	112	0.21	251	1.3
Unemployed	15269	28.39	8341	43.3
Studying	3477	6.47	6694	34.83
Other Activities	404	0.75	72	0.0374
Total	53777	100	19218	100

Source : Annual Technical Manpower Reviews, NTMIS, Institute of Applied Manpower Research, Various Issues, 1990s and 2000s

Table 3. Discipline and Gender wise distribution of Paid Employed Engineering Degree Holders of 2007 Batch in India

Discipline	Paid Employment								
	India			Abroad			Total		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
IT & Allied	23274	10868	34142	186	35	221	23460	10903	34363
%	68.16	31.84	100	84.016	15.84	100	68.27	31.73	100
All branches	70898	23926	94824	810	116	926	71708	24042	95750
%	74.76	25.24	100	87.46	12.54	100	74.89	25.11	100
IT Diploma	NA	NA	3729	NA	NA	2	NA	NA	3731

Source : Annual Technical Manpower Reviews, NTMIS , Institute of Applied Manpower Research, Various Issues, 1990s and 2000s

Table 4. Employees looking for a change: discipline wise

S.No.	Disciplines	Employed and looking for change of job	
		Male	Female
1	Aeronautical Engineering	0.00	100.00
2	Agricultural Engineering	96.15	3.85
3	Architectural Engineering	76.92	23.08
4	Bio Technology	84.62	15.38
5	Chemical Engineering	60.54	39.46
6	Civil Engineering	87.83	12.17
7	IT & Allied branches	75.36	24.64
8	Electrical Engineering	91.67	8.33
9	Electronics & Communication Engineering	75.61	24.39
10	Mechanical Engineering	92.31	7.69
11	Metallurgy Engineering	90.91	9.09
12	Mining Engineering	100.00	0.00
13	Industrial / Production Engineering	97.01	2.99
14	Textile Engineering	90.00	10.00
15	Others	168	29
	All India	80.45	19.55

Source : Annual Technical Manpower Reviews, NTMIS , Institute of Applied Manpower Research, Various Issues, 1990s and 2000s

Table 5. IT vs. Other Engineering Degree holders working in their own field (in Percentages): Select States

States	IT Graduates	Other Graduates working in their own field	
	Working in their own field		
Chandigarh	84	50	78
Delhi	100	69	86
Haryana	81	77	72
Himachal Pradesh	88	-	81
Punjab	58	62	56
Rajasthan	89	74	89
Andhra Pradesh	NA	NA	NA
Karnataka	99	96	97
Kerala	93	85	84
Tamil Nadu	NA	NA	NA
Assam	100	78	82
West Bengal	94	95	95
Gujarat	NA	NA	NA
Maharashtra	81	81	75
All India	92	78	85
	All India	80.45	19.55

Source : Annual Technical Manpower Reviews, NTMIS , Institute of Applied Manpower Research, Various Issues, 1990s and 2000s

IMAGE or DIAGRAM here.

Figure 1.

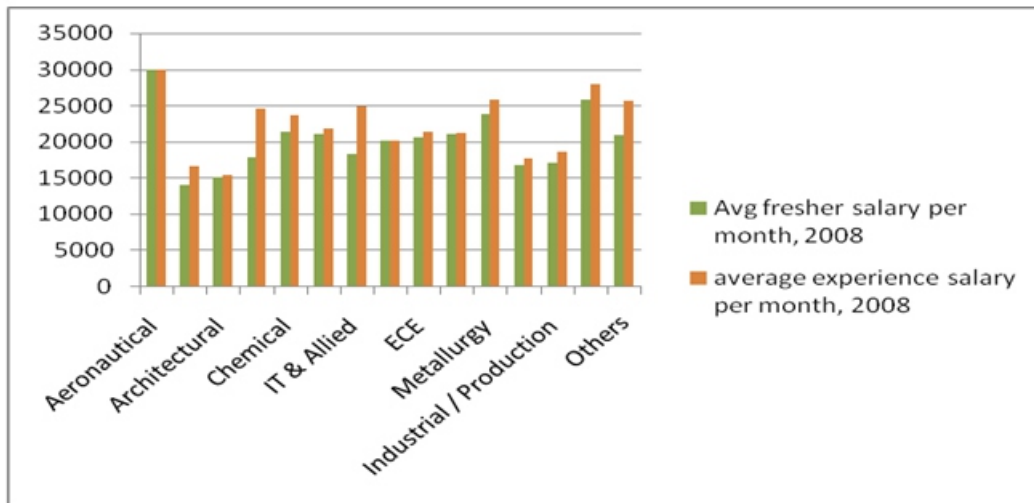
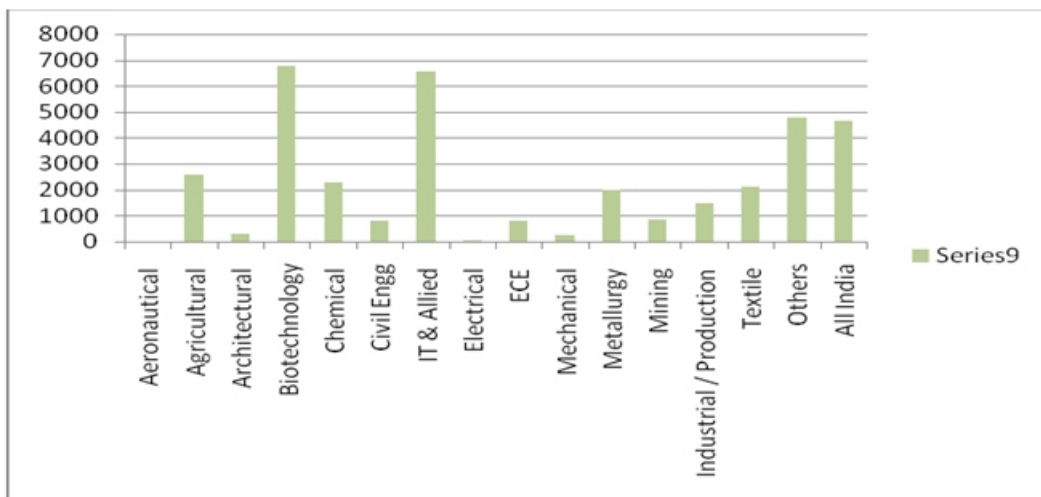


Figure 2.



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Strategies for Protecting Intellectual Property in Software and Databases

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ABSTRACT

This paper discusses various forms of intellectual property protection available for software and databases. Issues related to protecting software as a patent, as a copyrighted work, and as a trade secret are discussed. Generally there is no golden rule for protecting software and databases in particular manner and an analysis of the form and forum of protection is most suited must be done on a case-by-case basis. Specifically, the advantages offered by a specific type of protection, as well as potential pitfalls of each form of protection, are discussed to enable the original inventor, author, or discoverer, make educated decisions to suitably protect their rights.

1. INTRODUCTION

Intellectual property refers to an individual's interest in creations of the human mind that may be legally protected. There are several mechanisms for protecting intellectual property rights. These include protecting the intellectual property using copyrights, trademarks, patents, and trademarks. Copyright protection provided by the law to an individual or entity for original works produced by that author. Copyright law protects the authors of original works. Trademark law seeks to protect source identifying marks against customer confusion where distinctive word, phrase, logo or other graphic symbol that is used to distinguish one product, company or organization from another. Patent law provides protection for inventions or discoveries by granting a limited monopoly to the inventor in exchange for a complete and enabling disclosure of the invention for use of public good. And, trade secrets law protects confidential information regarding any process, method or design that a manufacturer or seller uses to design, market or otherwise develop a product where such confidential information confers a competitive advantage to the holder of the trade secret.

In this paper specifically, the role of each of these types of legal protections applicable within the realm of information technology, including software and databases, is examined.

2. PROTECTING INFORMATION TECHNOLOGY ASSETS

When it comes to protecting information technology assets, including software or databases, there are essentially three different mechanisms available under the existing intellectual property laws. Namely, software and databases may be protected as patents, copyrights, and trade secrets. Software being either a functional product, or a result of human creativity, will not be protected as a trademark since the sole purpose of a trademark is to serve as source identifier, as such the use of the Microsoft™ or Apple™ logo indicating to the potential customer that the product has been produced by that company. While, the source of software is typically designated by its creator using a trademark, as for example copies of operating system disks carry a trademark identifying the creator of the disks such as Microsoft™, the use of the trademark does not protect the software contained therein – rather it merely identifies the creator.

Protection of information technology assets, such as pieces of code, the design of a web site, the architecture of a web services facility, or the contents of a database may itself be protectable as a patent, copyright or a trade-secret. Specific issues related to protection of information technology assets as patents, copyright, or trade secret is discussed next.

2.1 Protecting Software as Patents

Patent rights granted by the government enable an inventor to exclude others from making, using, selling, or importing a patent owner's new, non-obvious, and useful invention. In the United States, this limited monopoly is granted to the inventor for 20 years from the date of filing a utility patent application, or for a period of 14 years from the date of issue of a design patent. Subsequent to the period of the limited monopoly, the invention falls into the public domain.

Specifically within the context of software, it is worth noting that under patent law, inventors can enjoin the making, using, selling, or importing of an infringing piece of software or database *even if the infringing piece of software was independently created*. It is therefore beneficial for an inventor to patent software as early as is feasibly possible to satisfy the requirements necessary of obtaining patent protection. Herein lies one of the hurdles for obtaining software patents. Specifically, US federal statute 35 USC 101 requires that the subject matter of a utility patent application be a new or improved useful “process, machine, manufacture, or composition of matter.” Furthermore, since *abstract ideas* are not patentable subject matter, an *algorithm* without more, is barred from issuing as a patent.

Most software patents fall within the purview of a “process” patent, unless the software is a part of a

a machine as is a micro-controller embedded within an electronically controlled device being patented. Theoretically, sequences of mental thoughts (algorithms) are processes also. As for example, the sequence of steps for doing long division is a process. However, public policy warrants that individuals not hold monopoly on fundamental concepts, thoughts and mental procedures. As a result, abstract ideas - including purely mathematical equations and algorithms, laws of nature, and natural phenomena are deemed to be non-patentable subject matter.

Courts have analyzed a number of cases related to computer software and algorithms. In *Gottschalk v. Benson*, an early 1970s case, the process of converting numbers represented as Binary Coded Decimal (BCD) into binary numbers was held to be a purely “mental” process and therefore statutorily non-patentable subject matter.

Later in 1978, an inventor sought to patent an equation where the claimed equation was used to set alarm limits in a catalytic converter. Even though the subject matter – the mathematical equation – on which patent was sought was implemented within a “system,” the court nonetheless held the equation as statutorily non-patentable subject matter.

It was not until 1981 that the courts granted a patent to Diehr for a computer program that implemented a mathematical equation to solve a “problem.” Specifically, the inventor sought patent a computer program that implemented the Arrhenius equation for curing rubber. However, the claims were not directed towards the equation but towards a process for curing rubber – the said process being implemented by a computer.

It is therefore instructive to note that while granting patent rights to software, the nature of the problem is viewed in the aggregate and the invention as a whole is considered to determine if the invention falls within the purview of patentable subject matter under 35 USC 101.

Later in the *State Street* case, the inventor sought to patent a “hub-and-spoke method” for price calculation, including a software that implemented this method. This was deemed to be patentable subject matter. The court stated that software or process yielding useful results are patentable. Specifically, the court stated that “software is considered patentable as long as [it] yields 'a useful, concrete, and tangible.'” As a result software patentability determination is often performed within the

¹*Gottschalk v. Benson*, 409 U.S. 63 (1972)

²*Parker v. Flook*, 437 U.S. 584 (1978)

³*Diamond v. Diehr*, 450 U.S. 175 (1981).

⁴*State Street Bank & Trust Co. v. Signature Financial Group, Inc.* 149 F.3d 1368 (Fed. Cir. 1998)

framework of the so-called Machine or Transformation or MOT test. Specifically, this test states that the patenting a process requires that a software or process must be (1) tied to a *Machine* or *Apparatus*, Or (2) *Transforms* a particular article into a different state or thing.

Most recently however, in *Bilski v. Kappos*, court in fact rejected that MOT test be exclusively used for determining patentability of software or processes. The Court stated that the MOT test not suited for Information Age and “would create uncertainty as to patentability of software, advanced diagnostic medicine ... data compression ... manipulation of digital signals.” The Court continued to state that 'Useful, Concrete and Tangible' continues to be the test for patenting Business Methods in general, a category that includes software as a process patents.

Prior to *Bilski*, the Court had in the case of *In re Allapat* had allowed an anti-aliasing process which took in one set of input intensities and produces another stream of intensities as the output. The anti-aliasing process was not tied to a specific machine and nor did it transform an article. Yet it was a useful, concrete, and a tangible process used in practically all computer display units.

In summary, *Bilski* has not invalidated any software patents. In fact, if anything, *Bilski* re-iterated that software, business methods, database applications, or process yielding useful results are patentable subject matter. In terms of determining if a piece of software is patentable therefore, the critical question should be if the results produced by the software are useful, concrete, and tangible.

2.2 Copyright Protection for Software

Let us next examine the protection of information technology assets, software, and databases using the process of copyright registration. In the United States Copyright Act is defined as a federal statute 17 USC 102. Copyright protection exists for original work of authorship fixed in any tangible medium of expression. With regards to the level of creativity required for copyright protection, the threshold is quite low – with a slight amount of creative spark sufficing to overcome this threshold.

In order for software or database to be protected by copyright, there must be some *original* creative expression. Facts, data, and utilitarian elements alone do not satisfy the requirements of copyright laws. Copyright laws provide protection for eight enumerated categories including literary works, musical works, pantomimes, pictorial, graphic and sculptural works, motion pictures, sound recordings, and architectural works.

Literary works are expressions comprising of words, numbers, or other printable or non-printable symbols regardless of which medium, such as books, manuscripts, records, films, tapes, or discs, used for their affixation. This is a broad category that includes fiction and nonfiction books, catalogs, reports, written speeches, pamphlets, and manuscripts. Computer programs, databases, and websites are treated as literary works since these works utilize expressions of letters, symbols, numbers, and words.

It is possible to obtain copyright protection for software, databases, websites, and any documents or manuscripts prepared in support of these works. However it is also worth noting that not all works are protected by copyright. 17 US §102 specifically lists those works that are excluded from the copyright protection. These excluded works are ideas, procedures, processes, systems, concepts, principles or discoveries regardless of the form in which they are described or explained.

This statutory provision exempts *ideas* from protection as copyrightable material. In general there is no protection of ideas under of laws. Ideas that have been reduced to practice may be protected as patents. Within the context of copyright law, this long-standing rule often referred to as *idea-expression* dichotomy has been a fundamental principle of copyright. The idea-expression dichotomy, whereby an idea is not protectable but its expression is, was first enunciated by the United States Supreme Court in a case of *Baker v. Seldon*⁷.

Thus an idea of performing a computer search of a database using the phonetic or voice input is not protectable as a copyright; however, a computer program that implements this search may be protected as a copyrighted work. Similarly, the idea of using an average change in valuation of a portfolio of securities to estimate their success is not protectable, but computer software that implements this approach and ranks a portfolio is. Furthermore, since these ideas are not protected, anyone can write their own software to implement these ideas; and so long as their implementation is not substantially similar to, i.e. a copy of, the copyrighted work it will not be deemed as an infringement of the copyrighted work.

Copyright protection in so far as source code is concerned therefore protects a program to the extent that another may not copy and paste it into their program. Copyright protection in so far a machine readable or executable code is concerned, actually offers a strong protection since the machine code may not be copied. And usually, without the ready availability of the source code, it is difficult to produce machine

⁵*Bilski v. Kappos*, 130 S. Ct. 3218, 177 L. Ed. 2d 792 (2010)

⁶*In re Allapat*, 33 Fed. 3d 1526 (Fed. Cir. 1994)

code that is substantially dissimilar to the protected work. Therefore, copyright protection works well where software is simply performing well-known tasks – a patent for those being highly unlikely due to a lack of the “novelty” requirement.

Also included in the scope of copyrightable works are derivative works. A derivative work is one that is based on one or more existing works. Within the context of software, different versions of the same software are considered derivative works. The author of a derivative work transforms or somehow modifies a pre-existing work. The resulting work is copyrightable also as long as it includes the original work and the original work was not obtained unlawfully. Derivative works, such as new versions of software, web sites, and databases, are each individually copyrighted as typically a software vendor release newer and revised versions of software or databases.

2.3 Maintaining Software as Trade Secret

A trade secret is defined as any valuable business information that affords a competitive advantage or benefit to its owner. Trade secret information generally includes formulas, patterns, programs, devices, methods, techniques, or processes that derive independent economic value from their not being generally known or readily ascertainable through proper means, and are subjected to reasonable secrecy by its owner. In order to be protected as a trade secret, its owner must safeguard it using reasonable measures. For example, the legendary formula of for Coca-Cola™ is locked in a vault and accessible only to a handful of executives. Trade secrets laws protect such information from being misappropriated by improper means such as theft or espionage. Furthermore, unlike patents and copyrights that exist for a limited duration, trade secrets can exist forever.

While copyrights and patents are subject to extensive federal statutory regulation, there is no equivalent federal system for registering or regulating trade secrets – no registration is required to obtain trade secret protection. In 1979 the National Conference of Commissioners on Uniform Trade Secrets drafted the Uniform Trade Secrets Act (USTA) to promote uniformity among with regards to trade secret protection. The USTA was amended in 1985 and has been adopted by 45 states.

Misappropriation of trade secret occurs when a person uses improper means to possess, disclose, or use a trade secret owned by another without their express or implied consent. Remedies for misappropriation

⁷*Baker v. Seldon*, 101 U.S. 99 (1879)

of trade secrets include injunctive relief, money damages and attorney fees. Plaintiffs you recover lost profits as well as profits made by the defendant. Moreover courts will also grant punitive damages for misappropriation of trade secrets. For example in 2005, California jury ordered Toshiba Corporation to pay \$380 million in compensatory damages, and \$84 million in punitive damages, for the theft of Lexar-Media's trade secrets relating to Lexar's digital cameras and camera phones.

Within the context of software, trade secrets law may be used for protection of source code. As long as an organization takes reasonable measures under the circumstances to protect the secrecy of its source code, it will be afforded legal protection as a trade secret. If object or machine code is released by a software company to its customers, and in so far as the object code is not decipherable, any steps taken by the competitors to “crack the machine code” to decipher the logic utilized by the company would be deemed as an improper means and potentially subjected to misappropriation penalties, including punitive damages.

In addition, a company may also protect the contents of its databases, marketing and customer lists, discount strategies, or sales-lead processing as trade secrets so long as this information confers a competitive advantage to the company and is generally not known to public. An organization's use of reasonable measures for guarding their secrecy would include requiring its employees to sign a non-disclosure and a non-compete agreement as a precondition for employment. A properly executed employment contract and restricted access to trade secret information will satisfy the requirement of taking reasonable means to guard secrecy.

In summary, companies related to creation of intellectual property, such as the information technology service organizations typically are, should take appropriate measures to safeguard these secrets. Its only when reasonable measures are used to protect that information that the information is elevated to the level of a trade-secret.

3. INTERNATIONAL ISSUES

A brief summary of international issues in intellectual property protection is discussed next. Suffice it to state that this area of law is quite complex; therefore the summary presented below is by no means comprehensive. Rather, it is presented to simply provide some guideposts for detailed analysis and to alert the reader to become cognizant of international issues related to protection of information technology assets.

Generally, patent rights of an inventor are territorial. The rights granted to the patentee in one country

only extend throughout that country and have no effect in a foreign country. Consequently, an inventor who desires patent protection in a country must apply for a patent protection in that country.

Nearly every country has its own patent laws that must be complied with to obtain protection in that country. Paris Convention for Intellectual Property Protection of 1883 is a treaty adhered by more than 170 nations. The Paris Convention requires that each member country give a “national treatment” to the citizens of other member countries. This simply means that citizens of other countries have the same rights and patent and trademark matters as that country's citizens. Accordingly, on the basis of patent application filed in one of the member countries, the applicant may within one year apply for patent protection in any of the other member countries. The latter application will then be regarded as it is on the same day as the first application in the first country.

The Patent Cooperation Treaty (PCT) of 1978 further streamlines the filing, searching, and examination of patents by using a standardized application format for simultaneously filing one “international patent application” in each of 140 PCT countries saving substantial time and money ordinarily incurred in filing separate application with each country. While this international application must still be prosecuted in what is termed as the “national phase” in each country where protection is sought, PCT applications afford a substantial window of time to inventors for keeping their options open in deciding whether to proceed with seeking protection in a specific country.

There also are no international copyright laws that protect copyrighted works in every country. More than 160 countries, however, adhere to the Berne Convention that requires that the member countries similarly to give national treatment to citizens of other member countries. Berne Convention requires that a minimum level of copyright protection be given to the authors including exclusive rights to the authors to perform, broadcast, record, use it works, ensuring that copyright laws of member countries are uniform. The Berne Convention provides that copyright protection cannot be conditioned upon compliance with any registration requirements imposed by country of origin. Therefore, works are automatically protected without requiring notice of copyright, or registration. Finally, Berne Convention provides that works are protected in all countries independent of any special requirements imposed by the country of origin.

In 1996, the World Intellectual Property Organization (WIPO) convened in Geneva, Switzerland, to amend international copyright laws to specifically address concerns over piracy of software and other copyrighted works over the Internet. As a result, the WIPO Copyright Treaty expressly states that computer programs are protected by copyright laws as literary works and makes it clear that authors’

exclusive rights for distribution extends to electronic distribution over the Internet or other electronic means. The WIPO Copyright Treaty also requires nations to impose remedies against any person altering electronic rights management information, and to provide adequate legal protection against the circumvention of security or encryption devices used by authors.

4. CONCLUSIONS

In summary software and databases may be protected as patents, copyright work, or trade secrets. Each one of these approaches has its set of advantages and pitfalls. Software having extensive utilitarian component, should generally be protected as patents. These include software used for embedded applications, such as the automotive and related real-time control applications. In some instances, however, software and databases containing no original expression or utility may only be protected as trade secrets. It must be noted that when software or database, such as the source code of an application, is protected as a trade secret, reasonable measures for safeguarding the trade secrets must be taken in order for the work to be so protected. In other instances different versions of software may only be protectable as derivative copyright works. Finally, we live in a global interconnected world. Therefore, an organization seeking to protect its software and database intellectual property assets must take necessary measures to extend the protection of its product internationally and be cognizable related to piracy and digital security.

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Information Technology for Competitive Advantage in the Petro Retail Industry

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ABSTRACT

This paper is an effort to present the application of information technology in the oil retailing sector and to study these technologies have enable the oil marketing companies to gain a competitive advantage. Retailing includes all the activities involve in selling goods and services to the final consumer. These include store management, inventory management, transportation, monitoring and control. The entire energy sector is in a state of continuous change. The challenges before this sector is also special as the various factors that affects the successful and profitable operation of the retail outlets are not in the direct control of the organization hence the technology used should be such that it encompasses the interest of various stakeholder of the petro retail system i.e. supplier, retailer and the consumer.

Information technology is the capability to electronically input process, store, and output, transmit, and receive data and information. It plays a very important role in today's business world. There are various technologies which are used in fuel retailing like Gas station management system, Fleet management system, fuel delivery management system at terminal, control room based management etc.

These technologies help in reducing the retail complexities and optimizing profitability at point of sale by reducing operation cost throughout the supply chain. They also improve customer experience at the forecourt by ensuring right quantity and quality. This helps in gaining and retaining loyal customers and creating good brand image.

Key words – Fuel Retailing, Oil marketing companies, supply chain, automation, remote operation, oil retailing.

INTRODUCTION

The retailing of petrol started in the year 1882 in India. The Standard Oil Company of USA was the first company to start the retailing of fuel in India. They used to retail kerosene in the country. In the year 1959, Indian Oil Ltd. was registered as the first marketing company of India. In the year 1964, Indian Refineries Ltd and Indian Oil Co Ltd. were merged and Indian Oil Corporation (IOC) was formed. Initially all the activities related to the petroleum business be it exploration, refining, distribution or selling were strictly regulated and protected by the government but after April 2002 with the dismantling

of APM private sector companies were also allowed to operate in the Indian market. The three major oil marketing companies (OMC) in India are Indian Oil Corporation Ltd., Bharat Petroleum Corporation Ltd and Hindustan Petroleum Corporation Ltd. These three PSU oil companies together constitutes about 83% of the total fuel sales in the country and about 94 % of the total number of retail outlets in the country (Fig 1).

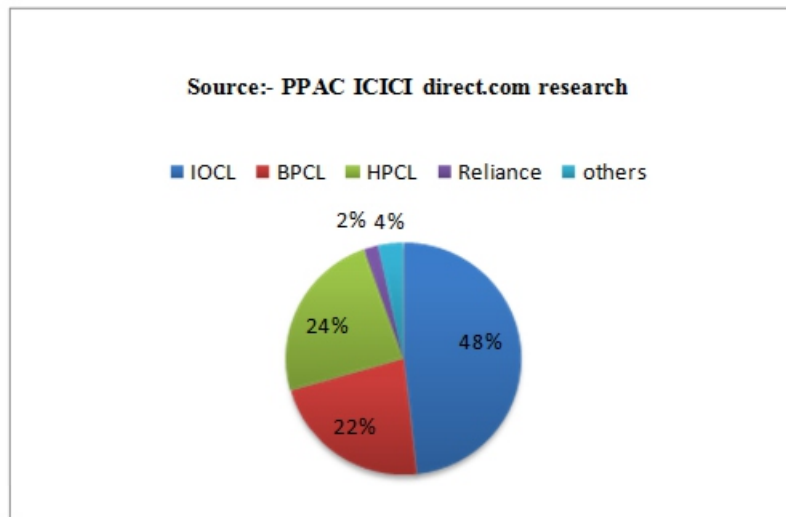


Fig 1: Market share of OMC in Fuel sales

Information Technology and Oil Retailing

In today's retailing world customer is the king. Providing value to the customer and meeting his demand has become a challenge. Today's customer wants value not only in terms of price and quality but also in terms of service and convenience. Information technology helps them in managing the cost and delivering the services. Many consumer research studies have shown that the consumers are willing to accept new technologies and solutions in different retail formats. Those technologies which help in reducing time at the counters and better selection of the product are among the most popular one. A fuel station is the final point of sale in a petroleum supply chain. It is a growing market worldwide. This market has become more competitive because of the lift of the control over the prices of the fuel in many countries. The role of government in determining and controlling petroleum prices are redefined and the petroleum market is deregulated as a result this sector is becoming more and more competitive.

Fuel retailing market is different from other retailing market as it sells homogeneous product. In this market the importance of price increases as the consumers are not able to differentiate between the products attributes. As prices begin to vary for the same product, customers differentiate outlets not only by the quality of the offering and the convenience of acquiring it, but also by the price being charged.

Beside price the other challenges faces by the petro retailers includes –

- How to retain and increase market share?
- How to retain and gain loyal customers through brand building and promotional activities?
- How to optimize petrol stations network?
- How to reduce the operational cost?
- How to reinforce the customer's perception for right quantity and quality?
- Can there be any supplementary revenue stream in the existing infrastructure?

Use of IT for Competitive Advantage

Information technology is a tool that gives answer of most of the above questions. Oil retailers utilizes the tools of information technology for carrying out day to day functions like keeping the record of transaction data, sales volume, market prices, pricing rules, asset utilization pattern. They use IT for keeping a record of demographic characteristics of the customer, usage patterns and retail network. They also use IT for efficient and automated operation of the petrol retail outlets. The most crucial issue of right quantity and right quality is the fuel retailing is addressed with the help of visual evidence. It has been made possible with the help of information technology. Remote operations monitoring and multiple retail propositions at point of sale is another use of information technology in retailing.

According to M. Lowe and N. Wrigley the various ways in which retailers uses IT to position themselves with a cutting edge of technological developments by investing in IT along with organizational changes, improved retail logistics, reduction in lead times or delay. They also use information about the consumers demand to reframe the retail policies and to sell their own products. Information technology is also used measure employee performance and for reduces transaction cost. The cost, productivity and marketing benefits information technology is as follows (Fig 2):

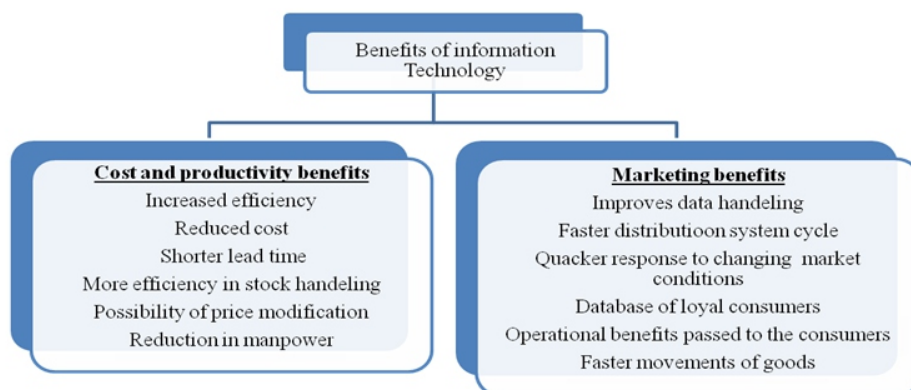


Fig 2 : Benefits of Information Technology

Technologies Used in Oil Retailing

Oil marketing companies use many information technology tools for their daily functioning to gain a competitive advantage over the competitors and to retain and gain consumer loyalty. The various issues related to the petro retail outlets are solved with the help of petro retail management system. The major area in which technologies used by the oil marketing companies are:

- Customer relationship management
- Inventory management
- Supply chain management
- And electronic data interchange

Starting from the point of production to point of sale information technology is used everywhere in the fuel retailing. The major technologies used are Gas station automation system, Fleet management system, Fuel delivery management system at terminals, Control room based management, Dynamic pricing, demand forecasting and distribution planning and scheduling technologies. These technologies offer an integration of hardware and software solution for the dispensing pumps, back office, forecourt, convenience store, networking and head office applications.

Gas Station Automation System- this system provides monitoring, controlling and management of gas stations with components like “ Forecourt Controller- this equipment monitor and controls the major forecourt activities,” “ outdoor payment terminal- to provide various payment methods ,” “ Tank level gauge- to provide measurement of products and water level, temperature and volume re-conciliation.”

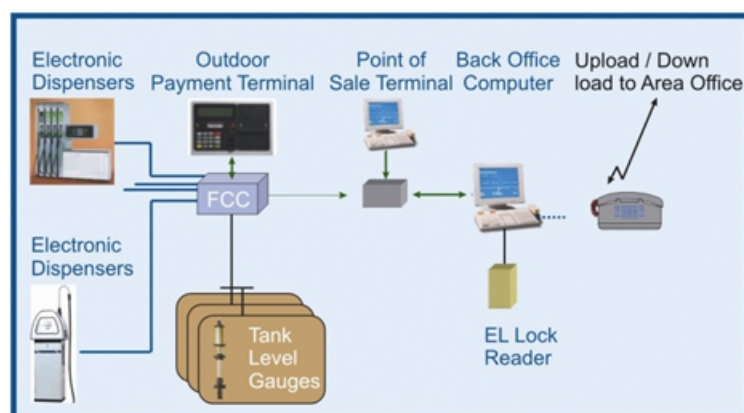


Fig 3: Gas Station Automation System (Source: Automation Industry Association)

Fleet management System – in fleet management system a Vehicle Information Unit (VIU) is fitted in each fleet vehicle. This unit is hooked up to the Odometer and with fuel cap. Once connected and initialized it keeps correct log of the miles traveled and also details on the fuel type required for vehicle, registration number, etc. A complete report of the vehicle can be send to the fleet owner with this information. Further, since the odometer reading of each vehicle is uploaded during the re-fuelling operation, fuel consumption pattern of each group of vehicles with respect to time and distance can be calculated and provided to fleet owner as report (Fig 4).

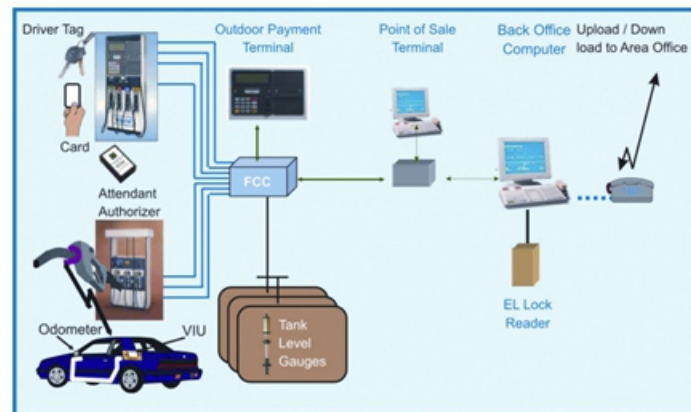


Fig 4: Fleet Management System (Source: Automation Industry Association)

Fuel delivery management system at terminals – This System manages the demand fulfillment side of the Petroleum Supply Chain. It ensures secure delivery of petroleum products from terminal to gas station and as per the replenishment schedule (Fig 5).

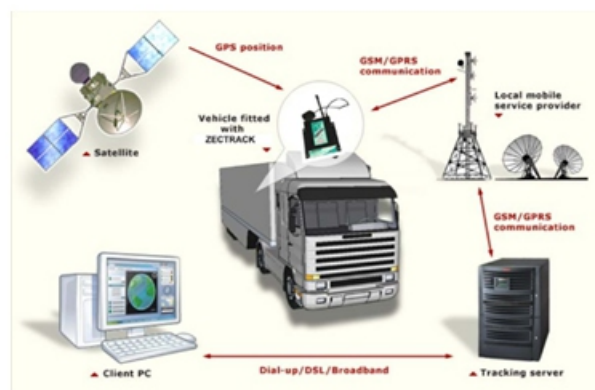


Fig 5: Fuel Delivery Management System (Source: Fleet Infotech private limited)

Control Room Based Management – This technology helps the supervisors and analyst to manage the entire operation from the comfort of a room. This helps in sorting and viewing of various data collected from the field.

The other technologies that are used in oil retailing industry are dynamic pricing, secondary distribution planning and scheduling and demand forecasting are used at the marketing head office level. At the corporate level network planning solutions are deployed to enable decision related to network optimization.

Conclusion

The information technology has revolutionized the oil marketing. They have a deep impact on the way the oil retailing and marketing business is being done. These technologies have helped the OMCs to keep a control on the major forecourt activities and provide value added services to its customer. These technologies have helped in reducing the retail complexities and optimizing profitability at point of sale by reducing operation cost throughout the supply chain. They also improve customer experience at the forecourt by ensuring right quantity and quality. This helps in gaining and retaining loyal customers and creating good brand image. Information technology can definitely impact the competitiveness of the oil marketing companies but to obtain it they have to invest heavily and continuously on these technologies.

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The Open Source Software for Library Management: An Overview

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ABSTRACT

Open source library software packages are increasingly gaining popularity now-a-days. Many open source software like Koha, NewGenLib, Evergreen, and Foss4Lib etc. are applications now available for library management and automation. The open source software model makes source code available to users, who can change the software to tailor it more closely to their own requirements. With many open source software applications now available for library and information management, organizations have a new option for acquiring and implementing systems, plus new opportunities for participating in open source projects. Factors associated with the successful adoption of open source software applications for library and information management include the match with an organization's culture, technical infrastructure, staff skills, software functionality, and the extent of community support available.

Key words – Free Software, Library Automation, Koha, Evergreen. NewGenlinLib, OSS.

INTRODUCTION

Open source software appeared in the mid – 1990s with the creation of the GNU (or GNU's NOT UNIX) project, aimed at developing a freely available UNIX – like operating system. The GNU website provides the following definition of “free software” which is key to the philosophy of the open source software: “Free software” is a matter of liberty, not price. To understand the concept, you should think of “free speech “not as in “free beer”. Free software is a matter of the user's freedom to run, copy, distribute, study, change and improve the software and computerization became very important for the smooth operation of Library. Library is a storehouse of knowledge .It is also called the heart of the institution. It help user for learning, research programme etc. Computerization and Automation in libraries increase the effectiveness and efficiency of library service. So the role of computer and automation in library is very crucial. Automation in Libraries helps to give better services to the user. Many open source library software now available in the market. Open Source Software is computer software that is available in source code form for which the source code and certain other rights normally reserved for copyright holders are provided under a software license that permits users to study, change, and improve the

software. Some open source licenses meet the requirements of the Open Source Definition. Some open source software is available within the public domain. The Open Source Initiative (OSI) was formed in February 1998 by Raymond and Perens. With about 20 years of evidence from case histories of closed and open development already provided by the Internet, the OSI continued to present the 'open source' case to commercial businesses. They sought to bring a higher profile to the practical benefits of freely available source code, and wanted to bring major software businesses and other high-tech industries into open source.

An indication of the worldwide applicability of open source software is provided by the number of languages in which homepage of the GNU website exists. Albanian, Chinese, Dutch, English, Korean, Italian, Japanese, Spanish,

Thai, Polish, Romanian. A Special license, known as the GNU License, is often used for the distribution of open source software. A directory of open source software is available from the Free Software Foundation on the GNU website. The directory was started in 1999 and since 2003 Unesco has been involved in its development. "Standard" open source software includes:

™ Apache – an http – compliant web server

™ Linux – an operating system

™ My SQL – a relational database management system that support the query language SQL (Structured Query Language)

™ Perl – a general, high – level scripting language

Open source software is of great benefit in many countries. In using such software it must be realized that a certain amount of expertise is required to enable any particular software to meet the needs of the particular digital library system being developed. Staffs with such expertise are likely to be in demand, and many not stay in the institution for a long time. In such cases it will be necessary to ensure that appropriate documentation has been produced so that use of the software and its "customization" to meet local needs can be understood by successive members of staff. Some LMS suppliers are beginning to be aware of open source software developments: innovative, for instance supports Linux^{[1],[10]}

Definition

The Open Source Definition is used by the Open Source Initiative to determine whether a software license can be considered open source. The definition was based on the Debian Free Software

Software Guidelines, written and adapted primarily by Bruce Perens. Perens did not base his writing on the "four freedoms" of Free Software from the Free Software Foundation, which were only widely available later^{[5],[14]}

What is Open-Source Software?

Open source software is computer software for which the human readable source code is made available under a copyright license that meets the Open Source Definition. This permits users to use, change, and improve the software, and to redistribute it in modified or unmodified form. Open source software is often developed in a public, collaborative manner. Open source software is the most prominent example of open source development and often compared to user generated content. The basic idea behind open source is very simple. When programmers can read, redistribute, and modify the source code for a piece of software, the software evolves. People improve it; people adapt it; people fix bugs^[3]



Open Source Software

Open source is a development method for software that harnesses the power of distributed peer review and transparency of process. The promise of open source is better quality, higher reliability, more flexibility and support open standards. OSS is invented in order to provide software to users with more rights than proprietary (or commercial) software does that everyone is allowed to use, copy, or distribute, unmodified or with modifications, for free or for money, but always together with the source code. There are so many open source software such as integrated library management, digital library, content management, databases etc., under the various free and open source foundations, for which the source code is freely and publicly available, though the specific licensing agreements vary as to what one is allowed to do with that code.

Features of Open Source Software

Open source doesn't just mean access to the source code. The distribution terms of OSS must comply with the following criteria:

- ™ Free redistribution
- ™ Source code
- ™ Derived works
- ™ Integrity of the author's source code
- ™ No discrimination against persons or groups
- ™ No discrimination against fields of Endeavour
- ™ Distribution of license
- ™ License must not be specific to a product.
- ™ License must not restrict other software

Koha Integrated Library Management Software

Koha is the first open-source Integrated Library System (ILS). In use worldwide, its development is steered by a growing community of libraries collaborating to achieve their technology goals. Koha's impressive feature set continues to evolve and expand to meet the needs of its user base.



Fig.1 Koha: Open Source Software

Indian Institute of Technology Bombay (IITB) established its management school in the year 1995 with the objective of transforming professionals with technological background to "Renaissance Leaders" of tomorrow. After that it named as Shailesh J. Mehta School of management (SJMSOM) with its commitment to learning provides the students with a fully equipped library consisting of more than 7000 books, journals, Audio Visual Material (CDs and Audio cassettes), databases, Thesis & Dissertation and

MDP reports. The SJMSOM library desperately needed the library management software to provide the service to its users and for housekeeping operations such as Acquisition, circulation and OPAC etc. There are so many open source library software are available such as PhpMyBibli, Alexandria, Evergreen, Koha, NewGenLib and PMB. The committee decided to use KOHA open source software for library management after careful study of the architecture, features like Simple, clear interface for librarians and members, Circulation and borrower management and Cataloging module with integrated Z39.50 client of the software and support of the open movement community developer. The KOHA 2.2.7 version was installed and it's . customized as per our requirement ^{[3],[4]}

Evergreen Software

Evergreen ILS is another option when researching open source ILS options. Developed by Equinox Software, Evergreen is a robust, enterprise level ILS solution development to be capable of supporting the workload of large libraries in a fault-tolerant system. It too is standards compliant and uses the OPCA interface, and offers many features including flexible administration, work-flow customization, adaptable programming interfaces, and because its open source, cannot be locked away and benefit from any community contributions. Evergreen is an open source Integrated Library System (ILS), initially developed by the Georgia Public Library

Service for Public Information Network for Electronic Services (PINES), a statewide resource-sharing consortium with over 270 member libraries. Beyond PINES, the Evergreen ILS is deployed worldwide in hundreds of libraries, and is used to power a number of statewide consortia catalogs.

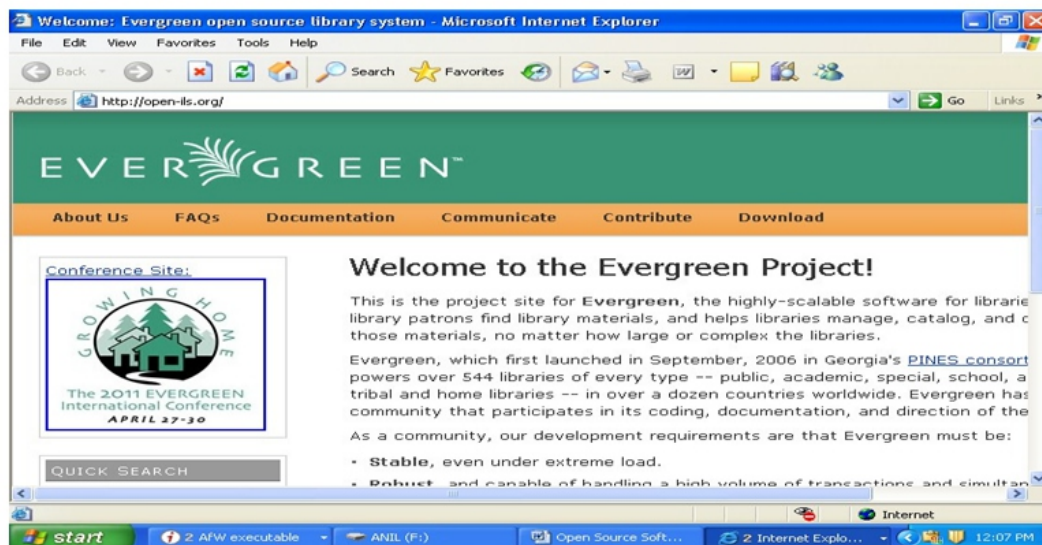


Fig. 2 Evergreen: Open Source Software

In 2007, the original Evergreen development team formed a commercial company around the software, Equinox . Software, which provides custom support, development, migration, training, and consultation for Evergreen^{[3],[12]}

NewGenLib NewGenLib (New Generation Library) is web-based Integrated Library Automation software which is jointly developed by Kesavan Institute of Information and Knowledge Management (KIIKM), a charitable trust and Verus Solutions Pvt. Ltd (VSPL), a software company, both located at Hyderabad, India. Domain knowledge and functionality testing was provided by KIIKM. Software development was done by VSPL

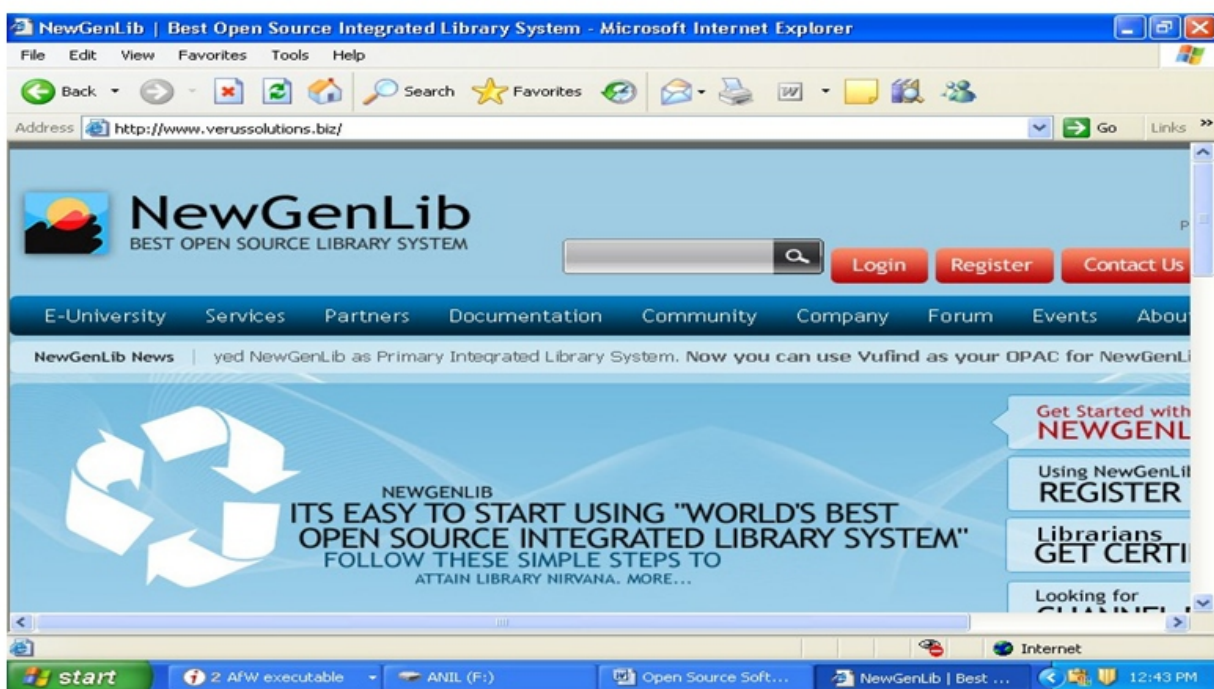


Fig. NewGenLib: Open Source Software

In March 2005, NewGenLib version 1.0 was released and versions 2.0 and 2.1 have come up later. on 9th January 2008, new genlib has been declared open source software.

The software, originally a commercial product (2003-2007), is now available as open source since January 2008 and released under GNU General Public License (GNU GPL) V3. Libraries can download, install and use NewGenLib. absolutely free of cost. Active community based support is also available^[3]

SOPS (SciX Open Publishing Software)

The Scix (open, self Organizing Repository for Scientific Information Exchange) project is an European Commission funded under the IST program, SOPS is a result of an EU funded research project. The first version was made available in the March 2004. SOPS is build on the top of the WODA (Web Oriented Database) which was created in 1996 by Ziga Task.

FOSS4LIB Software

FOSS4LIB thrives based on community-generated information! Software creators, users, and support providers are welcome to create an account on FOSS4LIB to add information about new packages, events, software releases, and support options as well as register an institution's own use of open source software.

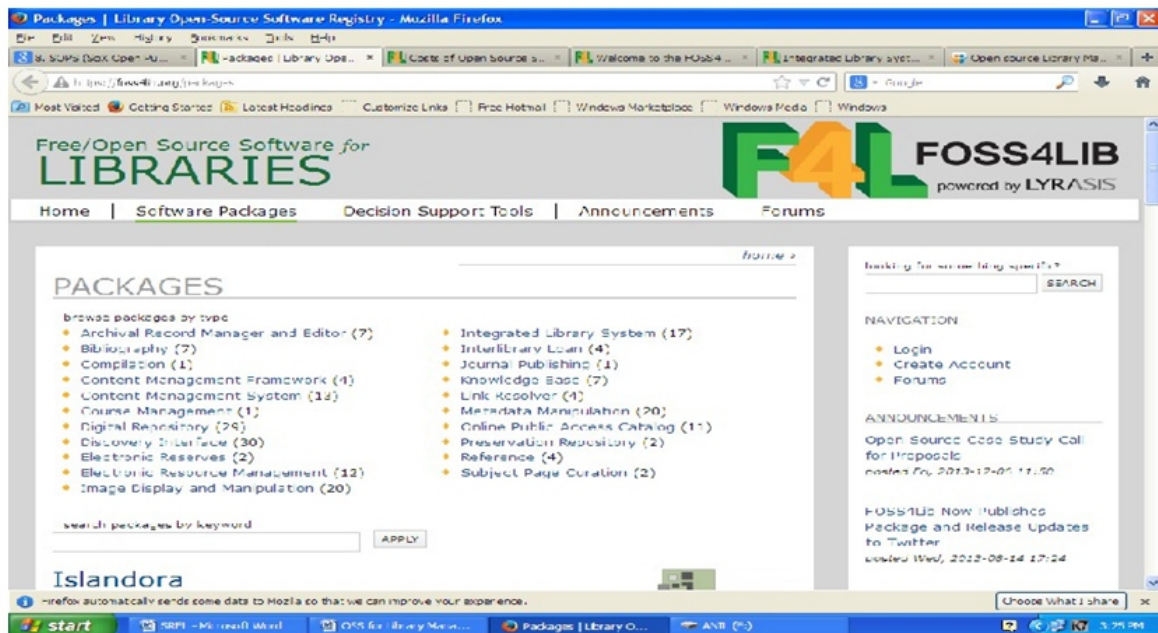


Fig.4 FOSS4Lib: Open Source Software

When packages are added or updated on FOSS4Lib.org or new releases announced, the FOSS4Lib twitter account will now publish tweets with links back to the FOSS4Lib site. From there readers are directed back to resources on the project websites for more information. ^[13]

How OSS differ from Free Software and Proprietary Software?

Freeware software often differs from open-source software in-that freeware is created by may be one or a few people. Freeware is generally closed-source, although the source is sometimes available. The distinction, even if the source is available is that it is still maintained by a closed group. Anyone can join an open source group if they can prove that they can contribute anything of use to the project.

Sometimes freeware is licensed for non-commercial use only. The term "proprietary software" is often used to mean computer software which is neither free nor open source. A literal meaning of "proprietary" in relation to software is that it has a copyright owner who can exercise control over what users can do with the software. However, the term is commonly used in a narrower sense to describe software with restrictions on use or private modification, or with restrictions judged to be excessive on copying or publishing of modified or unmodified versions. These restrictions are placed on it by one of its proprietors. In this sense it is also known as "non-free software" and is the opposite of free software, generally speaking^{[1],[6]}

Open Source System-Targeted Support Systems

OSS entities most often always provide a forum and guide for users that seek information and technical assistance regarding their particular applications. Additionally, within the realm of OSS ILS support, there is a niche of companies that provide technical and administrative support for a fee. So, even though the ILS itself may be provided gratis, technical support for OSS ILS applications can still be elected for purchase. Several companies also offer complimentary software which serves to aid with the maintenance and migration of ILS frameworks. Consequently, OSS ILS applications are complemented by a network of resources intended to ensure the product's sustainability.^[9]

Why Libraries Interested in Open Source Software?

The changing information environment dominated by Internet technologies has given libraries new choices in meeting the information needs of their users. Libraries are taking up OSS as a way to reduce the costs of expensive commercial products and as a viable alternative to the often expensive proprietary library automation systems. The benefits of OSS can potentially reduce costs, give users more control and increase software performance. OSS certainly appears to give libraries more control over technological choices and an ability to bring library values to software. Identified the advantages in the use of open source software for library automation in India:

™ OSS is an economical alternative to libraries' reliance upon commercially supplied software.

™ OSS is essential if libraries are to develop software and systems that meet their patrons' needs.

™ OSS ensures that library systems and online services will be more functional for patrons.

™ OSS democratizes the use of software applications in libraries irrespective of the type or size of the library.^{[2],[4],[7]}

Factors to be Considered While Implementing Open Source Software

The selection of software for library activities is driven by the nature of collection, availability of staff, budget, and management support. Thus while considering the OSS for libraries, they have to focus on the following factors.

TM **Software Acquisition Cost:** Some proprietary products have very low software acquisition costs. Other products can have high acquisition costs. In some cases, nonprofit organizations can get many software packages or web-hosted applications donated or at reduced costs, which may reduce or eliminate the acquisition cost for the software. Sometimes, however, organizations are limited in how many copies of a product will be reduced-price or donated. Virtually all open source software is available for no acquisition cost whatsoever, and no multiple licenses are needed.

TM **Implementation costs:** For some software, implementation is quite easy, and will take a staff person 10-30 minutes to install. More complex applications take days of staff and/or consultant time to implement, and convert information from an old system. When evaluating the options for a particular solution, be aware that in some cases open source projects can be more difficult to install than their proprietary counterparts, especially if the folks doing the installing are new to OSS.

Benefits of Open Source Software

Motivations for using and developing open source software range from philosophical and ethical reasons to pure practical issues. The first perceived advantage of open source models is the fact that open source software is made available gratis or at a low cost. Some of the benefits of OSS are:

TM **Lower software costs:** Open source solutions generally require no licensing fees. The logical extension is no maintenance fees. The only expenditures are for media, documentation, and support, if required.

TM **Simplified license management:** Obtain the software once and install it as many times and in as many locations as you need. There's no need to count, track or monitor for license compliance.

TM **Lower hardware costs:** In general, Linux and open source solutions are elegantly compact and portable and as a result require less hardware power to accomplish the same tasks as on conventional servers (Windows, Solaris) or workstations. The result is you can get by with less expensive or older hardware.

- ™ Scaling/consolidation potential: Again, Linux and open source applications and services can often scale considerably. Multiple options for load balancing, clustering, and open source applications, such as database and email, give organizations the ability to scale up for new growth or consolidate to do more with less.
- ™ Support: Support is available for open source—often superior to proprietary solutions. First, open source support is freely available and accessible through the online community via the Internet. And second, many tech companies are now supporting open source with free online and multiple levels of paid support.
- ™ Escape vendor lock-in: Frustration with vendor lock-in is a reality for all IT users. In addition to ongoing license fees, there is lack of portability and the inability to customize software to meet specific needs. Open source exists as a declaration of freedom of choice.
- ™ Unified management: Specific open source technologies such as CIM (Common Information Model) and WBEM (Web Based Enterprise Management) provide the capability to integrate or consolidate server, service, application, and workstation management for powerful administration.
- ™ Quality software: Evidence and research indicate that open source software is good stuff. The peer review process and community standards, plus the fact that source code is out there for the world to see, tend to drive excellence in design and efficiency in coding.[3]

Advantages of Open Source Software

- ™ Centralized hosting using the health center-controlled network model affords economies of scale
- ™ No cost or a lower cost for licensing "open source" solutions
- ™ Flexibility to adapt the software for particular health care solutions
- ™ Continuing software enhancements available through the open source community
- ™ "Mission" rather than "Market" objectives focused on patient-centered, population-based health improvement
- ™ Open architecture allows for greater opportunities for health information exchange
- ™ Ability to incorporate tools for personal health, such as personal health records
- ™ Many pre-existing tools for interface and reporting already developed
- ™ Tools make it easier to build generic rather than custom interfaces

Drawbacks of Using Open Source Software

- ™ Lack of formal training and support that a commercial software package offers.
- ™ Installing and maintaining OSS generally requires a higher level of technological sophistication that are not required for commercial software.
- ™ OSS are also not known for ease of use as the focus is usually at functionality.
- ™ With no vendor responsible for the software, support for the OSS application can vary and often depends on the users/developer's commitments to the project.
- ™ Documentation manuals of OSS is not very simple

Disadvantages of Open Source Software

- ™ Difficult to engage support of vendors with practical experience in supporting the application; often they have retired or left the agency
- ™ Often no single source to support all aspects of the application; multiple sources of technical and clinical support may be required
- ™ Must understand business logic to adjust configuration or make code adjustments to meet unique work flow and clinical needs
- ™ User assumes more "ownership" of the solution than under proprietary licenses, including initiation of upgrades, enhancements, configuration and support of software
- ™ Difficult for smaller organizations to afford the resources individually
- ™ May require sophisticated professional guidance on licensing issues and the preparation of contracts
- ™ The open source solution may not be CCHIT certified by the originating agency and this may provide challenges, especially if the user is seeking grant funding that requires, as a condition of funding, that the software to be acquired is CCHIT certified.™ Often have to adapt and develop training materials appropriate for the particular application of the open source solution
- ™ Must guard against information overload and alert fatigue

Difficulties in Using Open Source Software In India

There are some problems of using OSS in libraries in India, some of them are:

- ™ Rigidity in the publishers policies
- ™ Lack of proper Information & Communication Technology (ICT) infrastructure.

™ Lack of proper Planning and Integration of Information Resources

™ Lack of ICT strategies and policies

™ Management Support

™ Copyright /IPR Issue

Conclusion

Open Source Movement and Free Software Movement given lot's of thing to society. The Open Source Software has natural strengths which benefit individual users. Above and beyond this, the widespread use of OSS holds advantages open standards and open data. The implementation of above software is not possible without support of management and motivations. Open source and its benefits over proprietary software has always been a subject of dispute among user groups, as well as within the IT vendor community due to the speculations surrounded around open source. As correctly observes, the initial development of an open source project often depends on the vision of an individual, but it will only be successful through sustained effort at community development. Community building is thus an important theme in developing a set of best practices for library open source software. Any set of best practices will need to include the various issues of funding and management structure, leadership, code development, community building, and technical and financial sustainability. These issues are not necessarily particular to libraries, but nonetheless they need to be resolved if libraries are to be successful in developing and maintaining open source software. Finally, I could say that, successful Open Source Software/Free Software projects, technical skill, management skill, leadership skill are required.

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