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Focus: e-Governance

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Contents

Focus

e-Governance for Good Governance in Punjab in India: A Shared Vision

NIRMALJEET SINGH KALSI AND RAVI KIRAN

There is a need for transformation from traditional governance to e-governance. The present research is an effort to evolve the shared vision of three categories of stakeholders, viz. citizens, politicians and administrators, and academicians and practitioners about factors comprising of good governance in the Indian context through "Participatory Stakeholder Assessment." It also tries to find out whether the new information and communication technologies can make a significant contribution to the achievement of the objective of good governance. The study has also attempted to identify and establish linkages between the factors responsible for creating a conducive environment for effective and successful implementation of e-governance for achieving good governance. An effort has been made to identify the possible barriers in the implementation of e-governance applications. Finally, the study suggests a meaningful framework for e-governance map for enhancing good governance.

Nirmaljeet Singh Kalsi is IAS, Joint Secretary, Ministry of Home Affairs, Government of India, New Delhi and Ravi Kiran is Professor and Head, School of Behavioral Sciences & Business Studies, Thapar University, Patiala.

e-governance originated in India during the late seventies with a focus on applications in the areas of defense, economic monitoring, and planning. The efforts of the National Informatics Center (NIC) during the eighties to connect all the district headquarters from 1988 was a watershed. From the early nineties, e-governance has seen the use of IT for wider sectoral applications with policy emphasis on reaching out to rural areas and taking in greater inputs from NGOs and private sector as well. The Internet, in particular, creates an opening for new forms of interaction with the citizen that allows real-time participation in the governmental and democratic process. But as with e-business, once the opening is created and the tools are at hand, it is not so much a matter of choice as a matter of time. Customers and citizens expect governments to get with it; if they do not, they risk becoming irrelevant (Tapscott and Agnew, 1996).

Literature Review

e-governance is the use of emerging information and communication technologies to facilitate the processes of government and public administration. e-governance is providing citizens with the ability to choose the manner in which they wish to interact with their governments. It is about the choices governments make about how information and communication technologies will be deployed to support citizen choices.

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The study by Lal (1999) discussed how information and communication technologies (ICTs) can help to sustain e-governance process in three ways: (i) they can support tasks that involve complex decision making, communication and decision implementation, (ii) they can automate tedious tasks done by humans, and (iii) they can support new tasks and processes that did not exist before. When ICTs are properly aligned with governance goals, they can help to create gains in both efficiency and effectiveness.

Heeks (2001) studied the effect of new information and communication technologies and how it can make a significant contribution to the achievement of good governance goals. The article outlines the three main contributions of e-governance: improving government processes (e-administration); connecting citizens (e-citizens and e-services), and building external interactions (e-society).

Though most of the states in India have come up with their own IT policies, e-governance policies, policies for attracting investments in IT, ITES and BPO, no state has been able to come up with a comprehensive strategic policy framework for leveraging the total advantage of information and communication technologies.

Gupta and Jana (2003) have suggested a flexible framework to choose an appropriate strategy to measure the tangible and intangible benefits of e-government. Governance is "good" when it allocates and manages resources to respond to collective problems and when a State efficiently provides quality public goods to its citizens. This renders that states should be assessed in terms of quality as well as quantity of public goods provided to citizens (Rotberg, 2004–05). Three dimensions of governance are isolated as essential: efficiency, transparency, and participation (Mimicopoulos, 2006). Governance comprises the traditions, institutions and processes that determine how power is exercised, how citizens are given a voice, and how decisions are made issues of public concern. Social governance provides a moral foundation, economic governance provides a material foundation, and political governance guaranties the order and the cohesion of a society (Nzongola-Ntalaja, 2002).

Verma et al. (2008) undertook a Participatory Rural Appraisal exercise to assess peoples' needs and aspirations, which was followed by a Business Process Reengineering exercise to make government departmental working more efficient, transparent and adaptable to computerization. It was concluded that the information "should be for all and within reach of all" was the guiding

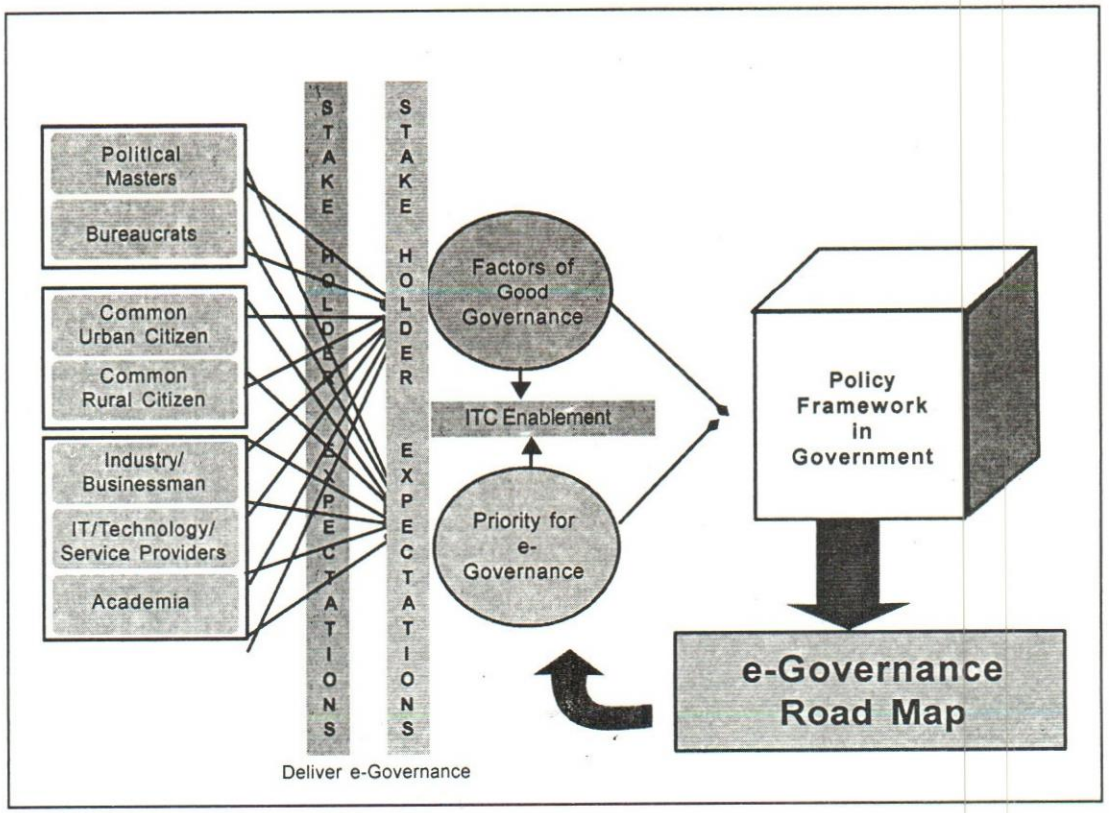

Figure 1: Research Framework

principle of the project. Kalsi et al. (2009) tried to study the e- governance initiatives of ten major states of India to identify best e-governance initiatives.

Research Framework

Design and Methodology

The details of sample size and percentage of respondents has been depicted through Table 1. The percentage of respondents was highest for citizens and it was 32.4 percent.

Demographic Profile of respondents highlight that the sample is dominated by males, singles, and Non Tax Payers.

As depicted through Figure 2, the sample is dominated by urban population constituting 66 percent. Although equal percentage of questionnaires were

Table 1: Questionnaires administered and the responses received

Stakeholders	Questionnaires Administered	Responses Received	%Responses Received
Citizens	2250	729	32.4%
Bureaucrats & Politicians	200	34	17%
IT/Academics	450	86	19.1%
Total	2900	849	29.27%

Table 2: Demographic Profile

Group	Number	Percentage	Group	Number	Percentage
Male	553	65.14	Illiterate	21	02.43
Female	296	34.86	Under Grad.	200	23.55
			Graduation	318	37.45
			Post Grad.	73	08.59
Single	450	53.00	Income BPL	27	03.18
Married	388	45.70	Non Tax Payer (not BPL	515	60.65
Widowed/Divorced	11	1.29	Card Holder)		
			Tax payer	307	36.16

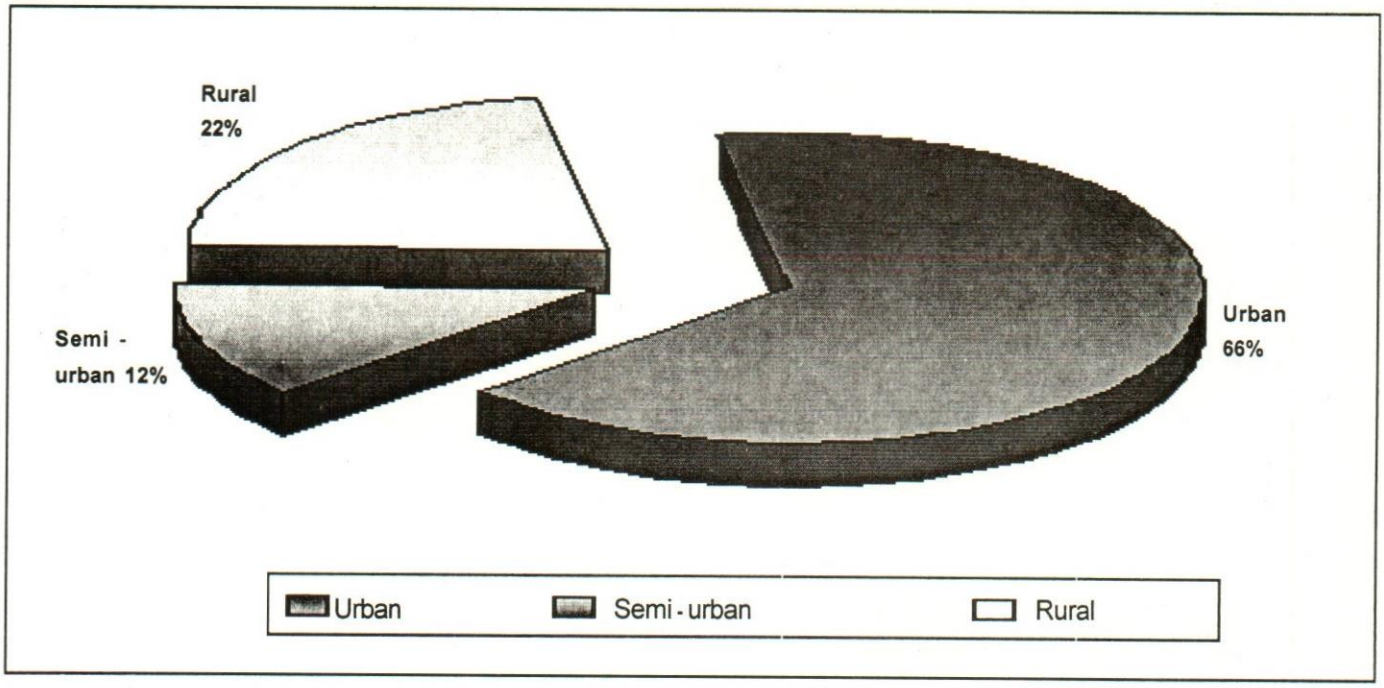

Figure 2: Area (Urban, Rural, Semi-Urban)

distributed in rural areas, but the number received was lower.

The sample had higher percentage of youngsters (Figure 3). A basic reason was that the response rate for this group was higher.

Only 20 percent of respondents did not have access to computers (Figure 4). Thus the group as whole was computer savvy and aware of e-services (Figure 5).

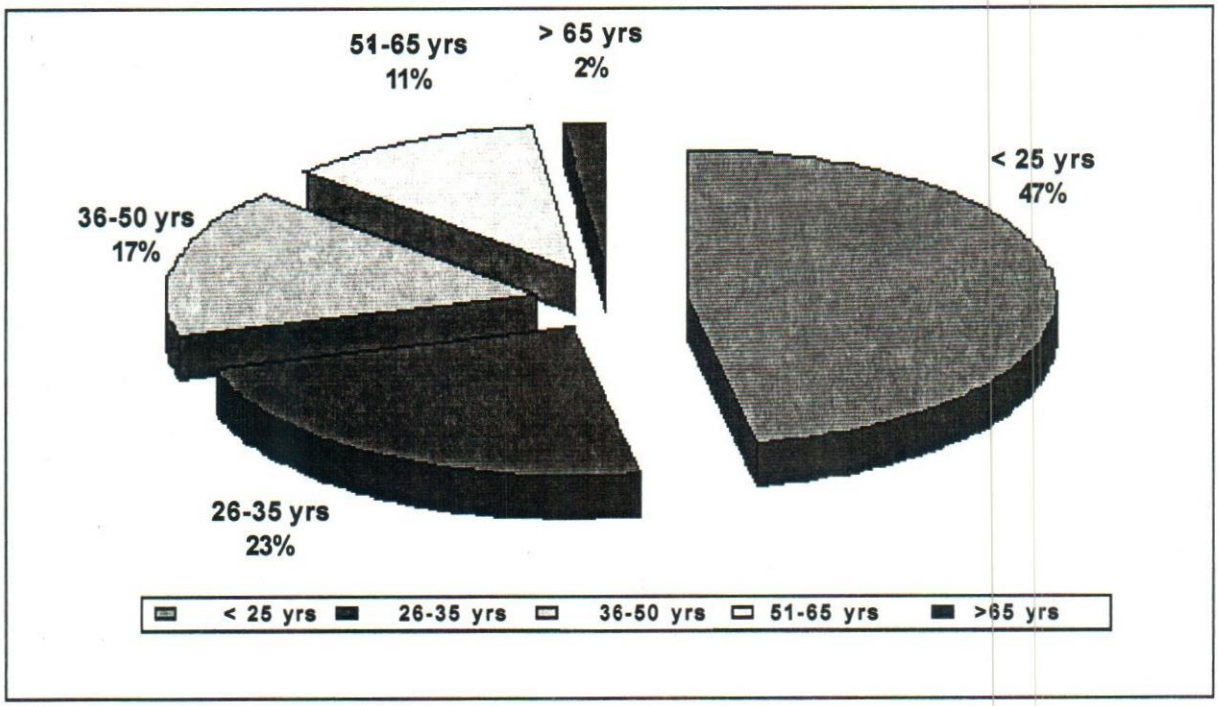

Figure 3: Age of Respondents

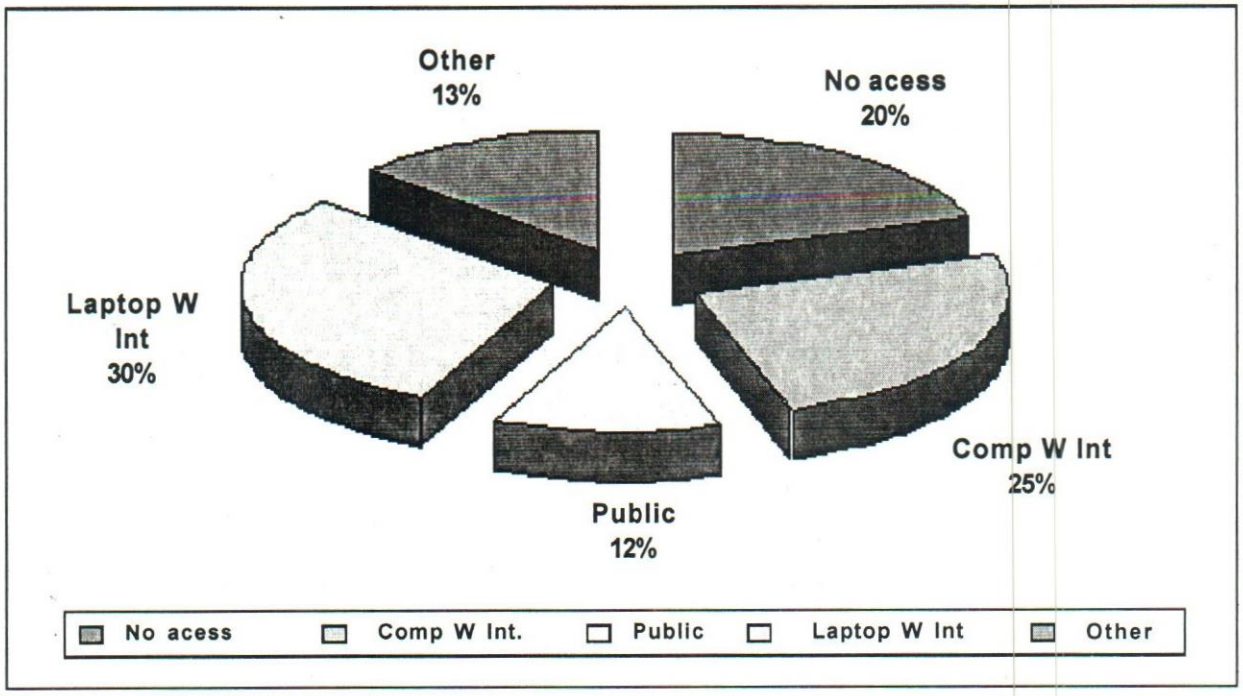

Figure 4: Access to Computers

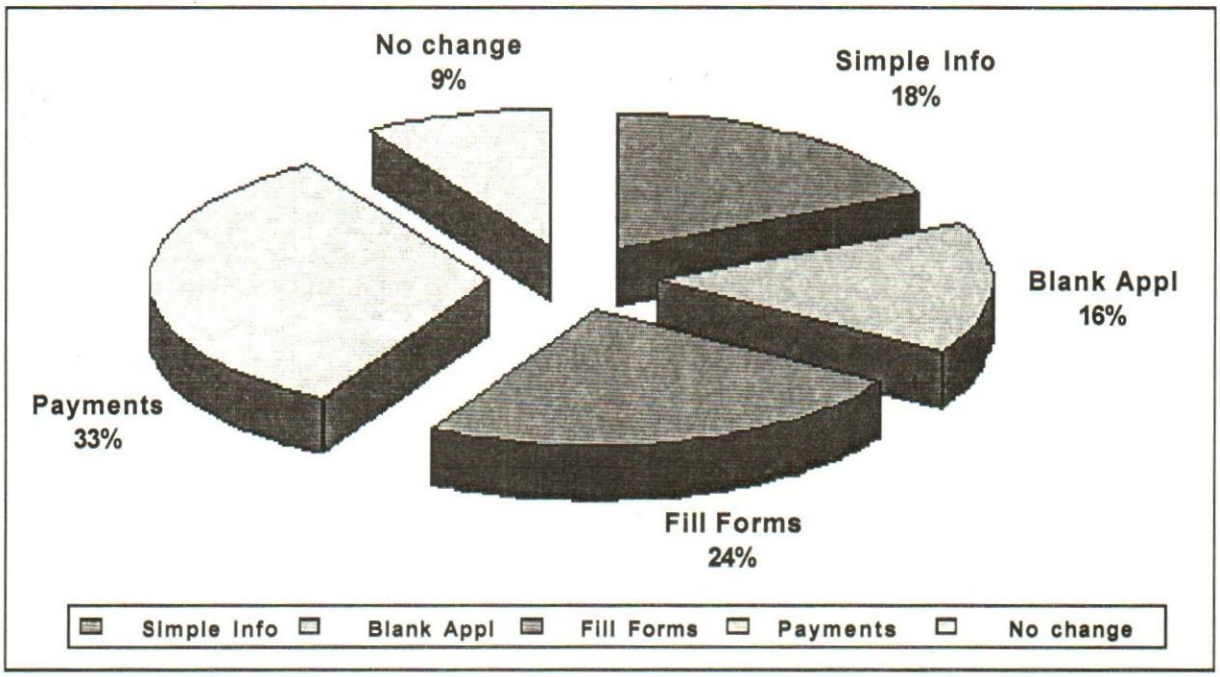

Figure 5: Level of ICT led e-Governance Services Consumer Perceives

Factors for Good Governance

The first step of research was to identify the factors considered essential for good governance. Factor analysis was used to satisfy this objective. The details of same are presented in Table 3.

Table 3: Factors for Good Governance

F. No		Factor Names/ Items	Provision of Basic Fundamental Facilities and SMART Governance	Creation of conducive Environment
1	i.	Maintaining rule of law and applying the same rules/yardstick to everyone	0.776	
	ii.	Creating new job opportunities in the private sector and the government		
	iii.	Safety of life and property and peaceful law and order	0.773	
	iv.	Transparency and accountability in the dealings with the government		
	v.	Citizen centric services in a responsive manner,	0.756	
	vi.	Corruption free dealings with the government	0.755	
	vii.	Basic infrastructure development like roads, bridges, power, telecom, Airports, irrigation, transport etc,	0.688	
	viii.	Effectiveness and efficiency of the working of government and its staff	0.688	
	ix.	Overall economic development of the state, growth rate of economy	0.679	
	x.	Good education facilities by the government which are job oriented.	0.677	
2	i.	Provide more concessions & freebies by the government, even at the cost of overall development	0.853	
	ii.	Reducing digital divide and other inequalities in the society by positive discrimination in favor of the poorest of the poor	0.582	
	iii.	Good business environment with free-market economy	0.519	
	iv.	Providing total freedom of speech, of religion, of work and an attitude of non-interference by government	0.357	

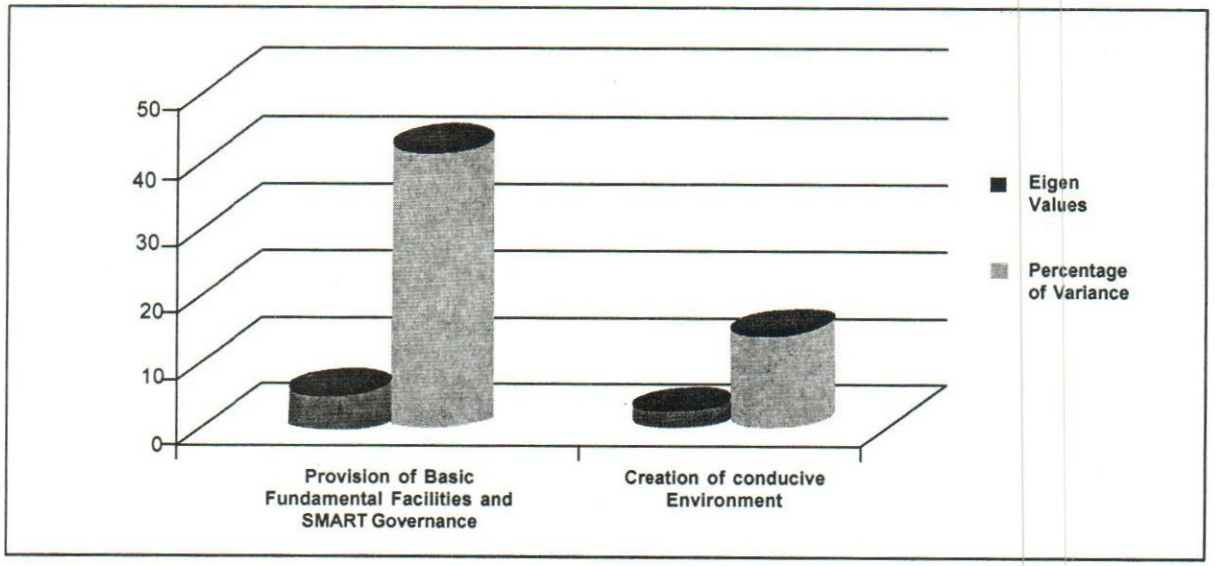

Figure 6: Eigen values and Total Variance explained for Factors for Good Governance

The details of factor analysis, i.e., eigen values and total variance explained has been depicted through Figure 6.

All citizens from all three categories viz. citizens; bureaucrats/politicians, and IT personnel/academics accepted that provision of basic fundamental services and SMART governance explained high variation. Items such as maintaining rule of law and applying the same rules/ yardstick to everyone; creating new job opportunities in the private sector and the government, safety of life and property and peaceful law and order, and transparency and accountability in the dealings with the government laded heavily on factor I. This is a very important finding of the study.

After identifying the factors for good governance, data was also collected for 26 major services being rendered by the government departments/institutions which normally span across the life cycle of a citizen. Most of these were services required by the citizens on a day to day basis. The idea was to understand the difficulty encountered by citizens in using these services and priority of using ICT for improving these services.

Citizens' Experiences and Priority About Various Government Institutions and Their Services On the Basis of Frequency of Use of the Services

Factor analysis of citizens' experiences about various government institutions and their services on the basis of frequency of use of the services resulted in four factors (Figure 7), namely:

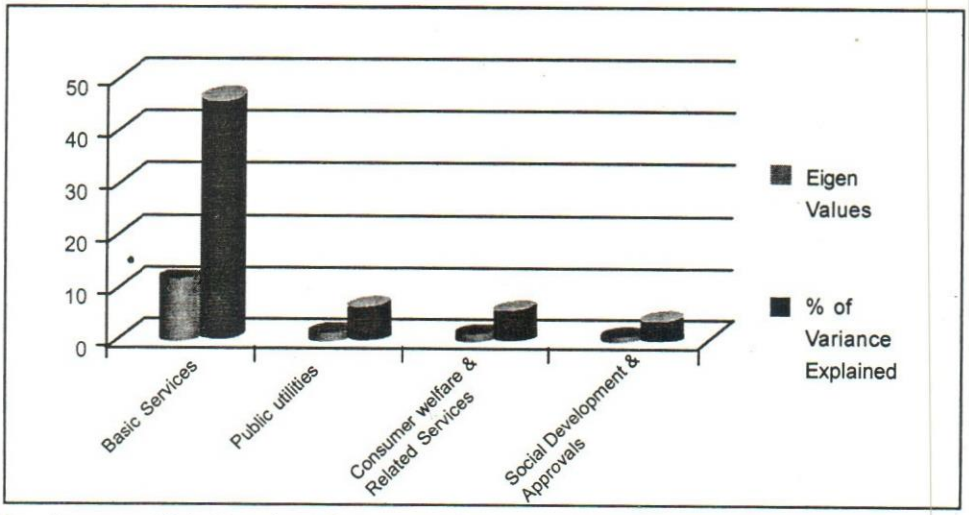

Figure 7: Citizens' Experiences and Priorities about Government Services on the Basis of Frequency of Use

- Basic services
- Public utilities
- Consumer welfare and related services, and
- Social development and approvals

The citizens wanted ICTs to be used for satisfying basic services (Figure 8). These services are:

Least prioritized service in basic services is urban development- quality of service, allotment of plots, passing of plans, change in land use, etc.

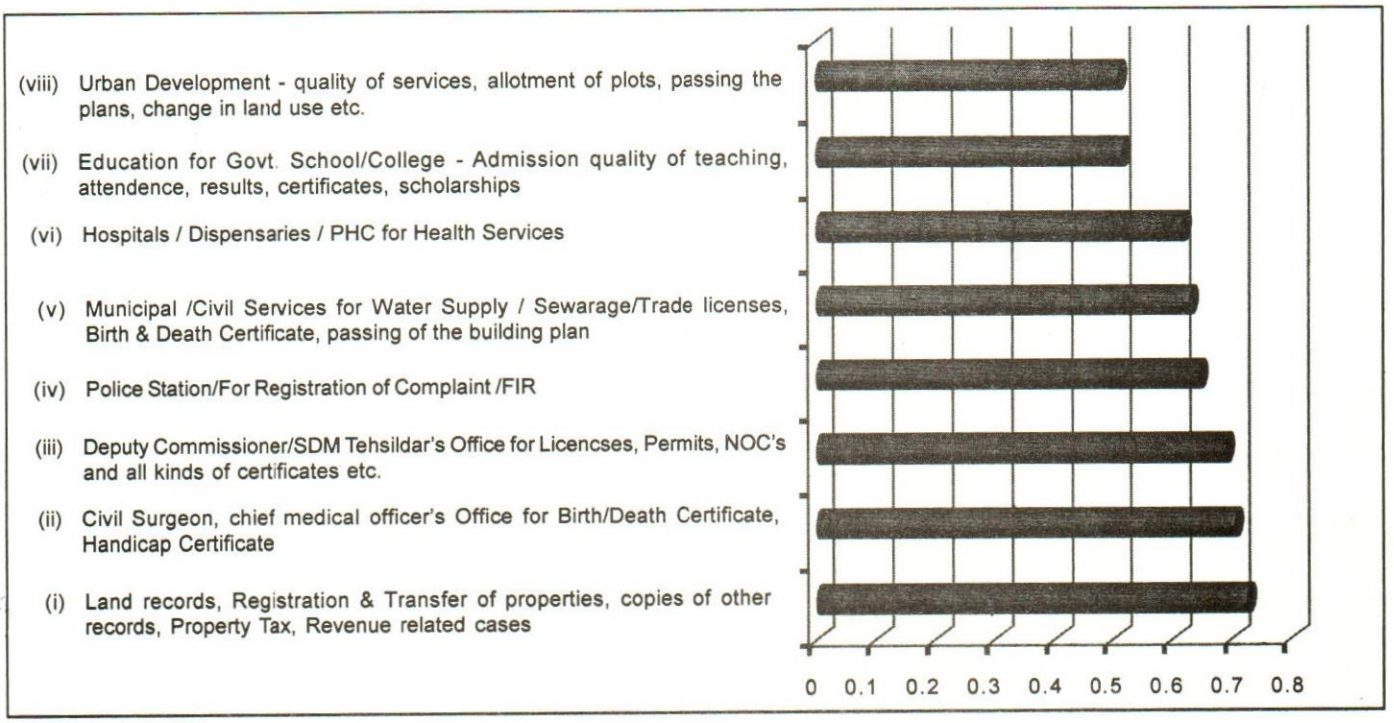

Figure 8: Priority of ICT for Basic Services

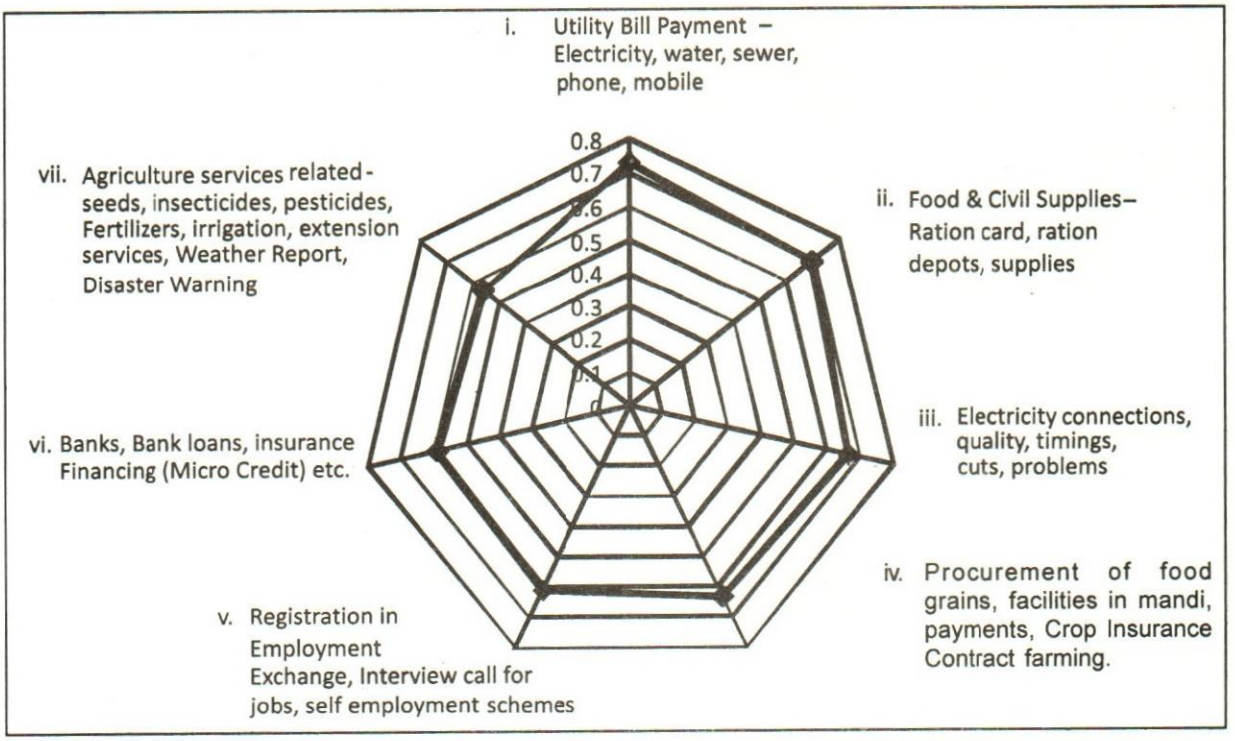

Figure 9: Priority of ICT for Public Utilities

As depicted through bar diagram Land record registration requires highest priority, followed by civil surgeon/ chief medical officer's office for birth / death certificate, handicap certificate and deputy commissioner/ SDM/tehsildar's office for licenses, permits, NOCs, and all kinds of certificates etc.

Regarding priority for public utility services utility bill payment—electricity, water, sewer, phone, mobile is demanding topmost priority followed by food and civil supplies—ration card, ration depots, supplies and electricity connections, quality, timings, cuts, problems.

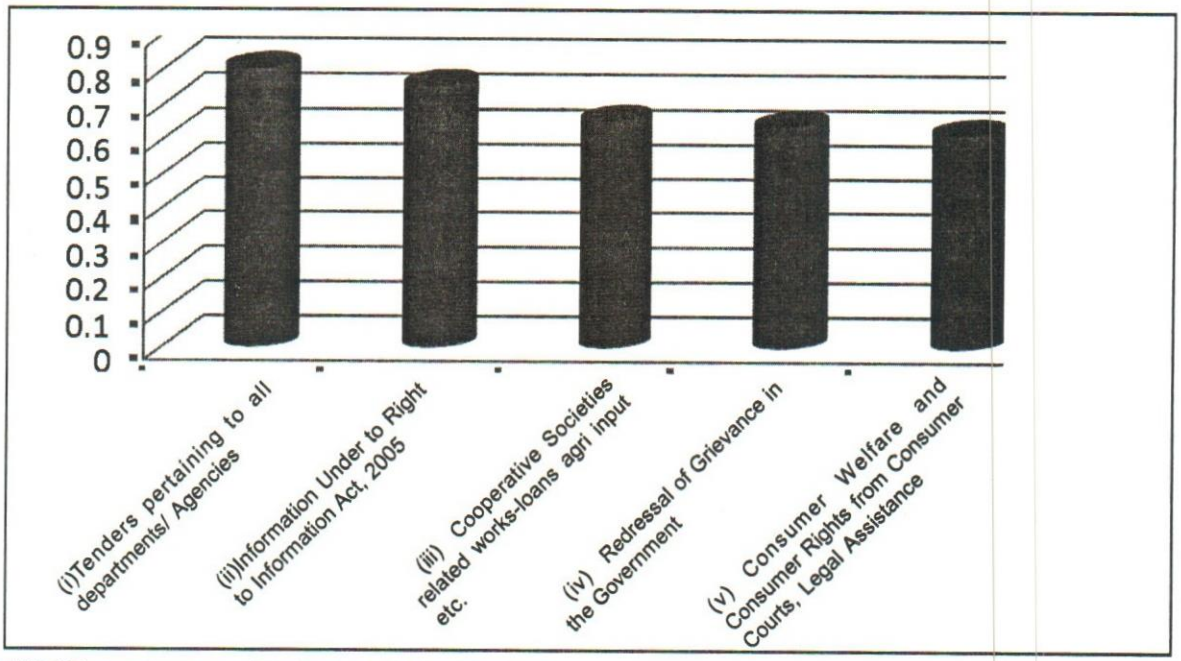

Figure 10: Third Factor: Consumer Welfare and Related Services

In case of the third factor—consumer welfare & related services—highest priority has been given to tenders pertaining to all departments/ Agencies, followed by Information under the Right to Information Act, 2005.

In the last factor viz. social development and approvals preference has been given to transport services, driving license, vehicle registration, renewals, transfers, bus service, mini bus licenses. This has been followed by sales tax, vat, excise, entry tax, other taxes etc. But overall results show low priority given to this factor.

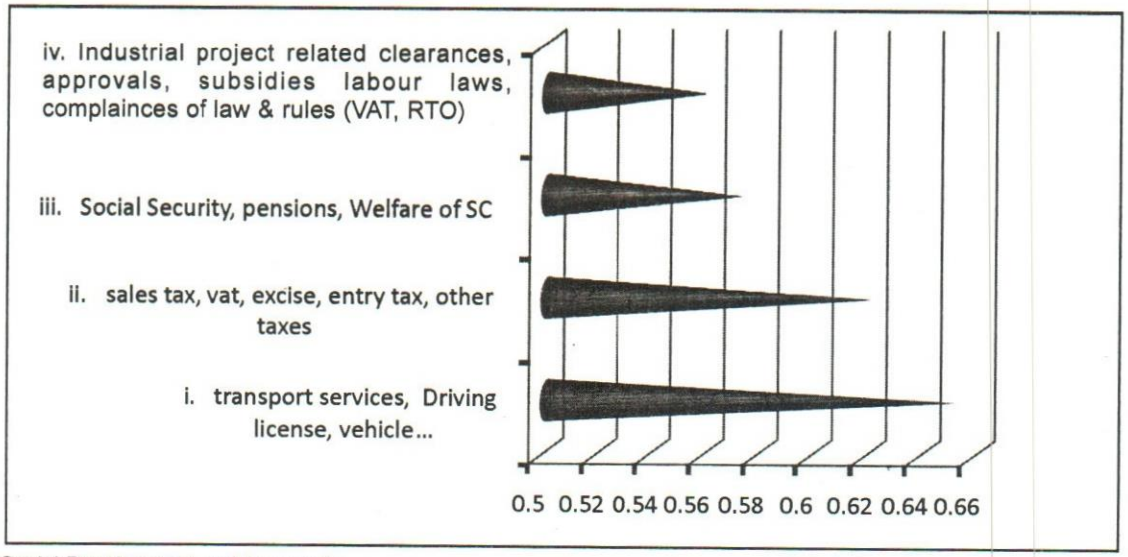

Figure 11: Social Development and Approvals

Factors Causing Pain and Harassment

Along with frequency of use of services, the factors causing pain and harassment were also considered. Factors rated high on mean score and considered to be causing pain and harassment and difficulties to the citizens in getting the citizen services from various government departments are: (i) Unreasonable delay, multiple visits even for small services, (ii) Poor public infrastructure/ lack of public infrastructure and its maintenance in government offices and (iii) need to visit many staff members for one single work and multiple points of contact for one task only.

Least important factors included: Lot of unwanted holidays further reduce time available to common man, arbitrary nature of dealings by some staff members without any recourse/remedy and limited working/visiting hours with long lunch and tea breaks by government staff. The results of factors causing pain and harassment again underscores the fact that Indian citizens preferred to have speedy service, good quality infrastructure and delivery from one kiosk rather than running from one place to another.

Table 4: Factors causing pain and harassment

Factors	Causing Pain and Harassment	Mean	S.D.	Rank
i.	Unreasonable delay, multiple visits even for small services	.89	1.334	1
ii.	Poor public infrastructure/lack of public infrastructure and its maintenance in government offices	.84	1.294	2
iii.	Need to visit many staff members for one single work. Multiple points of contact for one task only	.84	1.227	3
iv.	Not pointing out discrepancies/ shortcomings in the applications in one go	.82	1.250	4
v.	Non availability of government staff/ dealing hand on the seat	.82	1.282	5
vi.	Non-cooperative behavior and negative/ rough attitude of dealing government staff	.81	1.271	6
vii.	Collusion between the touts and the government staff	.80	1.228	7
viii.	Need for filling of multiple forms, filling same information in different forms	.75	1.310	8
ix.	Multiplicity of agencies without clear boundaries	.71	1.253	9
x.	Non-responsiveness of government staff to the needs / urgency of citizen	.71	1.355	10
xi.	Difficult access to senior government functionaries / officers	.71	1.317	11
xii.	Lack of information and guidance on the correct procedures, forms, rules, etc.	.71	1.379	12
xiii.	Lack of knowledge and training of government staff	.70	1.305	13
xiv.	Pervasive corruption at various levels, demand of speed money by dealing staff	.70	1.347	14
xv.	Limited working / visiting hours with long lunch and tea breaks by government staff	.69	1.304	15
xvi.	Arbitrary nature of dealings by some staff members without any recourse/remedy	.67	1.209	16
xvii.	Unwanted holidays further reduce time available to common man	.65	1.238	17

Framework for Good Governance

Most Indian citizens today believe in the power of ICT and want to access e-governance services.

In the understanding of citizens the most important factors for the success of an e-governance service are:

- Overall convenience and experience of the citizens;
- Reduction in the corruption levels by improvement in the transparency of government functioning;
- Awareness about the availability of service amongst general masses;
- Friendliness and simplicity of procedures and interface;
- Availability of self service options, properly maintained government record/ data of all kinds including files, registers, citizen record etc.; and
- Distance of service location/ access point from citizen's home.

The present study has been undertaken with an aim to evolve a "broad strategic e-governance policy framework" in terms of citizens' prioritization, preferences, methodologies, measuring success, for achieving "good governance" as per the expectations of stakeholders. The study takes the participatory stake holder analysis of the factors considered important for good governance of all three categories of stakeholders viz., (i) citizens, (ii)

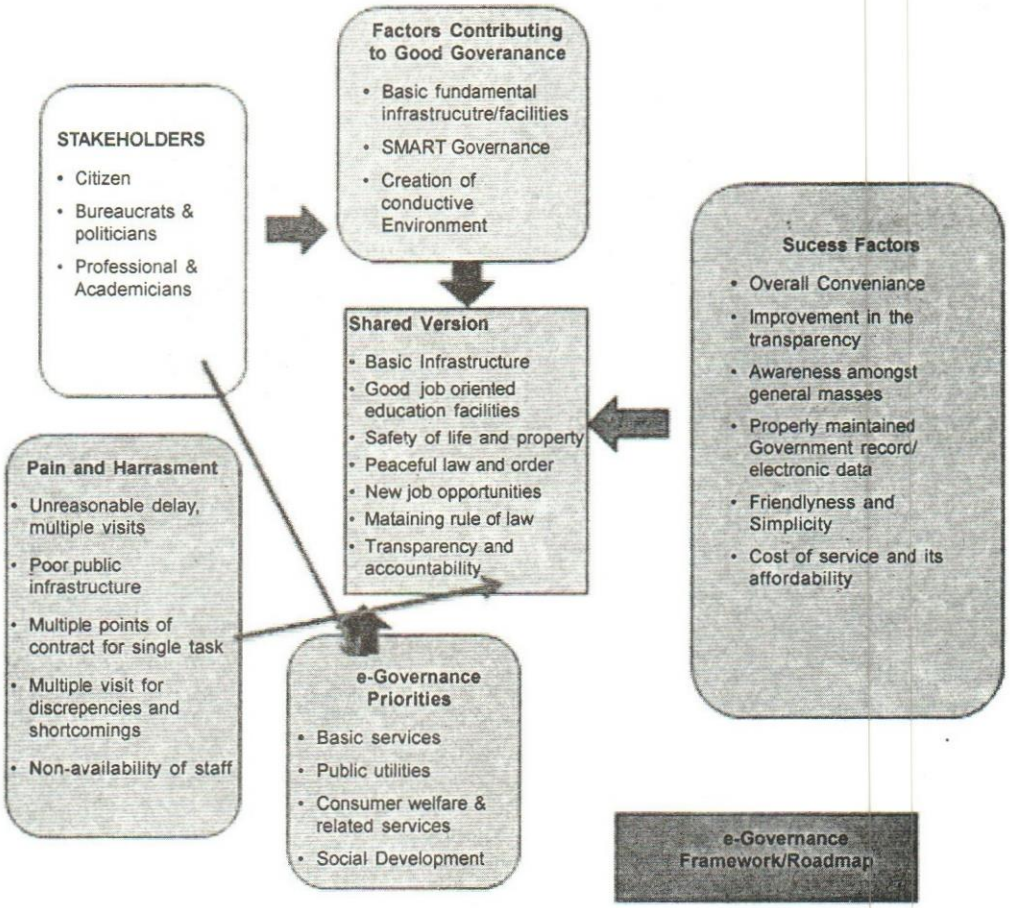

Figure 12: Framework for Good Governance through e-Governance

academicians and professionals, (iii) politicians and bureaucrats. The respondents in all three categories agree completely that the factors contributing to the good governance are: good education facilities, basic infrastructure, safety, peaceful law and order, creating new job opportunities, effectiveness and efficiency of the working of government and its staff, good business environment, reducing digital divide and other inequalities in the society by positive discrimination in favor of the poorest of the poor and providing total freedom of speech, of religion, of work and an attitude of non-interference by government.

Information and communication technology by itself is not the cure-all to the world's problems. But it can be a powerful tool to facilitate and enable affordable good governance, i.e., improved citizen services and high internal efficiencies. The requirements and expectations of the citizens from e-governance and how it is actually reflected and translated into the functioning of the government, is very interesting.

The changing economic and governance scenario demands a greater partnership between various major players in the society. Governance should be a collaborative approach and focus should be on results not on process.

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A well balanced, inclusive approach, according to certain standards and ideals, is essential for the proper governance of any country.

—Laisenia Qarase

Focus

Comprehensive Knowledge Management Framework for Strengthening Sustainable e-Governance : Various Sectors of Rural India

ALPANA UPADHYAY AND C. K. KUMBHARANA

e-Governance is emerging very speedily in entire world and in our country also. In the near future, it will become a part of human life. The most important objective of e-governance is to intensify good governance and expanding public participation, improving the productivity and efficiency of government agencies, improving the quality of life for disadvantaged communities. India is a country of villages. To develop potency of rural areas of our country is the major challenge in front of Indian government. e-governance can help for integrated empowerment of such areas, but e-governance has not yet laid its actual needed effect to develop them.

This research article discuses the sectored defragmentation of rural area so each sector can be focused properly for all over development and for implementing e-governance in a very effective manner. This paper also provides design of a generalized knowledge management framework for sustainable e-governance. This knowledge management framework can help to respond to various situations flexibly, makes sense to solve ambiguous circumstances and suggests alternate solutions to the erroneous conditions by assembly of strong and realistic decision making system.

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The perception of rurality is the subject of long-standing deliberation and controversy, until now there is no one universally accepted definition of "rural." To some, "rural" is a subjective state of mind and to others it is an objective quantitative appraisal. In the case of India the most suitable definition is the one given by Omkar Goswami. He wrote that:

> Rural India is a huge, heterogeneous entity that many of us know little of. Consequently, we often think it, as a vast tract of woefully poor people, who labor under the scorching sun with rude ploughs and emaciated bullocks. But rural India includes hundred millions of people, living very different lives. (Omkar Goswami, 2001)

India is a country of villages. Since the dawn of independence, concerted efforts have been made to ameliorate the living standard of rural masses. So, rural development is an integrated concept of growth and poverty elimination has been of paramount concern in all the consequent years, after independence. Integrated development of rural areas is one of the abiding tasks before the Government of India. So the Central government reiterates the cardinal importance of villages to the overall development of the country and commits to work towards development of rural areas, which for various reasons could not keep pace with urban areas in the past. In conformity with this commitment of the Government, the Ministry of Rural Development accords foremost priority to development in rural areas and eradication of poverty and hunger from the face of rural India. A number of initiatives have been taken in the recent years for creation of social

and economic infrastructure in rural areas to bridge the rural-urban divide as well as to provide food security and fulfill other basic needs of the rural populace (Ministry of Rural Development, National portal). Even Mahatma Gandhi, Father of Our Nation, accentuated on rural growth and beseeched for village swaraj (self-government). He wanted the engine of India's development to start rolling down from the villages. Since rural development essentially encompasses a multi-disciplinary approach, there should be an in-built mechanism to involve various sectors of rural India. Sector is a distinct subset of a society, industry, market, economy or community whose components share similar characteristics. In a way proper determination of basic functioning areas of rural India is highly essential. Researcher has determined several sectors so it seems that the real developmental challenge in India becomes the right balance between the imperatives and the compelling need to help rural people realize their own potential by using the gains of modern science and technology. India can stand at a turning point and can have the potential to bring rural areas into the mainstream of economic development.

Objectives of the Study

Thus, it can be inferred from the above, that still a lot needs to be done for rural development and to strengthen sustainable e-governance in rural India.

1. To determine various sectors for sustainable e-governance in rural India.
2. To propose generalized knowledge management framework for strengthening identified sectors for sustainable e-governance.

Determining Various Sectors of Rural India

Dividing a province into diverse like-pieces allows for more in-depth analysis, increasing productivity as a whole. The main Indian developmental challenges concern not only the human development front, but also education, health care, the removal of barriers to trade and investment, there is the need for generating employment and improving the living conditions of the villagers and in particular, to bridge the urban-rural divide. There are many sectors those should be taken in to account for sustainable e-governance in rural India but researchers have determined following sectors which are very essential to contribute towards rural development.

1. Education
2. Agriculture
3. Public Health
4. Women Empowerment
5. Entrepreneurship

Education

The vital stirring aspect in today's time for the development of our country is education. To discover this noteworthy part of education in India, especially in rural India, it is necessary to explain the failures and problems being faced by rural India for education. It also obligatory to concentrate on the various initiatives been taken by the government. The highlights of some of the suggestions are to be discussed for improving the education system in rural or remote areas like public-private program, bridging the divide, school networks, digital literacy, electronic libraries (ASER Report, 2011).

Agriculture

As we have entered in the new millennium, agriculture is still the backbone of the Indian economy, almost the entire economy being sustained by agriculture, which is the mainstay of the villages. Not only the economy, but also every one of us looks up to agriculture for our sustenance too. Rural economies are the keystones of food security. Consequently, rural and agricultural problems were considered to be virtually synonymous and it was often assumed that rural and agricultural objectives could be pursued through a single set of policies focused mainly on commodity price support. The thrust areas for the agriculture sector those needs government initiatives are availability of more and effective information, integration of entire agricultural population, train the farmers to use natural resources proficiently, equip the farmers with the latest available technologies, various cultivation processes, knowledge of crop design, various irrigation techniques, new concepts in fertilizers, pest control, timely and adequate availability of inputs, support for marketing infrastructure (Target UPSC, 2012).

Public Health

> We recognize health as an inalienable human right that every individual can justly claim. So long as wide health inequalities exist in our country and access to essential health care is not universally assured, we would fall short in both economic planning and in our moral obligation to all citizens. (Prime Minister Manmohan Singh, October 2005)

India is a populous nation where a majority of the population maintains to be located in the villages. The

ever growing population has also strengthened the problems being faced by the government in making available equal health benefits to everybody. The greatest challenge is being encountered in terms of rural healthcare where several issues are holding back the reach of medical reimbursement to many. Rural India does not have access to basic medical facilities and women and children are frequently persecuted by this core issues. The nonexistence of experienced doctors in the rural areas is the principal reason behind the death of women during childbirth. It is sad to know that 75 percent of the health infrastructure is concentrated in the urban areas. Private players dominate the health sector which has made adequate use of science, technology and research to fight against health problems and diseases (*The Hindu*, 2007b). The core aspects those needs government initiatives are to transform public health care into an accountable, accessible, and affordable system of quality services, convergence and development of public health systems and services those are responsive to the health needs and aspirations of the people, To rise public spending on health from 0.9 per cent of GDP to 2-3 per cent of GDP with improved arrangement for community financing and risk pooling, reduction in child and maternal mortality (Annual Report to the people on Health, 2011).

Women Empowerment

Women are considered as a focal point and the unifying force in the family. Women comprise nearly half of the national population of a country. Of course, globalization provided opportunities of education and employment to urban women and helped them to develop and posses all the rights equally with men. But the problem is that the women in rural areas are still backward in education, social status, economic background, political matters, etc. Hence, the development of the country is inescapably linked with the status of development of rural women. Economic empowerment is one approach to enable women to realize their inherent knowledge, skills and competences for creation of small business enterprises. There are shining examples from the developing countries to illustrate women entrepreneurs who started small and grew to large enterprises. They receive only small share in development opportunities and are often excluded from education, better jobs, participation in political system and better health care, decision making, etc. Besides, they suffer from physiological, physiological, social and cultural barriers, which hinder their empowerment (Ashappa C. and Sedamkar H., 2011). Empowerment of women involves many things—economic opportunity, social equality, and personal rights.

Entrepreneurship

Entrepreneurship development can be a significant mean of hostility economic inertia in rural areas that are located far from the main industrial center of a country. Rural development is more than ever before linked to entrepreneurship. Institutions and individuals promoting rural development now see entrepreneurship as a strategic development intervention that could accelerate the rural development process. Furthermore, institutions and individuals seem to agree on the urgent need to promote rural enterprises, development agencies see rural entrepreneurship as an enormous employment potential, farmers see it as an instrument for improving farm earnings, and women see it as an employment possibility near their homes which provides autonomy, independence and a reduced need for social support. To all these groups, however, entrepreneurship stands as a vehicle to improve the quality of life for individuals, families and communities and to sustain a healthy economy and environment. The entrepreneurial orientation to rural development accepts entrepreneurship as the central force of economic growth and development, without it other factors of development will be wasted or frittered away. However, the acceptance of entrepreneurship as a central development force by itself will not lead to rural development and the advancement of rural enterprises. What is needed in addition is an environment enabling entrepreneurship in rural areas (Rural development through entrepreneurship, Tea Petrin and Agnes Gannon).

Knowledge Management

Knowledge is considered as human understanding of a subject matter that has been acquired through proper study and experience. Knowledge can be derived from information available (Knowledge-Based Systems, 2010).

> Knowledge management is a discipline that promotes an integrated approach to identifying, capturing, evaluating, retrieving, and sharing all of information assets. These assets may include databases, documents, policies, procedures, and previously un-captured expertise and experience in individual. (Koenig Michael E. D., 2012)

With the help of such knowledge management, one can gain better understanding, sharing and utilization of existing knowledge. All of the knowledge management activities result in documentation of the knowledge in the form of a centrally available repository.

By this mean when knowledge management is involved, it is very indispensable that to deliberately provide an environment that is contributing to knowledge creation, knowledge incorporation and knowledge propagation in making appropriate decisions. Now an Expert System is a software based solution that imitates the interaction, a user might have with a human expert to solve a problem. The end user provides input by selecting one or more answers from a list or by entering data. The program will ask questions until it has reached to a conclusion. The conclusion may be the selection of a single solution or list of possible solutions arranged in order of likelihood. The Knowledge management systems can be used for interpretation, prediction, diagnosis, design, planning, monitoring, debugging, repair, instruction, control, etc. Such advanced technology should be made available in urban and rural areas to utilize expert knowledge for holistic development. Such systems export knowledge in underdeveloped and remote areas (rural areas) where expertise is rare and costly (Sajja and Akerkar, 2010).

This is where this article proposes a comprehensive knowledge management framework for sustainable e-governance in above determined various sectors of rural India. This framework can work on the top of the existing smoothly functioning system. This is a generalized knowledge management framework and this can be applied to all the identified sectors in specific manner.

Proposed Comprehensive Knowledge Management Framework

Any framework describes concepts, aspects, such as processes or systems as well as their relations of a certain domain or problem to create a better understanding or to support specific purposes. In many domains frameworks are used to understand the relation between components and to structure and guide through a problem domain (Pawlowski and Bick, 2012). The researchers understand the framework as a step towards building a theory for knowledge management understanding, for example cultural and contextual influence factors which has not been achieved yet. This knowledge management framework aims at describing and relating main components influencing KM design and acceptance. It provides a common terminology and frame of reference in general manner, involved in knowledge management. The framework is demonstrated in Figure 1.

Illumination of the Proposed Framework

Figure 1 demonstrates the new knowledge management framework that can be built up on any existing smoothly functioning e-governance system, so that the existing e-governance system can be converted to knowledge management system.

Knowledge Discovery

Knowledge is the justified true belief related to human actions and is created from a flow of messages. Knowledge is generally personal, subjective and inherently local - it is found "within the heads of humans" rather than existing objectively. (Nonaka and Takeuchi, 1995) Knowledge is most commonly categorized as either explicit or tacit (that which is in people's heads). The useful characterization is to describe knowledge as explicit, implicit, and tacit.

Explicit: Knowledge that is set out in tangible form. It is easy to transmit and conservable.

Implicit: Knowledge that is not set out in tangible form but could be made explicit.

Tacit: Tacit knowledge is all the implicit information we have created by personal reasoning, relationship, experiences and so on. Knowledge that is extremely difficult operationally setting out in tangible form. Knowledge discovery incarcerates knowledge elements from diversed resources. It is the process of knowledge extraction that creates knowledge from structured (relational databases, XML) and unstructured (text, CSV, documents, images) sources. The resulting knowledge needs to be in a machine-readable and machine-interpretable format and must represent knowledge in a manner that makes inference possible. Knowledge discovery process consists of six steps, 1) Data selection 2) Cleaning 3) Enrichment 4) Coding 5) Data mining 6) Analysis of results. After completing these six steps knowledge can be discovered. The discovered knowledge can be categorized as

1. High level knowledge: Describes how a problem is solved. This type of knowledge provides direction on how to do something.
2. Low level knowledge: Describes what is known about a problem.
3. Core level knowledge: Describes a rule-of-thumb that guides the reasoning process.

Knowledge Representation

This refers to activities associated with the flow of knowledge. This includes communication, translation, conversion, filtering and rendering. Knowledge

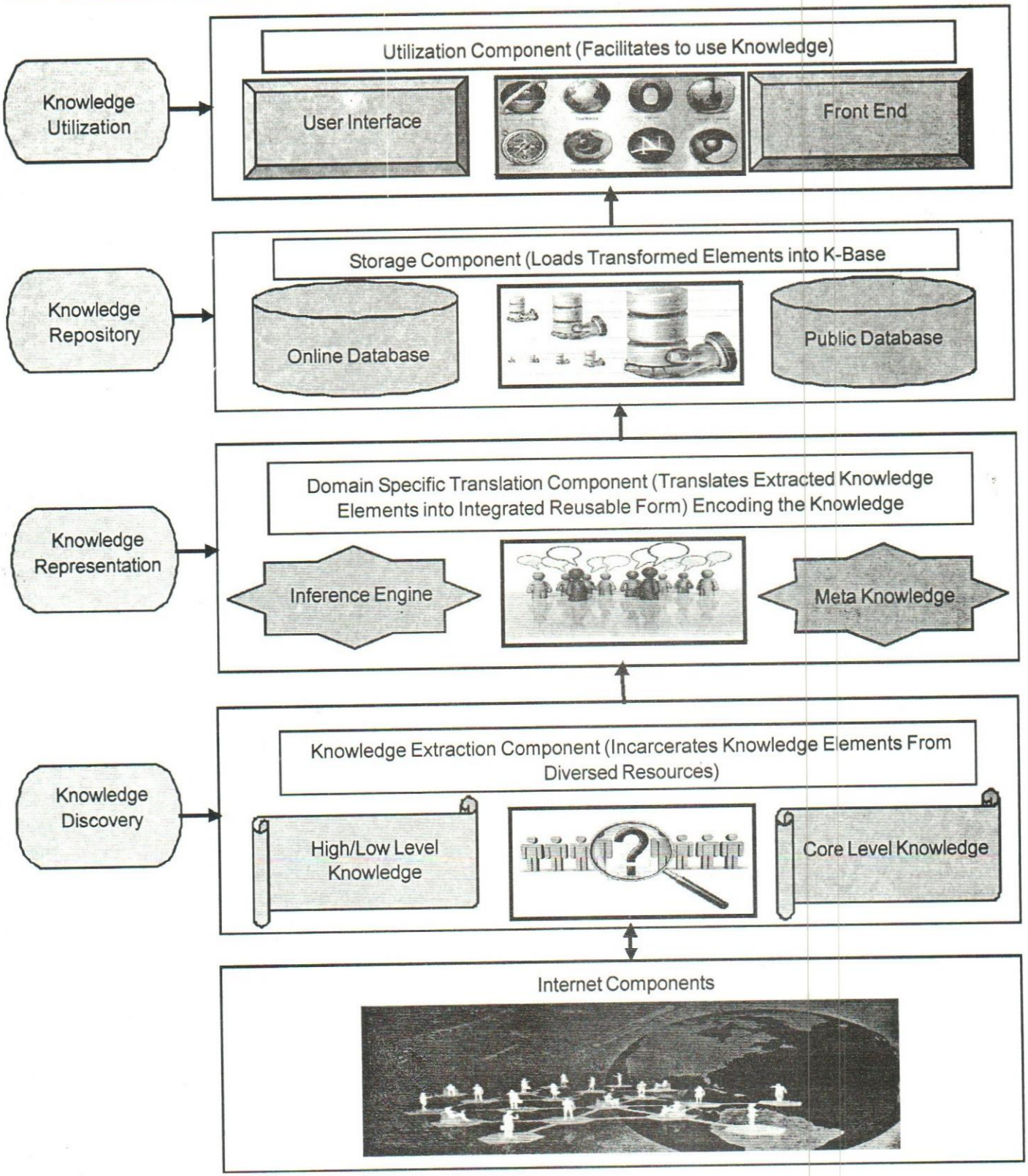

Figure 1: Comprehensive Knowledge Management Framework

representation is a distinct entity. It plays central but distinguishable roles in intelligent system. Representation is the way knowledge is encoded, it defines the system's performance in doing something. Different types of knowledge require different kinds of representation. The Knowledge Representation mechanism is frequently based on: Logic, Rules, Frames, Semantic Net. Different types of knowledge require different kinds of reasoning. Some means are needed to represent the knowledge. Following means can be used to represent knowledge.

1. Objects: Facts about the domain.
2. Events: Actions that occur in the domain.
3. Performance: Knowledge about how to do things.
4. Meta knowledge: Describes knowledge about knowledge. This type of knowledge is used to pick other knowledge that is best suited for solving a problem.
5. Inference Engine: Software code which processes the rules, cases, objects or other type of knowledge and expertise based on the facts of a given situation.

Domain specific knowledge is the valid knowledge for a specified domain. Specialists and experts develop their own domain knowledge and use it for solving problems.

Knowledge Repository

A knowledge repository is a computerized system that systematically captures, organizes and categorizes an organization's knowledge. The repository can be searched and data can be quickly retrieved. The effective knowledge repositories include factual, conceptual, procedural and meta-cognitive techniques. The key features of knowledge repositories include communication forums (Knowledge-Based Systems, 2010). A public database or an online database can be used to store either messages posted by the users or the represented knowledge in structured repository or case base. By representing the knowledge in a structural and systematic way, users were able to find and learn about their subject with relative ease. The document repository is used to store all knowledge records (i.e. norms, technical documents, pieces of technical information, etc.).

A multimedia knowledge repository primarily provides platform to long-lastingly uncluttered build up, edit, and create various kinds of digital knowledge. Objects such as digital images, sounds, films, literatures, pictures, and 3D models were the most basic units for constructing a multimedia knowledge repository whose contents can be formed by different sizes of small to big knowledge granules. Systematically organized and classified contents into different knowledge units according to needs and knowledge cultivation of users and knowledge subjects help in knowledge reusability.

Knowledge Utilization

Knowledge utilization is concerned with using and applying knowledge to organizational functions or business processes (Sajja and Akerkar, 2010). When knowledge resources are documented, stored and shared, knowledge utilization is made possible. This is the stage in knowledge management where value creation is delivered. By strapping up knowledge from different knowledge domains and competencies across the sector, contributes towards the overall development of various sectors of rural India and in a way it directly impacts on sustainable and very efficient e-Governance. From a technology perspective, knowledge utilization is the application of knowledge using computer-based tools which allows various associates to access knowledge through knowledge management systems. However, KM applications alone cannot ensure that knowledge will be applied to business operations or products and services (Dalkir K. 2005). Various utilization components like front-end applications or user interface facilitate to use knowledge.

Conclusion

In this research article, anticipated knowledge management framework can provide numerous advantages, such as,

1. Consistency : Provides consistency in decision making process
2. Timeliness : Information is available sooner for decision making
3. Completeness : An expert system can review all the possible solutions for a problem
4. Cost Effectiveness:Although expert system is expensive to build and maintain, they are inexpensive to operate. Development and maintenance costs can be spread over many users
5. Risk reducing: Proper decision always reduces the risk of users

6. Expertise: Gives expertise to producers in various decision making situation
7. Persistence: Expert system does not forget, but human experts may be, Knowledge can be preserved so available at any given time

By looking at these advantages the framework, proposed in this article has significant potential for deployment as an additional trait for strengthening sustainable e-Governance with respect to above discussed various sectors of rural India, as well as it is having further research opportunities in various magnitudes.

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Regional exchange can be a source of growth and development, and of enhancing good governance.

—Anna Lindh

Focus

Capacity Building and People's Participation in e-Governance in India: Challenges and Prospects

KIRAN PRASAD

National e-strategies focusing on modernizing government through e-governance involve the use of ICTs to benefit communities. This article will focus on the e-governance program in India with the Common Service Centres (CSCs) involving broadband-enabled computer kiosks that offer a range of government-to-citizen and business-to-customer services, besides promoting sheer access to the Internet to bridge the digital divide. The article also presents a case study of the Akshaya centers in Kerala which is integral to capacity building and advancing digital democracy. These Akshaya centers in Kerala can be a potential model for the rest of India and other developing nations.

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India has a strategic geopolitical position as the largest country in South Asia consisting of a population of over one billion and is credited as the largest, stable and functioning democracy. The Indian economy ranks sixth in the world. The United Nations Conference on Trade and Development (UNCTAD) has credited India with a projected economic growth of 8.1 percent—the fastest rate of expansion in the world after China (UNCTAD, 2011). Nevertheless, it is also a country of stark contrasts. India is home to the largest rural–urban disparities. It is a painful reality that almost 260 million people or around 25 percent of total population are below the poverty line. The Human Development Report 2010 (UNDP, 2010) ranked India's development index at 119 out of 169 countries.

e-governance has emerged out of a realization that ICTs can be utilized to effectively provide services to a population of over one billion people. e-governance is now mainly seen as a key element of the country's governance and administrative reform agenda. Taking note of the potential of e-governance to improve the quality of life of the vast population of the country, the Government of India has formulated a national program—the National e-governance Plan (NeGP). This article will focus on the e-governance program in India with the efforts of Common Service Centres (CSCs) to modernize government and create digital opportunities. It will also look at the challenges before the governments of developing countries including India in formulating e-governance policies to bridge the digital divide and advance digital democracy.

The article also presents a case study of the e-literacy project of Kerala which is integral to capacity building in modernizing governance and an effective way to advance digital democracy through people's participation. This article seeks to situate and highlight the Akshaya e-literacy

project in the specific context of Kerala. The only initiative to make ordinary citizens e-literate in India is in the state of Kerala, the study of which can assist in determining how e-literacy can impact e-governance.

The e-governance initiatives in Kerala have been commended by international agencies and have also won admirers from outside India. The World Bank delegation found the Kerala State IT Mission (KSITM) competent to perform the role of an international consultant, especially to developing countries in Asia and Africa. The KSITM had the added advantage of practical experience in rolling out e-projects and is a pioneer in the use of free and open software in e-governance (Praveen, 2011). A delegation from Zimbabwe visited Kerala in December 2010 to study how to revive its economy through the application of ICT solutions. A delegation from Bangladesh visited Kerala in May 2011 to learn from its experience in mobile governance applications and the citizen-centric delivery of e-governance services undertaken by the state through the KSITM. Bangladesh is in the process of setting up 4,500 net-enabled information centers similar to Kerala's Akshaya Common Service Centres (CSCs) and wants an integrated application of ICTs in the delivery of e-governance services. Such efforts in Bangladesh are presently scattered across multiple networks and servers.

Challenges for e-Governance

International communication policy debates which emphasize that creating digital opportunities is not something that happens after addressing "core" development challenges; it is a key component of addressing those challenges in the 21st century (G8, 2002).The Network Readiness Index rankings of 138 countries released by the Global Information Technology Report 2010–11 assess the conduciveness of national environments for ICT development and diffusion, including the broad business climate, regulatory aspects, the human and hard infrastructure needed for promotion, the degree of preparation for and interest in using ICT by key stakeholders and the extent of its use by them. India's Network Readiness Index stands at 48 out of 138 economies while China was at the 36th spot.

The United Nations (2006) has identified a strong correlation between a country's information and communication technology diffusion index (ICTDI) and its income and level of human development as measured by the UNDP's Human Development Index (HDI). The top ranks are dominated by industrial countries from North America, Western Europe and the Asian Tigers, while many of the lower ranking countries are from Africa. India and its neighbors—Nepal, Bhutan, Pakistan, and Bangladesh—also fall into this group. The information and communication technology expenditure by countries during 2003–2008 as a percentage of GDP shows that Bangladesh is far ahead of India (4.5 percent), Pakistan (4.4 percent), and Sri Lanka (4.3 percent) (see Table 1).

In the 1990s, globalization and the increasing information intensity of economic activity, coupled with rapid technological change and demand growth, made ICT critical to competitiveness and growth. But South Asia is faced with pressing concerns of infrastructure such as hardware, connectivity, and electricity. Connectivity is narrowly defined as the physical infrastructure available to a country, as distinct from broader factors determining access (e.g., literacy, cost). UNCTAD defined narrow "connectivity" as the minimum set of measures necessary

Table 1: Information and communication technology expenditure, worldwide by country 2003–2008 (percentage of GDP)

Country	2003	2004	2005	2006	2007	2008
India	3.2	3.8	4.4	4.1	3.9	4.5
Sri Lanka	2.4	2.7	3.3	3.8	4.6	4.3
Pakistan	3.2	3.3	3.9	4.2	4.4	4.4
Bangladesh	1.9	2.4	4.1	5.9	8.0	9.0
Indonesia	1.9	3.3	3.3	3.2	3.2	3.3
Singapore	10.1	9.7	9.6	8.7	7.5	7.1
Thailand	5.8	6.2	6.1	6.2	6.1	6.2

Source: The World Bank (2010).
Note: Information and communications technology expenditures include computer hardware (computers, storage devices, printers, and other peripherals), computer software (operating systems, programming tools, utilities, applications, and internal software development), computer services (information technology consulting, computer and network systems integration, web hosting, data processing services, and other services), and communications services (voice and data communications services) and wired and wireless communications equipment.

for ICT access, comprising Internet hosts per capita, PCs per capita, telephone mainlines per capita and mobile subscribers per capita. Even where PCs, mainlines and mobiles are available, they are not the same in high-income and low-income countries (United Nations, 2006). A PC is likely to be older and less powerful in a low income nation and more likely to be shared among users. Internet use is more likely to be in a shared facility in a low income nation, and less reliable and slower. This excludes supporting infrastructure (such as electricity supply and transport), affordability and broadband access. The demand for power necessary to maintain networks and ensure their functioning, often fall too short of supply in all developing countries of South Asia including India. There are several villages which have no access to electricity and it is estimated that 44 percent of Indian homes do not have electricity (Census of India, 2001).

The penetration and access to ICTs is highly unequal across and within developing countries. While 50 percent of the population in developed regions has internet access, only 7 percent in the developing countries and less than 1 percent in the 50 least developing countries have internet access (World Bank, 2006). The leading 20 countries worldwide with highest number of Internet users 2009 (millions and percentage) can be seen in Table 2. It can be observed that the top 20 countries account for 76 percent of the world internet users while the rest of world

Table 2: The leading 20 countries worldwide with highest number of Internet users 2009 (millions and percentage)

Rank	Country or Region	Population (million)	Internet users (million)	Penetration (percentage of population)	Growth 2000–2009	Share of population world users (percentage)
1	China	1,339	360	26.9	1,500.0	20.8
2	United States	307	228	74.1	138.8	13.1
3	Japan	127	96	75.5	103.9	5.5
4	India	1,157	81	7.0	1520.0	4.7
5	Brazil	199	68	34.0 1	250.2	3.9
6	Germany	82	54	65.9	126.0	3.1
.7	United Kingdom	61	47	76.4	203.1	2.7
8	Russia	140	45	32.3	1,359.7	2.6
9	France	62	43	69.3	407.1	2.5
10	South Korea	49	37	77.3	96.8	2.2
11	Iran	66	32	48.5	12,780.0	1.9
12	Italy	58	30	51.7	127.5	1.7
13	Indonesia	240	30	12.5	1,400.0	1.7
14	Spain	41	29	71.8	440.0	1.7
15	Mexico	111	28	24.8	917.5	1.6
16	Turkey	77	27	34.5	1,225.0	1.5
17	Canada	33	25	74.9	97.5	1.4
18	Philippines	98	24	24.5	1,100.0	1.4
19	Vietnam	89	22	24.8	10881.6	1.3
20	Poland	38	20	52.0	615.0	1.2
	Top 20 countries	4,375	1,325	30.3	359.9	76.4
	Rest of the World	2,393	409	17.1	461.5	23.6
	Total World	6,768	1,734	25.6	380.3	100.0

Note: Population data are estimates.
Source: Internet World Stats (2010).

accounts for only 23.6 percent of internet users. India has only 7 percent of its billion plus population using the internet which accounts for a miniscule 4.7 share of the world's internet users.

India lays stress on political processes such as decentralization and participatory governance. While pursuing these processes, it must be recognized that the motivations and imperatives for adopting e-governance in a developing country like India are vastly different from those in developed countries. India is the second largest nation with a population of over one billion with around 177 million households in 604 districts comprising 640,000 villages. Per capita income stands at around $1000. There are 22 officially recognized languages in India and 844 different dialects are spoken all over the country. Hindi is the national language which is widely spoken by at least 45 percent of the population while English is the second official language used for commerce and official communication. But less than 10 percent of the population can speak English. Universal literacy is still a distant goal. IT literacy is very low, both in absolute and relative terms. Telephone, PC, and Internet penetration levels are low in comparison. Hence e-governance initiatives need to be planned with reference to these ground realities in the country.

India's experience in e-Governance/ICT initiatives has demonstrated significant success in improving accessibility, cutting down costs, reducing corruption, extending help and increased access to un-served groups (Das and Chandrasekhar, 2007; Prasad, 2004). Most of the state governments in India have gone in for e-governance initiatives through the use of information and communication technologies (ICTs) and are in the process of making the citizens net-enabled too. E-governance is viewed as IT enabled governance (Vittal, 2001: 4).

According to Bagga et al. (2005),

> e-governance is government-to-people and people-to-government connections whereby citizens obtain direct access to records, rules and information about entitlements that they need or want in their daily lives...It also runs into strong resistance since disintermediation methods eliminate middlemen and others whose livelihoods and incomes depend upon the relative inaccessibility of government documents. (p.31)

NeGP is a comprehensive program of the Government of India and is designed to leverage capabilities and opportunities presented by ICT to promote good governance across the country. The vision of the NeGP is to "make all Government services accessible to the common man "in his locality" (http://arc.gov.in/11threp ARC_11thReport_Ch7.pdf). e-Governance is seen as a vehicle to initiate and sustain reforms by focusing on three broad areas:

Governance

- Transparency
- People's participation
- Promotion of a democratic society

Public services

- Efficient, cost-effective, and responsive governance
- Convenient services to citizens and businesses
- Greater citizen access to public information
- Accountability in delivery of services to citizens

Management

- Simplicity, efficiency, and accountability
- Managing voluminous information and data effectively
- Information services
- Swift and secure communication

The NeGP includes 26 Mission Mode Projects (MMPs) and 8 support components to be implemented at the central, state and local government levels. This plan attempts to cover all the important areas relating to e-Governance—policy, infrastructure, finances, project management, government process re-engineering, capacity building, training, assessment and awareness, etc., across the central and state governments. According to Kalam (2005), "e-governance should enable seamless access to information and a seamless flow of information across the state and central government in the federal set-up" (p.37). The MMPs comprise projects under the central government, the state departments, and those, which are integrated, spanning multiple ministries, departments or agencies.

NeGP entails planned interventions that can come from government initiatives, especially in the developing countries; such interventions are important and inevitable.

The government usually has the resources, the infrastructure and the authority to implement programs aimed at reducing the digital divide. The biggest advantage of the government intervention is its enormous reach and the wherewithal to carry out and sustain a program such as e-governance (Joshi, 2004).

Common Services Centers

The Common Service Center (CSC) is a strategic cornerstone of the National e-Governance Plan (NeGP), approved by the Government in May 2006, as part of its commitment to introduce e-governance on a massive scale. CSCs or broadband-enabled computer kiosks offer a range of government-to-citizen and business-to-customer services, besides promoting sheer access to the Internet. Information management systems are focused to ensure that relevant information is available anywhere anytime and in any way for interactions between Government to Government (G2G), Government to Citizens (G2C) and Government to Businesses (G2B).

The scheme creates a conducive environment for the private sector and NGOs to play an active role in implementation of the CSCs and become partners of the government in the development of rural India. The public/private partnership model of the CSC scheme envisages a three-tier structure consisting of the CSC operator (called Village Level Entrepreneur or VLE); the Service Centre Agency (SCA), that will be responsible for a division of 500–1000 CSCs; and a State Designated Agency (SDA) identified by the State Government responsible for managing the implementation over the entire State.

The CSCs are aimed at providing high quality and cost-effective video, voice and data content and services, in the areas of e-governance, education, health, telemedicine, entertainment as well as other private services. CSCs also offer web-enabled e-governance services in rural areas, including application forms, certificates, and utility payments such as electricity, telephone and water bills (http://www.csc-india.org/).

Capacity Building for Citizens

India has emerged as a major player in the sphere of IT-enabled services and the knowledge industry, but this development has, by and large, remained urban oriented, with the exception of a few rural initiatives in some states. It is important to understand that even if e-Government initiatives are implemented successfully, it would still be a big challenge to ensure that citizens use the services effectively. There is an urgent need to address the digital divide in the country in an integrated and holistic manner. This is only possible when the citizens are made aware about e-Governance initiatives and how they can effectively utilise it in their day-to-day affairs. Das and Chandrasekhar (2007) opine,

> NeGP is a massive initiative that can be successfully implemented in the 28 states and 7 Union Territories covering more 1 billion population only if comprehensive capacity building is undertaken covering all segments likely to be touched by the Plan. Through such capacity building measures, India would further strengthen the strong and dynamic democratic institutions and thereby secure growth and development for all its citizens in an equitable manner.

It has taken India 77 years to transition from an opaque system of governance, legitimized by the colonial Official Secrets Act, to one where citizens can demand the right to information (RTI) in 2005 (Prasad, 2009). The RTI forms the crucial underpinning of participatory democracy—it is essential to ensure accountability and good governance. The awareness of the right to information has influenced the people's demand for greater transparency in government, improving citizen satisfaction by delivering efficient services and improving government performance through the use of ICTs in e-governance (Prasad, 2009).

The capacity building amongst citizens began with awareness to the right to information created by all media like Internet, cable TV, community/FM radio and the vernacular press. Combined with appropriate content, connectivity, and capacity-building measures the media has helped in ushering in higher awareness about governance and motivating people's participation in political processes. Since India has opted for a model of assisted access, particularly in rural areas, building capacity amongst the service center operators is a key area of attention (Das and Chandrasekhar, 2007). e-governance initiatives have begun to catalyze development and to facilitate better quality public services in areas such as education, employment, environment, health, provision of business services, providing market prices and other information, e-trade opportunities, e-entertainment, e-banking, e-learning, digital photos, e-booking of tickets, internet linked services, etc.

The government has also established effective partnership with apex organizations of civil society bodies that are working for empowerment of citizens and use of IT for this purpose. For example, the CSCs are being implemented in close collaboration with Mission 2007, a National Alliance of nearly 200 civil society and private sector organizations aiming to leverage ICT for rural development and empowerment. The availability of the new media including mobile communications, social networking sites and the internet has also led to the organization of large-scale popular movements against corruption, the campaign for the right to information and environmental conservation in India. It is appropriate here to discuss e-governance capacity building efforts of Kerala through the Akshaya e-literacy project.

e-Governance in Kerala: A Case Study

The state of Kerala presents an interesting case in the study of e-governance in a region with high literacy and educational status, access to ICTs, civic engagement, and political participation as compared to other states in India. Kerala is in the forefront of implementing e-governance and m-governance. It is also the only state to implement the Akshaya e-literacy project towards facilitating capacity building for citizens to participate in modernizing governance and implementing an effective plan to bridge the digital divide.

In India, Kerala ranks first among states in literacy, human development, infrastructure development, and quality of life. Kerala citizens have high exposure to mass media and demonstrate high levels of political participation. The state of Kerala is also in the forefront of implementing e-governance initiatives. Kerala is credited with India's first fully computerized Gram Panchayat at Vellanad Village. The Information Kerala Mission undertook this pilot project to kickstart an ambitious electronic governance program covering the entire state. As a part of this project, computerized counters at the panchayat office render services like payment of bills, registration of births and deaths and issues of certificate. This project also facilitates the Gram Panchayat with a revenue collecting system ensuring high level of transparency. This gram panchayat is the first in India to have a full-fledged geographic information system, a citizen's database linking electoral rolls, ration card, and property ownership data (www.digitaloppurtunity.org/cgi-bin/index.cgi [*The Hindu*, January 15, 2003]).

The Union Ministry for Information Technology identified the Palghat and Kannur districts of Kerala for implementing the people-friendly e-District project as part of the NeGP. This section of the article uses the case study method with the interpretative research approach in which the phases of data gathering and data analysis comingle, as data analysis often leads to a new round of data gathering. The data are drawn from primary statistics, existing literature and publications on e-governance in Kerala, and in-depth interviews to gather information from ten entrepreneurs who run Akshaya centers.

The National Human Development Report 2009 (Government of India, 2010) ranks Kerala as the first among Indian states in the Human Development Index. The data presented in the report are dramatic, and Kerala had achieved a high level of human development by the early 1990s. Kerala's birth rate in 1991 was 20 per 1,000 females compared with a national rate of 31 and an average of 38 in the world's poor countries. Kerala's infant mortality was 17 per 1,000 live births versus 85 for India as a whole and 91 for other poor countries. Kerala's adult literacy rate was 91 percent while India's was 52 percent and other poor countries' 55 percent. Yet Kerala's per capita income in 1991 was $298 compared to the all-India average of $330 and a world poor country average of $350. By comparison, in 1991 the United States had a per capita GNP of $22,240. Yet Kerala's material quality of life indicators were far closer to those of the US than to those of the rest of India or those countries with similar income levels. Kerala's high level of human development achieved during the 1990s is remarkable because in the present day it continues to be first among all Indian states in human development.

Kerala achieved the UNESCO standards of mass media requirements (minimum number of newspaper copies, radio sets, cinema seats and TV sets) in a country which was underdeveloped as early as in the 1960s (Kuppuswamy, 1976: 332). In the mid-1980s though Kerala accounted for only 3.5 percent of India's population, 8.5 percent of all daily newspapers in India were in Malayalam language after Hindi the language of 38 percent of India's population, and English language newspapers, Malayalam ranked third in the number of newspapers produced each day. The ratio of Malayalam newspapers to population in 1991 was roughly 71 copies for every 1000 speakers of the language (*Manorama Yearbook*, 2010). There are more than 120 dailies being published in Kerala, more daily newspapers than any other region in India. *The Hindu*, *The New Indian Express*, *Malayala Manorama*, *Mathrubhoomi*, *Kerala Kaumudi*, *Desabhimani*, *Deepika*, *Madhyamom* and *Janmabhoomi* are a few of the prominent

daily newspapers and have online editions. Apart from the state-owned All India Radio (AIR) and Doordarshan TV channels, there are a dozen private satellite television channels in the local language Malayalam apart from over 200 satellite TV channels in different languages that reach the people in the state. Kerala has the highest exposure to mass media, particularly print media (81 percent) (NHDR 2009, 2010) due to high literacy.

The high levels of exposure to the mass media have led to high levels of political participation among the people of Kerala. The high rate of political participation of the people in Kerala can be illustrated by the high turnout at elections. The voter turnout (percentage of eligible voters) in Kerala during elections is consistently over 70 percent which is higher than the 60 percent voter turnout for India (Election Commission of India, 2006). The state is also in the forefront of implementing e-governance capacity building initiatives.

Akshaya centers

The Akshaya e-literacy project of Kerala Government inaugurated on November 18, 2002, was implemented jointly by the Kerala IT Mission and Department of Science and Technology, with tie-ups with local bodies and voluntary agencies. This project aims at making Kerala the first completely e-literate state in India. Under this project, state and local self-government bodies will be connected via the Internet and mailing facility in Malayalam will also be availed. The pilot project launched in Malappuram district has multipurpose community training centers to train people to handle computers, data entry, desktop publishing, Internet Browsing, Web based matchmaking, real estate, placements, etc. (www.digitaloppurtunity.org/cgi-bin/index.cgi [www.refiff.com, November13,2002]). The Akshaya project is aimed at bridging the digital divide in Kerala.

It is widely recognized that timely availability of information enables good decisions, increases productivity, and improves governance. However, to ensure that information is available in a timely manner, systems for collating data and converting them into information inputs are essential. This is true both within government, i.e., for decision makers as well as outside government, i.e. citizens, businesses, etc. In other words when the question of information management is considered, it is essential to have systems, which ensure that relevant information is available anywhere anytime and in any way for interactions between Government to Government (G2G), Government to Citizens (G2C), and Government to Businesses (G2B).

The emphasis of citizen-relevant data has been on reducing the transaction costs incurred by the individual citizen as on date. The transaction cost here does not refer to the pricing of services (user charges) but the cost involved in getting information, like cost of repeated travel, wastage of time, opportunity cost, etc. Currently, a citizen would need to make many visits to various government offices to get details of schemes or entitlements including certificates required by him. Invariably he would be required to file applications in a defined format and many a time he would require to buy application forms and then fill it up. If some clarification were required on filling up certain fields, he would again have to take the help of the office staff or intermediaries. For filing the application and enquiring the fate of the same as well as to finally receive the benefit repeated visits would be required to the same office, all of which adds to the transaction costs. Though such expenditure is not directly linked to the availing of the benefit, the impression is that the benefit comes free of user charges. Since many offices have limitations in physical infrastructure, citizen interface of the above nature is sub-optimal leading to customer dissatisfaction. Hence it is critical to have decentralized information access centers that cater to a range of citizen needs and has an inbuilt integrated front-end system as a one-stop multimode arrangement for all G2C information exchanges.

The Akshaya centers being implemented in Kerala are in line with the objective of increasing citizen participation in e-governance. They are access centers for G2C information interaction as well as for a substantial range of G2B information interaction. Apart from G2C information flows, G2G information flows especially data from field level offices to higher tiers is a critical information management issue. Given the fact that all the government departments and individual offices do not have automated systems or computerized backend information systems, currently such data flows are in the manual mode using defined proformas in specified periodical statements and has issues of delay and retrievability for analysis attached to it. The capturing of data in proformas and forwarding the same in electronic format to central repositories through the infrastructure available at Akshaya centers are crucial in strengthening e-governance until the capabilities are acquired in all the Government offices concerned.

Apart from G2G, G2C and G2B information interactions, it is also critical that some of the transactions

in these categories are also brought to decentralized and integrated front-ends. This would essentially mean that government can then concentrate more on the critical core backend operations that it is mandated to do and would channelize its information and transactions through a wide spread network of access points. A key component of such a decentralized system wherein the information and if possible transaction services happens outside the premises of government offices/institutions, would be the presence of electronic access points which could serve as information/transaction dissemination points as well as data collection and capture points. Akshaya seeks to provide such access points.

Akshaya for Bridging Digital Divide

The Kerala Model of development that had enabled the state to achieve substantive levels of social progress had essentially ensured that access points whether it is educational institutions, health care institutions, Public Distribution System outlets or anganwadis (child-care centers) are there within the easy reach of every family (Prasad, 2009). Akshaya has been modeled on this social philosophy, but with the critical difference that ICT access points are not state run institutions but entrepreneurial ventures. The Akshaya centers as key stakeholders in information and transaction dissemination are designed within a public-private partnership framework which would augment the financial viability of the centers. State support also facilitates the creation of a networked access points system which could have long ranging implications in governance, social improvement, and bridging the digital divide in Kerala.

The Akshaya e-literacy project of Kerala Government was implemented in 2002 jointly by the Kerala IT Mission and Department of Science and Technology, with tie-ups with local bodies and voluntary agencies. This project aims at making Kerala the first completely e-literate state in India. Under this project, state and local self-government bodies will be connected via the Internet and mailing facility in Malayalam language will also be provided. The pilot project in Malappuram district had multipurpose community training centers to train people to handle computers, data entry, desktop publishing and Internet browsing. The CTCs or the computer training centers/kiosks also offer the following services: continued e-learning program, data entry under e-governance program, DTP and job-typing work, computer training for public, design of invitation cards, visiting cards, banners, posters, paper bags, etc., and screen printing, data bank services and telemedicine applications.

The Akshaya project is aimed to develop over 10,000 numbers of networked multi-purpose community information kiosks called Akshaya centers to provide ICT access to the entire population of the state. At least one person in each of the 65 lakh families in the state will be made IT-literate. Ernakulam district is set to become totally e-literate as a part of the first phase of Akshaya Project. The objective of the e-literacy project that was launched in the Ernakulam district in December 2005 was to make at least one member from every household e-literate through a 15-hour course. The target was set based on the 2001 census according to which the district had 5,12,270 households. Of the 5,12,270 e-literate people in the district, 3,43,753 were trained in basic computer literacy by Akshaya (Praveen, 2009).

A unique method was adopted to spread e-literacy in Ernakulam after it was found that the 14 Akshaya centers initially allotted within its limits were insufficient to achieve the stated objective. To overcome this, 30 efficient Akshaya entrepreneurs from the Kochi city outskirts were roped in to cover the corporation area with the approval of the Corporation Council. Each entrepreneur was allotted two divisions each with sub-centers in at least six different locations within the division. Thus, Kudumbasree units (women's self-help groups), anganwadis (child care centers), political party offices, vacant buildings of the corporation, individual households and even police stations were turned into centers for computer learning (Praveen, 2009).

The Akshaya Project has an additional objective of enhancing the quality of available IT infrastructure in the state to bridge the rural-urban digital divide. It is expected that the IT infrastructure will be expanded to the rural areas to create and expand economic opportunities in the knowledge economy; empower individuals and communities through enhanced access to information; modernize and upgrade skill sets; integrate communities through creation of e-Networks; create awareness of ICT tools and usage; generate locally relevant content; and generate direct employment opportunities (http://www.akshaya.kerala.gov.in).

Evaluation of the Akshaya Project

The Akshaya Project is an e-governance initiative that has succeeded in drawing people to use technology in a socially deterministic ways to satisfy local needs. In an evaluation of the Akshaya Project it was found that it was successful in generating employment, providing IT literacy, enhancing communication and providing e-services

(Ghatak, 2006). The Akshaya program generated employment for the youth, particularly women, for work like DTP, typing, etc. Trainees particularly women could search for better employment opportunities at the end of their course. Akshaya program provides cheaper e-Literacy courses to the people. The courses offered ranges from easier ones (like MS Office, DTP) to harder ones (like diploma courses). Internet enabled kiosks are used by people to contact their relatives/ friends who are staying abroad or other States in India. Communication is also done for marketing of products. Akshaya kiosks are providing a range of services like registration of births and deaths; collection and feeding of health related data (in a way acting as databanks) of the local population (by tying up with village administrative units) (Ghatak, 2006).

The Akshaya centers mooted in 2005 had the mission of providing e-literacy or e-vidya during the first phase of its operations from 2005 to 2008. The e-vidya was a package of basic computer literacy consisting of fifteen classes to orient the people to use MS-Office software like word, excel and browsing the internet.From the second phase of the Akshaya Project between 2008-2011 the scope of the center expanded to offer e-pay services and also to offer citizen services like processing of ration card applications, sending online applications of the Public Service Commission exams, filing sales tax returns, processing applications of the Arogyahealth insurance scheme of the Kerala government, birth, death and marriage registration, payment of electricity and telephone bills, railway ticket booking services, and Western Union money transfer services.

The Akshaya Project is currently in the third phase from December 2011 and is approved as a CSCs by the central government. Presently it is aimed at elevating one Akshaya center to the status of a CSC for every 6 villages to provide 23 citizen services. The central government aims to create one CSC for every village. The Akshaya centers in Kerala have successfully trained thousands of candidates in several short term courses such as DTP, Tally, and Photoshop. It is also running the Keltron Certified Medical transcription course for those who have qualified intermediate or plus-two and above. The course is also run online for the benefit of those who wish to take it online (Prasad, 2011).

Akshaya also provides Intel Education Initiative's latest Technology & Entrepreneurship course through its 2,200 customer service centers across the state. Akshaya and Intel's Learning Initiative team jointly took the decision after their successful association resulting in imparting e-literacy to 86,000 students in the 8–16 age group. The curriculum was launched by Intel's Regional Director, Corporate Affairs (Asia-Pacific), Anjan Ghosh who said:

> Our association with Kerala IT has reaped huge benefits not just for students in the State, but also for Intel's learning initiative. The whole programme and its execution through various Akshaya centers have been a learning experience for us on how non-formal education system has a better and far reach through the right platform and is something that we can take back and try to implement in other Asia-Pacific countries as well. (http://www.hindu.com/2011/01/19/stories/2011011963310200.htm, *The Hindu*, January 19, 2011)

Akshaya Director Korath V. Mathew said,

> Intel's Learn program has been a major trigger in the growth and sustainability of Akshaya to what it is today. This has also inspired us into looking at various effective learning methodologies and work towards empowering the citizens of the State through the Akshaya network. (http://www.hindu.com/2011/01/19/stories/2011011963310200.htm, The Hindu, Jan 19, 2011)

Kerala is also in the forefront of setting up mobile governance. M-governance is defined as the strategy and implementation involving the utilization of wireless and mobile technology services, applications, and devices for improving benefits for citizens, business and all government units. The rapid diffusion of mobile ICT gadgets such as laptops, mobile phones, Personal Digital Assistants (PDAs), along with emails, instant messaging and other networking services have rapidly fuelled the mobile interaction. In order to take advantage of mobile and wireless ICT technologies as well as dealing with the fluidity of the interaction with the mobile society and booming mobile usage rates, the Kerala state government has initiated action to set up about 20 m government services offered by 8 departments identified for pilot level implementation and to deliver services through mobile phones accessible to the citizens in the field, in the street, at home or other convenient locations on a 24x7 basis, rather than the users having to visit government offices or log on to the Internet portals to access services.

Conclusion

The developing countries are enthusiastic adopters of ICT policies particularly in trying to promote internet access. Financing affordable Internet access and ICT competence including investment and training to create, maintain and expand computer networks may challenge the sustainability of e-governance in developing countries. The nature of diffusion of internet technology in India suggests that there are two routes through which technology can impact on the quality of life (Chandrasekhar, 2006). Skilled labor plays an important role because it affects the absorption rate of ICT applications within a country. Elite users, who use the technology to share information and analysis in crucial areas such as the environment, health, corporate practices, and labor conditions, can debate, develop, and contribute to creating international best practices in the relevant area. These can provide the basis for national policy and for mobilization of public opinion nationally and internationally to change policy regimes. This would be the top-down, trickle-down means for the technology to influence human development. The other route would be for technology to be diffused, leading to use and participation of the disadvantaged in the formulation and implementation of policies as well as to the direct provision of improved services that affect the quality of their lives. This is the more democratic face of technology and the most effective way in which it can be used to advance human development goals. Unfortunately, the current extent and pattern of diffusion of technology in India is such that it is the first of these that overwhelmingly predominates and is likely to continue to do so in the foreseeable future. The Indian government's e-governance program with the CSCs promoting sheer access to the Internet—as its vehicle seems to suggest that it wants to promote the second route which involves citizens through their participation in e-governance.

Providing access to the Internet alone is not enough—people must be enabled to use ICTs for citizen–government interaction. Literacy skills, greater awareness, education, and capacity-building efforts such as the Akshaya e-literacy project in Kerala are regarded as important factors that will enable greater civic engagement and citizen participation in e-governance. The Akshaya project is a unique partnership involving the government, private entrepreneurs, community volunteers, and citizens in improving the e-literacy skills of the community. Capacity-building initiatives like the Akshaya project can bridge the digital divide and advance digital democracy. Kerala had achieved almost total literacy before embarking on providing e-literacy to the people of the state. Though the 28 states of India are at various stages of development, the project attempts to highlight the possibilities for other states that are similar to Kerala in levels of development. It can be regarded as a model for emulation in other states of India and has also generated considerable interest throughout South Asia.

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Democracy, good governance and modernity cannot be imported or imposed from outside a country.

—Emile Lahud

Focus

Reinforcement of Knowledge Grid Multi-Agent Model for e-Governance Inventiveness in India

HARDIK GOHEL AND ALPANA UPADHYAY

Government of India focuses on growth and development of new and emerging technology areas. It has been increasingly using Information and Communication Technologies (ICT) to offer citizen-centric services as per convenient location with an initiative to make services more transparent and reduce response time with reducing costs. Knowledge grid is an intelligent interconnection environment that enables people and plays virtual roles to effectively capture, publish, share, and manage explicit knowledge resources as well as provide on-demand knowledge services to support people or services to carry out innovation, cooperative teamwork, problem solving and decision making. The existing data grid or other techniques encode potential solutions of problems simply by applying standard functions. The existing techniques are not useful to provide the best aspects of knowledge grid objectives. This leads to the development of the specialized knowledge grid environment applying multi-agent communication approach directed to support or provide better objectives or increasing functionality of knowledge grid. This research article discusses the main characteristics of knowledge grid, multi-agent communication and combines that approach with different applications and related works in the area. This article also lists the methodology for the knowledge grid with multi-agent communication with specially designed model of e-governance.

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Internet can be defined as a network of networks. The World Wide Web (WWW) is a large scale distributed hypermedia system on the internet platform. The WWW is based on the HTTP-protocol for data transfer, HTML mark up displays on top of the internet infrastructure that uses different protocols and content description schemes. According to Hans-Georg Stock (2002), the Web is experiencing two issues:

- It does not have the ability for "semantic" access and use problem
- It depends on the universality of physical access via high-bandwidth local loops and broadband wireless channels.

Semantic Web

Semantic Web is an extension of the current Web in which information is given well defined meaning by associating metadata (Berners-Lee, Handler, and Lassila, 2001). Basic objective of a semantic web is "making content machine understandable." The semantic web aims to allow web entities (software agents, users, and programs) for interoperating dynamically discovering and using resources, extracting knowledge, and solving complex problems. A layered model of the Semantic Web companies is (Cannataro and Domenico, 2004):

- A set of Web resources with a unique, global identity, described by metadata in a common and shared formalism with rules for inferring new metadata and knowledge through ontologies.
- A set of basic services such as reasoning and querying over metadata, ontologies, and semantic search engines. These services represent a great improvement over current internet services, such as the Domain Name System (DNS) and key-based search.

A set of high-level applications developed by using basic services.

Data Grid and Semantic Grid

Grids are large scale distributed computing systems providing mechanisms for the controlled sharing of computing resources. Grid computing involves resources from different distributed locations in parallel fashion. To do so, it divides a given task into several subtasks, which are executed by the resources in parallel. By this way it may decreases the cost and time. Grid support mainly data storage, data retrieval and data discovery processes through the data management infrastructure services on top of the management. Such grid can be called data grid.

In Figure 1, architecture of data grid is given to describe how a data grid works in different three layers

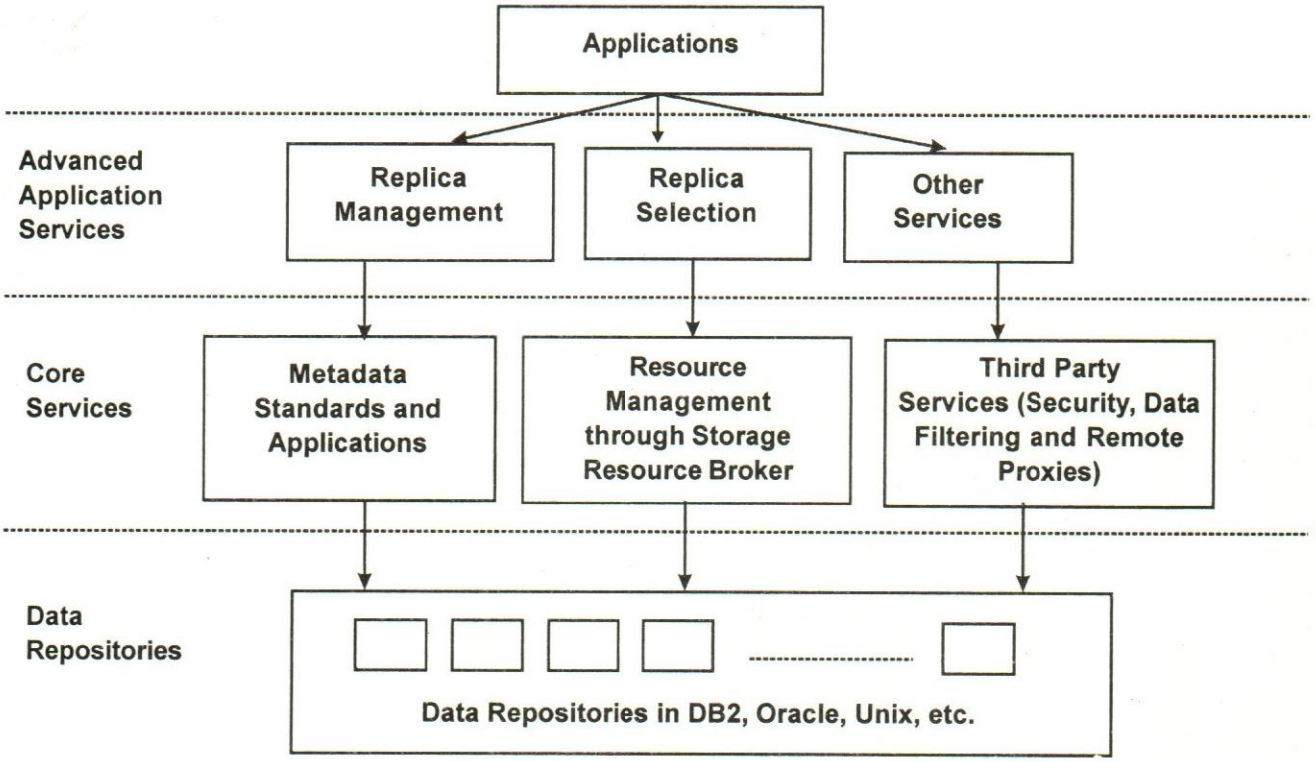

Figure 1 : Architecture of Data Grid

Source: Cannataro and Talia (2004).

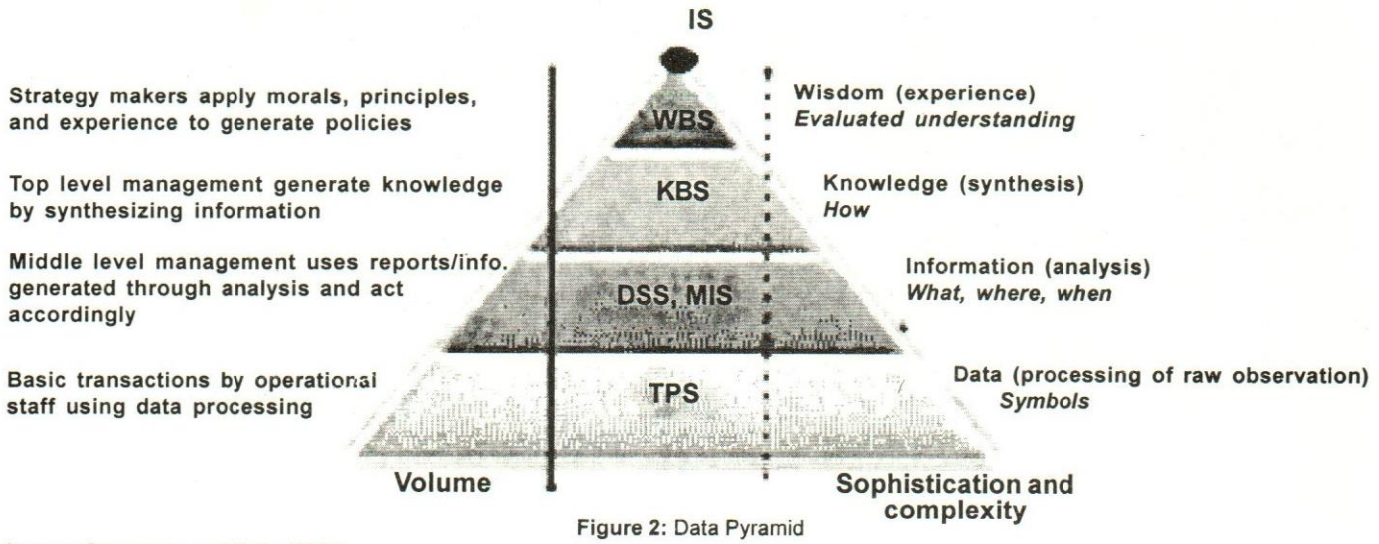

Figure 2: Data Pyramid

Source: Cannataro and Talia (2004).

(Cannataro and Domenico, 2004). So many data tools and applications are available. In data tools, there are some commercial tools available in the market, such as Delphi++, Jinni and Java Spaces, and Grid beans. The different applications like information retrieval, model evaluation such as weather, financials, military also financial computation, government and administration applications, scientific computing, military and security applications and network management and scheduling.

Semantic Grid incorporates the Semantic Web approach into the ongoing grid. Using semantics and ontology in grid can offer high-level support for managing grid resources. It also helps in designing complex applications that will benefit from the use of semantics. The data pyramid in Figure 2 shows layers of representing data means how it is available in various systems (Cannataro and Talia, 2004).

Knowledge and Knowledge Grid

Knowledge is a familiarity with someone or something, which can include information, descriptions, facts or skills acquired through experience or education. There are different types of knowledge like Tacit Knowledge, Explicit Knowledge, Commonsense Knowledge, Informed Commonsense Knowledge, Heuristic Knowledge, Domain Knowledge and Meta Knowledge. We can represent knowledge by using Factual Knowledge Representation, Semantic Network, Frame and Scripts.

Knowledge Grid

Knowledge grid is an intelligent interconnection environment that enables people or virtual roles to effectively capture, publish, share and manage explicit knowledge resources as well as provide on-demand knowledge services to support people or services to carry out innovation, cooperative teamwork, problem-solving, and decision making (Zhuge, 2004). A Knowledge grid must support some of the principles (Cannataro and Talia, 2003) like Data heterogeneity and large data sets handling, Algorithm integration and independence, Compatibility with grid infrastructure and grid awareness, Openness, Scalability and Security and data privacy. The figure 3 presents architecture of knowledge grid which is coming after exercising on data grid (Priti Srinivas Sajja and Rajendra Akerkar, 2010).

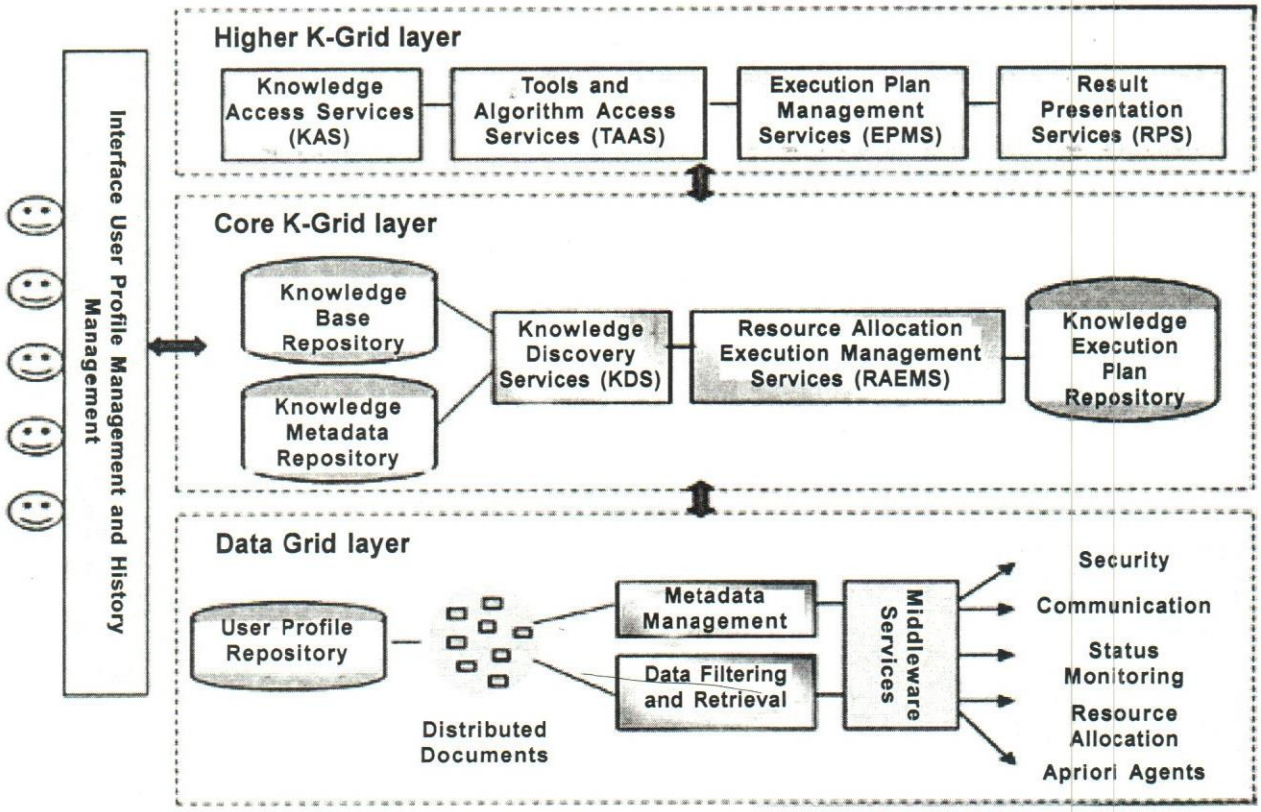

Figure 3: Knowledge Grid Architecture

Source: Sajja and Akerkar (2010).

Agent and Agent Topology

An agent is a computational entity that acts on behalf of other entities in an autonomous fashion, performs its actions with some level of proactively and/or reactivates. An agent also exhibits properties such as learning, cooperation, and mobility to a certain extent. Agents have capabilities like autonomy, cooperation, learning, and proactively.

Agent Topology

Agent can be classified according to several different parameters dividing them into proactive and reactive groups is a board classification.

- Collaborative Agent

This type of agent emphasizes autonomy and cooperation with entities like users and other agents of the environment in order to perform tasks. These agents are quite useful when the problem is large. As their name denotes collaborative agents interconnect different standalone legacy systems to define the problem and acquire resources and expertise from distributed areas. This enhances the structure and modularity of the system.

- Interface Agent

Interface agents are the ideal means for providing a user-friendly environment to work with a highly technical application. This type of agent is like a personal assistant, helping users to interact with the system. Their ability to learn about users can be enhanced to identify user level interact according to the user's need and style.

- Mobile Agent

The mobile agent offers an alternative for network and distributed computing that contrasts sharply with the predominant methodologies currently available; the client–server model, code-on-demand, and more recent Web services approach.

- Information Agent

Due to advances in ICT, a vast amount of information is available at users' fingertips. However, this information has

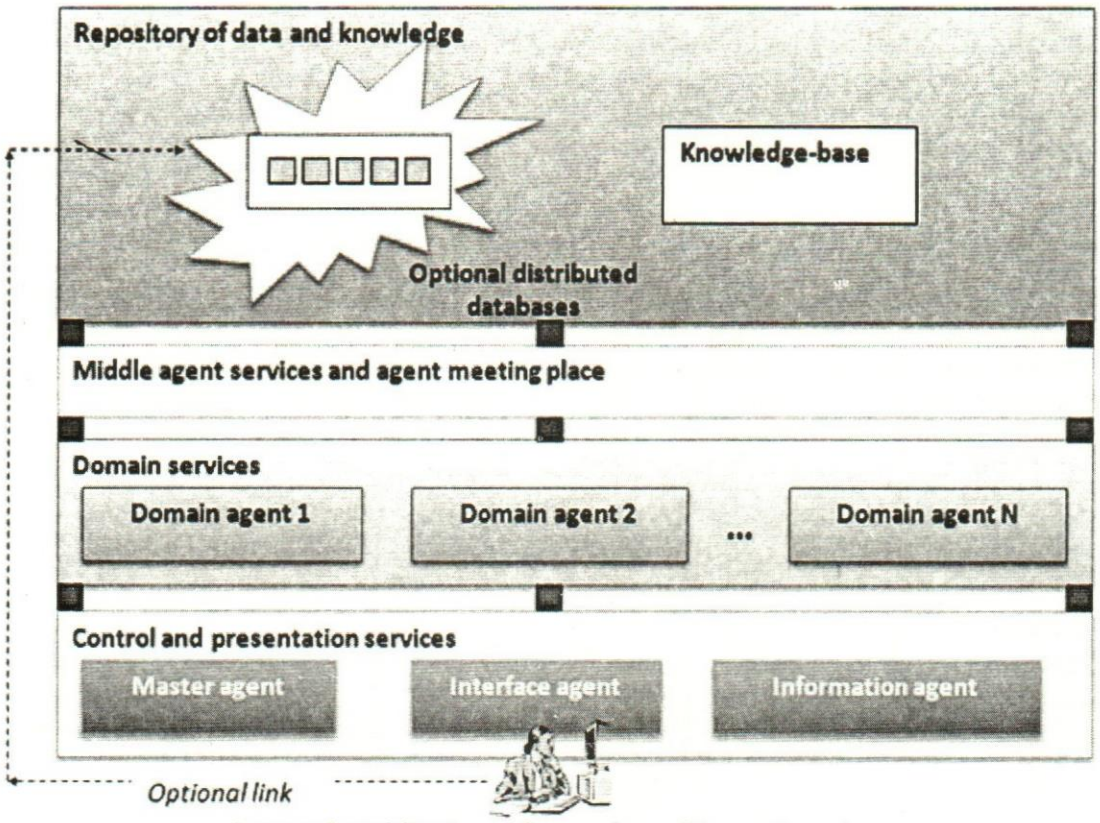

Figure 4: Layered Architecture of Generic Multi-Agent System

Source: Sajja and Akerkar (2010).

to be checked for its reliability and usability. Such an explosion of information in an unstructured and redundant format makes the task of problem solving difficult. Thus, information agents help by searching for and managing information on user's behalf. Such agents are enriched with techniques for information searching, ranking, extracting and filtering according to need.

- Intelligent Agents

Intelligent agents are defined as agents capable of flexible autonomous action to meet their design objectives. Such intelligent agents learn multiple objectives, create action plans, process the information received and perform reasoning (e.g., inferencing, synthesis, and analysis) through IA techniques (Rudowsky, 2004; Wooldridge, 2002).

Multi-Agent System

A multi-agent system (MAS) is a system composed of multiple interacting intelligent agents within an environment. Multi-agent systems can be used to solve problems that are difficult or impossible for an individual agent or a monolithic system to solve. Intelligence may include some methodical, functional, procedural or algorithmic search find and processing approach. Figure 4 shows interaction of multiple agents within their environment (Sajja, 2011).

Multi-Agent System for Knowledge Grid

In current research aspects multi-agent system for knowledge grid is most highlighted topic. Multi-agent system for knowledge grid provides interface between knowledge grid and multi agent system. Let us discuss case of e-governance. e-governance is the application of ICT for delivering government services, exchange of information, communication transactions, integration of various stand-alone systems and services. Figure 5 shows the common aspects of e-governance technology.

Figure 6 describes how different agents with particular functionality form a multi-agent system, accessing available distributed databases through grid middleware services.

The proposed model encompasses different agents for activities like GSEAN (Gujarat State Wide area Network), SWAGAT (State Wide Attention on Grievances through Application of Technology), e-Gram, e-Dhara, Health Management, e-City. All of these agents are working in collaboration.

Conclusion

The described knowledge grid architecture provides higher level services for problem solving. Searching resources and designing knowledge discovery processes in a structured manner. The grid will be proved as an effective infrastructure for managing very large data sources and providing high-level mechanisms for extracting valuable knowledge from them in near future.

Grid computing is most promising framework implementation of high performance data intensive distributed applications. Although today the grid is mainly used for scientific applications, in near future it will be used for industrial and commercial applications as well as government also as we have described above.

There are some research challenges like developing automatic ontology creation, testing techniques and standards for the knowledge grid. Furthermore, challenges also including platform-independent virtual grid in future to evolve harmoniously with the applications.

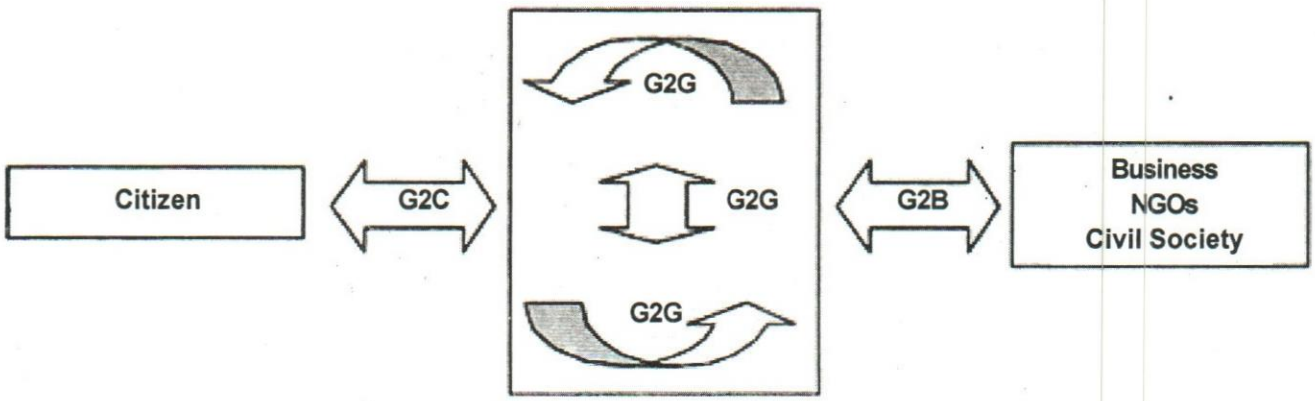

Figure 5: Aspect of e-Governance Technology

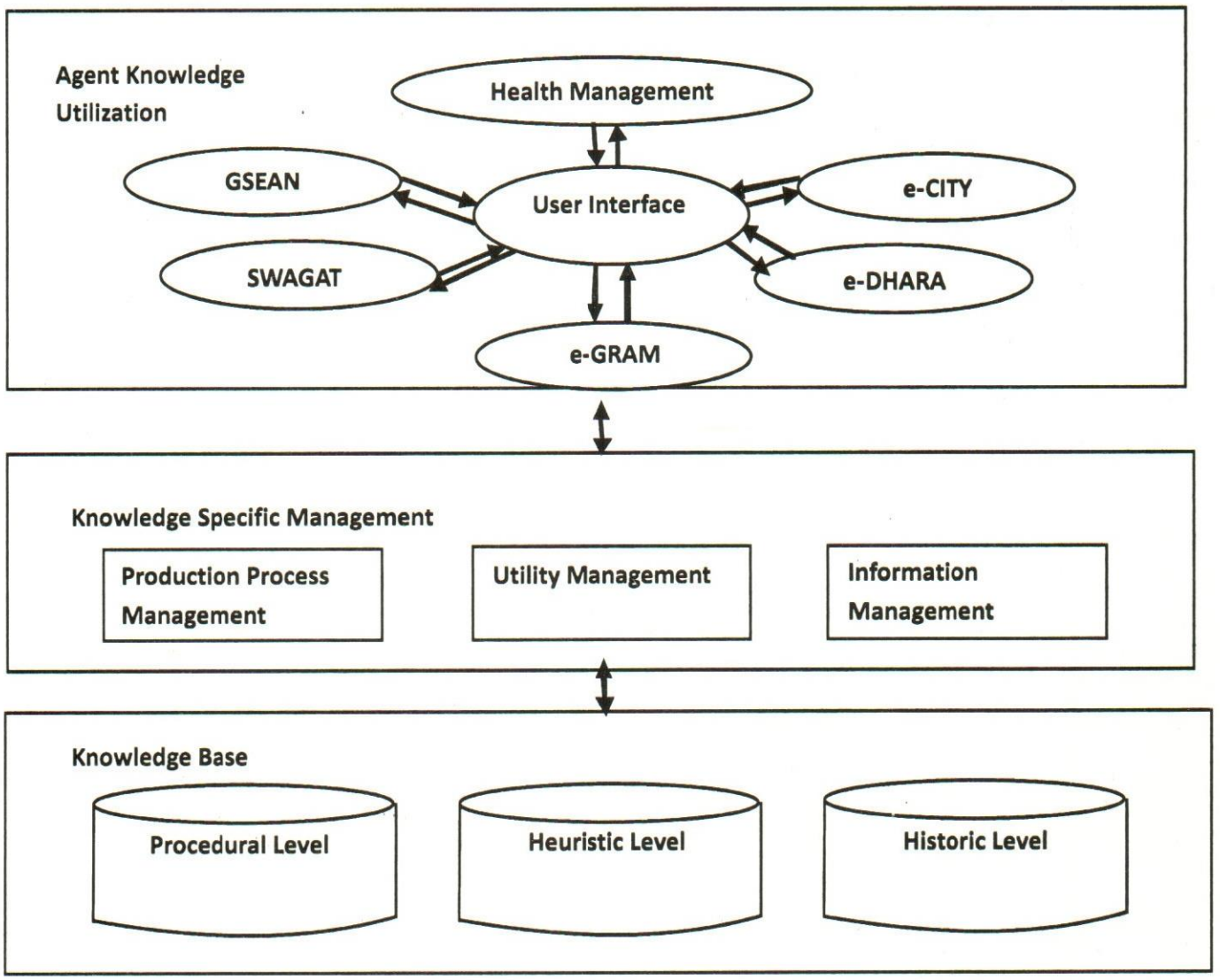

Figure 6: Proposed Knowledge Grid System Architecture

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Aid can work where there is good governance, and usually fails where governments are unable or unwilling to commit aid to improve the lives of their people.

—Lee H Hamilton

Focus

Changing Parameters of Customer–Bank Relationship in the Light of Electronic Banking System*

SAURABH JOSHI, PRIYA GROVER, AMIT JOSHI AND JITENDRA SINGH

If banking operations are delineated on a timescale, two prominent phases may be identified—the pre-EBS and post-EBS eras. Slow service and time lags marked the pre-EBS era. Drastic changes in terms of the nature of day-to-day transactions and other operations mark the post EBS era. It will not be an exaggeration to say that post EBS era is the reincarnation of the banking system. The volume and speed of banking transactions shot up whereas crowds at the branches reduced significantly.

The research article seeks to identify and elaborate the parameters that determine changes in the customer–bank dealings before and after EBS era. Efforts have been made to describe the factors that have affected banking transactions in terms of turnover, service time or dissemination of information, etc. Identification of causes, developing their association with the parameters of changes and consequently the impact there upon form an integral part of this article. Appropriate quantitative tools have been used for the purpose of analysis.

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**An independent study conducted within the Dehradun region to analyse the customer bank relations in the pre and post CBS eras.*

Theme of the study

Within the span of last two decades, functioning of banks has changed considerably. Operations of the banks have become much more high-tech today. The transformation from traditional to electronic banking system has affected customer–employee relations in a variety of ways. Gone are the days of long queues at teller windows, hectic formalities related to day-to-day bank related transactions or higher waiting time related to transfer of money etc. The effectiveness of Electronic Banking System(EBS) can be seen and analyzed on the basis of certain parameters viz. time, convenience, transparency, transaction settlement, etc. Productivity in banks in terms of above-mentioned parameters has improved significantly. The impact can be clearly seen in terms of reducing queues in banks, reducing rate of customer visits to banks, reducing rate of errors in banking transactions by bank staff and customers. Besides, there are many other direct or indirect impacts, that have completely reformed the banking sector. Consequently, the reforms at all levels have induced changes in customer–bank relations.

Authors in the present article have confined analysis to the impact of EBS on customer–bank relationship. Comparative analysis of pre-EBS and post-EBS period has been done. The analysis is based on the responses of customers' experiences before and after introduction of EBS.

Research Methodology

The sample comprises of 300 respondents selected from the stratum of main branches of four banks viz. SBI and PNB from public sector, ICICI, and AXIS Bank (formerly

UTI) from the private sector in Dehradun district of Uttarakhand. Selection of respondents has been done on random basis. Appropriate tables and charts (pie and bar charts) have been used to ensure simplicity in analysis. To test the validity of statement developed in the hypothesis Chi-Square test has been conducted. Aid of SPSS 17 has been taken for chart building and statistical analysis.

Justification regarding the selection criteria for banks and branches

Leading banks in terms of number of customers, annual turnover, profitability, market share and popularity were selected from private as well as public sector. Main branches of the respective banks were selected because executions of the all-latest technologies are primarily experimented at the main branches of the banks.

Justification regarding distinction between pre and post-CBS/EBS period

The decision to compare pre-CBS and post-CBS era is purely based on the experiences and responses of customers and bank employees.

- Adoption of CBS is a gradual process and cannot be expected to come into operation all of a sudden. Pre- and post-CBS periods are not considered from the date of notification made by the RBI regarding the execution of CBS by the banks. Execution of CBS is a phase-by-phase procedure followed by employees training, development of required infrastructure, etc.
- Establishment of ATMs by different banks is a systematic procedure based on traffic density of customers in bank tellers and daily cash turnover. Hence, responses of customers also vary accordingly.
- Based on the discussions with the customers and employees of the selected banks salient features of the electronic banking system came into operations from the year 2007 onwards and by the year 2009 people had become familiar with that. This fact has been considered for the purpose of classification between post- and pre-CBS period.
- Terms CBS (Core Banking System) and EBS (Electronic Banking System) have been used synonymously.

Constraints of the study

Following constraints were encountered during the course of the study:

- Possibilities of providing misleading information by the respondents always prevail.
- Sparing time to fill up the questionnaire absolutely depends upon the convenience of the respondent. That is, they cannot be compelled to respond.
- Due to scarcity of time and resources, only main branches of respective banks were considered for sample selection.
- Because of citing the professional ethics, employees of the banks were reluctant to share their views. Hence, they did not furnish relevant information.

Objectives of the study and Hypothesis development

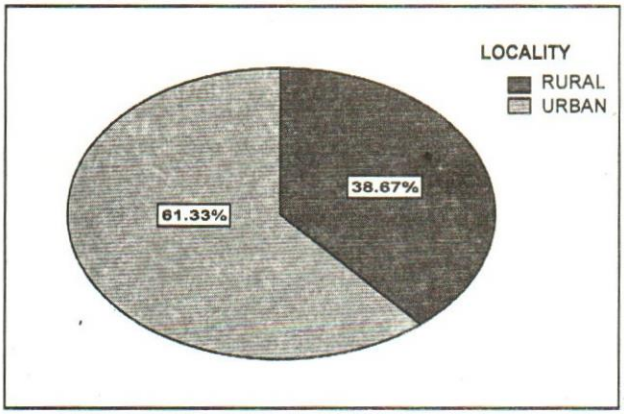
- To compare the customer–bank relationship during pre and post e-banking period.
- To analyze the effectiveness of determinants of e-banking system in smooth handling of customer-related issues.

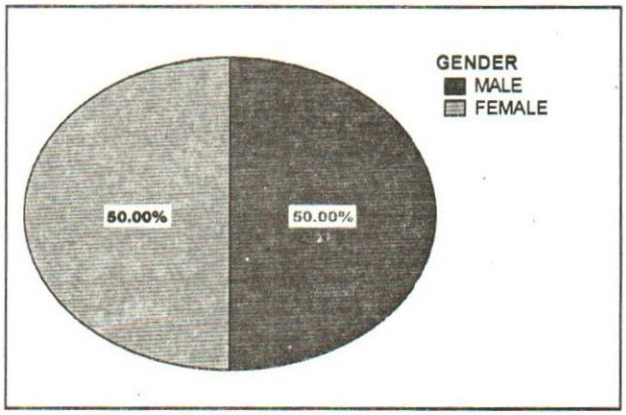
Following hypotheses were developed to check the efficacy of electronic banking system for improving customer–employee relationship.

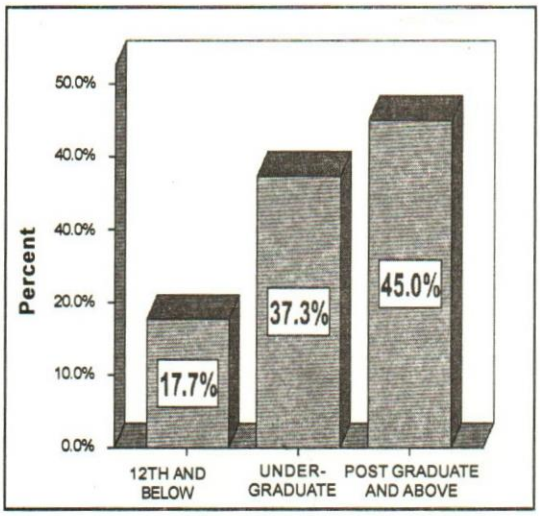
- After the adoption of EBS by banks, frequency of customer visits has reduced substantially. (To check impact of EBS over reduction of bank visits by customers.)
- Behavior of bank employees has improved significantly during the post EBS period. That is, a significant positive change can be observed in the behavior of bank employees with customers. (To check impact of EBS on customer - bank employees relations.)
- Professional rivalry among private and public sector banks has led to improvement in customer–employee dealings in the recent years.(To check the impact of rivalry between private and public sectors banks on customer-bank employee dealings)
- After the adoption of electronic banking system by banks, operational efficiency has improved. (To check the impact of EBS on operational efficiency of banks).

Data Organization and Analysis

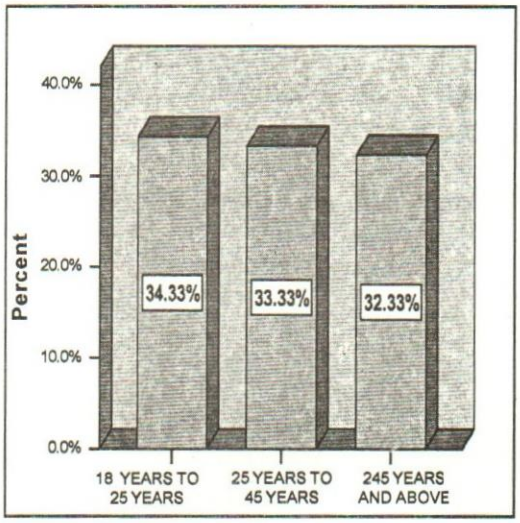
Charts displaying demographic factors



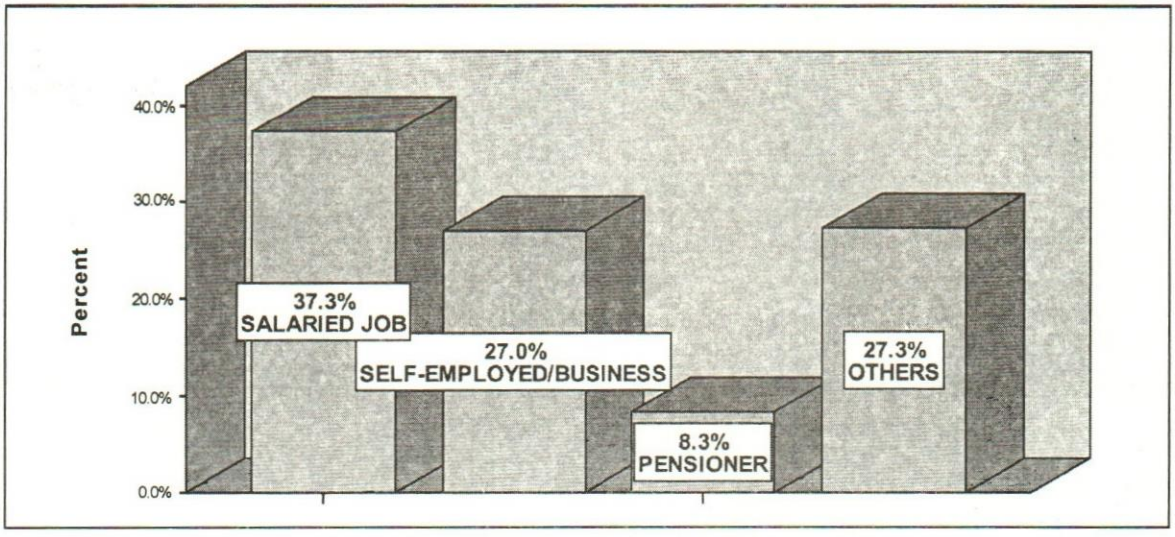




QUALIFICATION OF THE RESPONDENTS

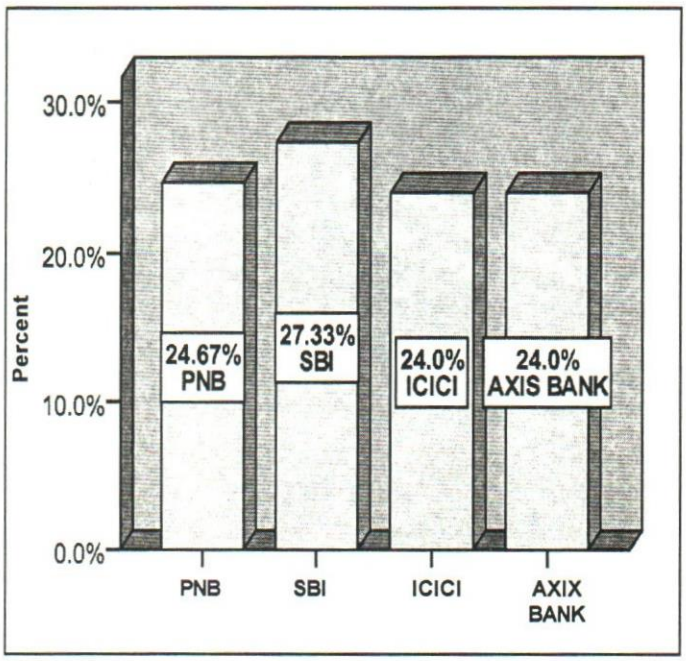


AGE OF THE RESPONDENT

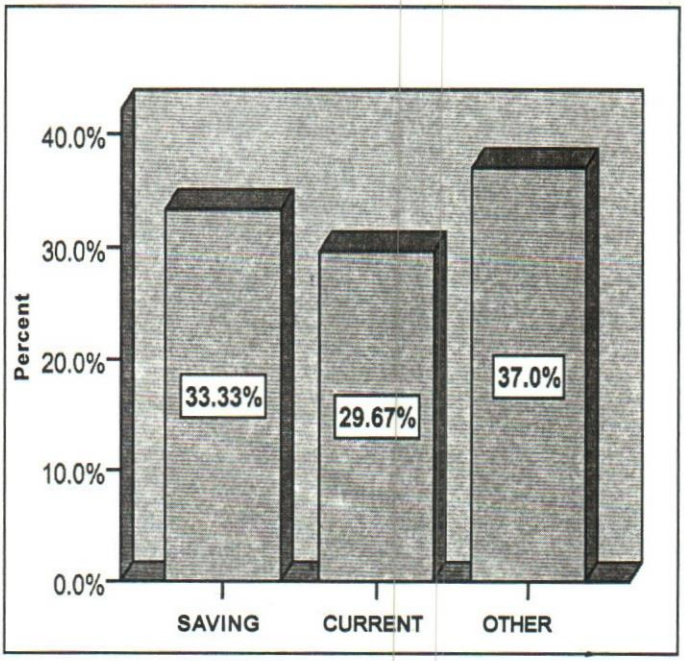


OCCUPATION OF THE RESPONDENT

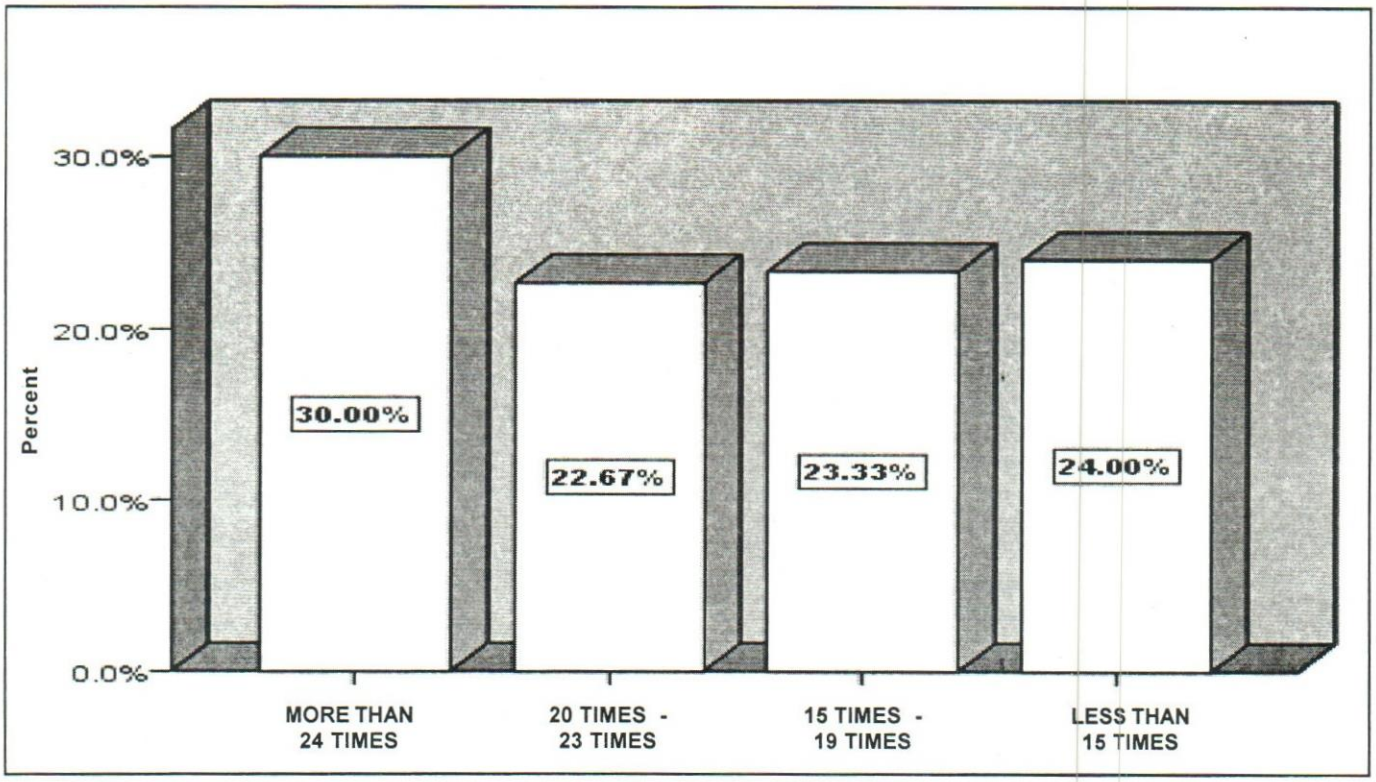
Charts pertaining to bank details



BANK ACCOUNT



TYPE OF SPECIFICATION



FREQUENCY OF MONTHLY VSITS TO BANK BEFORE CBS

Tables pertaining to demographical bank-related aspects

Table 1: Demographical Information about Respondents

GENDER (TOTAL -300)	MALE	IN NOS	150	MARITAL STATUS (TOTAL -300)	SINGLE	IN NOS	102
		IN %	50			IN %	34
	FEMALE	IN NOS	150		MARRIED	IN NOS	198
		IN %	50			IN %	66
RESIDENCE TYPE (TOTAL - 300)	OWN HOUSE	IN NOS	83	OCCUPATION (TOTAL -300)	SALARIED JOB	IN NOS	112
		IN %	27.7			IN %	37.3
	RENTAL BASIS	IN NOS	119		SELF EMPLOYED/BUSINESS	IN NOS	81
		IN %	39.7			IN %	27
	FACILITATED BY THE EMPLOYERS	IN NOS	50		PENSIONER	IN NOS	25
		IN %	16.7			IN %	8.3
	OTHERS	IN NOS	48		OTHERS	IN NOS	82
		IN %	16			IN %	27.3
AGE (TOTAL -300)	18 YRS -25YRS	IN NOS	103	TOTAL FAMILY INCOME ANNUALLY (TOTAL -300)	BELOW 3 LAKHS	IN NOS	100
		IN %	34.3			IN %	33.3
	25 YRS -45YRS	IN NOS	100		3 LAKHS TO 5 LAKHS	IN NOS	85
		IN %	33.3			IN %	28.3
	45YRS & ABOVE	IN NOS	97		ABOVE 5 LAKHS	IN NOS	115
		IN %	32.3			IN %	38.3
LOCALITY (TOTAL -300)	RURAL	IN NOS	116	NO OF EARNING MEMBERS IN FAMILY (TOTAL -300)	SELF	IN NOS	113
		IN %	38.7			IN %	37.7
	URBAN	IN NOS	184		SELF & SPOUSE	IN NOS	96
		IN %	61.3			IN %	32
					SELF, SPOUSE & OTHERS	IN NOS	91
						IN %	30.3
TYPE OF FAMILY (TOTAL -300)	NUCLEAR	IN NOS	151	QUALIFI - CATION (TOTAL -300)	12^{TH}& BELOW	IN NOS	53
		IN %	50.3			IN %	17.7
	JOINT	IN NOS	149		UNDER-GRADUATE	IN NOS	112
		IN %	49.7			IN %	37.3
					POST GRADUATE	IN NOS	135
						IN %	45
FAMILY SIZE (TOTAL -300)	UP TO 3 MEMBERS	IN NOS	102	NO. OF DEPENDENTS (TOTAL -300)	LESS THAN 2	IN NOS	115
		IN %	34			IN %	38.3
	4 TO 5 MEMBERS	IN NOS	99		2-3	IN NOS	117
		IN %	33			IN %	39
	ABOVE 5 MEMBERS	IN NOS	99		MORE THAN 3	IN NOS	68
		IN %	33			IN %	22.7

Note: Total Represents Number of Respondents

Table 2: Details Pertaining to Banking Transactions

NAME OF THE BANK (TOTAL 300)	SBI	IN NOS	74	DURATION OF ACCOUNT HOLDING SINCE IT'S INCEPTION (TOTAL-300)	LESS THAN TWO YEARS	IN NOS	35
		IN %	24.7			IN %	11.7
	PNB	IN NOS	82		TWO TO FOUR YEARS	IN NOS	59
		IN %	27.3			IN %	19.7
	ICICI	IN NOS	72		FOUR TO FIVE YEARS	IN NOS	105
		IN %	24			IN %	35
	AXIS	IN NOS	72		MORE THAN THE FIVE YEARS	IN NOS	101
		IN %	24			IN %	33.7
PURPOSE OF ACCOUNT MAINTENANCE (TOTAL -300)	INVESTMENT	IN NOS	73	PERSON VISITING BANK USUALLY FOR TRANSACTIONS (TOTAL-300)	SELF	IN NOS	85
		IN %	24.3			IN %	28.3
	SAVING	IN NOS	91		FAMILY MEMBERS	IN NOS	79
		IN %	30.3			IN %	26.3
	CONSUMPTION	IN NOS	69		RELATIVES	IN NOS	95
		IN %	23			IN %	31.7
	REPAYMENT OF LOANS	IN NOS	67		FRIENDS OR SUBORDINATES	IN NOS	41
		IN %	22.3			IN %	13.7
TYPE OF ACCOUNT WITH BANK (TOTAL -300)	CURRENT	IN NOS	100	TYPE OF ELECTRONIC BANKING FACILITY AVAILED (TOTAL-300)	ATM	IN NOS	96
		IN %	33.3			IN %	32
	SAVING	IN NOS	89		INTERNET/MOBILE BANKING	IN NOS	151
		IN %	29.7			IN %	50.3
	OTHERS	IN NOS	111		BOTH/ALL	IN NOS	53
		IN %	37			IN %	17.7
FREQUENCY OF VISITS TO BANK BEFORE THE INCEPTION OF CBS (TOTAL-300)	MORE THAN 24 TIMES	IN NOS	46	AVERAGE MONTHLY BALANCE MAINTAINED IN THE BANK A/C (TOTAL-300)	BELOW 5000	IN NOS	64
		IN %	15.3			IN %	21.3
	20- TIMES- 23 TIMES	IN NOS	71		5000-15,000	IN NOS	132
		IN %	23.7			IN %	44
	15 TIMES - 19 TIMES	IN NOS	112		15,000-30,000	IN NOS	51
		IN %	37.3			IN %	17
	LESS THAN 15 TIMES	IN NOS	71		ABOVE 30000	IN NOS	53
		IN %	23.7			IN %	17.7
FREQUENCY OF VISITS TO BANK BEFORE THE INCEPTION OF CBS (TOTAL-300)	REMAINED ALMOST SAME/NO CHANGE	IN NOS	72				
		IN %	24				
	REDUCED SLIGHTLY	IN NOS	47				
		IN %	15.7				
	REDUCED SUBSTANTIALLY	IN NOS	77				
		IN %	25.7				
	INCREASED SLIGHTLY	IN NOS	89				
		IN %	29.7				
	INCREASED SUBSTANTIALLY	IN NOS	15				
		IN %	5				

Note: Total Represents Number of Respondents

Hypothesis development

HYPOTHESIS 1 (TO CHECK IMPACT OF EBS OVER REDUCTION OF BANK VISITS BY CUSTOMERS.)

H_0 (NULL): There is no significant difference between the frequencies of customer visits to banks before and after the adoption of EBS by them.

H_1 (ALTERNATIVE): After the adoption of EBS by banks, frequency of customer visits has been reduced substantially.

Table: Frequently Operated Bank Account *Frequency of Monthly Visits to Bank is reduced after availing CBS Crosstabulation

Count

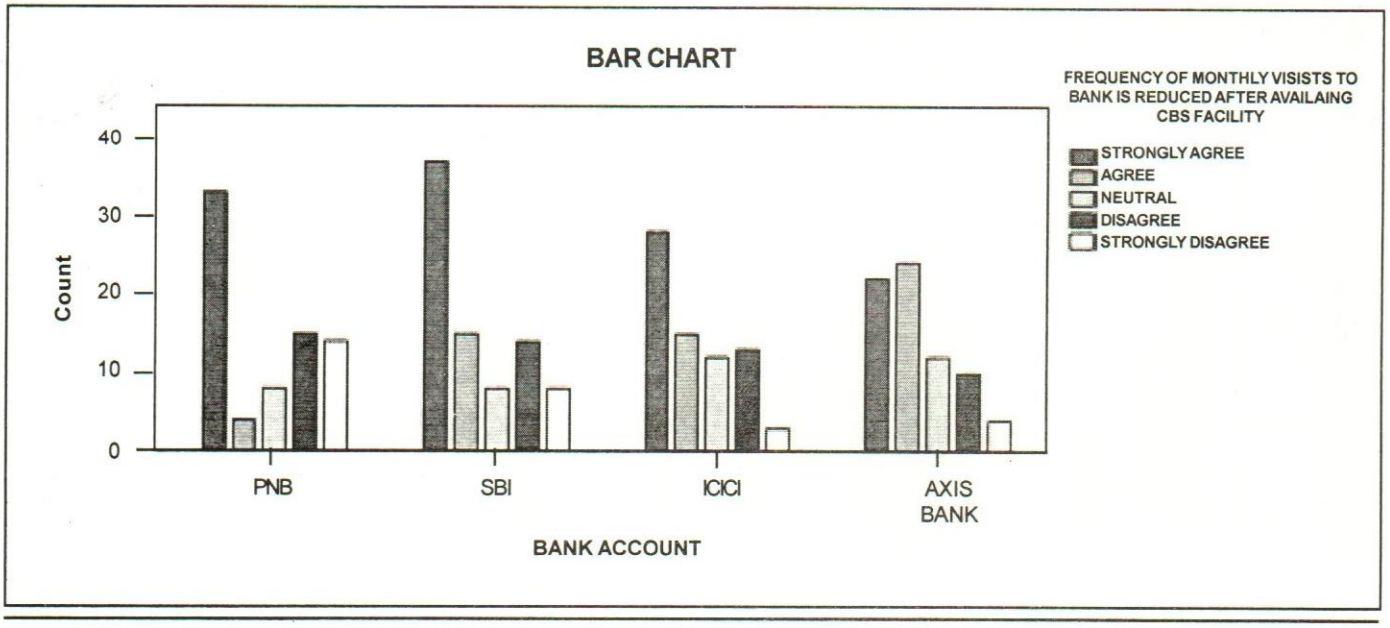
		FREQUENCY OF MONTHLY VISITS TO BANK IS REDUCED AFTER AVAILING CBS FACILITY BY BANKS					
		STRONGLY AGREE	AGREE	NEUTRAL	DISAGREE	STRONGLY DISAGREE	TOTAL
BANK ACCOUNT OF RESPONDENTS	PNB	33	4	8	15	14	74
	SBI	37	15	8	14	8	82
	ICICI	28	16	12	13	3	72
	AXIS BANK	22	24	12	10	4	72
TOTAL		120	59	40	52	29	300

CHI-SQUARE TESTS

	VALUE	DF	ASYMP. SIG. (2-SIDED)
PEARSON CHI-SQUARE	30.656[A]	12	.002
LIKELIHOOD RATIO	32.124	12	.001
LINEAR-BY-LINEAR ASSOCIATION	1.851	1	.174
No. OF VALID CASES	300		

[A] 0 CELLS (.0%) HAVE EXPECTED COUNT LESS THAN 5. THE MINIMUM EXPECTED COUNT IS 6.96.

The critical value of chi square at α=0.05 level from table is 21.026, which is quite below the above-calculated value. Hence, the null hypothesis is rejected and the alternative is accepted. That is, a majority of customers believes that the frequency of visits to banks has been reduced after the adoption of CBS technology by banks



HYPOTHESIS 2 (TO CHECK IMPACT OF EBS OVER CUSTOMER-BANK EMPLOYEES RELATIONS.)

H_0(NULL): Behavior of the bank employees with customers remains same in pre and post EBS period. That is, no significant change has been observed in the behavior of bank employees with customers even after the execution of EBS by banks.

H_1 (ALTERNATIVE): Behavior of bank employees has improved significantly during the post EBS period. That is, a significant positive change can be observed in the behavior of employees with customers.

Table: Bank Account * After The Phasewise Execution Of EBS System, Bank Employees Have Become More Sensitive Towards Customer Related Matters

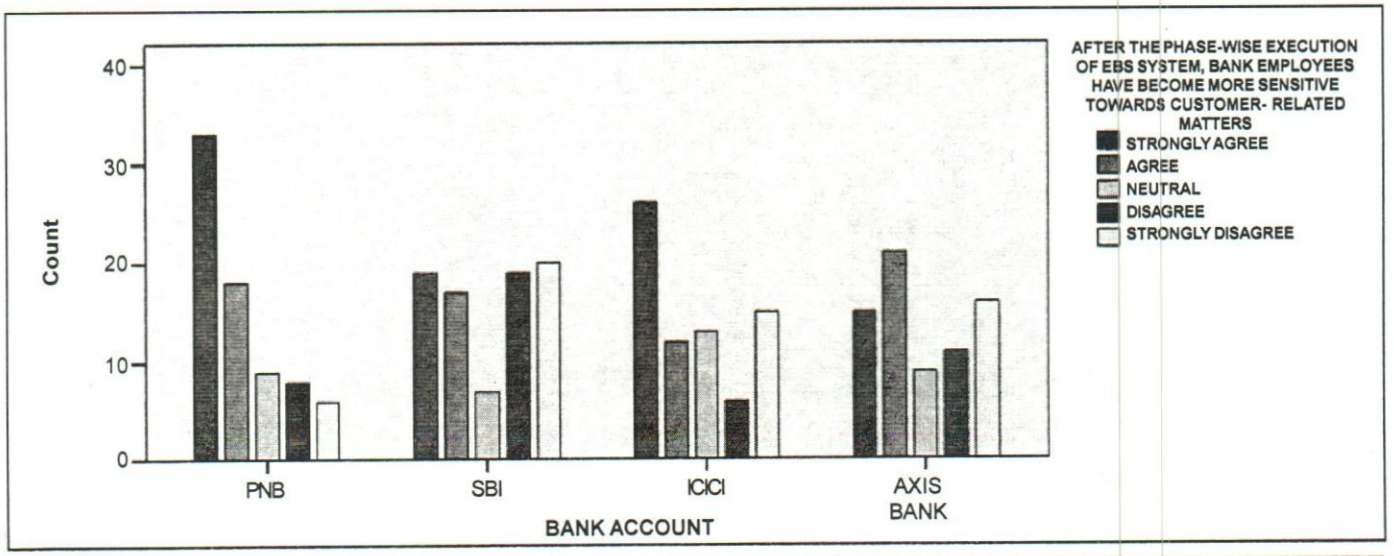
		AFTER THE PHASEWISE EXECUTION OF EBS SYSTEM, BANK EMPLOYEES HAVE BECOME MORE SENSITIVE TOWARDS CUSTOMER RELATED MATTERS					
		STRONGLY AGREE	AGREE	NEUTRAL	DISAGREE	STRONGLY DISAGREE	TOTAL
BANK ACCOUNT OF RESPONDENTS	PNB	33	18	9	8	6	74
	SBI	19	17	7	19	20	82
	ICICI	26	12	13	6	15	72
	AXIS BANK	15	21	9	11	16	72
TOTAL		93	68	38	44	57	300

CHI-SQUARE TESTS

	VALUE	DF	ASYMP. SIG. (2-SIDED)
PEARSON CHI-SQUARE	27.699[a]	12	.006
LIKELIHOOD RATIO	28.548	12	.005
LINEAR-BY-LINEAR ASSOCIATION	5.124	1	.024
No. OF VALID CASES	300		

[a] 0 CELLS (.0%) HAVE EXPECTED COUNT LESS THAN 5. THE MINIMUM EXPECTED COUNT IS 9.12.

The critical value of chi square at α=0.05 level from table is 21.026, which is quite below the above-calculated value. Hence, the null hypothesis is rejected and the alternative is accepted. That is, employee–customer relationship has improved after the execution of EBS by banks.



HYPOTHESIS 3 (TO CHECK THE IMPACT OF RIVALRY BETWEEN PRIVATE AND PUBLIC SECTOR BANKS OVER CUSTOMER-EMPLOYEE DEALINGS)

H_0 (NULL): There is no association between professional rivalry among private and public sector banks and improvement in the customer–bank dealings.

H_1 (ALTERNATIVE): Professional rivalry among private and public sector banks has led to improvement in customer–bank dealings.

The critical value of chi square at á=0.05 level from table is 21.026, which isquite below the above-calculated value. Hence, the null hypothesis is rejected and the alternative is accepted. That is, professional rivalry among private and public sector banks has led to improvement in customer–employee dealings in the recent years (post EBS period).

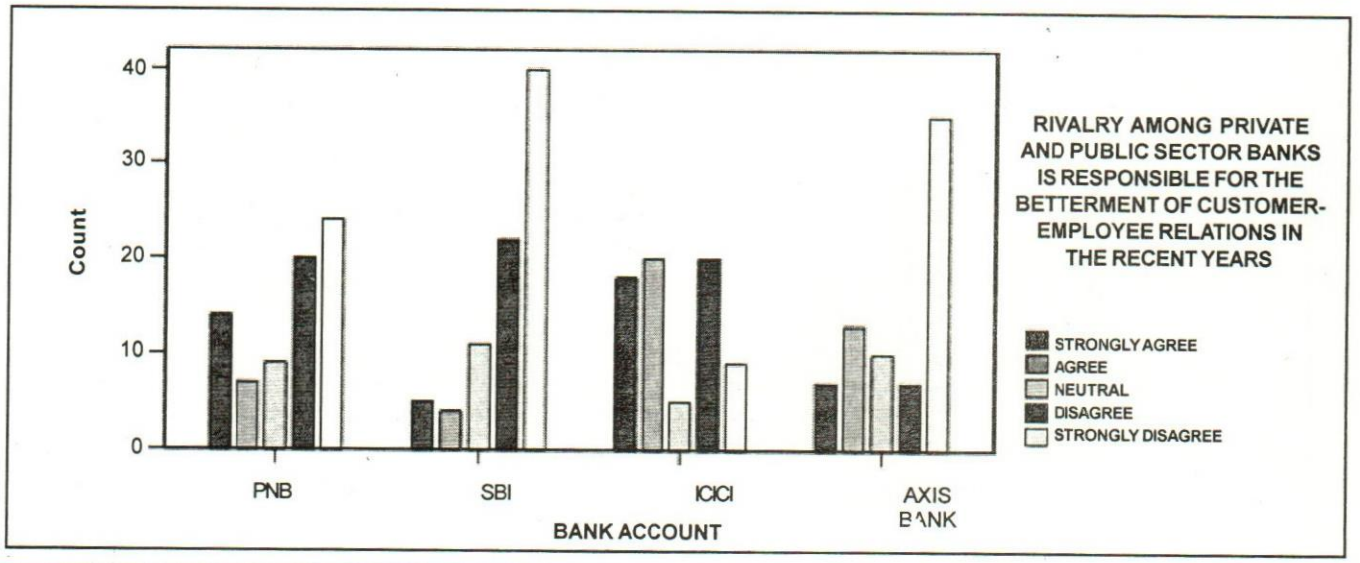
Table: Bank Account * Rivalry Among Private And Public Sector Banks Is Responsible For The Betterment Of Customer-employee Relations In The Recent Years Crosstabulation

		RIVALRY AMONG PRIVATE AND PUBLIC SECTOR BANKS IS RESPONSIBLE FOR THE BETTERMENT OF CUSTOMER-EMPLOYEE RELATIONS IN THE RECENT YEARS					
		STRONGLY AGREE	AGREE	NEUTRAL	DISAGREE	STRONGLY DISAGREE	TOTAL
BANKACCOUNTOF RESPONDENTS	PNB	14	7	9	20	24	74
	SBI	5	4	11	22	40	82
	ICICI	18	20	5	20	9	72
	AXIS BANK	7	13	10	7	35	72
TOTAL		44	44	35	69	108	300

CHI-SQUARE TESTS

	VALUE	DF	ASYMP. SIG. (2-SIDED)
PEARSON CHI-SQUARE	54.585[A]	12	.000
LIKELIHOOD RATIO	59.921	12	.000
LINEAR-BY-LINEAR ASSOCIATION	.695	1	.404
No OF VALID CASES	300		

[A] 0 CELLS (.0%) HAVE EXPECTED COUNT LESS THAN 5. THE MINIMUM EXPECTED COUNT IS 8.40.



HYPOTHESIS 4 (TO CHECK THE IMPACT OF EBS OVER OPERATIONAL EFFICIENCY OF BANKS)

H_0 (NULL): There is no significant change observed in the operational efficiency after the transformation of banking system from traditional to electronic one.

H_1 (ALTERNATIVE): After the adoption of electronic banking system by banks operational efficiency has improved significantly.

Table: Frequency Of Monthly Visits To Banks * e-banking System Is Less Time Consuming Than The Traditional Banking System Crosstabulation

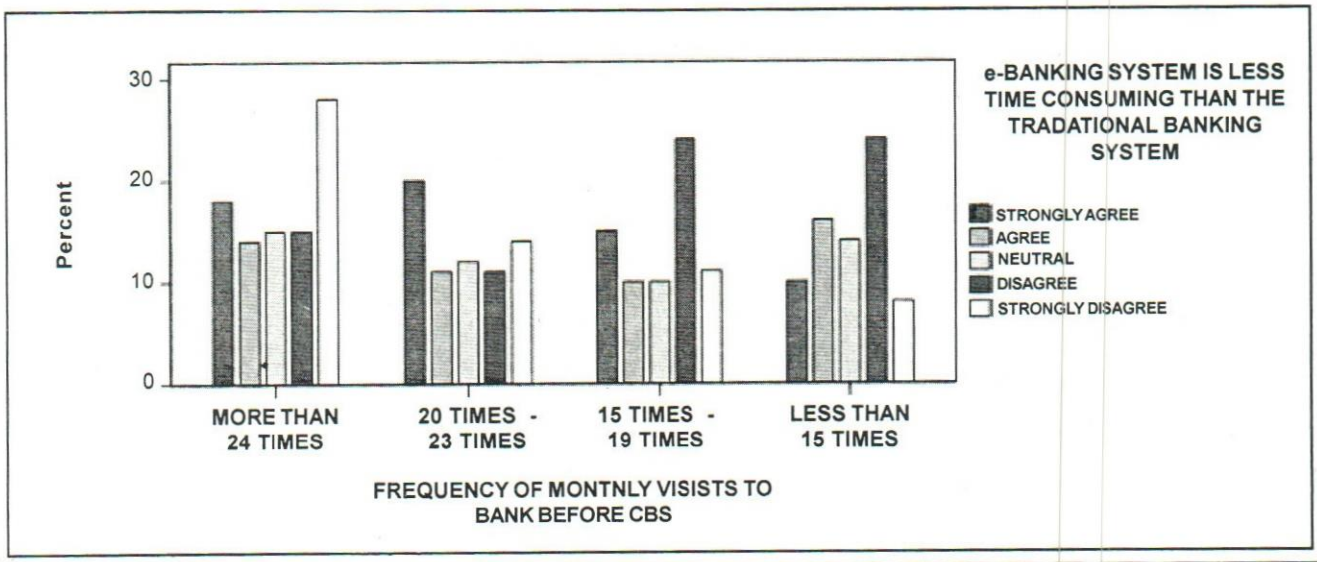
		E BANKING SYSTEM IS MORE CONVENIENT THAN THE TRADATIONAL BANKING SYSTEM					
		STRONGLY AGREE	AGREE	NEUTRAL	DISAGREE	STRONGLY DISAGREE	TOTAL
BANK ACCOUNT OF RESPONDENTS	MORE THAN 24 TIMES	18	14	15	15	28	90
	20- TIMES- 23 TIMES	20	11	12	11	14	68
	15 TIMES - 19 TIMES	15	10	10	24	11	70
	LESS THAN 15 TIMES	10	16	14	24	8	72
TOTAL		63	51	51	74	61	300

CHI-SQUARE TESTS

	VALUE	DF	ASYMP. SIG. (2-SIDED)
PEARSON CHI-SQUARE	24.279[A]	12	.019
LIKELIHOOD RATIO	24.198	12	.019
LINEAR-BY-LINEAR ASSOCIATION	.268	1	.605
No. OF VALID CASES	300		

A. 0 CELLS (.0%) HAVE EXPECTED COUNT LESS THAN 5. THE MINIMUM EXPECTED COUNT IS 11.56.

The critical value of chi square at α=0.05 level from table is 21.026, which is below th above-calculated value. Hence, the null hypothesis is re ted and the alternative is accepted. That is, after the adoption of electronic banking system by banks operational efficiency has improved significantly.



Conclusion based on tables, charts and hypothesis tests

Following are the interpretations based on charts and tables:

1. The sample of 300 comprises an equal representation of both the genders.
2. Most of the customers in the population live in rental houses.
3. The sample comprises of people mostly in the age group 18–25 years.
4. The urban population is more than the rural population.
5. The population has an almost equal representation from nuclear and joint families.
6. With the shift towards nuclear family, the family size has been restricted to three.
7. Most of the customers in the sample comprise of salaried class, married people.
8. The family has either only the spouse working or both the spouse and his wife and the total family income is above 5 lakhs.
9. Most of the customers are post-graduated followed by graduates and have 2–3 dependents.
10. Most of the respondents are in the age group of 18–45 years, are salaried class and prefer having accounts in the public sector banks.
11. Most of the customers have bank accounts in public sector banks with PNB the preferred one followed by SBI. Among private banks, ICICI is the most preferred one.
12. For most of the customers, the purpose of account maintenance is saving.
13. The frequency of visit to the bank for most of the customers in the sample was on an average 15–20 times and it reduced drastically after the introduction of CBS.
14. Most of the customers have their accounts in the same bank for the last 4–5 years or more than 5 years.
15. Most of the customers visit the bank for transactions of self or their family members.
16. The type of electronic banking facility preferred by most of the customers is Internet/Mobile banking followed by ATM.
17. The average monthly balance maintained in the bank by the customers is 5000-10,000/-.

Explanation of hypothesis 1: Frequency of visits to banks has reduced after the introduction of CBS. The public sector banks performed better than the private banks. SBI scores over PNB. This clearly shows that the customers are very comfortably using CBS and feel there is little need tovisit banks regularly. This has improved the perceived value customers have for their services and reduced the customer's queuing and waiting time and psychological discomfort. At the same time, it has increased the efficiency of thebanks as queues have been reduced, the rush of customers is maintained and more stress is put on the services offered through CBS.

Explanation of Hypothesis 2: With the introduction of CBS, banks have become more sensitive towards customers. PNB tops the list of four banks followed by ICICI showing that public sector banks are providing better services than the private banks and people still rely on public sector banks, The CBS system has highlighted the importance of customer relationship and so employees are putting stress on customer related matters like customer services and customer complaints. The employees are being trained to handle their queries and maintain better relations with them.

Explanation of Hypothesis 3: Post-liberalization, with the rise in service sector and technological advancement, the competition among the public and private sector banks has increased. The companies are trying to provide customized services and putting up every effort to maintain and satisfy their loyal customers. So, the level of customer–employee relation is increasing in the recent years with the public sector banks moving ahead than the private banks.

Explanation of Hypothesis 4: It can clearly be derived from the results of the hypothesis that customerscan easily distinguish between the traditional banking and electronic banking systems. Convenience in terms of consumption of time, clearance of queues or settlement of transactions etc can easily be felt. Thus, efficacy of EBS in terms of above-mentioned parameters is quite evident.

Observations

The system of EBS is more prevalent among the educated young salaried class. The customers rely more on public sector banks and have been very loyal customers. The introduction of EBS system has reduced the frequency of

visits of the customers to the banks but has enhanced the employee-bank relationship. The banks are focusing more on customized services. The bank employees are comparatively skilled and trained to satisfy queries of customers. But still, the system of EBS is restricted to a selected class of customers. In a country like India, there is need for providing better and customized services to the customers. Banks must be concerned about the attitudes of customers with regard to acceptance of online banking. Inorder to broaden its base, banks need to address the other segments of customers, generate awareness and give proper training to their customers also from time to time so that they feel comfortable using EBS.The banks also need to employ new technologies for the smooth functioning of EBS. Banks may organize seminars and conference to educate the customer regarding the advantages of online banking and also address their security and privacy concerns.Some customers are reluctant to use online banking due to lack of computer skills. They need to be educated on basic skills required to conduct online banking. Banks must emphasize the convenience that online banking can provide to people. Banks must emphasize the cost saving that online can provide to the people, such as reduced transaction cost etc.

Certain issues still remain to be addressed, such as other factors that may have led to improved *customer–bank* besides introduction of EBS. Increased competition and economic reforms may also influence relationships.

Low crowd can always not be interpreted as the virtue of EBS; on the contrary, it may be due to switching over of customers to other banks providing better services.

It is essential to keep track of *customer–bank* relations on a continuous basis.

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"A 'no' uttered from deepest conviction is better and greater than a 'yes' merely uttered to please, or what is worse, to avoid trouble." – and "You must be the change you wish to see in the world . . ."

— Mahatma Gandhi

e-Governance Implementation of Publicly Funded Projects/Portfolios using Global Project Monitoring System (GPMS) Cloud: Lessons Learnt

RAJA SEEVAN

This article describes the lessons learnt and best practices evolving from case studies, pilot projects and research in large scale implementation of e-governance projects. It covers the end-to-end spectrum starting from:- viz: current challenges in e-governance projects, Evolving Innovative solutions, Piloting them in the 3rd largest City Municipality, Sustaining the implementation through the challenges over a period of 3 years, Demonstrating benefits on key Governance parameters including ROI. The source of much of the article is from the practical experience of the author in implementing GPMS-FMS-IRMS municipality e-governance solutions modules in BBMP that looked at needs of municipalities and their citizens towards improving city governance, bringing efficiency, transparency, accountability and the use ofGPMS-FMS-IRMS to deliver public services.

1. INTRODUCTION

This article brings out the case study of an incredible journey (spanning 3.5 years) in designing and delivering such an innovative solution in the e-governance field. It would focus on the key differentiators, innovative approaches and paradigm shift in the way egovernance projects can be implemented.

It is hoped that the learning shared in this paper would enable policy makers and implementers at various levels in the Governance structure (at country, state, district, city and unit level) to effectively manage all types of resources, derive productivity improvements at each phase of the project implementation and achieve the outcomes expected.

A typical Municipality delivers comprehensive citizen services. This can be taken as a fractal. If the proposed model for effective egovernance implementation can succeed in this fractal, we can replicate it with similar success in other fractals across the country.

Raja Seevan is Founder Trustee, Indian Centre for Social Transformation, A Public Charitable Trust.

2. Glimpse of an e-governance Fractal:

To give an idea of what all is involved in 1 Municipality, here are a few metrics.

The numbers behind a typical Municipality(3rd largest in India)

.....seeking to deliver better citizen services

Bangalore Municipality – with for 16,657+Employees, 27 departments, Administration, Health, Accounts, Forest, Revenue, Engineering, Horticulture, Education, Legal Cell, Welfare, JNNURM, Estate, Town Planning, Markets, Advertisement, TVCC, Land Acquisition, Animal Husbandry, Solid Waste Management Cell, Lakes across head office, all 8 zones, Divisions, Sub-Divisions, 198 wards, 450 offices, etc., Accounts departments, 327 Receipt-codes, Payment codes, 936 bank branches, 1800 hospitals, schools, colleges, universities, over ***92,000 works/projects*** *with a value over Rs 14000 crores to be monitored online (in 1 of the 21 departments alone) by 7500 Engineers, 20lakhs+ properties registered , Area : 800 SqKm,Zones: 08,Wards: 198, Assembly Constituencies : 28, Population : 100 lakhs, Road Length : 10121 Kms, Primary & Secondary Storm Water Drains : 840 kms; Road Side Drains : 13000 kms; Play Grounds and Stadium : 154; Parks : 1079.... And so on...*

3. The team trying to design and develop the Solution soon had a glimpse of the expected challenges and issues that would need to be addressed across the Project lifecycle.

A typical (partial) list of Challenges faced was as follows

Partial list of challenges:-

Overburdened municipalities, lack of transparency within working bodies in sharing information, existence of multiple agencies with minimum coordination resulting in poor levels of citizen service delivery, delays and overruns., low accountability as a result of crisscrossing administrative jurisdictions of city agencies that have no congruence with political boundaries e.g. Bangalore is divided into 278 parts for garbage collection division, 88 parts for policing, 39 for electricity, 30 for property tax, 12 by the PWD etc. In none of the above is there overlap between the administrative jurisdictions of these agencies, or congruence with the ward boundary. The result: the citizen is confused, the local politician is confused, the agency representatives are confused.

Difficulties faced:

1. *Non-cooperation of departments*
2. *Giving false information/data*
3. *Shortage of manpower/resources at ward level*
4. *Fear among wards for sharing data.*
5. *No verification/checking of data*
6. *There are 530 accounts for salary disbursement and issuance of letter of credit.*
7. *Threat perception due to increased transparency and more Accountability*

and so on.

4. It was in this backdrop that Indian CST took up this challenge and put together and a unique model for executing e-governance projects.

The Team drew up a Solution wish list that started from scratch and took some very unconventional decisions. This was based on the wisdom that

"The way we approach a Problem, can alter the very nature of the Problem"

The team decided to approach the eGovernance challenge not as an IT company delivering services; but as a Social Entrepreneurship Organization delivering transformational change in the Quality of life of citizens. What this meant was that IT was only one of the many components. Many missing components were identified that would enhance the Solution with "What More is Possible?".

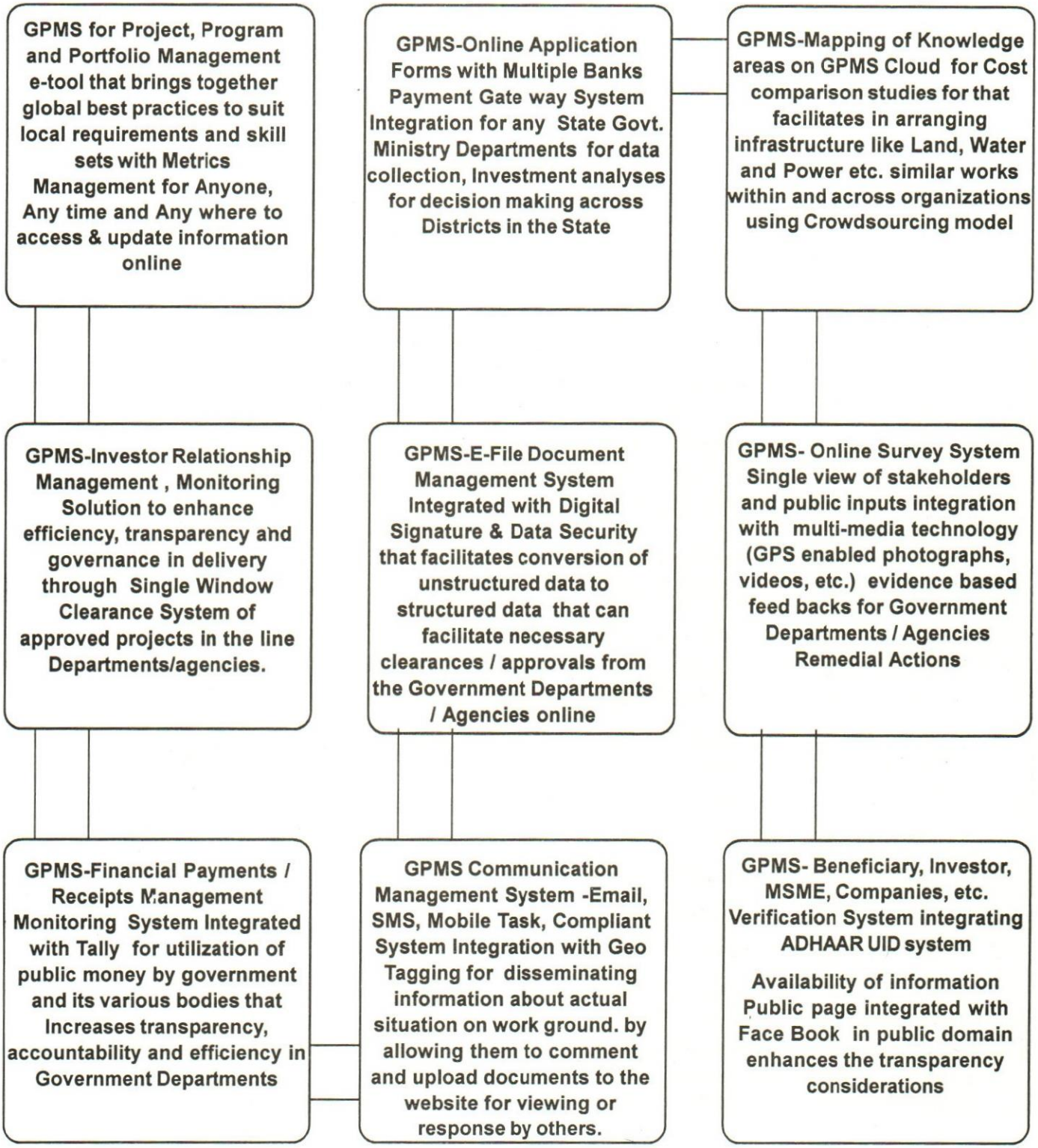
5.0 Solution Wish list :- A glimpse into the solution wish list arrived at is as below (this is a partial list)

Solution Wish list (not in any particular order)

- *Make the use of the global best practices to process the information, as it gets validated, collated, analysed and transformed to actionable intelligence*
- *Use of Crowd sourcing*
- *Track progress (specially of public funded projects) from conception to completion*
- *Information continuously gets collated, analysed and presented to domain experts for their inputs and interventions — at source and instantly disseminated*
- *serve as a knowledge management through which capacity and skill building interventions for all stakeholders is made possible*
- *Create a network of networks to get things done*
- *Real time monitoring*
- *Capture audio, video, text and other information as required by tasks – with authentication. This geo-stamped data to get updated against specified project task and reside in server ; accessible to concerned.*
- *Strengthen the power of oversight, review and administrative control mechanism of elected leaders, departmental heads and other stakeholders over the functioning of government organizations.*
- *Public page that displays the real time information for citizens to make their comments online,*
- *Beneficiary verification using mobiles using remote eye monitoring devices. (eg- reliably verify whether a house construction and the corresponding beneficiary are as stated in the priority list. There must be a one-to-one correspondence between beneficiary and house. The idea is to use GPS to locate the house and then associate the beneficiary record with the geo-location.*
- *Affordable solution, adaptable to local conditions, amenable to quick deployment and a fool proof System*
- *Track changes and audit trails*
- *Enable exception reporting*
- *Alert generation for higher echelons*
- *Flexible Model (Building blocks of solution) that can be added as and when the Municipality is ready to rollout each one*
- *Enable collaboration and citizen participation in governance*

Having a wish list is easy. Translating it into a framework that can seamlessly deliver the wish list is indeed challenging. The Indian CST framework arrived at by the Team was as follows.

6. The Indian CST Cloud Computing Solution Framework – Deliveries.



7.0 The GPMS Solution:

Indian CST designed, tested, and piloted on over 20 Beta sites to fine tune their Solution framework – called GPMS (Global Project Monitoring System).

The salient features of the GPMS Solution that seamlessly embeds the Solution wish list is as shown below. (Again this is a partial glimpse – to balance with the objective of bringing out best practices as the objective of the paper).

Indian CST's in-House GPMS cloud computing solution www.gpmswiki.org

Salient features of the GPMS Solution :

1. *Global Project Monitoring Solution (GPMS) is a cloud computing platform with integrated system tools that takes care of the complete life cycle of the projects based on a CVCMARK framework (Capture, Validate, Check, Measure, Analyze, Reports) .*
2. *Uses open platform tools for more collaboration, inclusive decision making with civil society, partners ,and private sector actors .*
3. *It Enables, Empowers and Engages stakeholders and has developed unique features for enhanced transparency by allowing public access to its web based monitoring systems.*
4. *It has ability to send in actual geo-tagged photographs of work locations that can then be used to discuss and disseminate information about actual situation on work ground.*
5. *It enables public to register complaints, view projects of their interest and update delays or inconvenience caused.". They are able to view details of projects and able to comment and upload related GPS photographs or videos to the website for viewing or response by others.*

This is an extremely powerful tool for transparency and useful to:

1. *Show accurate, verifiable and approved data from the authorities providing the base data.*
2. *Monitor data and comments to avoid any infringements of the law and allow freedom to reply.*
3. *Upload videos of meetings where extracts can be taken out of context and misrepresented for public consumption. Provides a single platform for citizens to access services..*
4. *Highly Replicable Model with Potential to replicate, with customized changes , across other states in India and across other countries.*
5. *Anyone, Any time and Anywhere to access & update information online*
6. *Complete monitoring of projects from start to end*
7. *Sufficient inputs for easy decision making*
8. *Single view of stakeholders and public inputs*
9. *Cost comparison for similar works within and across organizations*
10. *Clarifications asked through auto generated questionnaires*

8. It dawned on us that all Government departments are interdependent for ultimately delivering a solution to the citizen. Any e-Governance solution has to necessarily have a basket of sub solutions ready that cuts across the departmental boundaries, virtually and seamlessly. This would avoid endless effort and rework to make the system current to provide integrated resources for any solution.

A sample list of Solution components that can be used as 'plug and play' components was developed by Indian CST. Discerning Customers in the Departments were quick to recognize the productivity gains that their departments and functions could gain, by having access to this suite of GPMS Solutions.

A sample list of plug and play Solution components (not exhaustive) is as listed below

1. **GPMS-Global Project Monitoring System** – is an end-to-end solution for any Government department to manage their projects online and get real time information updates across stake holders
2. **GPMS- E-File management System** for any Government department to move files online for giving approvals/rejection. Facility to digitize data by viewing the scanned documents online.
3. **GPMS-Investor Relationship Management System** for any government department to manage investors investing in the country, monitor communications, projects, tracks various stages of investments, schemes and grants, etc.
4. **GPMS-Online Survey System with Geo tagging** for any Government Project, for conducting Implementation feedback / Impact Analysis Studies/Program Surveys etc. The location Latitude / Longitude is captured automatically. Hand Held/Mobile Devices Capture Data from Ground; Beneficiary Verification System. Data and Metrics get stored in a Central Location/Data Centre.
5. **GPMS-Task Management System** for any Government Project monitoring online. Facility to use through mobile phone to assist task teams by having a wide array of reliable data. Decreased the need for Supervision efforts.
6. **GPMS-Environment Health Safety System** for any Government Project to monitor remote sites with Video Surveillance: monitoring medical reimbursement schemes online of the organization or project stakeholders/ employees.
7. **GPMS-Compliant Management System** for any Government Project or Citizen charter's use and for bringing in the public participation in this specific project or view status of complaints online.
8. **GPMS-Financial Management System** for any government department to scan and upload their vendor bills online, digitize and post to Accounting software for generating various tax compliance reports or mismatch tax wise reports etc. Enabling respective departments to track their incoming receipts and outgoing payments happening in real time along with bank reconciliation facility enabled online.
9. **GPMS-Public page integrated with** facebook for any government department to display their project status for pubic to view, send their feedback, comments, complaints or upload the photos, videos, audios, documents, etc.
10. **GPMS-Stake holder Management System** for any Government department to validate their vendors, beneficiaries, organizations employees, NGOs, MSMEs, etc. online and update the information in real time to Improve governance and accountability, public voice in governance, public pressure, and civil society engagement: Information collected from the field can be made available through public sites to improve transparency on program performance and public voice in governance. Stakeholder teams can access the dashboard through the internet and engage in continuous supervision from their offices
11. **GPMS-Family Tree** for any government department or Individual to create or validate their tree information etc.
12. **GPMS-Bullion Network System** for any Intelligence agency or government department to use to track the network information related to that particular project.

13. **GPMS-Financial Transaction Tracking System** for income tax department or any other tax department or Investigating Agency use for collecting details for evidence of the particular transaction related to the individual or organization

14. **GPMS-Vault System** for any Individual person or any government department use to validate the repository based on GPMS databases.

15. **GPMS- Beneficiary Verification System** for any government department use to improve evidence based decision making by policy-makers; governance and accountability; continuous monitoring of progress towards output / outcome indicators and collection of reliable information from the field

16. **GPMS for Municipalities** for monitoring infrastructure projects,

17. **GPMS for Finance Management System (FMS)**-General Payments and Receipts monitoring online,

18. **GPMS for Birth and Death Monitoring** taking place in the particular location and for monitoring online reporting from various hospitals, PHC's, nursing homes, etc.

19. **GPMS for Education for monitoring students** examinations (for Preliminary, High school, Pre-University, UG and PG)

20. **GPMS for Health Information Monitoring –** cloud based solutions for Hospital Information monitoring system, Patient Monitoring System, for PHC, State,

21. **GPMS-Connect**-A cloud based video conferencing and surveillance online facility

22. **GPMS Survey System** for Beneficiary monitoring of BPL families along with their social-demographic details for online capturing

23. **GPMS for MSME**- A cloud based solution to monitor MSME programs and registrations online, Indian CST consultancy for preparing Business Proposals, Connect for Offering Video conferencing, MSME GPMS IRMS customer relationship management system

24. **GPMS-IRMS-CRM** cloud solutions, GPMS-e-file management system for documentation monitoring system, citizens charter services.

25. **GPMS-Cloud computing End-to-end solutions are available for** programs government Schemes, Fund, CSIR-Products and technologies monitoring as services online.

26. **GPMS for PostalBallot Monitoring and Management System** for the benefit of lakhs of employees who will be on election duty is been enabled to cast their votes into their Local Assembly Constituency.

27. **GPMS e-Governance Facilitation Council Services**-Subject Matter Experts available online, Governance Experts—Retired IAS, IPS, IRS Officials, Bureaucrats, Judicial authorities, Public Sector & like-minded Public Servants etc., Domain Experts-Doctors, Engineers (major discipline), Auditors, Charted Accountants, Lawyers, Project Management Professionals etc., Information Technology Experts, Specialized in e-Governance, Project Management, Cloud Computing, Mobile, Security Technologies etc., Media, Public relations, Coverage, Case Study, Publications etc. offered as consultancy services under Indian CST.

9. Having in-depth domain knowledge of government departments, the processes , challenges and human frailties that are part of the challenge was crucial . This has influenced the solution design, in terms of using the best that technology has to offer. Several challenges were pre-empted by having a technology intervention embedded eg: REMS Remote Eye Monitoring, simple and innovative ways to induce public participation to steer the success of these projects. This is just the tip of the iceberg of 'What More is Possible?

Did the GPMS Solution deliver scalable and Replicable Solutions? This was an important item on the wish list to make the solution affordable to the citizen.

Various e-governance GPMS cloud computing solutions, pilots and prototypes done that can be replicated across India is available at Indian CST. A partial list is as below.

1. For any Municipality engineering departments GPMS-REMS project monitoring system can be replicated across India
2. For any state Municipality Accounts Departments GPMS-REMS Revenue monitoring System for Collection of Taxes and Revenues, Tolls and Taxes etc. can be replicated across India
3. For the health care departments, GPMS-REMS Birth and Death with Hospital System for Information Therapy can be replicated across India
4. For the rural districts, the Valsad GPMS-REMS Solution can be replicated across India
5. For the low cost housing, the IAY Bihar GPMS-REMS Solution can be replicated across India
6. For the entire state, the Delhi government GPMS-REMS Solution can be replicated across India
7. For PWD Departments, the GPMS-REMS-BBMP along with GPMS_REMS NHAI solution can be replicated across India

Key tasks that the GPMS solution can perform include:

- Information analysis
- Strategic planning
- Process Improvement
- Human resource development
- Operational results
- Stakeholder satisfaction

Benefits of GPMS System

- **Effective Expenditure Monitoring:** Global Project Management Solutions to monitor Projects to Bring in Transparency and do effective project management for delivering, executing projects well on time for income saving.
- **Brings Transparency for Value Increase:** Financial Management and monitoring solution for managing financial resources and to monitor income coming in and out going payments done to curb excess expenditure
- **Increases Incomes:** GIS based Property Tax system for income generation by bringing more properties into the tax net that can make the corporation self-sustainable
- **Improves Operational Efficiency:** Mobile Governance for monitoring Garbage clearances , Addressing Public Grievances redressal system to bring over all visibility, extra operational efficiency,
- **Empowers Citizens: Beneficiary Monitoring System:** for monitoring government to citizen programs and funding schemes, health management system for monitoring citizens, health records, data captured from the population will ideally form part of an electronic health record that will help integrate information from public health Informatics, clinical informatics and demographic databases, monitoring diseases and interventions over time, public health informatics can add considerable value to the successful planning, execution and evaluation of public health programs
- **Innovative Services:** Disaster Management for Main Data Disaster recovery Back up Centre on Indian CST Infrastructure
- Complete monitoring of projects from start to end
- Sufficient inputs for easy decision making
- Single view of stakeholders and public inputs
- Cost comparison for similar works within and across organizations
- Clarifications asked through auto generated questionnaires

10. Snapshot view of GPMS-FMS Solution On going Implementation at BBMP

Name of the BBMP Project	Status	Remarks
1) **BBMP GPMS Project:** Monitoring of Municipality Projects across Urban Bengaluru and Rural Bengaluru.	Implemented and currently running successfully	92000 Municipality projects worth Rs 14,000 crores across 8 Head offices, 198 wards, 7500+ Engineers get monitored for efficient Project execution and benefits reaching the public.
2) **GPMS-BBMP FMS Project:** Integrated Financial Management System for Payments and Revenue Receipts.	Implemented and running successfully.	Incoming general receipts (including help-centres) of approx. 27 departments of BBMP (covering 8 zones, 1 Head Office, 450 Offices)
3) **GPMS-BBMP-Health** Birth and Death Records system	Pilot Implemented	Used for records, verification, printing of birth and death certificates.
4) **BBMP Health Care Services**	System study done. Implementation in progress.	This is for their staff of 12000 plus BBMP employees medical reimbursements.
5) **BBMP Property Tax Management System:**	System study done. Integration with GPMS-FMS	Property tax collection and decision reports across 20 + Lakh Property entities and generate real time Receipts online for citizens along with Multiple Payment Gateway integration underway
6) **BBMP FMS Financial Management System for Receipts / Payments :**	Ongoing Pilot project Implementation that is running successfully at Head office and now is being extended to all their 450 BBMP offices and Bangalore One Centres across Bangalore.	Seeing the successful implementation of the Payments, Receipts systems that has been integrated with 936 bank branches across employee payments, contractor payments, salary, tax deduction etc.

11. How the GPMS-FMS implementation improved municipality department's efficiencies and performances?

A few of the activities at ground level that enabled implementation:

Periodical training programs, fortnightly reviews meeting and status updates were conducted on regular basis for all the engineers, staff and officers. This was done by fixing responsibility for initiating the majority of actions required to guide the projects and programs as they started. They were trained to report current progress, to update status and asked to add missing data information, validate the data, and generate their daily / monthly/ quarterly types of reports online. They showed continuous improvement and an substantial increase in the working efficiency of these department engineers, officers and its staff. Overall it resulted in bringing more transparency across all the departments reporting online, on-going projects status, financial approvals status, payments done etc.

Now in the last few years BBMP engineers and staff have been using **GPMS-BBMP-FMS** e-governance municipality integrated solution which has all the various 936 Nationalized, private, Cooperative, bank branches across Bengaluru associated with all BBMP departments together. A total number of 2,50,000 plus general receipts has been generated online and issued to citizens of Bangalore, bank challan's have too been automatically generated online and submitted to the respective banks, totalling an amount of several thousand has been updated in real time online from across all BBMP offices as on 24-02-2013 against the 327 R-CODEs. Property Tax Amount, General Receipts, Total Receipts Amount Payment Amount Re. 4500 plus crores plus has been updated online into GPMS-FMS in real time by the BBMP engineers and staff themselves.

GPMS Enables Real Time Citizen Engagement & Feedback on outcomes and consequences of actions at each stage of the service delivery chain Connecting Policy Makers, Providers, Beneficiaries and their Voice that Enables Results Agenda, Good Governance and Clients.

BBMP Accounts Department and Revenue department also has been benefited by in the head office, 8 zones, Divisions, Sub-divisions, 198 wards and 450 offices for each engineer to report revenue collected daily basis and payments done to be reported in real time brining in total transparency in its BBMP operations.

Multiple bank payment gateways integrations enabled

Hence better delivery of services was achieved by identifying strengths and weaknesses in each of its offices by remote monitoring of project status was possible to improve efficiency, reduce costs, Thus this in turn has enabled a sustainable improvement in the performance of the urban municipality as a whole. This became the first time in the country where one could see 92,000+ publically funded projects online with an approximately value of above Rs.14000 crores.

Return on investment to the Municipality

This by far is the single largest collection of civil infrastructure project information in any government body in Karnataka or across India.

The BBMP is transforming from its archaic system of financial monitoring to the modern financial management system on real-time basis with the help of a pioneering technology developed by the Indian CST. The service is scalable, Secure and efficient, while improving over all service and reducing costs.

Further, to address the sensitivity of information in various e-governance projects as well as information about citizens, data security as the NDSAP standards is being enabled.

12. How does GPMS-Financial Management / Monitoring System work?

GPMS essentially addresses the complete life cycle of a project by using the technique of capture, validate, check, measure, analyse , report along with key performance indicators. While it enables organizations to easily monitor their projects, it can also be successfully used for pre and post award analysis of projects besides enabling investigations if any that need to be carried out. While the projects are effectively checked, analysed, measured and reported using relevant indicators, the data gathered is used as a Knowledge Management System which holds vast repository of RFPs (Request for Proposals), tender processes, vendors and their performances, rate as well as technologies available in the market.

The GPMS also stores data on the brief history of the organization, details, tenders, analysis of payment process, tax deduction practices, duplicity, besides also analysing the necessity of a project under consideration. Further, apart from the 360 degree view of the projects under consideration, the employee's and contractor's history is also stored, facilitating a detailed analysis from all angles and when required.

GPMS-FMS-BBMP Financial Management System consists of:

1. Revenue Monitoring system
2. Revenue Receipts data entry sheets
3. Generation of Automatic receipts online
4. View Receipts online
5. Generation of relevant MIS reports

Incidentally, the capturing of this data makes it the single largest information collection system in civil infrastructure project any government body in Karnataka or across India, offering information on payment, collection and deposit into the various bank accounts of the BBMP.

Some of these details can be viewed here online:

a. http://bbmp.gov.in/web-based-project-management-system

b. BBMP Financial Management Solution Login Page

c. BBMP Financial Mangement Public Information

d. Up to Date Summary of Online Receipts of Property Tax

e. Work Bill Report of 15 Nov 2012 (Similar reports can be generated for other days)

1. *Bruhat Bengaluru MahanagaraPalike (BBMP) has collected funds and processed and paid payments totaling Rs. 10 billion in 2012-13 ❑ 2,230,548,919.34 Received in Jan 2013*

2. *In this financial year so far—Bengaluru citizens have received payments, receipts from the BBMP cloud after depositing—house tax, building cess, conservancy charges and fees for birth and death registration etc etc.*

3. *Though the Ministry of Urban Development (MoUD) has issued a set of guidelines for implementing the project to the various state governments, it did not specify the solution to be applied in rolling out the project. Other factors apart, lack of standardised application to roll out this massive plan has been widely felt in all such projects being undertaken by different municipal bodies across the country.*

4. *Hence, it is very important to bring in the awareness to the government agencies to change their traditional procurement models if they are serious about procuring GPMS resources from the cloud.*

How GPMS open source integrated platform tools enables, empowers, engages social, local, mobile, video ... cloud apps and the future of content.

The system called Global Project Monitoring System has been developed by Indian Centre for Social Transformation that has developed a unique feature for enhanced transparency by allowing public access to its web based monitoring systems. It includes the ability to send in actual geo-tagged photographs of work locations that can then be used to discuss and disseminate information about actual situation on work ground.

Indian Centre for Social Transformation system – particularly for GPS / GIS based imagery – transparency

Indian CST states it brings "transparency into the activities of public funded projects under the Right to information Act. Our GPMS[1] enables public to register complaints, view projects of their interest and update delays or inconvenience caused."[2]

The detailed demonstration showed the GPMS based on Wiki technology to be an extremely powerful tool. Indian CST has already populated the system from many states in India. The Wiki technology members of the public are able to view details of projects and allowing them to comment and upload related GPS photographs or videos to the website for viewing or response by others. This appeared to be an extremely powerful tool however to be transparent and useful it has to:

- Show accurate, verifiable and approved data from the authorities providing the base data.
- Monitor data and comments to avoid any infringements of the law and allow freedom to reply.
- Ensure care is taken in the use of uploading of videos of meetings where extracts can be taken out of context and misrepresented for public consumption.

Global Project Management Solution (GPMS Version 3.0) is offered as a management tool that will introduce high end technological platforms like cloud computing and crowd sourcing to bring about efficiency, transparency and accountability in a user friendly fashion. Global Project Management System (GPMS 3.0) is an e-tool that brings together global best practices to suit local requirements and skill sets. GPMS 3.0 is a cost effective and continual improvement program which enhances the use of e-tools in the management/monitoring of projects to enhance efficiency, transparency and governance in delivery. The most important component of the GPMS 3.0 is the Metrics Management system (MMS). It enables measurement of areas of concern or targets set periodically and compare the same from the "As is "situation, thereby increasing the success of any project or program and assess its impact potential.

[1]GPMS Global Project Management Solutions
[2]Extracted from ICST website http://www.indiancst.in

Key Strength in Transparency

GPMS solution may have unique advantages in terms of transparency considerations. In particular, integration of multi-media technology (GPS enabled photographs, videos, etc.) with the project management system has the potential to increase service delivery by the contractors and put pressure on the agencies to act faster. Availability of information in public domain enhances the transparency considerations.

There is integration available with popular Web 2.0 platforms as face book where even logins from Face Book accounts are permitted. This product thus aims to bring crowd sourcing in the public sector projects.

1. Indian CST's Products, Technologies, Integrated Solutions are made available for all Citizens, MSMEs, NGOs, Central, State Government, Companies and International Organizations to trade online.

GPMS enables real time Citizen Engagement & Feedback on outcomes and consequences of actions at each stage of the service delivery chain Connecting Policy Makers, Providers, Beneficiaries and their Voice that Enables Results Agenda, Good Governance and Clients.

The success is mainly attributed to the continuous hand holding and periodic training programs done on regular basis for a period of three and half years over and still continuing to bring about transparency in public funded project or programs transactions at grass root level.

In short, GPMS-REMS act as an important and cost-effective means to make the project management/ monitoring in real time working more efficient introducing higher levels of accountability and transparency in the system.

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"Do your little bit of good where you are; its those little bits of good put together that overwhelm the world."

—Desmond Tutu

Feature

Effectiveness of Watershed Development and Sustainable Livelihoods: Some Evidences

U. HEMANTHA KUMAR

The watershed programmes that were implemented in India under different guidelines have the focus on enhancement of the viability and quality of rural livelihood support systems. But the results from these initiations are mixed in nature. The present article endeavors to bridge the gap and explore the possible reasons for success of watershed development in India. An analysis of 10 sample watersheds in five states reveals that there was a shift towards diversification of crops, increase of employment, income and livestock population especially increase of milch animals and milk yield among all size class of farmers. The overall impact of watershed projects on livelihood security is ensured sustainably.

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The purpose of the initiation of watershed intervention in India is the promotion of economic well-being and the social improvement of the people in resource poor regions. Many projects designed within this approach were, at different points of time, taken up by the Government of India. The Drought Prone Areas Programme (DPAP) and the Desert Development Programme (DDP) were brought into the watershed mode in 1987. The Integrated Wasteland Development Programme (IWDP) launched in 1989 aimed at the development of wastelands on watershed basis. These programs were implemented under different guidelines. All these attempts have the focus on enhancement of the viability and quality of rural livelihood support systems. The results from these initiations are mixed in nature. The present article seeks to bridge the gap and explore the possible reasons for success of watershed management in India. The findings of the study under watershed management in India would help to replicate same to other watersheds especially in the Integrated Watershed Management Programme (IWMP) implemented under New Common Guidelines (2008). The *objective* of the article is to analyze the overall impact of watershed projects on livelihood security in sustainable mode. The inferences made through the analysis are that the collective action arrangement (norms, rules, equity, distribution, delivery, and linkages of forward and backward), training and exposure visits and dynamic leadership have made much dent for sustainable maintenance of livelihoods in the watershed project areas. The study has been carried out in five states namely the Andhra Pradesh, Karnataka, Madhya Pradesh, Maharashtra, and Uttarakhand in the year 2011–12.

To study the effectiveness of watershed development, the sample was taken up in 10 watersheds; covering 6 under drought prone area development programme (DPAP), 2 under integrated waste land development programme

(IWDP), and 1 each under National Watershed Development for Rainfed Areas (NWDPRA) and Uttarakhand Decentralised Watershed Development Programme (UDWDP). In all 5 districts in 5 states, 300 beneficiaries were chosen for the study. In the sample, there were 50 beneficiaries each from Small and Marginal Farmers (SMF) and large and medium farmers (LMF) categories, and 100 beneficiaries from landless/asset less and the rest 100 beneficiaries from watershed committee (WC) , self-help groups (SHGs), Village secretary, gram panchayat (GP) and project implementing agency (PIA) (see Table 1). The pre-project data was taken as control. Not less than 30 primary stakeholders per watershed (both SMF & LMF) were selected and their views were elicited. In the case of eliciting views on community benefits, focus group discussions (FGD) approach was adopted.

Table 1: Details of Sample Villages/Watersheds

S. No.	State	District	Mandal/ Block	Watershed Name/ Village	Sample size			
					SMF	LMF	Landless/ assetless	Others (include WC/VS/GP/ PIA/SHGs
1.	Andhra Pradesh	Visakhapatnam	Kotavarutla	Pandur/ IWDP Watershed (2003–2008)	05	05	10	10
			Makavaripalem	Rachapalli/ IWDP Watershed (2003–2008)	05	05	10	10
2.	Karnataka	Chikbhallapur	Siddagatla	Kannemangala/ DPAP Watershed (2002–2008)	05	05	10	10
			Chintamani	Hirekattigenahalli/ DPAP Watershed (2002–2007)	05	05	10	10
3.	Madhya Pradesh	Chindwara	Mohkhed	Sarungbehri/ DPAP Watershed (2007–08 to 2011–12)	05	05	10	10
			Parasia	Satnoor/ DPAP Watershed (2007–08 to 2011–12)	05	05	10	10
4.	Maharashtra	Sangli	Kadegoan	Nerli/DPAP Watershed (2003–04 to March 2012)	05	05	10	10
				Sonkeri/DPAP Watershed (2003–04 to March 2012)	05	05	10	10
5.	Uttarakhand	Dehradun	Kalsi	Aragad/NW DPRA Watershed (2007–08- continued)	05	05	10	10
			Pauri (Garhwal)	Sarnoka Khala (UDWDP-World Bank) Watershed(2005–06- continued)	05	05	10	10

Livelihood Opportunities in Sample Watershed Villages

Watershed project is playing an effective role in enhancing the crop productivity by making irrigation water available in appropriate way. The primary survey result shows that the average water use per acre has increased significantly for the commercial crops for the large farmers; while in the case of food crops and horticulture average water use efficiency has improved due to water retention capacity for small and large farmers as well during the post-project period.

Productivity Enhancement

Change in cropping pattern and productivity

Watershed interventions provide an opportunity for change in cropping pattern on hand and strengthening the existing cropping systems on the other hand and it was observed from the data analyzed that the farmers both the small and the marginal as well as large category have been benefited from the change in cropping pattern and increase in productivity during the watershed development program in the sample watershed villages. During the kharif season, Jowar is the main cereal crop followed by Bajra and Maize.

Table 2: Change in Cropping Pattern (Average of 10 Watersheds)

Crop	Pre-project per farmer				Post-Project per farmer			
	Small holders		Large holders		Small holders		Large holders	
	Area (ha)	Yield (kg/ha)	Area (ha)	Yield (kg/ha)	Area (ha)	Yield (kg/ha)	Area (ha)	Yield (kg/ha)
Kharif								
Cereals (Jowar, Bajra, Maize, Vegetables)	1.11	1990	3.12	2445	1.21	2980	3.98	3342
Pulses (Moog, Urd, Tur, Chana)	0.28	1267	0.77	1453	0.39	1688	0.99	2002
Oil seeds (Soyabean, Groundnut)	0.18	779	1.18	1068	0.27	1022	1.59	1327
Rabi								
Cereals (Wheat, Bajra, Maize, Jowar, Vegetables)	0.70	1980	1.58	2895	1.28	3113	1.98	3894
Pulses (Chana, Moong)	0.19	566	0.58	980	0.28	778	1.18	1012
Oil seeds (Soyabean, Groundnut)	0.15	1021	0.39	1353	0.28	1969	1.05	2254

Percentage Change per farmer

Small holders		Large holders	
Area (ha)	Yield (kg/ha)	Area (ha)	Yield (kg/ha)
Kharif			
9.0	49.7	27.6	36.7
39.3	33.2	16.9	37.8
50.0	28.6	34.7	24.3
Rabi			
82.8	57.2	25.3	34.5
47.4	37.4	103.0	3.3
86.7	92.8	169.2	66.6

The pulses during this season in the watershed are Moong, Urd (black gram) followed by Tur (pigeon pea), and Chana. The oilseed crops during this season are Soyabean, followed by Til and Groundnut. During the rabi season main cereal crop is Wheat followed by Bajra, Maize, and Jowar. The important pulses during this season are Chana followed by Moong. Soyabean and Groundnut are important oilseed crops. The summer season crop is not very common in this area. Area under pulses has increased significantly during the post-project period. Area under vegetables has also shown significant improvement in the sample watershed villages. Productivity of Jowar has increased across all areas in the Kharif season. Moong also shows a significantly increased productivity in the Kharif season (Table 2).

Crop Productivity

The change in the area and productivity of the major crops in both rabi and kharif season for both small and large farm category of farmers is given in Table 3. The data show that per farmer analysis on an average for the small farmers, the area of major cereal crop Jowar during kharif season has increased to some extent (percentage change 9.9) in the post-project period but productivity has increased (percentage change 52.4) significantly (Table 2). For the pulses crop and oilseed crop in kharif season for small farmers, area and productivity both has improved. Whereas, for large farm category both the area and productivity of cereal crop Jowar in Kharif season has gone up. Area under pulses and oilseeds has also increased but there is also improvement in the productivity of pulses and oilseeds in Kharif season for large farmers. The highest change in the area and productivity is observed during the post-project period for the cotton crop. For both the category of farmers it has significantly improved. Overall the impact of investment in watershed has favored small farmers both the area as well as productivity of cotton, vegetable, and course cereals. During the rabi season major cereal crops were Maize and Bajra. Area and productivity both have improved for the rabi cereal crop in the post-project period. For pulses and oilseeds crops, the change is in favor of small farmers where both the area and productivity has increased significantly (Table 2).

Cropping Intensity

Crop intensity (CI) is a major source of productivity increase and agriculture growth in the country. Enhancing the cropping intensity is one of the ways to increase crop production. The farmers with large holdings may look for enhancing production by vertical growth of yields while smallholders may look for increasing CI to have more income. Back in 1981–82 more than one crop was grown only 1/4th of the area. During the two decades since then, crop intensity increased from 124 to 128%. Three points of the Input Survey show that the crop intensity remains the highest in marginal holdings and declined with an increase in farm size. In the latest year of the Input Survey marginal farmers took a second crop on 39% area compared to 25% and 21% on medium and large holdings (Ramesh Chand et al., 2011). These results show that small and marginal holders in India have been making much more intensive use of land compared to upper size categories. Enhancing the Cropping Intensity (CI) is one of the ways to increase crop production. The farmers with large holdings may look for enhancing production by vertical growth of yields while smallholders may look for increasing CI to have more income.

Cropping intensity on an average per watershed in the 10 sample watersheds for both the small and large cultivators has increased but it was more in case of small farmers. The cropping intensity has improved on an average in Andhra Pradesh (6.3%), Karnataka (19.1%), Madhya Pradesh (4.1%), Maharashtra (4.3%), and Uttarakhand

Table 3: Cropping Intensity

		SMF			LMF		
Name of the State/Watershed (Average)	Programme	Pre-Project (%)	Post-Project (%)	Percentage Change	Pre-Project (%)	Post-Project (%)	% Change
Pandur/Rachapalli	IWDP	130.0	140.0	7.1	150.0	160.0	6.3
Kannemanagala/ Hirekattigenahalli	DPAP	110.0	145.0	31.8	110.0	131.0	19.1
Sarungbehri/Satnoor	DPAP	117.5	128.7	9.5	122.4	127.9	4.5
Nerli/Sonkeri	DPAP	67.9	122.6	79.4	114.0	118.9	4.3
Aragad/Sarnoka Khala	NWDPRA, UDWDP	125	128.0	2.4	131	138	5.3

(5.3%) respectively for large farmers and by 7.1%, 31.8%, 9.5%, 79.4%, and 2.4% respectively for the small farmers (Table 3). Nevertheless, for both large and small farm category of farmers the data is showing an increase in the cropping intensity.

Crop diversification

One of the major objectives of the watershed development programs was to diversify crop in order to generate high income and employment opportunities within short period from limited available land. Therefore, the diversification examined the temporal shifts in the area towards food crops to commercial, horticulture and vegetables crops. To augment HH income the farmers tend to move to (a) commercial crops and (b) horticulture crops include vegetables. In fact the SMF contribute up to 50 percent of fruits and vegetables to the national pool.

Diversification to commercial crops

There was a perceptible increase in area under commercial crops in the semiarid areas of Karnataka and Maharashtra being 35.4 and 25.7.ha/watershed with SMF and 21.0 and 33.4 ha/watershed with LMF. However there was a thrust on commercial crops in semiarid areas of Andhra Pradesh, Madhya Pradesh and humid region of Uttarakhand (Table 4). The data revealed that in both SMF and LMF the crop diversification took place towards food crops to commercial crops. When compared in different agroclimatic regions, there was perceptible difference in semi-arid as well as humid areas where large holders increased area under commercial crops as compared to the case of smallholders.

Table 4: Diversification in Agriculture—Food crops to Commercial crops (SMF & LMF) (Area in ha per Watershed)

Name of the State/Watershed (Average)	Programme	SMF	LMF
		Increase/ decrease in area (ha)	Increase/ decrease in area(ha)
Pandur/ Rachapalli	WDP	2.2	3.6
Kannemanagala/ Hirekattigenahalli	DPAP	35.4	21.0
Sarungbehri/ Satnoor	DPAP	2.4	5.7
Nerli/ Sonkeri	DPAP	25.7	33.4
Aragad/ Sarnoka Khala	NWDPRA, UDWDP	3.2	6.8

Diversification to horticulture

Diversification has brought mixed results in our 10 sample watershed villages across five states. As pointed out earlier, the smallholders brought more area under horticulture. The sample watershed states as Karnataka, Maharashtra, and Uttarakhand where the small farmers brought more area under horticulture (Table 5). At the same time the sample states as Andhra Pradesh and Madhya Pradesh where the large farmers brought more area under horticulture.

Table 5: Diversification in Agriculture—Crops to Horticulture (SMF & LMF) (Area in ha per Watershed))

Name of the State/Watershed (Average)	Programme	SMF	LMF
		Increase/ decrease in area (ha)	Increase/ decrease in area(ha)
Pandur/ Rachapalli	IWDP	5.4	7.0
Kannemanagala/ Hirekattigenahalli	DPAP	6.6	5.0
Sarungbehri/ Satnoor	DPAP	2.8	4.4
Nerli/ Sonkeri	DPAP	5.0	4.8
Aragad/ Sarnoka Khala	NWDPRA, UDWDP	5.0	4.9

Availability of cereals for consumption at HH level

From the primary surveys, availability of cereals was ascertained with SMF and LMF. With the implementation of the project, the availability of cereals at HH level increased to 49.7 percent with SMF and to 36.7 percent with LMF. There was significant increase in semi-arid Andhra Pradesh. Insofar as LMF are concerned, the range was 22.5 percent in semi-arid Andhra Pradesh to 23 1 per cent in semiarid Karnataka. The per cent increase was more with SMF (49.7) than with LMF (36.7). But the availability levels were generally better with LMF (Table 2 & 3). The SMF of Uttarakhand were having availability less in accessing food (cereals: rice) as compared to other ecosystems. Overall availability was more with the semiarid areas such as Andhra Pradesh, Karnataka, Madhya Pradesh and Maharashtra due to the impact of the project.

Livestock Enterprises

Watershed programmes are often not recognized to have substantial benefits for livestock-based livelihood dependence; however, the enhanced productivity of biomass

that should be accessible to landless or marginal farmers from watershed programme implementation is crucial to livestock-dependent livelihoods. There is no great increase in total livestock population as a result of the watershed development programmes, but there is a change in composition of the population.

The Changing Scenario on Livestock

In the 17th census of livestock a few important changes in livestock composition were observed (Tables 6 & 7).

The data from Tables 6 & 7 indicated that

- There was a decrease in work animals.
- The thrust for milch animals is visible with significant increase in crossbreed cattle as well as buffaloes.
- In the poultry sector, the fowls are continuing to expand in number.

Table 6: Livestock population dynamics in India

Livestock	Population (Million)		Percent change
	1997	2003	
a. Livestock			
Cattle	198.9	185.2	-6.9
Buffaloes	89.9	97.9	8.9
Sheep	57.5	61.5	6.9
Goat	122.7	124.3	1.3
Total Livestock	**485.4**	**485.0**	**-0.08**
b. Milch Animals			
Crossbred cattle	8.36	11.23	34.41
Indigenous cattle	49.87	46.86	-6.05
Buffaloes	42.73	47.22	10.51
c. Work Animals			
Cattle	58.92	56.36	-4.3
Buffaloes	6.80	5.83	-14.2
d. Poultry			
Fowls	315.4	457.4	45.0
Ducks etc.	32.2	31.6	-1.8
Total	**347.6**	**489.0**	**40.7**

Table 7: Livestock population ('000s)

State	Cattle		Buffaloes		Sheep		Goat	
	1997	2003	1997	2003	1997	2003	1997	2003
Andhra Pradesh	10602	9300	9638	10630	9743	21376	5213	6277
Karnataka	10832	9538	4361	3991	8003	7256	4875	4484
Madhya Pradesh	19497	18912	6648	7575	657	546	6470	8142
Maharashtra	18072	16303	6073	6145	3368	3094	11434	10684
Uttarakhand	2030	2181	1094	1228	311	296	1070	1158

Source: Directorate of Economics and Statistics, MoA, GoI.

Table 8: Livestock-Bovines & Small Ruminants

		Bovines			Small Ruminants		
Name of the State/Watershed (Average)	Programme	Pre-Project (Nos)	Post-Project (Nos)	Percentage Change	Pre-Project (Nos)	Post-Project (Nos)	Percentage Change
Pandur/Rachapalli	IWDP	46	68	48	124	203	63
Kannemanagala/ Hirekattigenahalli	DPAP	195	360	85	665	790	19
Sarungbehri/Satnoor	DPAP	186	221	19	211	266	26
Nerli/Sonkeri	DPAP	498	634	27	468	551	18
Aragad/Sarnoka Khala	NWDPRA, UDWDP	56	97	73	150	171	14

In the selected states the livestock population were as follows.

In the present study, the stock of bovines and small ruminants per watershed was reported during pre and post-project periods. Diversification towards livestock farming has very important role in increasing the farm income. Average number of livestock per household has increased during the post-project period for both small and large category of farmers in the sample village watersheds. Increase is much higher and significant among the large farmers for buffalo. Number of milch cows and buffalo has also increased in the post-project period (Table 8). It was also observed that considerable positive impact towards increase of small ruminants in almost all the sample village watersheds.

Milk Production

In our 10 sample watershed villages milk production per annum for small and large farmers in pre and post-project period shows that total milk production in the selected sample watersheds for small and large farmers have increased significantly whereas it was more for small farmers. Marginal increase in milk days was observed for both the categories of farmers (Table 9). The total milk production from cows by small farmers has increased to 14.4–94.4 percent. However, for the large farmers, it has changed 13 to 49.4 percent. As per primary survey at HH level of the SMF and the LMF, the adequacy plus surplus of milk produced by them was examined.

Overall there was an increase in the adequacy at HH level 1.3 to 56.7 percent with SMF and 10.8 to 67.9 percent with LMF. In case of SMF the range was 1.3 percent (Karnataka) to 56.7 Maharashtra during the post-project period. However significant increase in adequacy was observed in Andhra Pradesh, Maharashtra and Madhya Pradesh (Table 10). Insofar as LMF are concerned, the post–project range was 10.8 per cent in Karnataka to 67.9 percent in Madhya Pradesh.

Table 9: Increase in Milk Production [Cows + Buffaloes (SMF & LMF)]

		SMF			LMF		
Name of the State/Watershed (Average)	Programme	Pre-Project (litres/ annum)	Post-Project (litres/ annum)	Percentage Change	Pre- Project (litres/ annum)	Post-Project (litres/ annum)	Percentage Change
Pandur/Rachapalli	IWDP	606	1177	94.4	747	1055	41.1
Kannemanagala/ Hirekattigenahalli	DPAP	798	913	14.4	1227	1545	26
Sarungbehri/Satnoor	DPAP	1110	1590	43.3	1284	1919	49.4
Nerli/Sonkeri	DPAP	943	1121	18.9	1023	1156	13
Aragad/Sarnoka Khala	NWDPRA, UDWDP	137	168	22.6	550	648	18

Table 10: Availability of Milk for Consumption at Household Level

		SMF			LMF		
Name of the State/Watershed (Average)	Programme	Pre-Project (%)	Post-Project (%)	Percentage Change	Pre- Project (%)	Post-Project (%)	Percentage Change
Pandur/Rachapalli	IWDP	61.6	76.4	24.0	73.6	88.8	20.7
Kannemanagala/ Hirekattigenahalli	DPAP	94.1	95.3	1.3	80.7	89.4	10.8
Sarungbehri/Satnoor	DPAP	42.4	58.6	38.2	45.5	74.5	63.7
Nerli/Sonkeri	DPAP	21.2	33.2	56.7	28.0	47.0	67.9
Aragad/Sarnoka Khala	NWDPRA, UDWDP	85.0	90.4	6.4	78.8	95.9	21.7

Employment Generation

Economic effectiveness is considered as one of the major achievement of watershed program. Increase in income from different activities of agriculture, livestock, and non-farm sector has been found significantly in most of the sample watersheds. The study has worked out income levels of different size classes of farmers of their average income per household per annum. The increase of employment generation in our sample watersheds were influenced by several ways. First is the enhanced crop production (increase in CI, increase in irrigated and/or rainfed area). Second is diversification to enterprises like dairying. Third is micro enterprises live vermincompositing, green fodder production, homestead farming etc. The fourth area is non-farm activities like NTFPs, bee keeping, mushroom production etc.

Non-farm rural employment

Abraham (2008) showed that male members are employed more in non-farm sector than women as seen below. In their study, the Institute of Economic Growth, Delhi found that the share of non-farm employment out of the total employment varies in nature (Table 11). In fact in several states over the years the non-farm employment is on the rise. In another pioneering study of Lanjouw and Sheriff - NCAER (2002), income from non-farm employment varied from state to state being 19.6 percent in Maharashtra. Farm income from cultivation was more in Karnataka (69.6 percent) (Table 12). It is varied in nature. There was considerable contribution from non-farm sector too in our sample watershed states. In other words employment on farm alone would be inadequate for a sustainable living of the farmers, more so the SMF.

Table 11: Per cent share of farm and non-farm employment (percentage)

	State	Agriculture		Non-agriculture	
		1983	1999	1983	1999
1.	Andhra Pradesh	74.93	77.24	25.07	22.76
2.	Karnataka	80.43	80.80	19.57	19.20
3.	Madhya Pradesh	86.61	86.43	13.39	13.57
4.	Maharashtra	78.50	79.74	21.50	20.26
5.	Uttar Pradesh	80.01	77.74	19.99	22.26

Source: NSSO

Table 12: Non-farm Income in Rural India by State

	State	Cultivation	Agri. Wages	Non-farm	Others	Real Per Capita income (Rs)
1.	Andhra Pradesh	55.7	19.7	23.4	1.1	5046
2.	Karnataka	69.6	8.9	20.1	1.4	4767
3.	Madhya Pradesh	69.4	7.3	21 .4	1.9	4159
4.	Maharashtra	66.9	10.0	19.6	3.4	5524
5.	Uttar Pradesh	54.6	2.9	40.4	2.1	4185

Source: Working paper Series No.81 of NCAER: Rural non-farm employment in India: Access, Income and Poverty Impact P.Lanjouw & A.Shariff (2002).

Table 13: Increase in labor days per annum—Agriculture Activity (Men & Women)

		Men			Women		
Name of the State/Watershed (Average)	Programme	Pre-Project (No)	Post-Project (No)	Percentage Change	Pre- Project (No)	Post-Project (No)	Percentage Change
Pandur/Rachapalli	IWDP	41	62	21	45	69	24
Kannemanagala/ Hirekattigenahalli	DPAP	195	250	55	172	231	59
Sarungbehri/Satnoor	DPAP	64	106	42	43	65	22
Nerli/Sonkeri	DPAP	217	245	28	226	273	47
Aragad/Sarnoka Khala	NWDPRA, UDWDP	74	120	46	35	54	19

On-farm labor days during pre and post-project periods

Overall, there was increased employment days range from 21 in Andhra Pradesh to 55 in Karnataka for men and 19 in Uttarakhand to 59 in Karnataka for women during project and post-project scenario (Table 13). Agro-climatologically, the increase in on-farm labor days was almost all 10 sample watershed villages in the case of both men and women in semi-arid and humid areas. In semiarid areas the increase was a range of 21 (Andhra Pradesh) and 55 (Karnataka) days for men and 22 (Madhya Pradesh) and 59 (Karnataka) days for women. The on-farm labor days were highest in semi-arid for both men and women and lowest in hilly humid areas for women.

Non-farm labor days

As reported by Abraham, the number of non-farm labor days was lower with women compared to men. The study results also reveals the same. They were 7 days (Andhra Pradesh) and 35 (Uttarakhand) for men and 6 days (Madhya Pradesh) and 19 days for women increased in the post-project period (Table 14).

Table 14: Increase in labor days – Non-farm Activity

		Men			Women		
Name of the State/Watershed (Average)	Programme	Pre-Project (No)	Post-Project (No)	Percentage Change	Pre- Project (No)	Post-Project (No)	Percentage Change
Pandur/Rachapalli	IWDP	22	29	7	26	36	10
Kannemanagala/ Hirekattigenahalli	DPAP	80	93	13	89	98	9
Sarungbehri/Satnoor	DPAP	16	28	12	5	11	6
Nerli/Sonkeri	DPAP	108	123	15	88	106	18
Aragad/Sarnoka Khala	NWDPRA, UDWDP	72	107	35	18	37	19

As pointed earlier, the men were more involved in non-farm activities than women. Agro-climatologically both in humid and semi-arid zones the non-farm employment was more. Additional labor days were highest with men of hilly humid area and lowest with women of the semi-arid ecosystem.

Economic Effectiveness

The economic effectiveness was measured in terms of increase in income generation at HH level of both the SMF and the LMF. Further, the debt reduction in both SMF and LMF perspectives as well as percentage reduction in migration in both men and women was analysed. Finally, the CBR and IRR were also examined.

Increase in income generation

The economic effectiveness measured through increase in income show that there is substantial increase in income (nominal rate) of the people in the post-project period. The survey data shows that for small farm category farmer, total average annual household income from agriculture, non-farm sector, and livestock have increased

Table 15: Economic Effectiveness—Increase in Income Generation per HH (SMF & LMF)

		SMF			LMF		
Name of the State/Watershed (Average)	Programme	Pre-Project (No)	Post-Project (No)	Percentage Change	Pre- Project (No)	Post-Project (No)	Percentage Change
Pandur/Rachapalli	IWDP	38660	54447	40.8	104338	133472	27.9
Kannemanagala/ Hirekattigenahalli	DPAP	31873	45670	43.3	75826	101304	33.6
Sarungbehri/Satnoor	DPAP	27476	40227	46.4	101878	138788	36.2
Nerli/Sonkeri	DPAP	105423	152137	44.3	151286	214870	42.0
Aragad/Sarnoka Khala	NWDPRA, UDWDP	59524	97115	63.2	60831	92352	51.8

Table 16: Economic Effectiveness – Debt Reduction with WDP (SMF & LMF)

Name of the State/Watershed (Average)	Programme	SMF		LMF	
		Debit Reduction (Rs./Year)	Percentage Change	Debit Reduction (Rs./Year)	Percentage Change
Pandur/Rachapalli	IWDP	19793	-22.4	23793	-19.4
Kannemanagala/ Hirekattigenahalli	DPAP	4588	-6.8	6657	-9.9
Sarungbehri/Satnoor	DPAP	16942	-16.1	15096	-42.9
Nerli/Sonkeri	DPAP	4150	-48.8	216225	-29.0
Aragad/Sarnoka Khala	NWDPRA, UDWDP	8777	-36.0	18669	-3.6

Note: (-) sign indicates debt reduction

Table 17: BCR & IRR

Name of the State/ Watershed(Average)	Programme	Cost-benefit ratio	Internal rate of return (%)
Pandur/Rachapalli	IWDP	1.2	12.0
Kannemanagala/ Hirekattigenahalli	DPAP	1.7	18.0
Sarungbehri/Satnoor	DPAP	1.2	33.0
Nerli/Sonkeri	DPAP	4.2	57.5
Aragad/Sarnoka Khala	NWDPRA, UDWDP	1.2	16.5

by 40.8 percent (Andhra Pradesh) at lowest and 63.2 percent (Uttarakhand) at the highest. Whereas this increase for large farm size category farmers have been 27.9 percent (Andhra Pradesh) at lowest and 51.8 percent (Uttarakhand) at the highest (Table 15). Therefore, we can say gain is more to the small farmers. The sources of increase in this income has mostly come from crop production followed by non-farm sector include labor and livestock. Income increase in watershed programme is inevitably related to the sustenance of the project as the beneficiaries consider the project as one of the important option to be engaged for their livelihood.

Debt reduction

The impact of WS project is more visible and effective an income generation at HH levels. It has positive impact on debt reduction. Overall, there was 6.8 percent (Karnataka) and 48.8 percent (Maharashtra) reduction with SMF (Table 16). In the case of LMF, it was a reduction of 3.6 percent (Uttarakhand) and 42.9 percent (Madhya Pradesh).

BCR and IRR

The planning commission suggested a BCR of 1.3 as viable entity in the case of watershed. In the present study, the overall BCR was 1.2 (Andhra Pradesh, Uttarakhand and Madhya Pradesh) and 4.2 (Maharashtra) and 1.7 (Karnataka) (Table 17). It ranged from 1.2 in semiarid Andhra Pradesh to 4.2 in the case of semiarid Maharashtra. The IRR (per cent) was 57.5 in semiarid Maharashtra to 12.0 in semiarid Andhra Pradesh.

Thus Maharashtra watershed development programme indicated superiority, largely due to increased diversification, particularly livestock activities.

Impact on Migration

Watershed development implementation can affect migration through an increase in short-term employment as well as long-term productivity gains. The evidence indicates that many watershed development programmes do succeed in reducing migration rates at least during the implementation phase. Sastry et al. (2003) showed that migration rates reduced in all the 37 watersheds studied and the reduction ranged from 22 percent. The 10 sample watershed villages the data reveal that there was reduction in migration 27 percent (Madhya Pradesh) and 53 percent (Uttarakhand) with men and 25 percent (Andhra Pradesh) and 55 percent (Karnataka) with women (Table 18). The

Table 18: Percentage Reduction in Migration (Men & Women)

Name of the State/Watershed (Average)	Programme	Men	Women
Pandur/ Rachapalli	WDP	44	25
Kannemanagala/ Hirekattigenahalli	DPAP	47	55
Sarungbehri/ Satnoor	DPAP	27	47
Nerli/ Sonkeri	DPAP	33	46
Aragad/ Sarnoka Khala	NWDPRA, UDWDP	53	42

overall reduction in migration was more than 25 percent with the implementation of the project.

To sum up, increased area under different crops was found and also the productivity has gone up in both the seasons among different size class of farmers due to the soil conservation measures especially the land leveling, strengthening of field bunds, gully checks and continues contour trenches (CCTs). Soil moisture has improved and water retention period had increased to 9 months.

- This helped a lot to the farmers where the cultivation of vegetables has intensified.
- It is also learnt from the field data that increase of income through diversification of cropping pattern is positive to some extent especially in the case of commercial crops and horticulture.
- Another indicator observed from the data was that increase of employment. There was a considerable increase in number of labor days per annum per HH in agriculture, non-farm sector and livestock.
- There is a positive impact from watershed activities towards decrease of migration in both skilled and unskilled labor. However, the economic surplus value of these interventions has shown very limited benefit-cost ratio (1:2) in some of sample watersheds. Since the pattern of investment is very low and continuous flow of money was not regularly made.
- Diversification of agriculture towards food crops to commercial crops like pulses (Chana, Moong Dal) and oil seeds (Soyabean) has visible impact. The watershed intervention has made some sort of positive influence on diversification of agriculture. This has been confirmed with the different size class of farmers during focus group discussions.
- The impact of investment in watershed of 10 sample watersheds in five states reveal that there was a shift towards livestock population especially increase of milch animals and milk yield among all size class of farmers.

Policy Implications

- More frequently raised issue is that small holders (constituting 86% of the HHs) do not get the benefits to the same extent as the medium and large holders in the watershed development program.

  Further for inclusive growth of the smallholders centered effort is needed to generate more non-farm employment besides diversification to activities like poultry, vermicompositing etc. The Farmers Technology Transfer Fund (FTTF) of NABARD can be utilized on a Pilot basis at least in one place per district.
- A revisit to NRM is needed in view of the new paradigms developing in the recent past. It is the upstream vs downstream farmers in SC works as well as rainwater harvesting. The former are service providers and the latter are the beneficiaries.

  The service providers have to be compensated. Such Payments for Environmental Services (PES) are functional in some countries. We have to emulate them to avoid further conflicts and to ensure sustainability.
- Biomass generation in any form needs more attention to sustain production systems in rainfed areas.
- Credit to smallholders still is not adequate from the institutional channels. Many of the poor depend on private money lenders (with very high interest rates). A special dispensation to provide timely credit to smallholders is needed.
- So as to mitigate the effects of drought (which is likely to be more frequent with climate change), seed and fodder banks have to be established for clusters of watersheds.
- Cooperative systems of management of the surplus agricultural commodities that become available in good monsoon years need support. The sheep and other small ruminants besides backyard poultry need to be cooperatized for sustainability.

- The taking up livelihood support systems was less than encouraging and needs focused attention.
- Focus of watershed activities should shift towards better utilization of wastelands for the benefit of poor.
- Afforestation program may be considered as an important component in the watershed project.
- The poor families in the villages have peripheral roles in the watershed development projects. This could be improved by specially designing project (inclusive) processes and allocating budgets for the poor
- Support livelihood systems for homestead for setting micro enterprises is a viable component and should receive still more investment.
- For livelihood diversification demonstrations on fish farming would help integrate water management with that of land.
- There is good potential for dairy based livestock development as seen from the study. The farmers should be provided linkage with agencies for cold storage and milk collection centers.

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"Courage is what it takes to stand up and speak, Courage is also what it takes to sit down and listen."

—Sir Winston Churchill

Feature

Technical Efficiency of Manufacturing Sector in Punjab—An Application of Data Envelopment Analysis

SATISH VERMA AND GURINDER KAUR

Based on 16 two-digit industrial groups (NIC-1998) for the period spanning 1997–98 to 2007–08, this study empirically examines technical efficiency of manufacturing sector in Punjab. Data Envelopment Analysis (DEA) technique has been used for this purpose. Mean technical efficiency of Punjab's manufacturing sector was 59 percent implying that to become fully efficient it must reduce inputs by 41 percent. Both pure technical inefficiency (26 percent) and scale inefficiency (19 percent) are responsible for this inefficiency in Punjab's manufacturing sector. On the whole, 75 percent of the industrial groups were found operating at less than 70 percent of technical efficiency.

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Punjab economy, especially its industrial sector, has underwent many ups and downs during different phases of development. At the time of partition, Punjab was divided into two parts—East Punjab which is in India and West Punjab which is in Pakistan. Most prosperous and developed West Punjab (also industrially), namely Lahore, Gujranwala, Sialkot and Wazirabad went to West (Pakistan) Punjab and only a few industries remained in East (India) Punjab. All the important industrial centres of Amritsar, Ludhiana and Batala, and 40 percent of the registered factories completely closed down because of their being in a dilapidated condition. Industry started shifting to other prosperous states like Delhi. Punjab was in a chronic situation during the 1950s (Maini, 2004, p. 60).

The situation of industry in Punjab further worsened in 1966 when it was divided on a linguistic basis into three separate states—Haryana, Himachal Pradesh, and Punjab. The major mineral and forest resources went to Himachal Pradesh and Haryana, and the divided Punjab was in a chronic position without any mineral resources (Kaur, 2007, p. 33). The state made a spectacular revival with the advent of Green Revolution. Punjab reached new heights. Agricultural sector showed tremendous growth. It also provided new opportunities for the development of the industrial sector. Growth of GDP in Punjab was higher than the national average in 1970s and 1980s. Small scale sector dominated the growth of Punjab's industrial sector. But this economic progress could not sustain for long. Economic policy of 1990s seems to have worsened the situation. Opening of the Indian economy to imports as well as domestic competition and encouraging private sector resulted in decelerating conditions (Ahluwalia et al., 2007, p.1). Table 1 shows that the growth rate of India's manufacturing declined from 7.44 percent in the decade of the eighties to 7.02 percent in the decade of nineties and then accelerated to 8.2 percent in the first decade (2000–09) of the new millennium. Whereas in Punjab,

Table 1: Growth Rate of Manufacturing GSDP (at 1993–94 prices)

Major States	1980-81/ 90-91	1990-91/ 00-01	2000-01/ 08-09
Andhra Pradesh	5.36	5.2	6.92
Bihar	6.24	3.18	13.95
Gujarat	8.29	9.48	11.71
Haryana	10.42	6.8	8.13
Karnataka	7.07	6.9	10.51
Kerala	3.26	5.92	6.19
Madhya Pradesh	6.52	6.58	5.44
Maharashtra	6.79	6.27	8.64
Orissa	8.78	4.17	15.6
Punjab	8.98	6.43	6.18
Rajasthan	6.66	9.37	7.84
Tamil Nadu	4.06	5.06	7.74
Uttar Pradesh	9.53	4.8	6.26
West Bengal	3.32	6.36	6.07
INDIA	7.44	7.02	8.2

Source: Papola et al. (2011, p. 17)

alongwith other eight states, it decelerated. Majority of other states, of course, recovered from liberalisation setback, but Punjab's industrial sector further decelerated, as the rate of growth of its manufacturing sector declined from 8.98 percent in the decade of the eighties to 6.43 percent in the decade of the nineties, and further to 6.18 percent in the first decade (2000–09) of the new millennium. Punjab's growth rate of manufacturing has been less than even that of the national average. Many factors are responsible for this, and technical inefficiency of its manufacturing sector may be one reason for this decelerating trend.

Different studies were conducted in the past to measure the performance of manufacturing sector through technical efficiency. Mahadevan (2000, see table 1, p. 2009) measured the technical efficiency of Singapore's manufacturing sector by using 28 industrial groups for the time period 1975 to 1994. By applying Stochastic Frontier Analysis, the study examined that mean technical efficiency of all the industrial groups range between 52 percent and 97 percent. Baten et al. (2009, see table 7, p. 1167) while applying the same technique on two digit industrial groups of Bangladesh from 1988–89 to 1999–2000 evaluated the technical efficiency at 34.3 percent in case of normal distribution and 36.7 percent in case of half normal distribution. Using the second census data, Nikaido (2004, see table 2, p. 595) measured the technical efficiency of 18 two digit industrial groups in India and found the mean technical efficiency to be 81 percent. Mukherjee et al. (2004, see table 1(a) and 1 (b), p. 23) examined the impact of reforms on Indian manufacturing sector by applying Data Envelopment Analysis. Using the data of aggregate manufacturing of 22 Indian states from 1986 to 2000, the results revealed that mean technical efficiency has declined from 96 percent in pre-reform period (1986–90) to 93 percent in post reform period (1990–2000). Baumik and Kumbhakar (2007, see table 2, pp. 26, 27, and 28) using Stochastic Frontier Analysis measured the technical efficiency of 14 two digit industrial groups of India from 1989–90 to 2000–01. The results revealed that all the industrial groups except for Leather and Leather products and Wood and Wood Products have shown a decline in technical efficiency in the post-reform period.

Not much work has been done to examine the poor performance of Punjab's industrial sector as regards the technical efficiency of its manufacturing sector. In this article, an attempt has been made to measure the technical efficiency of manufacturing sector of Punjab by considering 16 two-digit industrial groups. This article provides estimates of technical efficiency both year-wise and industry-wise. It examines the extent of scale inefficiency and pure technical inefficiency. The paper is organised as follows: The present section has introduced the issue. The methodology section discusses the methodology used. Data and definitions highlights the data, its sources, coverage, and the adjustments. Emperical analysis discusses the empirical results. Major findings and conclusions are reported in the conclusions section.

Methodology

There are two approaches for measurement of efficiency—Parametric and Non- Parametric approaches. Parametric approach includes Stochastic Frontier Analysis (SFA), an econometric technique used to measure efficiency. Stochastic estimations impose an explicit functional form and distributional assumption on the data (Kumbhakar and Lovell, 2000, p. 8). Non-Parametric approach includes Data Envelopment Analysis (DEA), a mathematical approach given by Charnes, Cooper, and Rhodes (1978), and was further extended to include variable returns to scale by Banker, Charnes, and Cooper (1984) (Coelli, 1998, p. 162). DEA does not specify a functional form, and involves solving linear program in which an objective function envelops the observed data. Then efficiency scores are derived by measuring how far an observation is positioned from the envelope or the frontier (Zamorano, 2004, p. 35). "DEA measures the relative technical efficiency of a group of decision making units (DMUs) by simultaneously evaluating multiple inputs and outputs common to each unit. Each

DMU is thus assigned an efficiency score. The DEA model is a family of fractional linear programs. Each linear program measures the relative efficiency of a particular DMU" (Aggarwal et al. 2010, p. 217). DEA models can be divided into input-oriented models and output-oriented models: the former favor the potential improvement of resource utilisation and the latter analyse the potential improvement of produced outputs.

Let there be N decision making units with K inputs and M outputs each.

In order to maximise the efficiency of ith decision making unit, following BCC DEA model is solved:

$$\text{Min}_{\theta\lambda}\ \theta,$$
$$\text{st}$$
$$-y_i + Y\lambda \geq 0$$
$$\theta x_i - X\lambda \geq 0$$
$$N1'\lambda = 1$$
$$\lambda \geq 0$$

where θ is a scalar, λ is an Ix1 vector of constants and N1 is an Nxl vector of ones.

The value of θ obtained is the efficiency score for the i-th firm. The value of $\theta = 1$ implies technically efficient DMU lying on the frontier line. The linear programming problem must be solved n times once for each DMU and the value of θ for each DMU.

DEAP Version 2.1 software has been used to measure technical efficiency.

Data and Definitions

The present study makes use of two-digit industry level data collected from Annual Survey of Industries, RBI Bulletin, whole sale prices in India prepared by the office of Economic Advisor, Ministry of Industry etc., covering a period of 10 years commencing from 1997–98 to 2007–2008. As National Industrial Classification changed according to changes in the International Standard Industrial Classification (ISIC), so till today NIC-1962, NIC-1970, NIC-1987, NIC-1998 and NIC-2008 have come into being. For analysis of time series data, concordance needs to be met between these classifications. But, due to the limitation of non-availability of a 4-digit industrial classification at state level, concordance could not be met between NIC-1987 and NIC-1998. Therefore, we were constrained to take 1997–98 as the beginning year and limit analysis to 10 years' data, i.e., from 1997–98 to 2007–08, covering 16 two-digit industrial groups according to NIC-1998 of Punjab. For calculating technical efficiency, one output, i.e., Gross Value Added, and two inputs, i.e., Fixed Capital and Total Persons Employed have been taken.

Output

Output is measured by gross value added. For deflating real value added, there are two approaches:

1. Single Deflation Method: It deflates the nominal value added by an index of the price of gross output.
2. Double Deflation Method: It deflates gross output by output price index and material input by the input price index. The difference is treated as real value added (Balakrishnan, 2004, p. 1467).

Double Deflation Method suffers from certain limitations over Single Deflation Method:

1. It is highly sensitive to the set of weights used to derive the input price index and hence is more prone to errors.
2. Double Deflation provides different answers for different base years for constant prices whereas the single deflation method gives a unique answer (Dholakia and Dholakia, 1994, p. 3344).

So, single deflation method is preferred for deflating Gross Value Added which is Net Value Added plus Depreciation.

Net Value Added has been deflated by industry specific Wholesale Price Index (Base 2004–05=100) collected from the Office of Economic Advisor, Ministry of Industry. Depreciation has been deflated by the Wholesale Price Index of Machinery and Machine tools (Base 2004–05=100).

Inputs

Two inputs have been taken, i.e., labor and capital.

Labor

Total persons employed has been taken as a measure of labor force.

Capital

Capital stock deflated at 2004–05 prices has been taken as a measure of capital input. The estimates are based on "Perpetual Inventory Method." The perpetual inventory method requires an estimate of the capital stock for a benchmark year and estimates of investment in the subsequent periods. In the present study, the value of finished equipment of a balanced age composition is assumed to be exactly half the value of equipment when it was new. Thus, twice the book value of the base year has been taken as an estimate of fixed capital for the bench mark year. This approach has also been followed by Banerji (1975), Burange (2000, p. 4), Burange (2004, p. 4), Goldar

(1986), Kumar (2001, p. 118), Samra and Rao (1990), Singh and Ajit (1995), and Roychaudary (1977).

The investment figures were obtained using the formula:

$$I_t = (B_t - B_{t-1} + D_t)/P_t$$

where "B" is the book value of the fixed capital, "D" is depreciation, and "P" is an appropriate deflator for fixed capital. For "P", we have used the wholesale price index of machines and machine tools (base 2004–05=100).

The capital stock in any year is then calculated as:

$$K_t = K_{t-1} + I_t + d.K_{t-1}$$

where d= Annual rate of discard of capital.

Following Goldar (1986, p. 99), Burange (2000, p.5), Burange (2004, p. 5), we have taken 2 percent annual rate of discard of capital.

Empirical Analysis

Using Input-Oriented Variable Returns to Scale Data Envelopment Analysis model, overall efficiency is decomposed into pure technical efficiency and scale efficiency. This section puts light on the efficiency estimates of industrial groups of manufacturing sector in Punjab from different aspects.

Table 2 shows the year-wise mean technical efficiency of Punjab's manufacturing sector. It revealed that manufacturing sector in Punjab realizes about 59 percent of its technical abilities. It comprises of 73.6 percent of pure technical efficiency and 81.22 percent of scale efficiency. By eliminating these inefficiencies, the industry can reduce the inputs (both labor and capital) by at least 41 percent to produce same level of output. Overall, average annual efficiency displays an increase from a low of 46.2 percent in 1998–99 to 52.1 percent in 2007–08 with the highest figure of 72.5 percent in 2005–06 during the entire study period. Increasing technical efficiency indicates that Punjab's manufacturing sector has moved a bit closer to the production frontier overtime whereas pure technical efficiency remained same and scale efficiency increased by 10 percentage point over this period. The fall in technical efficiency from 65 percent in 2006–07 to 52 percent in 2007–08 is because of pure technical efficiency which has reduced from 80 percent in 2006–07 to 66 percent in 2007–08 while scale efficiency remained the same.

Table 2: Mean Technical Efficiency—Year-Wise

Year	Overall Technical Efficiency	Pure Technical Efficiency	Scale Efficiency
1998–99	0.462	0.662	0.724
1999–2000	0.528	0.655	0.799
2000–01	0.535	0.679	0.815
2001–02	0.572	0.734	0.786
2002–03	0.625	0.733	0.864
2003–04	0.654	0.765	0.855
2004–05	0.630	0.796	0.799
2005–06	0.725	0.873	0.837
2006–07	0.648	0.801	0.823
2007–08	0.521	0.662	0.82
Average	0.590	0.736	0.8122

Source: Authors' Calculation.

The classification of two digit industries according to National Industrial Classification–1998 is shown in Table 3. Table 4 depicts mean overall technical efficiency of 16 two-digit industrial groups from 1997–98 to 2007–08, which is decomposed into pure technical efficiency

Table 3. National Industrial Classification (NIC)—1998

Industrial Code	Industry Group
15	Manufacture of Food Products and Beverages
17	Manufacture of Textiles
18	Manufacture of Wearing Apparel; Dressing and Dyeing of Fur
19	Manufacture of Leather and Leather Products
20	Manufacture of Wood and Wood Products
21	Manufacture of Paper and Paper Products
24	Manufacture of Chemical and Chemical Products
25	Manufacture of Rubber and Plastic Products
26	Manufacture of Other Non- Metallic Mineral Products
27	Manufacture of Basic Metals
28	Manufacture of Fabricated Metal Products, Except Machinery andEquipments
29	Manufacture of Machinery and Equipment N.E.C.
30	Manufacture of Office, Accounting and Computing Machinery
31	Manufacture of Electrical Machinery and Apparatus N.E.C.
32	Manufacture of Radio, Television and CommunicationEquipment and Apparatus
34	Manufacture of Motor Vehicles, Trailers and Semi-Trailers
35	Manufacture of Other Transport Equipment

Source: Annual Survey of Industries.

Table 4: Mean Technical Efficiency—Industry Wise

Ind. Code	Overall Technical Efficiency	Pure Technical Efficiency	Scale Efficiency
15	0.77 (3)	0.95 (4)	0.82 (9)
17	0.43 (13)	0.59 (12)	0.78 (12)
18	0.58 (8)	1 (1)	0.58 (14)
19	0.48 (10)	0.66 (11)	0.72 (13)
20	0.31(16)	0.93 (5)	0.34 (16)
21	0.48 (11)	0.54 (15)	0.88 (8)
24	0.97 (1)	A.98 (2)	0.99 (2)
25	0.52 (9)	0.56 (14)	0.93 (7)
26	0.69 (5)	0.82 (6)	0.8 (10)
27	0.65 (6)	0.67 (10)	0.97 (4)
28	0.74 (4)	0.76 (7)	0.98 (3)
29	0.95 (2)	0.95 (3)	1 (1)
31	0.46 (12)	0.57 (13)	0.79 (11)
32	0.33 (15)	0.69 (8)	0.5 (15)
34	0.64 (7)	0.67 (9)	0.94 (6)
35	0.43 (14)	0.44 (16)	0.96 (5)
Average	0.59	0.74	0.81
Min	0.31	0.44	0.34
Max	0.97	1	1
Std Dev	0.2	0.18	0.19
C.V.	33.53	24.52	23.96
Max	0.97	1	1
Std Dev	0.2	0.18	0.19
C.V.	33.53	24.52	23.96

Source: Authors' Calculation.
Note: Figures in the parenthesis are the ranks of the respective efficiencies.

and scale efficiency. The estimates of overall technical efficiency for different industrial groups of Punjab range between 31 percent and 97 percent. The Chemical and Chemical Products (24) industries is the most efficient of all the industry groups in Punjab. This industry realizes 97 percent of its technical potential. The manufacture of machinery and equipment (29) realizes 95 percent of its technical potential. The least efficient of the sample industries is manufacture of wood and wood products and cork (20) which realizes only 31 percent of its technical potential. The inefficiency in this industry (20) is mainly because of scale inefficiency. It needs to change its scale size in order to become fully efficient.

The result of coefficient of variation shows that during the study period, the degree of variation of technical efficiency among industrial groups is to the extent of 34 percent. As far as pure technical efficiency is concerned, Manufacture of Wearing Apparel, Dressing and dyeing of fur (18) and manufacture of Chemical and Chemical products (24) are most efficient and manufacture of other transport equipment (35) is least efficient of all. Moreover, there is around 25 percent of the variability among the industrial groups as far as pure technical efficiency is concerned. The results of scale efficiency reveal that manufacture of fabricated metal products, except machinery and equipment (29) operates at most efficient scale size and manufacture of wood and products of wood and cork (20) operates at least efficient scale size. There exists 24 percent of the variability in scale efficiency among sampled industrial groups.

Details about technical efficiency of each industrial group during all the years of the study period are presented in tables 5, 6 and 7. Table 5 shows the results of overall technical efficiency. The results reveal that manufacture of other non-metallic mineral products (26) has shown the maximum improvement in overall technical efficiency during the study period, followed by manufacture of food products and beverages (15), and manufacture of wearing apparel, dressing and dyeing of fur (18). Manufacture of machinery and equipment (29) has become technically inefficient over the period under reference. Its efficiency has decreased from 100 percent to 54 percent. The degree of variability among the industrial groups has decreased from 54 percent in 1998–99 to 48 percent in 2007–08.

Table 6 shows that manufacture of wearing apparel, dressing and dyeing of fur (18) have no pure technical inefficiencies. Half of the total industrial groups have shown improvement in pure technical efficiency. The degree of variability between the industrial groups decreased from 38 percent in 1998–99 to 15 percent in 2005–06, and then increased to 37 percent in 2007–08.

In case of scale efficiency, as can be seen from Table 7, it has improved in majority of the industrial groups. The scale efficiency variation across the industrial groups has narrowed from 36 percent in 1997-98 to 31 percent in 2007–08. Manufacture of chemical and chemical products

Table 5: Overall Technical Efficiency of Punjab's Manufacturing Sector

Ind Code	1998–99	1999–00	2000–01	2001–02	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08
15	0.551	0.46	0.678	0.82	0.865	0.933	0.646	0.737	1	1
17	0.289	0.261	0.437	0.411	0.341	0.425	0.502	0.632	0.613	0.416
18	0.48	0.28	0.415	0.443	0.621	0.803	0.359	0.77	0.61	0.97
19	0.297	0.708	0.506	0.375	0.734	0.545	0.561	0.487	0.391	0.24
20	0.213	0.196	0.282	0.326	0.437	0.367	0.412	0.361	0.313	0.229
21	0.492	0.132	0.454	0.374	0.468	0.434	0.543	0.76	0.678	0.499
24	1	1	1	1	1	1	1	1	1	0.712
25	0.282	0.757	0.599	0.413	0.617	0.568	0.469	0.619	0.549	0.368
26	0.103	0.227	0.425	0.468	0.753	1	1	1	1	0.933
27	0.457	0.759	0.365	0.892	0.593	0.689	0.95	0.861	0.591	0.383
28	0.466	0.731	0.736	0.652	1	0.99	0.804	0.841	0.654	0.51
29	1	1	1	1	0.986	1	1	1	1	0.548
31	0.308	0.216	0.557	0.52	0.395	0.457	0.415	0.724	0.514	0.446
32	0.626	0.334	0.358	0.305	0.213	0.175	0.182	0.4	0.407	0.306
34	0.417	0.39	0.557	0.61	0.728	0.745	0.881	0.916	0.644	0.475
35	0.414	1	0.2	0.547	0.249	0.327	0.361	0.487	0.403	0.304
Mean	0.462188	0.528188	0.535563	0.57225	0.625	0.653625	0.630313	0.724688	0.647938	0.521188
Min	0.103	0.132	0.2	0.305	0.213	0.175	0.182	0.361	0.313	0.229
Max	1	1	1	1	1	1	1	1	1	1
SD	0.24812	0.315895	0.227791	0.235219	0.259977	0.277999	0.270988	0.211344	0.234751	0.252634
CV	53.68377	59.80735	42.53295	41.10427	41.59627	42.53195	42.99272	29.16349	36.23055	48.47275

Source: Authors' Calculation.

Table 6: Pure Technical Efficiency of Punjab's Manufacturing Sector

Ind Code	1998–99	1999–00	2000–01	2001–02	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08
15	1	0.493	1	1	1	1	1	1	1	1
17	0.41	0.262	0.703	0.526	0.35	0.549	1	1	0.689	0.422
18	1	1	1	1	1	1	1	1	1	1
19	0.484	0.812	0.653	0.559	0.812	0.665	0.68	0.695	0.659	0.568
20	1	0.69	0.82	1	1	1	0.799	1	1	1
21	0.619	0.188	0.48	0.505	0.471	0.461	0.568	0.791	0.736	0.606
24	1	1	1	1	1	1	1	1	1	0.764
25	0.365	0.781	0.663	0.444	0.631	0.572	0.504	0.642	0.603	0.371
26	0.664	0.564	0.579	0.619	0.797	1	1	1	1	0.938
27	0.487	0.76	0.374	0.894	0.597	0.7	0.952	0.863	0.614	0.426
28	0.497	0.744	0.769	0.687	1	1	0.821	0.848	0.673	0.512
29	1	1	1	1	1	1	1	1	1	0.549
31	0.438	0.314	0.597	0.672	0.513	0.54	0.5	0.841	0.721	0.53
32	0.74	0.456	0.447	0.605	0.56	0.648	0.64	0.836	1	1
34	0.462	0.412	0.572	0.661	0.738	0.77	0.907	0.951	0.704	0.56
35	0.426	1	0.204	0.567	0.251	0.331	0.365	0.501	0.418	0.346
Mean	0.662	0.65475	0.678813	0.733688	0.7325	0.76475	0.796	0.873	0.801063	0.662
Min	0.365	0.188	0.204	0.444	0.251	0.331	0.365	0.501	0.418	0.346
max	1	1	1	1	1	1	1	1	1	1
SD	0.253808	0.277944	0.242473	0.209594	0.257291	0.235204	0.22142	0.153244	0.194456	0.247178
CV	38.33955	42.45033	35.72024	28.56722	35.12502	30.75569	27.81662	17.55378	24.27472	37.33814

Source: Authors' Calculation.

Table 7: Scale Efficiency of Punjab's Manufacturing Sector

Ind Code	1998–99	1999–00	2000–01	2001–02	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08
15	0.551	0.933	0.678	0.82	0.865	0.933	0.646	0.737	1	1
17	0.706	0.997	0.621	0.782	0.973	0.773	0.502	0.632	0.889	0.984
18	0.48	0.28	0.415	0.443	0.621	0.803	0.359	0.77	0.61	0.97
19	0.615	0.873	0.775	0.671	0.903	0.819	0.825	0.701	0.593	0.423
20	0.213	0.284	0.344	0.326	0.437	0.367	0.515	0.361	0.313	0.229
21	0.795	0.702	0.946	0.74	0.994	0.942	0.956	0.962	0.92	0.824
24	1	1	1	1	1	1	1	1	1	0.931
25	0.772	0.97	0.904	0.93	0.978	0.993	0.929	0.964	0.91	0.993
26	0.155	0.402	0.734	0.757	0.945	1	1	1	1	0.994
27	0.939	0.999	0.978	0.999	0.993	0.985	0.998	0.997	0.961	0.9
28	0.937	0.983	0.957	0.948	1	0.99	0.98	0.992	0.971	0.996
29	1	1	1	1	0.986	1	1	1	1	0.997
31	0.703	0.687	0.933	0.774	0.771	0.846	0.83	0.862	0.713	0.842
32	0.845	0.733	0.801	0.503	0.379	0.27	0.284	0.478	0.407	0.306
34	0.903	0.947	0.973	0.923	0.986	0.967	0.972	0.964	0.916	0.847
35	0.973	1	0.979	0.965	0.991	0.987	0.988	0.971	0.966	0.879
Mean	0.724188	0.799375	0.814875	0.786313	0.863875	0.854688	0.799	0.836938	0.823063	0.819688
Min	0.155	0.28	0.344	0.326	0.379	0.27	0.284	0.361	0.313	0.229
max	1	1	1	1	1	1	1	1	1	1
SD	0.264193	0.261705	0.208591	0.210014	0.205693	0.22391	0.252124	0.20433	0.225125	0.258047
CV	36.48125	32.73869	25.59789	26.70866	23.81046	26.19792	31.55498	24.41404	27.35215	31.48111

Source: Authors' Calculation.

(24) and manufacture of machinery and equipment (29) have employed the perfect scale size. All the industrial groups are working under increasing returns to scale except for manufacture of food products and beverages (15) and manufacture of textiles (17).

Table 8 shows the range of technical efficiency of different industrial groups. It can be seen that 44 percent of the industrial groups had less than 50 percent of technical efficiency. It means that, to become efficient, these industries will have to decrease their inputs by 50 percent and to produce the same level of output. These industries are manufacture of textiles (17), manufacture of leather and leather products (19), manufacture of wood and wood products and cork (20), manufacture of paper and paper products (21), manufacture of electrical machinery and apparatus n.e.c. (31), manufacture of radio, T.V and communication equipment and apparatus (32), and manufacture of other transport equipment (35). Only two industrial groups namely manufacture of chemical and chemical products (24) and manufacture of machinery and equipment (29) exhibit more than 90 percent of technical efficiency. No industrial group was in the range of 80 to 90 percent. Considering cumulative figures, it is disheartening to note that 75 percent of the industrial groups have less than 70 percent of technical efficiency and hence majority of the industrial groups in Punjab are off the production frontier and need to work towards improving efficiency.

Table 8: A Frequency Distribution of Technical Efficiency in Punjab Manufacturing Sector

Range of efficiency	Frequency of Occurrence	Relative Frequency of Occurrence	Cumulative frequency of occurrence
LESS THAN 0.50	7	43.75	43.75
0.50 to 0.60	2	12.5	56.25
0.60 to 0.70	3	18.75	75
0.70 to 0.80	2	12.5	87.50
0.80 to 0.90	-	-	87.50
Above 0.90	2	12.50	100

Source: Authors' Calculation.

Conclusion

The study was conducted with the objective of analysing the efficiency of major two-digit industrial groups of Punjab spanning over the period 1997–98 to 2007–08. By applying DEA technique, it was found that on average, manufacturing sector of Punjab realizes only 59 percent of technical abilities. Overall, technical efficiency has increased from 46 percent in 1997–98 to 52 percent in 2007–08. Chemical and Chemical products (24) and Manufacture of machinery and equipment (29) are the most efficient of all the industrial groups. These industries also have the perfect scale size. During the study period, manufacture of food products and beverages (15), manufacture of wearing apparel, dressing and dyeing of fur (18) and manufacture of other non- metallic mineral products (26) registered maximum improvement. The least efficient of all the industrial groups are manufacture of wood and wood products (20) and manufacture of radio, television and communication equipment and apparatus (32). Coefficient of variation shows that there exists 34 percent of the variability in technical efficiency among the industrial groups. On the whole, it is concluded that 75 percent of the industrial groups had less than 70 percent of technical efficiency. Inefficient management, inappropriate scale size and absolute neglect of manufacturing sector in the state by the Punjab government are responsible for its poor performance.

Policy Implications

Considering entire manufacturing sector of Punjab, there is a dire need to improve the pure technical efficiency. Industry wise analysis reveals that industrial groups Manufacture of Paper and Paper Products (21), manufacture of Chemical and Chemical Products (24), Manufacture of Basic Metals (27), Manufacture of Fabricated Metal Products (28), Manufacture of Radio, Television and Communication (32), Manufacture of Motor Vehicles, Trailers and Semi-Trailers (34) and Manufacture of other Transport Equipment (35) should concentrate on improving pure technical efficiency in order to move towards the production frontier. Good infrastructure, uninterrupted power supply and skilled manpower can contribute in improving pure technical efficiency. There is a need to develop the efficiency-oriented plans and policies by the government. Punjab Government should come forward for developing SEZ's, industrial parks and industry specific industrial clusters where world class infrastructure is provided. Government should develop training centers to improve the labor skills. Apart from pure technical efficiency, Manufacture of Food Products and Beverages (15), Manufacture of Wearing Apparel (18) and Manufacture of Wood and Wood Products (20) need to change their scale size in order to become fully efficient. It can be done by removing the financial constraints, reducing the input cost etc. Government should develop policies of providing easily accessible loans for industry. Input cost in Punjab is very high as compared to other neighboring states. 4.5 percent entry tax on cotton yarn, iron and steel scrap and 13 percent on marble, cement, plywood by Punjab government increases the cost of production. Thirteen percent electricity duty, 10 percent octroi on electricity, 8 paise per unit for fuel surcharge, excise duty on garments, 6 percent VAT imposed by state government further add to the cost of the manufacturing sector, which reduce its efficiency. So, for improving efficiency, there is a dire need on the part of Punjab government to announce the industry friendly policies which should increase technical and scale efficiency of the manufacturing sector in the state.

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"You do not have to do anything improper to have a conflict of interest; it is strictly situational."

—Paul J. Friedman

Feature

Assessment on the Development of Ornamental Plants in Indonesia

AGUS MUHARAM, BUDI MARWOTO, RITA INDRASTI AND SITI SEHAT TAN

Indonesia has abundant genetic resources of ornamental plants which have the potential to be developed for commercial commodities. Development of floriculture industry is expected to generate farmer's income, open labor opportunities, and stimulate related supporting industries. Although some progress has been achieved, floriculture industry in the country is challenged by many problems, not only in the aspects of knowledge and technology, but also on capital investment and the regulation system. The strategy of research and development of ornamental plants is based on the analysis of strengths and weaknesses as internal elements, and opportunities and threats as external components. With some being basic efforts being established by Indonesian Agency for Agricultural Research and Development (IAARD), Ministry of Agriculture, Republic of Indonesia to accelerate the development of floriculture industry, in the near future, floriculture industry in Indonesia will hopefully be established to meet domestic and global markets.

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Situated in the tropical region, Indonesia is enriched with soil and agroclimatic conditions for most favorable growing of 25,000 species of flora (USAID, 2008). Most of them still exist in the forests which are not yet being explored for commercial purposes. About 15 percent of those species are known as ornamental plant members of Orchidaceae, Araceae, Musaceae, Palmae, Compositae, Maranthaceae, Zingiberaceae and others. The species are exotic possessing valuable characteristics which are very popular and being claimed as the best species in the world (Mittermeier et al., 1997). In the several international events, those species are often awarded to be the champion in their classes. Many collectors all over the world have desired to obtain the species, even though they have to pay with considerably high prices for it.

The national floriculture industry has grown increasingly for the last five years proven by available statistic data of planting areas, production, productivity, and export volume during the period 2006–2010. In the year 2006, planting area was only 7,500 ha and the production was around 188 million stems. This data increased by 18,700 ha for planting areas and 417 million flower stems for production in the year of 2010 (Statistik Pertanian (Agricultural Statistics), 2011). However, on the same period, export value of floriculture produces were decreasing. Export value achieved US $ 13.5 million in 2006, and then decreased by US $ 9 million in 2010 (Agricultural Statistics, 2011). The increase of ornamental consumption in the country may cause the gradual decrease of the export value. Those all presented data revealed that floriculture business has good prospects as one of the potential resources for development of economic in the rural areas. Development of floriculture industry would be expected to: (1) generate farmer's income, (2) open labor opportunity, and (3) stimulate related supporting industry. The future prospect of floriculture business will be more pronounced as the consequence of increasing

market demands generated by development of tourism industry, houses, offices, hotels and restaurants, and people's lifestyle as well (Directorate Genderal of Horticulture, 2011).

Although some progress has been achieved, floriculture industry in the country is challenged by many problems—(i) lack of superior plant varieties produced from breeding activities based national genetic resources, (ii) common occurrence of small scale farming with traditional crop maintenance, (iii) lack of cultivation technology and quality standard, (iv) low knowledge and skill of human resources, (v) unavailability of information system, (vi) lack of farmer organizations, networking and partnership, (vii) limited capital investment and promotion, and (viii) uncomfortable regulation system. Therefore, it is necessary to establish intensively integrated coordination among organizations both governmental institutions and private companies those are related to efforts in solving the problems (Directorate of Floriculture, 2010).

As mentioned above, the farmers have used traditional technologies in operating their cultivation system causing low productivity and quality of the products. In addition, the application of traditional technologies is not able to ensure the continuity of product supply to fulfill both domestic and global markets. Therefore, introduction of modern technologies based on national resources is urgently established to raise yield quality, productivity, production efficiency, and continuity of supply meeting with consumer's preference. In this article, modern technology resulting in research program of ornamental crops is discussed.

Strengths and Opportunities

Indonesia is well known as a mega-diversity country possessing highest variation of tropical ornamental plants species in the world. Those species are available in several islands—Sumatera, Java, Kalimantan, Celebes, Bali, Maluku, and Papua. Each island has own typical species with different characteristics of flower and plant performance. Thus, the species can really be valuable to be taken as a comparative advantage of each island. Many provincial governments have endorsed the farmers to develop the species to be major component of their business. To use them for being commercialized, several measures have to be exceeded, such as (1) selection and evaluation based on consumer preferences, (2) mass propagation using proper technology, (3) cultivation and flower production, (4) conservation and rehabilitation, (5) genetic improvement, and (6) development of added value through application of post-harvest handling and marketing technologies (Fehr, 1991). These all measures will certainly open the opportunity for the local people to gain their new jobs, stimulate growth of supporting industries and encourage development of infrastructure that finally generating, economic growth in the respective region.

Beside the genetic resources, climatic conditions are also encouraged for development of floriculture industry. So far, production center areas have been established in different elevations of the country. In each elevation, a group of species having similarity in growth requirement is commercially cultivated. The availability of the production areas of the species is necessarily made based on agro-ecological zoning. Tropical species are mostly being cultivated in lowland areas; meanwhile subtropical ones are grown in the highland areas. Those areas should be locally developed using proper technologies to explore the genetic potential. The production areas will grow strongly as a basis place for supplying best quality produce of ornamental plants. To support further development of the areas, infrastructure related to distribution and marketing activities have to be provided. Indeed, it is a part of local government tasks to realize all basic facilities related to those business activities in their region. Without any participation from the government, floriculture business will not develop as being expected (Indonesian Centre for Horticulture Research and Development, 2010).

Human resource is also abundant and potential to be one of major components to achieve comparative and competitive advantages. Relatively low payment of the labor has affected production cost of ornamental plants in Indonesia to be relatively lower than that in other countries. The growers are able to gain the benefit from this situation to compete with other growers in selling floriculture products to international market (FAO, 2007).

Market prospect of ornamental plants are getting more optimistic for the last 10 years. It is estimated that the demands will increase around 10–15 percent per year up to the end 2020. This will be good opportunity to start with straightening up the existing condition from which it enable to produce good quality products of ornamental plants, especially orchids, appropriate to market preference. In addition, there is new trend in the global market that tropical species is now being more preferred than those of subtropical ones. That is why local producers have to catch this opportunity through development of the products to be more attractive and competitive (Indonesian Ministry of Agriculture, 2005).

Weaknesses and Threats

There are two groups of floriculture business actors in the country. The first one is farmers who have small farm areas managed in the traditional way. Produces yielded by the farmers vary in their quality. They are normally not able to fulfill the demands in largely scale yields. The second is companies that are large scale farming operating advanced technology completed with modern infrastructure. The companies produce prime quality yield which are most for export. At present situation total yields produced by the companies is still lower compared to those produced by total overall farmers. This is because numbers of farmers who are engaged in floriculture business is more than total numbers of the companies. Efforts have to be made to transform the existing structure amounts of companies. It can be done by initiating cooperation among the farmers in order to enlarge capacity production under supervision of one management system (IOCRI, 2005).

Human resources play an important role in transferring the industry from the existing condition to the modern and competitive one. Other weakness found in the floriculture industry in the country is low knowledge and skill of human resource. Therefore, all efforts to increase quality of human resources are highly appreciated. These attempts have been developed not only by related government institutions, but also by private companies who concerns in development their own business.

. Floriculture industry has not enabled yet to produce superior commercial hybrids to compete with imported ones. Even though crosses among species have been carried out by the breeders, the selected hybrids cannot be proliferated in large scale because of lack capability in applying mass propagation technology. It is very urgent to develop a lot of tissue culture laboratories that are experts in generating mass propagation technology for superior hybrids of selected species. The laboratories should be easily accessed by the breeders to propagate their hybrids in particular amount. Nowadays, there some private orchid growers in some large cities in the country establish tissue culture for orchid propagation, but for limited market only (Indonesian Agency for Agricultural Research and Development, 2005).

So far information system related to floriculture industry has not yet well developed in the country. It is very important to provide information system which is useful for the business actors. The information should cover supply-demand, export/import, on farm/off farm technologies, production area, quality standard, quarantine and CITES regulations, air freight schedule and others. Those all information can be presented through printed and electronic media as well as computer base system. By accessing the information, the growers enable to make strategic planning of production, distribution and marketing their produces. In the era of globalization, information system will place the strategic position especially in development of new market (Hill, 1990).

The national floriculture industry is threatened by other producing countries, especially Thailand, Taiwan, Malaysia, China, Korea, and Japan. It is realized that rapid progress of floriculture industry has been occurred in those countries. Based on the available data known that Thailand and China successes in extending the production areas achieving 25,000 ha and 10,000 ha, respectively. In order to prevail in the global competition, Indonesia has to surpass strategic measures, including development of hybrids base national genetic resources, increasing efficiency of production, applying quality insurance and preparing regulation on export incentive.

Developing Competitive and Strong Floriculture Industry

Based on the assessment carried out on the development of floriculture industry in Indonesia, some basic efforts have been established in the country as follows.

Participatory Breeding Program

To develop strong and competitive floriculture industry, innovations must be introduced, because they are important as a tool to the increase of added value (Sperling et al., 2001). Many kinds of innovations can be established of which novel superior varieties are the most important ones. Those varieties are used to be major components of floriculture industry that are directly sold to the consumers. Therefore creating new varieties meet with consumer preferences is a must in generating the demands. To make new varieties inter-specific and inter-generic crosses of selected parents are done following with selection using criteria appropriate with consumer preferences (Simmonds, 1993). The individual selected plants are subsequently mass propagated to produce sufficient planting materials before they are be obtained through application of biotechnology (genetic transfer and protoplast fusion), but this method is relatively expensive and not to be used for commercial purposes. By developing breeding activities, the industry may be transecting the new demands. This is a strategic way to prevent listlessness of the market and to repress import penetration (Indonesian Agency for Agricultural Research and Development, 2010).

In other cases breeding activities of ornamental plants are known to be high cost and long run business activities. The investment is needed for building greenhouse and laboratories, paying the employment, and providing plant materials (Salazar, 2001). Therefore, inviting other parties who have capital investment is very urgent. For three years, from 1995 to 1998, The Indonesian Center for Horticulture Research and Development (ICHORD), Indonesian Agency for Agriculture Research and Development (IAARD), The Ministry of Agriculture, Republic of Indonesia, conducted research cooperation with The Netherlands for developing superior varieties of chrysanthemum, roses and gladiolus. This research cooperation resulted in many new varieties of the crops that were released and some of them have been developed commercially by some private companies.

The ICHORD has also established a breeding program so called participatory breeding program involving local companies in the breeding activities of ornamental plants, and also of vegetable crops and fruits (Sanjaya et al., 2004b). In this breeding scheme, the companies share budget and facilities in the particular phase of breeding activities. The consequence of participation in the budget and facilities, they will get the exclusive right as the owner of new varieties achieved in the breeding program. Most of popular new varieties of chrysanthemum, rose, gladiolus and carnation released in the domestic market were resulted from the participatory breeding program.

Strengthening seed industry

So far, the floriculture seed industry in the country is not well developed. There is an indication that import seed has increases in the last five years. In order to avoid the dependence on imported seeds, the national seed industry of ornamental plants has to be strengthened through several activities, such as (1) rehabilitation of old tissue culture laboratories existed in every provincial agriculture services, (2) preparation of quality control and insurance system, (3) setting up guidelines of seed production of major ornamental plants, (4) developing mass propagation technology, and (5) improving distribution and marketing system (Hartmann et al., 1997). Recently, Seed Production Unit has been established in each Assessment Institute for Agricultural Technology (AIAT) in every province in the country. The institute has initially established in 1995, under coordination of Indonesian Center for Agricultural Technology Assessment and Development (ICATAD), Indonesian Agency for Agriculture Research and Development (IAARD), The Ministry of Agriculture (Subagyono, 2011). The Seed Production Unit mainly produces foundation seed (FS) and stock seed (SS) to provide seed producers in developing extension seeds for farmers. The term of "seed" covers not only true seeds but also other planting materials such as bulbs and stem cuttings and plantlet. This system has been developed in several provinces for chrysanthemum. The aim of strengthening floriculture seed industry is to provide good quality of planting materials of ornamental plants (IOCRI, 2012b).

Good agriculture practices principle

Corresponding with the increase of global issues related to save and environmentally friendly products, it is urgently required to consistently apply cultivation guidelines or standard operational procedure (SOP) based on Good Agriculture Practices (GAP) (Daughtrey and Bensar, 2005). Each ornamental crop management need specific SOP depends upon locally specific areas and product quality to meet market demands. There are at least four reasons why we have to apply the guidelines: (i) maintaining highly sustainable crop productivity, (ii) increasing farmer's income, (iii) holding out farmer's security during field operation, and (iv) maintaining consumer safety. The FAO issued indicators of success in applying the guideline, as follows: (i) sustainable balance of soil ecosystem which can be measured from number and kind of beneficial microorganisms i.e. predators, decomposers, rhizobium, and low or no soil erosion, (ii) balance of soil nutrient (amount of N/P/K inorganic, portion of N fixation and emission of Nitrogen), (iii) elimination of pesticide residues, (iv) increase of biodiversity, (v) increase of product value, (vi) no water pollution, and (vii) increase of livestock health. The guidelines have to be socialized continually before it is applied in the field (Warren, 2002).

Information technology

Development of floriculture industry has to be supported by prime information system. Recently, information system of horticultural products has gradually developed in the country, including for ornamental plants. Valuable information particularly market preferences and demands are generally disseminated among a group of business actors who have modern facilitation to access. Whereas, most farmers are not directly involved in business networking. In "Nucleus – Plasm" cultivation system, marketing of ornamental products is merely carried out by the company as the nucleus, whereas farmers were responsible for producing good quality produces needed by the nucleus (Ministry of Trade, 2012). Information technology of ornamental plants should be accessed fairly

by all business actors, even though much funding needed to prepare supporting infrastructures. In most cases the information system is necessary for several purposes, such as: (i) to support the national development planning of floriculture industry, (ii) to establish marketing strategy, (iii) to record production centre areas, (iv) to provide communication tool among the business actors, (v) to determine zonation of specification of crops, and (vi) to evaluate implementation of floriculture industry development.

Floriculture Research and Development Program

Government policies indicated that horticultural research and development in the future including ornamental plants should be projected not only to supply demand-driven products, but also demand-driving products and technology. Related to these concerns, IAARD has composed selected commodity setting priority based on the criteria of core governmental program, collaborative research project, commercial values of the crops and corporation, impact in agribusiness, human and natural resources capabilities, esthetics and Intellectual Property Right-orientation. Based on these criteria, lily and orchids, chrysanthemum, rose, carnation, anthurium, alpinia, costus, and philodendron have been selected as the major commodities of research and development, while the tropical ornamental plants have been prioritized for the trendsetter commodities.

A comprehensive program on these selected crops has been constructed through the following research and development project steps.

Exploration, collection, characterization, pre-evaluation, conservation and documentation of ornamental germplasm

This program covers the activities of gathering the targeted accessions, evaluation of the collected accessions, conservation, and documentation of important characters of accessions (Convention on Biological Diversity. Dutch NGO-Working Group, 1996). The targeted of collected accessions are wild types, land races, ecotypes and other potential forms that almost extinct and have specialty in characters needed for breeding program. The collected accessions are then, characterized agro-morphologically and molecularly and evaluated for the specific manner of related aspects. The collected data related to the characters and genetic potential are documented in database system that have been established "IOCGIS" (Indonesian Ornamental Crops Germplasm Information System) (Effendie and Kartikaningrum, 2005). To ensure the availability and the use of collected accessions in breeding program, the collected plants then are conserved via in vivo and in vitro techniques for medium and long term storage depended on the need and characteristics of the crops (Haryanto et al., 1998).

Genetic improvement through conventional and biotechnology breeding program

Since 1994, ICHORD-IAARD has developed marketable varieties of ornamental plants that have superior characteristics on the novelty flowers, unique, productive, resistance to important pests and diseases and adaptive to extreme environments. The program have been continued and developed by more intensive technique and method to other potential crops. The development of superior and candidate varieties are projected to genetic improvement of local landraces through conventional and biotechnology assessment i.e. inter-specific and generic hybridization, molecular bombardment, polyploidization, and other methods (Ahloowia and Maluszynski, 2001).

Improvement of building capacities for ornamental healthy seed production

The program composed of technical and managerial assessment to increase the institutional capacities on the production and distribution of healthy seeds from the released varieties. It has covered the improvement of human resources who are merely mandated to develop healthy quality seeds including free status against infection of systemic pathogens (Budiarto and Marwoto, 2007).

Technology modification for environmental and user friendly eco-farming

The program focused on the eco-physiological and biological aspects on the production process (Sanjaya et al., 1994). The program are oriented to the microclimate modification, the use of alternative local agro-input, nutrition analysis, PGR application, bio-pesticide and natural enemies for pest and disease control and other related aspects.

Ornamental commodity profile and market mapping

Research and identification on ornamental market related with agribusiness and agro industry aspects are conducted to gain accurate and detail information about commodity profile, level of technology in commercial production scale and dynamic of regional and international market. The information is needed for the evaluation of the progressed program and future policy orientation. Post harvest handling is also to accomodated in the research program that is

important to keep the quality flower product in the high perform (Murtiningsih et al., 2002; Prabawati et al.,2002).

Development of innovative model for ornamental agribusiness

This dissemination program focused on initiation of newly production area, involving area-based R&D institution, local government, and farmers. The implementation of this program involves AIATs, ICATAD as the major institution which plays important roles on technology dissemination in the province (Panduan Umum Pelaksanaan Program Penelitian dan Pengkajian Serta Informasi, 2004). The program started with the training of selected persons to become trainers, demonstration plots, and initiation of Farmers Corporation in selected areas. Market development for the product has also been initiated to establish the production area (IOCRI, 2012 a).

The improvement of institutional capacities and publicities

This program comprised of regular and structural activities related to the institution development and policy orientation. The program involves human resources development, professionalism and quality improvement, laboratory and administrative facilities, maintenance the optimal operational equipment, construction, network and soft and hard ware stuffs, improvement and maintenance of accreditation status of laboratories and public service, and other productive and procedural activities to obtain alternative financial resources.

Dissemination of research product and technology

This dissemination program enables ICHORD and AIATs, ICATAD, IAARD to take apart into direct activities on scientific forum and actively involved in agribusiness environment. The program comprised of the initiation of discussion forum for regional and international communication (seminar, homepage development, and other communicative media), exposes and public show, ornamental competition, and other public service activities.

Research Results

Under IAARD, ICHORD has played important and significant roles in national floriculture business development. Breeding program of chrysanthemum, roses, baby rose, gladiolus and carnation had been revealed as superior candidates and released as national varieties. These varieties have been successfully adopted and widely used in commercial growers in Indonesia up to this moment. Adaptive and applicable technology for low input production system with nite-break cyclical lightening for chrysanthemum has also been recommended for standard procedure in commercial production (Marwoto et al., 2004). The alternative soilless media, slow release fertilizers for ornamental production, dry product formulation, flowers preservation have also been formulated and commercialized (Louwaars, 1994).

Rapid detection methods for systemic diseases in selected ornamental crops have been developed to support the production of healthy planting materials, such as chrysanthemum, carnation, orchid and roses (Marwoto et al., 2004). Bio-pesticide formulated from *Gliocladium* and *Pseudomonas fluorescence* have been patented and licensed to a private company to take further distribution and commercialization.

To accelerate and fasten the research product dissemination, ICHORD has drawn several important steps, i.e., increasing research collaboration for commercialization with private sectors with the involvement of intellectual property right office, stabilizing the operation and maintenance of technology commercialization and seed production unit, intensive synchronization and cooperation with related institutions in selected ornamental research program, increasing the frequency of research products promotion and optimizing scientific discussion and collaboration of ornamental issues with national and international forum. Within IAARD, ICHORD has strongly cooperated with AIATs, ICATAD to accelerate technology dissemination at farmer levels (Peraturan Menteri Pertanian, No.301/Kpts/OT.104/7/2005).

Several important research collaborations with international agencies also gave significant impacts on the performance of IAARD. Started from the cooperation with APR-The Netherlands under the core program called BIOBREES, ICHORD-IAARD had established conventional and in-conventional breeding and production management of chrysanthemum, roses and gladiolus. Mutation breeding techniques on selected ornamental plants had also been developed under the collaborative program with IAEA. Considering the global warning of biodiversity and natural conservation, the institute had also taken into account important related issues and pioneered the collaborative work on tropical agriculture and germplasm management. Within the framework of HORTIN Program, ICHORD-IAARD had been established the standard of bio-safety in ornamental production under plastic house in the tropics and ornamental gene-bank management with PPO and CGN, The Netherlands (Sutater and Marwoto, 1999).

The execution of Law No. 22 and 25/1999 about decentralization and regional development has also contributed to the agricultural R&D orientation and management. The area-based R&D institutions have been supported to take wider legal determination and priority setting of their areas. Consequently, commodity-based R&D institutions including ICHORD, and also ICATAD-IAARD should have more elaborative and direct programs to the local governments which have potential agro-ecological resources for the pin point of floriculture development.

Instead of floriculture industries contribution to the national income, the existing constraints in production process and development are still need to be taken into consideration. The existing gaps between commercials and potential plant productivity inferred that the adoption of recommended technology and applicative and specific superimpose program are urgent to be developed for local resources improvement. The conversion of potential and productive areas to non-agricultural settlement is also become very serious problem especially in Java, while supported-infrastructure in other islands is still limited for hastening the floriculture development.

The huge genetic diversity of native and potential ornamentals are not yet optimally explored and developed, and subtropical crops are still dominating the floricultural products in Indonesia (Sanjaya, 2004a). To get high quality product in tropical regions, such crops actually need very costly expenses. Moreover, the global concern of bio-safety and natural conservation also has indicated that over-use of chemicals and other dangerous substances is no longer recommended. Consequently, innovative breakthrough of production technologies based on Good Agricultural Practices (GAP) and Standard Operational Procedure (SOP) with lower input consumption should be introduced and disseminated as far as these concerned to maintain the center of production area. The implementation of Total Quality Management (TQM) principle also becomes urgent mission to be done (Warren, 2002). Collective and cooperative network supported by feasible information technology system has been drawn to facilitate collaborative research and development activities. Concerning the tight competition in scientific and commercial service to the public, ICHORD-IAARD has pioneered the implementation of Good Laboratory Practices (GLP). The laboratory of DUS and systemic disease test for ornamental crops have been accredited based on ISO/IEC 17025: 2005, while other laboratories are still in the process of accreditation up to this moment.

Conclusions

1) Indonesia floriculture industry has grown relatively fast since the last five years giving significant impact to the national economic development. Those fast growing of the industry results in generating employment opportunity, raising farmer income, increasing the national foreign exchange and developing supporting industries.

2) As a mega-diversity country, Indonesia has genetic resources of ornamental plant species which are potential to be used as trend setter commodity. Development of the endemic tropical species for commercial purposes will generate new market preference in the international community.

3) Modern technology is one of the most important components to develop strong and competitive national floriculture industry. The modern technologies are required to improve plant genetic quality, strengthen seed industry, raise yield quality, plant productivity, increase production efficiency and ensure supply continuity.

4) Fulfilling user's demands, IAARD has prepared the modern technologies easily adopted by the farmers. The technologies include new superior varieties, plant in vitro and in vivo propagation, environment modification, soil fertilizers, pest and disease control, and the application of plant growth regulators. Before being introduced to the farmer, those technologies have to be accessed perfectly involving the stakeholders.

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"Not everything that counts can be counted, and not everything that can be counted, counts."

—Albert Einstein

Feature

Application of Quality Filter Mapping for Process Improvement : A Case Study in Foundry

GIRISH C. PUDE AND G. R. NAIK

The lean production movement (Womack and Jones, 1996) developed and presented the value stream mapping (VSM) tool (Rother and Shook, 1998) as a functional method aimed at reorganizing production systems with a lean vision. To date, many cases have been brought to light, mainly highlighting the success of the tool's application. However, nothing has been revealed empirically about the actual practical difficulties the practitioners have had to face, or the keys to obtain a maximum effectiveness from the tool. Quality Filter Mapping is a new Value Stream Mapping (VSM) tool specially designed to focus on the defects produced (internal as well as external supply chain) relating to the physical products. Current effects of wastes on processes are observed. In this article a case study in ABC foundry is carried out to find out the casting defects by identifying internal supply chain within the foundry. Current state map shows about 3.74 percent of total monthly defected castings after the final inspection. After the case study and defect analysis it is reduced to about 2.67 percent of total monthly defected castings after final inspection in future state map. So the analysis saved 1.06 percent of total monthly defected castings from defects at final inspection. Statistical charts are prepared for the identification of bottleneck product is presented.

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Castings with defects very often have to be scrapped. This is a major cost for the foundry, both in terms of productivity and, often, reputation. Defects that have slipped through inspection have the highest value as they may not be discovered until they reach the machining stage or, even worse, the end user. Systematic logging of defects may seem time consuming, but is a worthwhile exercise so that the most serious problem can be addressed as the priority. Many foundries spend inordinate amounts of time and money addressing minor issues while not focusing resources on the major defects. Good maintenance, raw material selection and careful metal handling are the three key criteria in defect control (Ecob C.M. *et al.*, p. 9). There are mainly three different types of defects—product, scrap and service (Hines and Rich, 1997, p. 54).

Product Defects

The first of these is the *product* defect. Product defects are defined as defects in goods produced that are not caught by in-line or end-of-line inspections and are therefore passed on to customers. These losses are physical and consume capacity for which no value is extracted. In a few cases companies found faulty products that were detected but still passed to customers (Hines Peter, Silvi Riccardo *et al.*, 2002, p. 41).

The other type of defects is called *validation escapes* and refers to product defects that are only detected by the end customer. The number, composition, and matter of warranty issues serve as a useful metric for serial engineering in this concern. The root causes are similar with those from engineering escapes. A very basic reason for both engineering and validation escapes are poor testing and verification.

Service Defects

The second type of quality defect is what may be termed the *service* defect. Service defects are problems given to a customer that are not directly related to the goods themselves, but rather are results of the accompanying level of service. The most important of these service defects are inappropriate delivery (late or early), together with incorrect paper work or documentation, incorrect packaging or labeling, incorrect quantity and incorrect invoicing (Hines Peter, Silvi Riccardo *et al.*, 2002, p. 41). In other words, such defects include any problems that customers experience which are not concerned with production faults.

Scrap Defects

The third type of defect is *internal scrap*. Internal scrap refers to defects produced in a company that have been caught by in-line or end-of-line inspection (Hines and Rich, 1997, p. 54). The in-line inspection methods vary and may consist of traditional product inspection, statistical process control or through poke-yoke devices.

The scrap defects are due to metallurgical problems. The Pareto chart is the most common tool used to pinpoint major causes of scrap in a foundry. Several approaches are being used in foundries to diagnose metallurgical casting defects. In most cases, a simple visual evaluation of the defect is conducted. Nevertheless, metallurgical casting defect analysis is also accomplished by chemical analysis, microscopic examination, destructive testing, and non-destructive testing. The logical classification of the origin of a casting defect presents great difficulty because of the wide range of interrelated molten metal and casting process contributing factors. In a broader classification, the metallurgical defects may be grouped under four generic origin sources: melting, moulding, pouring, and finishing. Casting defects are very often the result of these variables not being properly controlled (SEM—Invaluable and practical tool for casting defect analysis before a DOE, p.11).

While using Quality Filter Mapping, the following method is used.

Three different types of quality defects—product, scrap and service—occur in the supply chain.

a) Identify and separate out these three different types of defects.

b) Service defects are due to inappropriate delivery (late or early), together with incorrect paper work or documentation.

c) Find out the defect rate in Parts per Million (PPM) for each of the defects.

d) Identify the supply chain of the foundry which consists of distributor, assembler, first-tier supplier, second-tier supplier, third-tier supplier and raw material source.

e) Present the defects graphically where the x-axis represents various stages of the supply chain and the y-axis represents defect rate.

f) Map the three types of defects along the various stages of the value stream, using PPM or percentage scale. If appropriate, plot with the logarithmic scale (Hines, Silvi *et al.*, 2002, p. 42).

g) If the tool is being used inside a company, use individual departments or work areas instead of different companies. In that case, record product defects where they are passed on to an internal customer or the next department. Service defects would similarly refer to non-product defects passed on to internal customers. Scrap defects would simply refer to any scrap within each particular work area or department (Hines, Silvi *et al.*, 2002, p.42).

h) Graph will show where defects are occurring and hence identifies problems, inefficiencies and wasted effort.

Methodology Adopted for Quality Filter Mapping

Step 1: Identify the bottleneck product for case study

Slip Yoke 1180 from the product family is the bottleneck product corresponding to customer Spicer Jodali (Figure 1).

Step 2: Causes for bottleneck

2.1 The product selected for the study is Slip Yoke corresponding to customer Spicer Jodali as this product possess more pouring time up to 17 seconds which is greater than any product or product family on the production line. See Figure 1 showing the graph of customer versus average pouring time in seconds.

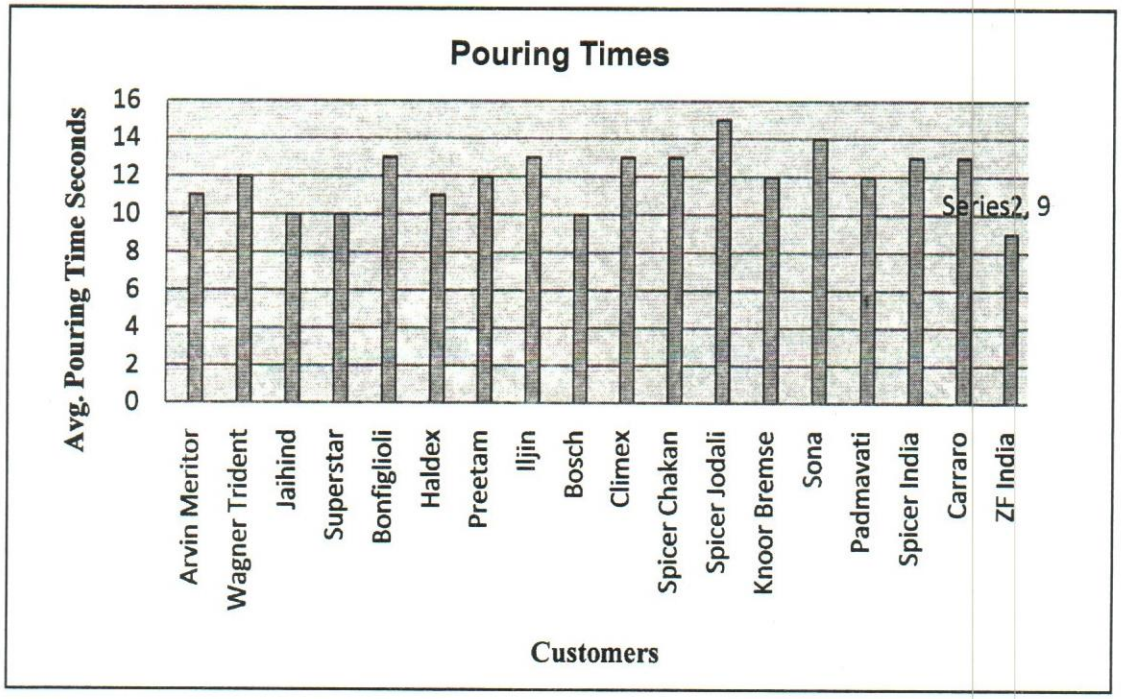

Figure 1: Bottleneck Product

Source: Marketing department of ABC foundry.

2.2 Further the number of cavities and mould cycle times for Slip Yoke are greater than any other product or product family on production line.

Step 3: Selection of the value stream mapping tool

3.1 The Value Stream Analysis Tool (VALSAT) is done to select the proper tool (Hines and Rich, 1997, p. 59).

Table 1: The Seven Value Stream Mapping Tools

WASTES/ STRUCTURE	MAPPING TOOLS						
	Process Activity Mapping	Supply Chain Response Matrix	Production Variety Funnel	Quality Filter Mapping	Demand Amplification Maping	Decision Point Analysis	Physical Structure (a) Volume (b) Value
Overproduction	L	M		L	M	M	
Time Waiting	H	H	L		M	M	
Transport	H						L
Inappropriate Processing	H		M	L		L	
Unnecessary Inventory	M	H	M		H	M	L
Unnecessary Motion	H	L					
Product Defects	L			H			
Overall Strucutre	L	L	M	L	H	M	L
Origin of Tool	Industrial Engineering	Time Compression/ Logistics	Operations Management	New Tool	System Dynamics	Efficient Consumer Response/ Logistics	New Tool

Notes: H = High correlation and usefulness
M = Medium correlation and usefulness
L = Low correlation and usefulness

Source: Goriwondo, Samson *et al.,* 2011, p. 237.

The value stream to be reviewed is first identified and through a series of preliminary interviews with managers the wastes are found out and ranked based on the weightage to a particular waste. The Value Stream analysis is done on the basis of correlation matrix of the seven wastes and appropriate tools are selected for the analysis.

According to VALSAT, three tools, namely, process activity mapping, quality filter mapping, and production variety funnel have shown greater effectiveness to reduce the waste in foundry. However, only quality filter mapping is considered for case study.

Step 4: Case details

The time study for all the foundry operations was carried out for 45 days by using a stopwatch as a recording technique. We have worked on casting defects for the *bottleneck product Slip Yoke 1180* for the month of June–July 2012 with the quality department. We found the defects at primary inspection, secondary inspection, and final inspection area which are presented in Table 2.

Table 2: Different types of casting defects

Type of Defect	Total	Percentage Rejection	PPM
Pin hole	5	0.15	1539.41
Blowhole	3	0.09	923.65
Shrinkage	47	1.45	14470.44
Sanddrop	4	0.12	1231.53
Slag inclusion	14	0.43	4310.34
Coldshut	11	0.34	3386.70
Core shift	0	0.00	0.00
Short pour	63	1.94	19396.55
Broken	0	0.00	0.00
Bad core	0	0.00	0.00
No core	8	0.25	2463.05
Extra metal	5	0.15	1539.41
Casting damage	3	0.09	923.65
Drill out	0	0.00	0.00
Extra fettling	1	0.03	307.88
Scab	0	0.00	0.00
Hardness prob	0	0.00	0.00
Bad microstructure	0	0.00	0.00
Bad mould	3	0.09	923.65
Destroyed testing	20	0.62	6157.64
Mismatch	0	0.00	0.00
M/c rej/ trial	0	0.00	0.00
Total defects	187	5.76	57573.89
Rej in tonnage	374		
Production	3248	0	

Step 5: Study of the manufacturing process flow

The ABC foundry production line is semi-automatic dedicated to flow the product. The process starts step by step from raw material along with component drawing, pattern design/pattern making and methoding, furnace, molten metal pouring into moulds, mould making, core making, sand preparation, knock out, collection of samples for hardness and microstructure testing, degating, shot blasting, fettling, rework, final inspection, and dispatch. The movement of material and information to produce final castings through various processes takes place from supplier to end customer.

Step 6: Identification of wastes

After the study of VALSAT analysis and waste assessment program, the seven wastes are found in percentages as

- overproduction and unnecessary motion shows 9.375 percent of waste,
- waiting and transport shows 15.625 percent of waste,
- inappropriate processing shows 18.75 percent,
- unnecessary inventory shows 6.25 percent and
- defects are 25 percent.

Step 7: Identification of Value Stream

The value stream is identified and it comprises of all the activities that are value added and non value added. Identification of value stream will give the detailed information about the product flow, wastes that occur within the value stream, step by step activities with cycle times, distances, etc. The process flow is studied and foundry downstream processes are focused for defects because scraps are observed at end-of-line inspection.

Step 8: Quality Filter Mapping

The ABC is a foundry industry capable of producing the castings from raw materials to finished goods through various production processes.

8.1 Product Defects:

Product defects are defined here as defects in goods produced that are not caught by in-line or end-of-line inspections and are therefore passed on to customers. In any kind of industry it is not practicable or possible to check out each and every incoming material from supplier; rather it is a tedious and time-consuming process. Therefore lot is accepted or rejected depending on the sampling method. In this foundry the acceptance sampling is done at the entrance of the company in a separate department. The accepted lot is carry forwarded by this department for processing. In order to find out product defects the supplier of the foundry needs to be considered.

8.2 Service Defects

Service defects are problems given to a customer that are not directly related to the goods themselves, but rather are results of the accompanying level of service. In practice these defects are not concerned with production faults. Such defects include any problems that customers experience; therefore, in order to find out service defects the customer of the foundry needs to be considered. It is also tedious or difficult to contact the customers of the foundry and to get their feedback about service defects related to castings for which they are investing.

8.3 Scrap Defects

The third type of defect is internal scrap. Internal scrap refers to defects produced in a company that has been caught by in-line or end-of-line inspection. Scrap defects are possible to detect internally which is the requirement in our study. Only scrap defects are presented at downstream processes.

8.4 Current State Map

In this foundry the sample is tested for its microstructure and hardness after the knock out, but it will hardly show any defects. Also this testing is not performed after each cycle. The sample testing at this workstation is done specially for microstructure and hardness testing. The defects are seen at end-of-line, i.e., after shot blasting (primary inspection), after fettling (secondary inspection), and at final inspection area. After primary inspection the defected castings are re-shot blasted (if necessary) and after secondary inspection it goes to final inspection area where dye penetrate testing and ultrasonic testing is carried out to find out internal defects, after that it is decided whether to dispatch or to rework the casting. This cycle repeats until defect-free castings are produced. Current state map generally shows that at the primary inspection the defects are 3.55 percent of total castings produced per month and secondary inspection gives 2 percent defective castings to that of total casting per month. Final inspection shows 0.21 percent defects to that of total castings produced per month.

The foundry needs to find out defects internally as defects are more 25 percent. Also supply chain study for foundry will not reveal the internal defects that are being analyzed. Therefore this tool is used inside a company using individual departments or work areas instead of

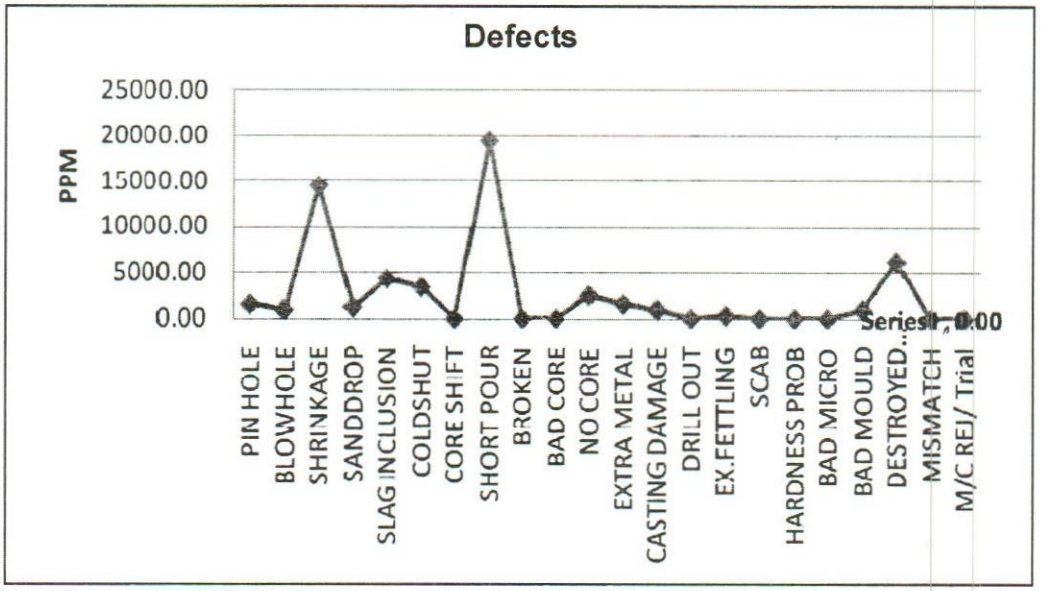

Figure 2: Various Casting Defects for the Month of June 2012

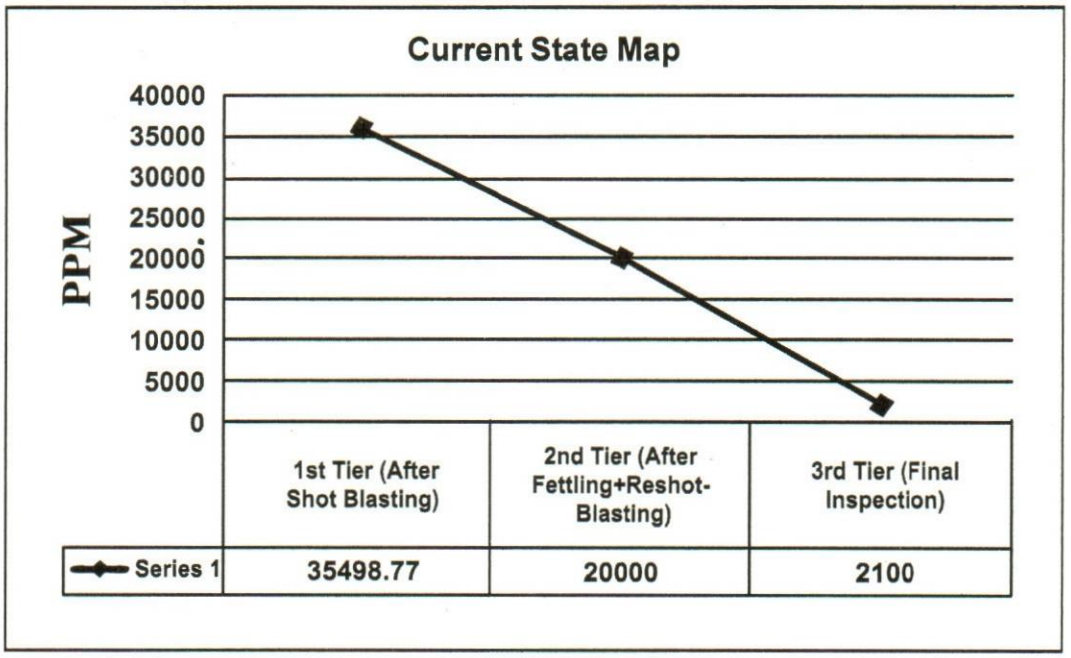

Figure 3: Internal Structure of Current State Quality Filter Map

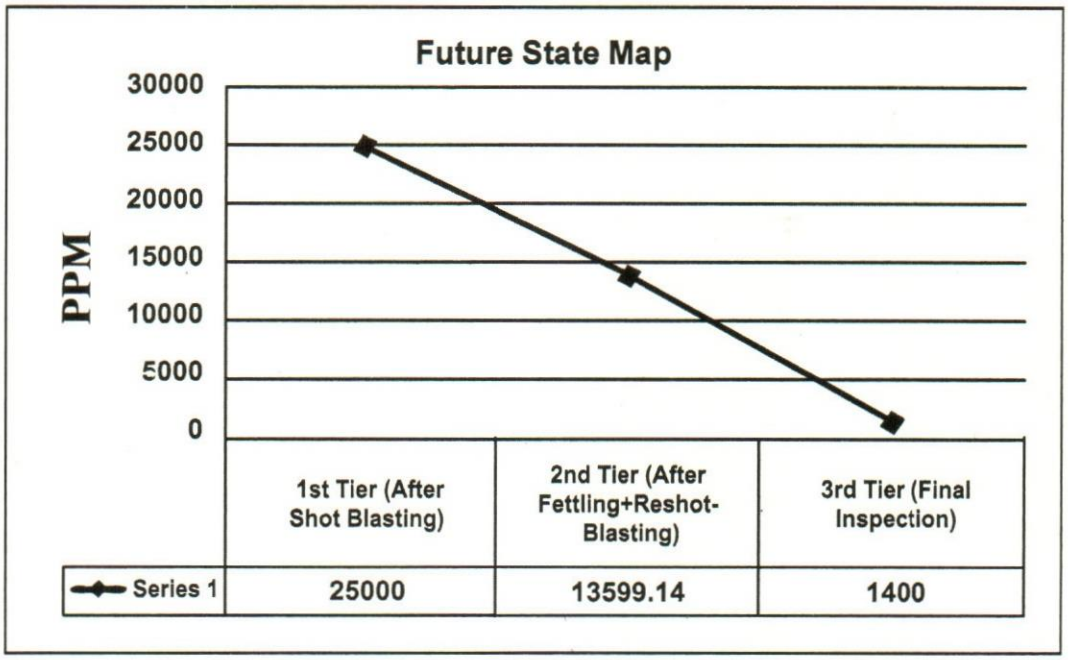

Figure 4: Future State Quality Filter Map

different companies. Scrap defects simply refer to any scrap within final three work areas, i.e., shot blasting, fettling, and final inspection. The various casting defects for *months June–July 2012* are plotted by considering the final inspection as shown in Figure 2 and after that current state quality filter map is plotted considering three different downstream work areas as shown in Figure 3. Future state map is considered in Figure 4. The following table shows the defects after working with quality department for the month. The data analyzed for current state quality filter map is shown in Table 3 and corresponding to that for the future state is shown in Table 4. Total production for the month of June 2012 is 3248.

8.5 Future State Map

After current state map, we focus on the four generic origin sources responsible for defects, namely, melting, moulding, pouring, and finishing.

Table 3: Data Analysis for Current State Quality Filter Map

Tiers of supplier	Internal processes	Inspection stages	Percentage of total production	Parts per million(PPM)
1st	After Shot Blasting	Primary	3.55 percent of 3248=115.30	35498.77
2nd	After Fettling + Reshot-Blasting	Secondary	2 percent of 3248= 64.96	20000
3rd	Final Inspection	Final	0.21 percent of 3248 =6.8208	2100

Table 4: Data Analysis for Future State Quality Filter Map

Tiers of supplier	Internal processes	Inspection stages	Percentage of total production	Parts per million(PPM)
1st	After Shot Blasting	Primary	2.5 percent of 3248=81.2	25000
2nd	After Fettling + Reshot-Blasting	Secondary	1.36 percent of 3248= 44.17	13599.14
3rd	Final Inspection	Final	0.14 percent of 3248 = 4.55	1400

Melting

Melting is done for the temperature of around 1586 °C (1400–1600 °C). During melting, the raw materials like R.R (Runner-Riser rejection), CRCA (Cold Rolled Cold Annealed), Carbon, Silicon, Magnesium, Manganese, Sulphur, Phosphorous, and Copper, etc., are mixed in furnace depending on the casting grades or customer requirement. After melting, the charge is poured into tandish flask specially designed for pouring the charge into moulds and controlling the rate of pouring. The stipulated melting time and in time pouring was previously not done properly and therefore microstructure gets changed as time of pouring changes. This may cause internal cracks within the castings so it is avoided by controlling the time and temperature parameters.

Moulding

High pressure moulding machine KOYO (Japan) is used which produces 300 moulds per hour. Green sand moulding with addition of Bentonite, coal dust, fresh sea sand, and water is used for preparation of mould. Core mask is used for mould also the ceramic filter is used for filtering the metal during the metal pouring.

Pouring

Pouring molten metal from the tandish flask to mould is controlled. Due to tandish tilting problem the pouring was not properly obtained which further causes the breakdown and delay for pouring and ultimately leads to uneven cooling for the castings which may cause the defect. Tandish problems are solved and now the pouring rate is controlled.

Finishing

For good surface finish phenyl and paint is layered on the surface of core so that surface finish obtained is of better quality. For this core baking is done. Anexine is added in the mould cavity during pouring to obtain the polished glow surface finish. Further the speed of rotating drum is adjusted to remove any burr or edges on the castings. After that shot blasting gives further surface finish to the castings and finally fettling operation reduces extra metal or edges and parting lines of the castings, giving the complete finished product.

After controlling these four parameters, the results showed reduced internal scrap. Future state map showed that at the primary inspection the defects are reduced to 2.5 percent of total castings produced per month and secondary inspection gives 1.36 percent defective castings to that of total casting per month. Final inspection showed 0.14 percent defects to that of total castings produced per month.

From the Quality Filter Mapping

This approach has clear advantages in identifying where defects are occurring and hence in identifying problems, inefficiencies, and wasted effort. This information is used for subsequent improvement activity as stated below.

I) From quality filter map we realized the sources of defects at the generic workstations.

II) Current state analysis showed that at 1st tier there are about 61.5 percent of total monthly defected castings, at 2nd tier it reduces to 34.76 percent of total monthly defected castings and after 3rd tier it shows 3.74 percent of total monthly defected castings.

III) It is obvious that before 1st tier, i.e., before shot-blasting during the knock out and prior to knockout during metal pouring into moulds there are more chances for defective castings.

IV) The metallurgical defects are more dependent on the generic origin sources: melting, moulding, pouring, and finishing. Also the casting defects are very often the result of these variables not being properly controlled.

V) After the analysis we observed the causes and workstations responsible for defects. We then focused on controlled the pouring rate, melting time, temperature and microstructure parameters to reduce the defects.

VI) After future state map 1st tier shows about 43.32 percent of monthly defected castings, at 2nd tier it reduces to 23.53 percent of monthly defected castings and after 3rd tier it gives 2.67 percent of total monthly defective castings. It means that about 60 castings/month are defect free after the analysis.

VII) Generally in current state map as well as in future state map the defects at final inspection stages are 3.5 percent of 6 (total defects).

VIII) After knock out the sample is tested for its microstructure and hardness, at this stage it hardly shows any internal defects.

IX) After controlling the above parameters the defect rate is reduced and minimum scraps are observed.

Conclusion

Value stream mapping tool can be used effectively in any kind of sectors as it is a world class manufacturing tool. The analyzed study is a case study in the foundry industry. The prime objective is to find out the possibility of casting defects produced at each stage of production process for waste reduction. In actual practice it is difficult to predict or analyze the defects at each foundry processes as the final inspection gives the clear picture of internal defects. But it is possible to reduce the chances of defects at the generic origin sources, i.e., at melting, moulding, pouring, finishing and by controlling the melting parameters like pouring time, temperature, etc. In this study bottleneck product is identified. Further, Value Stream Analysis Tool (VALSAT) is employed for identification of wastes in a process and to select Quality filter mapping as a VSM tool. The significance of each type of error was studied and waste identification is carried out. Process flow and value stream is identified. Then defect mapping for the month followed by current state quality filter map is presented. The key sources for internal scraps are identified and these are analyzed and improvement is carried out in these areas. After that future state quality filter map with findings are presented. Future state map revealed that about 700 castings per million are saved from defects. It is however to be noted that there is a significant cost to carry out any required changes but the increased throughput will pay back for investment.

This study is carried out on foundry production Line 1 (KOYO), which produces 98 percent of total castings in foundry, therefore study is focused on 1st production line. Value stream mapping tools can be effectively employed to reduce wastes and to improve the process.

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—Etienne Aigner

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