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# Profitability, Productivity and Sustainability through Innovative Extension Approaches among Tribal Farm Families of East Godavari District

K. SUMAN KALYANI, T.G.K. MURTHY AND C. CHANDRASEKHAR RAO

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*The effectiveness and efficiency of the agricultural extension system in India can be improved by motivating and mobilizing the rural and tribal folk towards sustainable productivity. It requires efficient and innovative approaches in order to organize and strengthen the farming community in an effective way for better participation, adoption and empowerment. A sample of 500 tribal families were selected on stratified random sampling procedure from four village panchayats and seven hamlets based on purposive random sampling method. A socio-economic survey was carried out by using PRA techniques to analyze the tribal scenario of East Godavari District. Major problems were identified and agro-based interventions were proposed suitable for the selected tribal area. After implementing an externally funded extension based DBT project for a period of three years (2009-12) and implementing the interventions in tribal area of East Godavari District, it was found that the selected innovative extension approaches were found to be more effective based on the farming situations. These are essentially needed to help the farmers to access information, innovate and strengthen their capacities and to solve the present agro-based problems in an effective way. Hence, it was found that suitable innovative extension strategies yield good results for bringing a desirable change in improving the livelihood of rural and tribal societies towards productivity and sustainability.*

## **Introduction and Objective:**

The present agricultural extension system in India can be empowered by strengthening the rural and tribal folk by mainstreaming them by technological revolution. The present departmental mode of organization and management public systems in agricultural research and extension need to be transformed into an innovation system framework. The extension approaches should aim at self training and group learning based on the real life situation. A substantial methodology is needed to upgrade technical, managerial and organizational skills of the human resource to prepare the human capital to respond to emerging challenges in the phase of increasing competition and specification. Extension approach should also change according to the developmental phases, strategies adopted and changing needs of the clientele. The main objective of the study is to ascertain suitable extension approaches for sustainable productivity of tribal and rural households. Various innovative extension approaches were suggested in the study which was found to be effective while implementing the interventions in an externally funded project implemented by CTRI. After identifying the agro related problems in the tribal area, a project is proposed based on the principle of technology dissemination process with bottom up approach. The project entitled 'Empowerment of Tribals of East Godavari District through Agro-ecological Conservation and Biotechnological Approaches' was duly approved by the Department of Biotechnology (DBT), New Delhi.

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## Method

A sample of 500 tribal families in general and 100 farmers in specific were selected on stratified random sampling procedure from tribal villages of Rampachodavaram and Maredumilli mandals, East Godavari district were selected based on purposive multistage random sampling method.

A core team of scientists identified the aforesaid villages in Rampachodavaram Mandal, East Godavari District considering the majority of marginal farmers, cultivating podu. The information about agro eco-system and socio-economic conditions in the villages are obtained through Participatory Rural Appraisal (PRA) techniques by a multi disciplinary team of scientists. Major problems were identified and agro-based interventions were proposed suitable for the selected tribal area. The PRA techniques such as trend analysis, seasonal analysis, venn diagram, matrix ranking, livelihood analysis and wealth ranking were used (Suman et al, 2010). There is vast difference between tribal and rural farm population. Identification of problems, interaction and recommendation of interventions has taken a long time because of primitive nature, extensive psychosocial barriers, ignorance, illiteracy and lack of technological awareness of the tribal poor. Low productivity in field crops, low economic net returns in crops, drudgery in agro-based activities. Non utilization of natural resources, low income from alternative sources of livelihood, poor health and nutritional status, occupational health hazards are other peculiar features found in the tribal population (Suman et al, 2010);

After implementing an externally funded extension based DBT project for a period of three years (2009-12) and implementing the interventions in tribal area of East Godavari District, it was found that the selected innovative extension approaches were found to be more appropriate as per the farming situations. Hence, it was found that suitable innovative extension strategies yield good results for bringing a desirable change in improving the livelihood of rural and tribal societies towards productivity and sustainability.

## Results and Discussion

Innovative extension approaches are essentially needed to help the farmers to access information, innovate and strengthen their capacities and to solve the present agro-based problems in an effective way. Some of the extension approaches viz., Area approach, Community Development Approach, Target Group Approach, Employment Approach, Integrated Development Approach, Single Line Approach, Participatory Approach were suggested by Baldeo Singh (2003). The following extension methods were followed

based on the available farming situation and presented below.

1. **Group Centered Approach (GCA):** The reforms in agricultural extension on the aspects of research extension linkages include promotion of direct interface between farmers and scientists to minimize transmission losses. The extension approaches not only focus at individual, but they should also meet the requirements of communities and groups by 'Field School Approach' and 'Farmers- Scientists - Traders interaction approaches' where there will be discussions among the extension stakeholders, farmers and scientists.

The proposed intervention strategies in the project helped in increasing the productivity of field crops. This was possible by introducing and intensifying the need based technologies through innovative approaches viz., 'field school approach', 'farmers-scientists-traders approach'. The field school approach was possible where the farmers were trained by seeing and believing. The stem borer control and 'T' mosquito control in cashew orchards (monocrotophos@0.05% at flushing stage, endosulphon@0.05% at flowering stage and carbaryl @0.1% at fruiting stage) was possible because the problems were identified and the remedial measures were proposed on the farm itself by training all the neighboring farmers together along with client (Suman et al, 2010). Rodents and leaf blight in paddy were also controlled with the help of these methods.

The farmers-scientists-traders interaction was successful while imparting income generation activities. Marketing of the forest products (adda leaf plates and herbal powders) was linked with Girijan Cooperative Corporation (GCC) and tourism department. Because of this interaction approached the marketing of the finished products by Self Help Groups (SHGs) was made easier. This has increased the self confidence level and reduced the social barriers of the tribal farmers and farm women.

2. **Capacity Building approach (CBA):** Capacity building and training of extension functionaries and para-professionals improves wide skills which include need assessment of farmers, group formation of target population, development of entrepreneurial skills, agri-business, marketing of agricultural products, post-harvest management, management of resources, use of mass media, communication skills, and market information systems etc.

The capacity building of grass root level workers viz., Village Administration Officers (VAOs), Non-government Organizations (NGOs), Auxillary Nursery Mid-wife (ANMs) Field Assistants, Gopala Mitras, Anganwadi Teachers and self-employed graduates were trained in the basic and fundamental courses viz., health and nutrition (hygiene, vitamins and minerals, first-aid, safe drinking water, environmental sanitation, communicable diseases), agricultural technologies (green manuring, soil health, advanced agricultural implements, high yield varieties, nutrient management, integrated pest management, value addition, milch animal management, poultry management (vaccination), horticulture management (grafting techniques) good agricultural practices, kitchen gardening (bed preparation, manure making). As the selected para-professionals have the advantage of fluency and flare to communicate in local language, they were readily accepted by the farming communities. The local grass root level extension functionaries after undergoing training programmes in-turn have created awareness among the target group viz., farmers and farm women. This has motivated the youth in gaining additional family income apart from the improvement of abilities. 'Master trainer approach', identifying and training the skillful persons and keeping them as master trainers to train the targeted group in villages has helped to solve many problems at grass root level.

3. Information and Communication technology approach (ICTA): Increased use of information technology in agricultural extension has been advocated for developing knowledge and skills among farming community. Access to information and improved communication is a crucial requirement when applied to rural and tribal areas can improve the communication, increase participation and disseminate the technological information. Promotion of T.V. channels, telephone services, video-conferencing, cell phones, digital cameras, call centre services, 'e-choupal' (tobacco farmers' portal, ITC-CTRI), internet facilities, CYBER extension (E-mail, FTP, Usenet News groups, Tel-Net, World Wide Web, Social Network) etc., for varied farming groups at various phases have shown success in achieving good impact in agricultural marketing sector.

The tribal farm families in our project were encouraged to see the annadata programmes in ETV2 Channel which has increased the knowledge, abilities and skills

of the farmers. A series of CDs and charts for the cultivated crops were developed presented to community halls where the information is displayed and was telecasted during the occasions. The farmers were taught to give telephone messages and encouraged to discuss their field problems on telephone with the state department officials, agricultural officers and scientists. They were also provided a monthly magazine (local language), annadata for their community hall for giving additional information. This has helped them to reduce their psycho-social barriers and increase the net returns by adoption the good agricultural practices.

4. Integrated Extension Approach (IEA): The extension system with the involvement of Government agencies, NGOs, farmers' organizations, farmers clubs, private sector agencies, para workers, etc is giving effective and dynamic results. Slight changes in the institutional and organizational set up of our extension system will yield better results. Services on aspects like marketing, credit insurance, infrastructure (including cold-chains), entrepreneurship etc., is possible only through integrated approach. The extension system has to be sent on a 'system management' mode, since the goal of extension has to make a shift from 'technology dissemination' to 'system management'. Many of the Govt. welfare programmes are planned independently by different departments and hence there is possibility of dilution. All the programmes should be planned in an integrated way so as to focus the welfare programme and targeted groups during particular period of time.

In our project, the welfare and development programmes and training programmes were carefully implemented and integrated with the other departments viz., Integrated Tribal Development Agency (ITDA) and state departments and KVKs to have a focus on the specific targeted groups. The programmes were linked with the horticulture programmes where the credit inputs (grafts and implements) were given by the Horticulture department, where as the technology was given by the scientists of projects for the cashew farmers. During poultry management programme of the project, the veterinary doctors of local line-department have provided vaccines, AI and the CTRI-KVK has provided training and fodder inputs. Exposure visits in collaboration with Krishi Vigyan Kendra (CTRI) and regional research stations (RARS, Maruteru, AP) has





helped the extension workers and farmers to develop their knowledge and capacities and increase the rapport with the scientists. Thus, the collaborative programmes were carefully planned in such a way that different target groups were covered by different programmes.

5. Agri-preneurship/Entrepreneurship/Empowerment Approach (AA/EA) : Farmers should be trained in developing entrepreneurship, capacity to take initiatives in new ventures; business acumen, marketing skills and competence to infuse primary processing activities (grading and labeling) so that the finished goods / product gets maximum price and profitability. Acquisition of skills by farmers through training and other programmes also form integral component for empowerment of farmers. Inter-active learning replaces transfer of technology as the principal function of the extension systems, which has helped in transferring many of the skills to the farmers. Seed village concept among farmers was popularized through which breeder seed was multiplied and sold to fellow farmers. The selected farmers were empowered in simple need based technologies, viz., seed treatment, green manuring, vermin composting, soil test based fertilizer application, IPM in cashew etc., for improving the knowledge, skills and abilities of the farmers (Suman et al, 2010).

If women are empowered, entire family gets the benefits of empowerment either economic or social. The main objective of the project is to bring desirable and qualitative changes in the living standard of the targeted group. Implementation of extension programmes by 'family centred approach', by keeping the family as basic unit of

the village was identified as the best method to teach certain skills (management of cattle). The family centered approach was fruitful while imparting cattle management and backyard poultry keeping. Special programmes for improving access to extension, training and knowledge to enhance abilities of rural and tribal women farmers are the important measures for livelihood security. This approach was found to be better when training was offered to the female counterparts along with the farmers as they are the bread winners and part and parcel of the tribal family system.

The tribal women were empowered through homestead units like value addition of minor forest produce, fruit and vegetable preservation. They were also provided technical and marketing assistance along with skill up gradation. This has enriched the family income of tribal farm families during lean period. The farm women of Thallapalem and Pedageddada villages were trained in certain agri-preneurial (entrepreneurial) activities viz., kitchen gardening, poultry and value addition to the minor forest produce during their lean (offseason) period. Through these activities, the skills of the tribal women were upgraded. This has helped the tribal families to enhance their family income (Suman et al, 2013). Adda leaf plate unit at Devarapalle village, Hill broom unit at Pedageddada are the better examples for this approach. The percent of success rate for extension approaches is depicted in Table 1.

### Conclusions and Recommendations

The present challenges in agriculture for optimum socio-economic growth have acquired a new dimension in the context of the current development scenario. The important agricultural challenges are:

**Table 1: Situation wise Success Rate of Extension Technologies**

The approaches given below cannot be compared mutually as each one of the approach is effective in its own way. The approaches can be selected and implemented depending on the psycho-social situation.

Sl. No.	Name of the approach	Success rate (%)	Situation	Targeted beneficiaries
1	Group Centred Approach(GCA)	75-85	On farm/ spread of pests and diseases	Tribal and rural farmers
2	Capacity Building Approach (CBA)	80-90	Regular crop season	Farmers/rural youth/farm women
3	Information and Communication Technology Approach (ICTA)	80-90	Questions unresolved	Farmers/rural youth/ farm women
4	Integrated Extension Approaches (IEA)	75-85	Multiple agencies working for similar goal	Tribal farmers/farm women
5	Agri-preneurship/Entrepreneurship/ Empowerment Approach (AA/EA)	85-95	Skill improvement	Rural youth/self help groups

- agricultural sustainability in the green revolution area
- harnessing production potential of rainfed area
- judicious use of land and water resources
- management of common property resources
- development of human resources
- emphasis on diversification
- emphasis on post-harvest technology

In order to meet the above challenges, the innovative mode of extension approaches viz., Group Centred Approach (GCA), Capacity Building Approach (CBA), Information & Communication Technology Approach (ICTA), Integrated Extension Approaches (IEA), and Agri-preneurship/ Entrepreneurship/Empowerment Approach (AA/EA) are essential. The extension system with the involvement of Government agencies, NGOs, farmers' organizations, private sector agencies, para-extension workers, etc., is going to be more effective and dynamic. The agricultural extension system will have to transform itself with the capacity building to meet the challenges arising in rural and tribal situations by utilizing the resources effectively. The transfer of technology system is likely to undergo radical reforms as the farmers need a wide range of services on aspects like marketing, credit insurance, infrastructure (including cold-chains), entrepreneurship, etc. It is possible only through changes in the institutional and organizational set up of our extension

system by adopting important extension strategies. Hence, it is concluded that the present innovative extension approaches that were followed in the project interventions has brought a desirable change in sustainable productivity and livelihood security among tribal societies. Thus the approaches used in the present project are highly useful in replicating the studies with similar primitive groups.

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*Innovation is taking two things that already exist and putting them together in a new way.*

— Tom Freston

# Innovation Management: A New Framework for Enabling Agricultural Innovation

V. RASHEED SULAIMAN, ANDY HALL AND T.S. VAMSIDHAR REDDY

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*This paper provides a framework to help analyze the sorts of innovation management tasks that are becoming important. This framework distinguishes three elements of innovation management: (i) Functions (ii) Actions (iii) and Tools. The paper's analysis of the innovation management in the Research Into Use (RIU) projects in South Asia suggests that it is not technology access-related tasks alone that are important, but the bundling of these with other activities, which include the development of networks, advocacy for policy change, training and other negotiated changes in practice and action. The implication for policy is that putting new knowledge into use requires projects, organizations and/or initiatives whose chief characteristic is not primarily as a conduit to technology but rather is one of being able to undertake a much wider range of innovation management tasks.*

## Introduction

Agriculture currently accounts for only 14 per cent of India's Gross Domestic Products (GDP). However, its importance in the economic, social and political fabric of the country is much larger than what is indicated by its economic importance. It is still the main source of livelihood for the majority of the rural population. The country registered 3.3 per cent growth in agriculture sector during the XI Five Year Plan, which is much higher than that achieved during the last two plan periods. Though these are definite signs off improved performance, Indian agriculture faces a number of formidable challenges.

The land and water resource base for an average farm holding has declined over the last few decades and this essentially means producing more food from less land and water resources. Indian agriculture is essentially small farm agriculture. More than 63 per cent of land holdings belong to marginal farmers with less than 1 ha. Increasing de-regulation of trade has forced Indian farmers to compete on quality and prices on several products not only in the export market, but also in domestic markets. However, quite often only the large farmers are able to integrate their production to suit the demand cycles and quality standards and small and marginal farmers are left out of these arrangements. Increasing private investment in agricultural research though has added to improved flow of new technologies, there are concerns on the higher costs of these technologies and, therefore, the restricted access and small farmers being by-passed. The country is also experiencing change in key climate variables, namely temperature, precipitation and humidity which has already started affecting its agriculture and farmers need support in applying adaptive measure to cope with these changes.

*The authors V. Rasheed Sulaiman, Andy Hall and T.S. Vamsidhar Reddy were part of the Central Research Team constituted by the Research Into Use (RIU) programme as Head of Asia Research, Head of the CRT and Research Fellow respectively.*

Addressing many of these complex issues requires solutions which are beyond the decision-making capacities of individual farmers. Collective decisions on resource use and marketing would necessitate forming new forms of collaboration and this is particularly important as this sector is dominated by small farms — often with weak bargaining powers and limited political voice. To be successful, farmers require a wider range of knowledge from different sources and support to integrate these different bits of knowledge in their production context. To deal with the new challenges, farmers currently need a wider range of support, including organizational, marketing, technological, financial and entrepreneurial.

Science and Technology will continue to be the main drivers for transformation of Indian Agriculture. There are wide gaps in yield potential and national average yields of most commodities are low. However the technological changes should now interface more closely with newer sources of growth, like institutional change, human capital, and innovations in the creation and application of new knowledge.

There is an increasing realization that research, education and extension are usually not sufficient to bring knowledge, technologies and services to farmers. Innovation requires a much more interactive, dynamic and ultimately flexible process in which the actors within the innovation system deal simultaneously with many conditions and complementary activities that go beyond the traditional domains of R&D and extension (World Bank, 2012). While there has been an increasing urge to enable agricultural innovation, ways of enabling this idea have not been well articulated mainly due to lack of empirical evidence.

This paper builds on the experiences of the Research Into Use (RIU) programme in South Asia that tried to up-scale promising new knowledge from agricultural research to wider use. The paper discusses the new understanding of innovation in the next section (Section II). It then discusses the details of the RIU programme in Section III. The key elements of the innovation management witnessed in this programme are discussed in Section IV. The implications of this for agricultural policy are discussed in Section V. Conclusions are discussed in Section VI.

### **Innovation and Innovation Systems**

In the old way of thinking, agricultural innovation was a task related to the production of ideas by research, the supply of these by extension to farmers, and then their

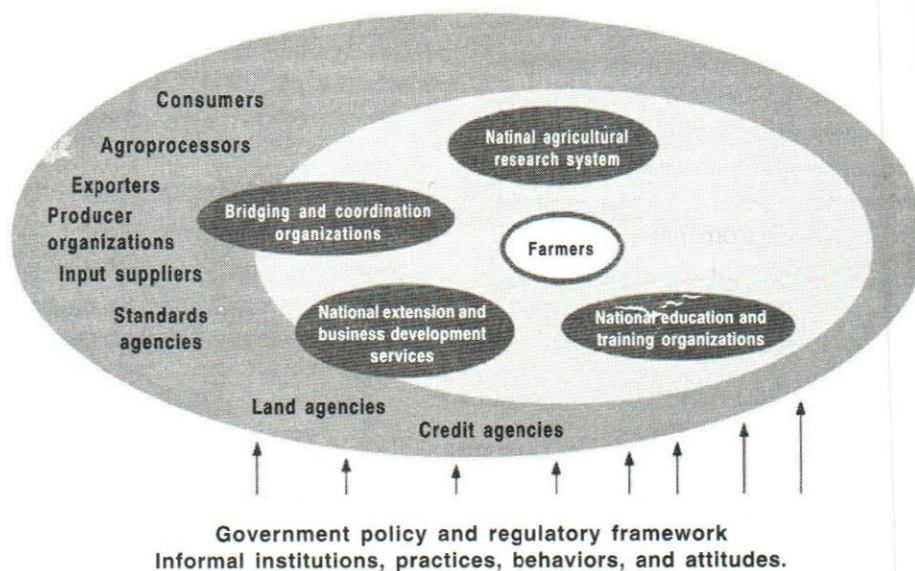
consequent use. Innovation was considered as new information or technology developed by research (Rogers, 1962). The role of extension in this earlier framing was about making sure that farmers were aware of new ideas developed by research. In other words, its role was to communicate innovation. Today, innovation is increasingly recognised as a process by which new knowledge is generated, diffused, adapted and used to effect social and economic change. This process requires interaction and knowledge flows among multiple actors (Hall *et al.*, 2004; Hall, 2009) in the Agricultural Innovation Systems (AIS).

Systems' thinking in agricultural innovation has evolved over the years, through approaches such as Agricultural Knowledge and Information Systems (AKIS) and it recognized the importance of connecting scientific knowledge to local knowledge. However, a weakness is that they often remained centred around research, education, extension and farmers, and do not always consider the importance of other actors in the wider system for application of new knowledge. The idea of the innovation systems highlighted the importance of a large number of other actors and effective interactions among them for innovation (Sulaiman and Hall, 2002; Rivera and Sulaiman, 2009).

An innovation system is defined as *networks of organizations, enterprise and individuals focused on bringing new products, new processes and new forms of organizations into social and economic use, together with the institutions and policies that affect their innovative behaviour and performance* (World Bank, 2006). Its attraction is that it recognizes that innovation is not a research-driven process simply relying on technology transfer. Rather, innovation is seen as a process of generating and accessing knowledge and putting it into use.

The AIS concept (Fig 1) is increasingly recognised as useful to identify interventions, design investments and organise complementary interventions that appear most likely to promote agricultural innovation and equitable growth (World Bank, 2012).

Communication can play a major role in supporting the three essential processes relevant to innovation. Extension agencies have traditionally used some of these communication strategies, including advisory communication, organising horizontal exchange in support of diffusion, persuasive mass media campaigns, awareness raising, training, information provision, etc. New evidence indicates that these classic strategies need to



Source: Adapted from Rivera, M.W., Alex, G., Hanson, J. and R. Birner, 2006. *Enabling Agriculture: The Evolution and Promise of Agricultural Knowledge Frameworks*. Paper Presented at the Conference of the Association for International Agricultural Education and Extension (AIAEE) in Clearwater Beach, Florida, May 14-18, 2006.

Figure 1. An Agricultural Innovation System

be accompanied by other communication strategies and services for innovation to take place (Leeuwis and Van Den Ban, 2004; Klerkx and Leeuwis, 2009). These include: *network-building, supporting social learning and dealing with dynamics of power and conflict* (Klerkx and Leeuwis, 2008).

These wider tasks are referred to under various names: some call it 'boundary work' (Kristjanson *et al.*, 2009); others refer to it as 'intermediation' (Howells, 2006; Klerkx and Leeuwis, 2008); more recently, the term 'innovation brokers' has been used (Klerkx and Leeuwis, 2009). It is important to stress that the old innovation-management tasks of providing access to technology are not superseded by these new tasks. Rather, these old tasks only have usefulness as part of a wider set of tasks that allow innovation to take place. The great value of the AIS concept for extension is that it allows the role and organisation of extension to be understood as part a wide canvas of actors, processes, institutions and policies that are critical for innovation (Sulaiman and Davis, 2012).

For the question of how to put new knowledge into use for innovation, understanding what these wider sets of tasks are, how they should be operationalized and by whom becomes critical. The RIU project implemented in Asia during 2008-2011 provides several insights on how to do this.

### I. Research into use (RIU) Programme

Commissioned by the UK Department for International Development (DFID) in 2006, the RIU programme had two purposes. First, to get the best research results from past DFID-supported research into widespread use in Africa and South Asia. Second, to draw lessons on the process of putting research into use; in other words, to tease out when and under what circumstances and settings a range of different approaches become more or less useful in making the best use of agricultural research as a policy instrument for development.

The programme emphasised the use of an 'innovation systems' approach in its call for proposals. This was primarily understood in the programme as an approach that gave importance to partnerships and networking among a wide range of actors for horizontal and vertical scaling up and use of research results. The programme received 123 concept notes and finally selected 13 projects. These were referred to as the Asia Innovation Challenge Fund (ICF) projects. Started in July 2008, these were modest-scale projects building on earlier research by members of project teams with the logic that a final 'into use' phase would address the impact-at-scale objective of RIU. The researchers were part of the Central Research Team that was constituted during the project.

**Table 1: Research Products Put into Use in the RIU South Asia Projects**

Type of Research Products Intended to be Put into Use	Approaches/Activities Envisaged
<i>I. Technology</i>	
Improved seeds of rice and legumes developed through participatory crop improvement (PCI)	Subsidised mass production and distribution of seed and its promotion through NGOs and community seed producers, subsequently establishing seed companies under NGOs
GIFT (genetically improved fish tilapia) and production of fish fingerlings in rice fields	Establishing a new value chain and linking actors in this chain
Ecologically based rodent management	Training of communities by local NGOs and encouraging companies to manufacture rat traps
Technologies for coastal fisheries (crab-fattening, mollusc culture, seaweed culture, improved fish icing, improved fish drying)	Training of and establishing enterprise groups by NGOs will connect fishing communities to markets and facilitate technology adoption
Production and processing technologies in under-utilised crops	Establishing new value chains through organising crop fairs and establishing germplasm orchards and food-processing parks at the community level
Multi product silvicultural practices, improved harvesting techniques of medicinal plants	Training communities on harvesting and value addition, and linking them to market intermediaries and manufacturers of herbal products
<i>II. Process / approach</i>	
Participatory action-plan development; adaptive co management and learning approach, joint reflections	Training community based organisations and brokering their links with technical, legal and policy expertise
Improved and democratic governance in community forest-user groups	Training community forest-user groups for local-level institutional development and using this evidence to influence macro policy
Integrated delivery of services, mainly micro credit and improved access to inputs and technical advice	Institutional development at the community level and brokering linkages to financial services and input agencies to create a demand pull for drawing new technical knowledge
Participatory market-chain analysis	Linking the existing actors in the value chain

Based on a review, two projects were dropped in 2009, reducing the project portfolio to 11. Table 1 provides the details of the research results that were put to use in the RIU in Asia.

At the time that the projects were conceived, the narrative of the programme was about putting research findings into wider use. So, despite programme rhetoric about systems of innovation 'approaches', projects found it necessary to present themselves as having rather archaic technology-transfer logic. However, the projects had deployed many sophisticated innovation-management strategies that included, but went beyond, partnership. Some of this involved brokering and maintaining partnerships and relationships – not just in operational field domains, but also in policy and institutional domains. Some of the projects clearly knew many of these innovation-management tasks from earlier experience, while others had to learn them along the way.

## II. Innovation Management

The analysis of the RIU project portfolio in Asia revealed the wide range of functions, activities and tools that are critical for enabling innovation, which is collectively referred to as 'innovation management tasks'. These are summarised in Table 2.

it is also notable that projects do not just deploy one function or one action but cluster these. The following points seem to be important:

### *Functions*

#### *Networking and partnership building*

Without exception projects have performed this function, but there have been a number of different variants. Most projects have built partnerships to implement the project. But as the projects progressed they had to build new partners to manage the innovation process. For example,

**Table 2: Innovation Management Tasks Observed in the RIU Asia Projects**

Functions	Actions	Tools
Networking and partnership-building Setting up / strengthening user groups Training Advocacy for institutional and policy change Enhance access to technology, expertise, markets, credit and inputs Reflective learning	Convening Brokering Facilitating Coaching Advocating  Information dissemination	Grain cash seed bank Community based seed producer groups Community based user groups Producer companies NGO led private companies  Market-chain analysis Market planning committees Community germplasm orchards Village crop fairs Food-processing parks Use of lead entrepreneurs

the projects dealing with value chain development had to broker relationships among a variety of market agents, input dealers and producers. The projects dealing with promoting seeds developed through Participatory Crop Improvement had to network with seed growers, local agro-vets (agro-input sellers), millers and radio stations.

*Setting up/Strengthening user groups*

Setting up user groups and building their capacity is another common function undertaken by all these projects. Community-based seed producer (CBSPs) groups in Participatory Crop Improvement; community-based organizations (CBOs) and community forest user groups (CFUGs) in Natural Resource Management; self-help groups for micro-finance, occupational groups for commercial production of marine products are all such examples, where the projects either had to form or work with existing user groups to manage innovation.

*Training*

Training user groups and other actors in the wider implementation network is another important function these projects have had to undertake. Topics covered included quality seed production, brood fish management, fingerling production, rodent management, democratic governance of forests, enterprise development, business skills, account keeping, etc. In other words it was both technical training associated with a particular technology-based innovation as well as training in wider aspects of organizational and institutional development.

*Advocacy for institutional and policy change*

As policy plays an important role in the wider uptake of knowledge, all the projects are either collaborating with policy-relevant partners or are looking for opportunities to

engage with policy actors at the national level. While promoting Participatory Crop Improvement, the projects in Nepal had to engage with the Nepal Agricultural Research Council and the National Seed Board to bring about changes in policies related to varietal release and seed laws. This was essential in order to get the NGOs official recognition for their role in plant breeding and release of varieties as well as their promotion of good practices, including the promotion of community-based seed producers in government seed self-sufficiency programmes.

The Integrated Floodplain Management project in Bangladesh had to engage with policies related to lease of water bodies and needed support to deal with legal challenges. The project is working closely with the Society for Water Resources Management (SWRM) — a federation of water management community-based organisations — to influence policies. Community-based forestry enterprises can succeed in Nepal only if the forestry department's excessive bureaucratic controls could be relaxed; thus, the Federation of Community Forest Users, Nepal (FECOFUN) is an important partner in the community forestry project in that country. Both Bangladesh Environment Lawyers Association (BELA) and the Nepal's Forest Action have extensive experience in working for policy change and are part of several policy-level consultations.

*Enhance access to technology, expertise, markets, credits and inputs*

Rural communities need access to a wider set of support and other services to apply the new knowledge being promoted. Projects, therefore, had to enhance access to technology, expertise, markets, credit and inputs. For

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instance, the microfinance project in Bihar began its activities by forming self-help groups before lending to them, and then linking the communities to sources of inputs, technology, sources of larger credit and technical training on crop production and small enterprise development. The project on promoting aquaculture technologies in Bangladesh set up two crab hatcheries to support enterprise groups on crab fattening enterprises promoted *under the project*. It also had to link the groups to market agents (retailers and exporters) in the fish value chain. The project on promoting community value addition initiatives in under-utilised crops in India had to search for small-scale technologies for processing millet in India to support the communities it was working with.

#### *Reflective learning*

Reflective learning is an important function in most of the projects and this is evident from the wide range of consultation-based activities undertaken. These include reviews, reflections, experience sharing workshops, negotiations among different groups, study visits, setting up resource centres, etc. This is more evident in the natural resource management cases, where workshops to reflect on past progress and decide on future course of action are held regularly.

#### **Actions**

A wide range of actions had to be taken to manage innovation and this is more or less common across all projects.

#### *Convening*

As innovation management requires performing several functions and coordinating a wide range of partners, convening meetings, platforms, consultations, and discussions among the implementation and operational teams is an essential action that needs to be undertaken by project teams. While the lead partner has been doing this activity at the implementation level, other partners have been performing this activity at the field level with other implementation partners. Who performs this action is essentially decided based on the nature as well as location of the task at hand. For instance, in the value chain project in Nepal, while the lead partner IDE (International Development Enterprise) convened project meetings and interfaced with policy (the Department of Agriculture, the National Agricultural Research Council, donors, etc.) the Marketing and Planning Committee convened other kinds of training and linking activities at the community-managed collection centre-level.

#### *Brokering*

Innovation management essentially depends on creating many-to-many relationships among the wide range of actors. This action, which involves developing, maintaining and strengthening these relationships, is increasingly considered an important feature of innovation management. The brokering in the RIU projects was found to be implemented by different organizations at different levels, depending on tasks at hand and expertise. Some organizations involved have a long history of brokering. For instance, IDE is considered an important market development broker and under RIU in Nepal and Bangladesh it has been brokering relationships among the actors in the horticulture and freshwater fisheries value chain respectively. Forest Action in Nepal is a policy broker and a well-recognised think tank on forest policy management and under the RIU project it has been brokering relationships with the federation of community forest user groups and the state forest department.

#### *Facilitating*

This is a more operational task, where the lead partner needs to ensure different sets of activities take place. For instance, the network of NGOs associated with the Integrated Floodplain Management project in Bangladesh facilitated discussions of community-based organization members around the issue of Participatory Action Plan Development. The Centre for Promoting Sustainable Livelihoods (CPSL), the specialist micro-finance NGO in the state of Bihar in India, facilitated poor women to link with sources of technical expertise related to agriculture and small household-level enterprise development. Similarly, Forward and Li-bird, the two NGOs in Nepal, facilitated the community-based seed producers to access public funding from government sources to strengthen infrastructure.

#### *Coaching*

This action is closely related to building capacities of user groups and other partner organizations through 'hand-holding' so that they can better articulate their needs, perceptions and views to others. This involves some training, but is something more than that. For instance, in the community forest management project in Nepal, formation of hamlet-level committees and thematic committees have helped rural communities to understand clearly the roles and functions of community forest user groups and how to manage them. Similarly, Forward and Li-bird have been coaching community-based seed



producers (CBSPs) on improving their business skills. It is this kind of coaching that has allowed the CBSPs to partner with the new seed companies being put in place by the project. The value chain project on promoting decentralized fish seed production in Bangladesh is coaching actors in the value chain on managing produce in a way that will allow them to sustain and expand this enterprise.

#### *Advocating*

Advocating for changes in policies and institutions is a critical activity for successful innovation management. Inviting policy-relevant staff from government agencies in project deliberations held at district and national levels is a commonly-used activity across various projects. Organizations such as BELA and Forest Action are members of committees and policy working groups formed by the governments in Bangladesh and Nepal, respectively. This allowed them to present evidence from RIU projects to advocate for relevant changes in policy. Another strategy employed is to work with federations of user groups, which are relatively more powerful in a democratic set-up. Partnering with FECOFUN (the Federation of Community Forest User Groups) and SWRM (a federation of CBOs) allowed the Natural Resource Management projects under RIU to engage better with policy relevant actors.

#### *Information Dissemination*

Although this is a traditional activity, it has an important role in innovation management. What is interesting here is the power of this activity when performed in relation to the other sets of activities mentioned above. The Participatory Crop Improvement projects in Nepal used FM radios, which are very popular in rural Nepal, to disseminate information on the availability and significance of seeds produced by the community-based seed organizations. The rat management project in Bangladesh has been promoting improved rat management practices on national television. The community forest management project in Nepal has invested resources in community radio stations in Nepal to sensitize listeners to new ways of governing community-managed forests.

#### *Negotiating*

This activity involves the process of reaching a satisfactory compromise or agreement between individuals or groups. For instance, conflicts between farmers and fishermen over dry season water are a common feature in the floodplains of Bangladesh. Through a series of workshops the project on Integrated Floodplain Management reached a

consensus between two parties, ultimately using technological and institutional options to maximize floodplain productivity. Hamlet-level and thematic committees formed by Nepal's community forest management project negotiate over rights of marginalized and poor people at forest user group meetings.

#### *Mediating*

This is a form of conflict resolution in which the mediator tries to improve dialogue between disputants to help parties reach an agreement. For instance, in the floodplain management project in Bangladesh community-based organizations are often at odds with rural elites over issues of leasing and using water bodies. The BELA advises and supports CBOs but also mediates between the CBOs and the rural elites toward reaching some sort of resolution outside the courts.

#### *Tools*

Tools are the formats or operational mechanisms used in projects to manage innovation — innovation platforms being the most commonly-cited, albeit less tangible option. The grain cash seed bank is another tool or a mechanism adopted at the community-level to help resolve the issue of seed availability. Community-based seed producer groups, producer companies and other organizational forms such as NGO-led private commercial seed production companies are all formats that allow bringing together different actors and complementary knowledge needed for managing innovation. Participatory Market Chain Analysis is a tool used to strengthen the value chain in the IDE-led project in Nepal. To implement this approach, other forms of platforms had to be created, including thematic committees, marketing and planning committees, etc. Community-based germplasm orchards and food processing parks are other tools used in the value chain projects. Community resource centres are used as tools for knowledge sharing and dissemination in the Natural Resource Management projects. Advisory/steering committees are tools to enhance visibility of the interventions to policy-makers.

### **III. Implications**

What quickly become apparent when one looks at the detail of RIU projects is that the way innovation is managed is a highly iterative process. Three aspects which are very relevant for policy clearly stand out:

Firstly, the review of the Asia projects does not only reveal the diversity of innovation management tasks that are being performed, but it also stresses the bundling

together of these. While facilitating access to technology is important in putting research into use, this as one of a range of innovation management tasks only has value when it is bundled together with other supportive tasks (access to markets, convening consortia, etc). This has a very important implication for policy. It means that putting new knowledge into use requires projects, organizations and/or initiatives whose chief characteristic is not primarily as a conduit to technology but rather is one of being able to undertake a much wider range of innovation management tasks.

Secondly, if one takes a more historical look at the RIU projects and the way they are managing innovation, it is clear that the distinctions between research and extension have been blurring in practice. While researchers led many of the previous initiatives that focused on generation of new technologies and approaches, they played a secondary or supporting role in most of the RIU projects. Putting new knowledge into use is not a post-research, information dissemination task per se. Moreover, innovation often needs further research support, sometimes as a source of expertise, sometimes to adapt existing techniques and sometimes to solve a new problem or learn how to do something new.

Thirdly, intermediary organizations — and these are often civil society organizations adopting enterprise-like principles who may not necessarily have a technical stake in the innovation process they are managing, can play a major role in managing innovation. This is because innovation management requires a different and broader set of expertise which is not normally available in research and extension organizations. And, indeed, as this paper has showed a range of organizational types can perform innovation management tasks. There are still empirical questions about whether, under some circumstances and for specific objectives such as social equity, some types of organizations are more suited to performing this task in rural development domains than others.

#### IV. CONCLUSIONS

Innovation is not a linear process of science developing new knowledge and transferring it on to extension for wider dissemination. It involves a wide range of functions, activities, and tools (performed by several agencies that work through platforms, alliances, or partnerships) that are collectively referred to as innovation management. Traditional interventions such as support to research, extension, and education and creation of links among

research, extension, and farmers are not sufficient to bring about innovation. While facilitating access to technology is important in putting research into use, it has value only when it is bundled together with other innovation management tasks such as development of networks, organizing producers, communicating research needs, mediating conflicts, facilitating access to credit, inputs and output services, convening innovation platforms, advocacy for policy change, and other negotiated changes in practice and action. The focus of capacity development in agriculture should therefore shift from strengthening technical expertise to developing innovation management expertise.

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*If we boost productivity, we can improve economic growth.*

*— Tony Abbott*

# Excellence through Innovations in Public Enterprises

V.N. SRIVASTAVA

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*Public enterprises, which were once the pride of the nation, are above 300 in number. Majority of them have been loss making and average performing enterprises. Very few, who later came to be known as Navaratnas and Maharatnas, have been performing well. All tried to achieve excellence. However, only some could achieve. Some are still striving to achieve excellence. While it is true, there have been inherent constraints in both creation and management of public enterprises, nevertheless, some form of constraint or the other are there in all enterprises. Enterprises do and necessarily have to operate in constraints. The challenge lies in achieving excellence amidst constraints which have to be managed and can not be removed. This paper deals with the various issues of excellence and finally bring out how innovations help achieve excellence. It starts with a review of studies on Excellence in Public Enterprises in India and also internationally, various underlying theories and models for studies in public enterprises, various studies on excellence in public enterprises in India, public sectors pursuit of excellence and some innovations that make a difference. It finally concludes, all public enterprises can excel, be whatever the constraints.*

## Introduction

Public enterprises have been striving to achieve excellence ever since the beginning of their inception. There have been inherent constraints in both creation and management of public enterprises and there has been mixed growth in the initial years till mid-1980s in India. There have been instances of very good public enterprises turning low performing, low and poor performing turning around and there have been also stories of forced closures such as them being referred to Bureau for Industrial Reconstruction (BFIR). The 1970s saw a heavy emphasis on nationalization wherein a large number of banks, mines were nationalized and we have today a number of public sector banks and a number of leading enterprises such as Coal India Ltd (CIL) and others. With announcements of liberalization and globalization in the 1990s there has been structural adjustments and a trend towards privatization of public enterprises. This is not to contradict or criticise the various political decisions with respect to the fate of public enterprises but to think of road maps for organizational excellence of public enterprises. The very fact that the Government also even today thinks of mobilizing resources to the extent of even 40000 crores by disinvestment of public enterprises go to sufficiently explain that public enterprises still have tremendous capacities and potentials who can stand firmly in times of national financial requirements. A number of studies on organizational excellence have been undertaken in the public and private sectors, both in India and abroad.

## Studies on Excellence in Public Enterprises in India

In India, this has been the subject of interest in leading institutes of management viz., the Indian Institute of Management (IIM) at Ahmedabad, Kolkata, Bangalore and Lucknow; Indian Institute of Public Administration (IIPA),

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All India Management Association (AIMA), etc. There is also a growing interest in organizations to initiate measures for achieving excellence, and become world class (Collins, 2001). Research interest on various aspects and at all levels of organizational excellence in India have been on the increase. It caught the attention of researchers and organizations in India after the pioneering work of Peters and Waterman (1982) titled "In Search for Excellence". There is, however, evidence of work in Indian literature on organizational excellence as early as 1980 and 1982. Ganesh (1980) studied six academic institutions teaching management in India and suggested essential processes needed for institutionalizing excellence in organizations. Paul (1982) studied six development programmes in developing countries and indicated management aspects essential to make a developmental impact on the lives of millions of poor people.

Khandwalla (1992a), pointed out that the individual and group level excellence required to be synchronized to achieve organizational excellence and identified six forms of organizational excellence such as competitive, rejuvenatory, institutional, creative, missionary and versatile. The dimensions studied by him related to the mission, vision of excellence and core values of the organization; styles of management; strategic management; structures and systems; and the organizational renewal processes.

According to Shukla (1997), knowledge base requires to be thoroughly updated about emerging technologies, new trade relations, emerging markets, mergers, acquisitions, etc. to evolve a core corporate strategy. In the same context, Bhandarker (2003) discussed some of the new HR practices such as competency mapping, adopting better and newer ways of talent management, 360 degree feedback, etc. for achieving corporate transformation. In the public sector, controlling increasing attrition rates has become a serious issue in the recent past and employee engagement has emerged as an important process that could sustain the achieved excellence. These organizations are also working to identify new HRD roles to achieve corporate transformations.

Ahmad and Chopra (2004) in a path-breaking research study on "Passion to Win", have evolved models of how winning companies develop and sustain the competitive edge. The work again, though an extension of Peters and Waterman's work on the search for excellence, is not just another study on the search for excellence, but is about the search for sustainability of excellence in the

Indian context. Two-thirds of the 43 companies that were chosen and described as models of excellence in Peters and Waterman's study become non-excellent organizations within five years of the publication of this study; most of the organizations faced crisis and disappeared. The major question was of studying the sustainability and not only of discovering the secret of excellence. Ahmad and Chopra's study reflects on some important essential issues as to how business organizations can become outstanding organized by achieving superior performance and competitive ability relative to others, sustain these over a long period of time, and become globally competitive organizations. They have come up with five clusters in a pattern of overlapping circles that led to the 5-I framework of key elements that distinguish outstanding organizations with "**sustainable competitive edge**" such as "Inspiring Leadership", "Innovative Strategy", "Implementation Skills and Process-driven Execution", "Internal and External 'Win-Win' Relationships" and "Identity-Purpose, Values and Culture". Ganesh (2007) developed a 6-S framework in terms of vital, essential and desirable actions of essential dimensions—"survival, stability, strength, success, superiority and sustainability". The Confederation of Indian Industry's (CII) recent initiative has also laid high emphasis in terms of "corporate sustainability" by strengthening "Environmental Management Systems".

A commonality exists in how various researchers have explained what organizational excellence is. Peters and Waterman's definition of excellence basically extends to those organizations with excellent track of continuous and sustained high corporate performance over a fairly long stretch of time. Ganesh (2007) calls excellence as "knowing your limits and going beyond them". Research indicates that there are some basic key attributes that contribute to organizational excellence. Several studies have been carried out to study these attributes, their form and the manner in which they promote organizational excellence. A review of a number of studies on excellence relate to various key attributes of organizational excellence.

### **Studies on Excellence Internationally**

Peters and Waterman's work on excellence focused on strengthening the internal dynamism of organizations based on the McKinsey's 7S model for achieving excellence—Structure, Staff, Skills, Styles, Strategies, Systems, and Shared values. Their work on excellent companies—in which they studied both high and low

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performing organizations—identified eight important attributes for achieving excellence: bias for action, closeness to customers, autonomy and entrepreneurship, productivity through people, hands on value driven, sticking to the knitting, simple form and lean staff, and simultaneous loose tight properties. The work sent waves of further research in the area, both nationally and internationally. Some of these attributes themselves became subjects of applied/action research. Bruch and Ghoshal (2004), in a further extension of this work and as a part of their 10-year study of managerial behaviour in different industries from banking to software to airlines to consulting, concluded that only 10 per cent of managers work purposefully to get important work done. The other 90 per cent squander their potential by procrastinating, detaching from their work or spinning their wheels in a flurry of “active nonaction”. According to them, the most effective managers succeed not because they possess unique characteristics or excel at motivating others, but because they harness personal willpower through a potent combination of energy and focus, making them excel.

According to Hickman and Silva (1984), excellence can be created through a rational and visionary blend of strategic planning and corporate culture building. They identified six essential leadership skills—vision, sensitivity, insight, versatility, focus and patience—for creating excellence. According to them, an enterprise which performs really well and are successful, create models of excellence.

In a study of the United Kingdom’s top 20 companies, Goldsmith and Clutterbuck (1985) focused on specific characteristics and found them to be possessing a natural curiosity for growth, having long term international perspectives, market orientation, attention to employee communication, a sense of ownership, ability to get back to fundamentals, innovation, team concept, clear leadership and direction, clear and demanding objective setting, and clear corporate mission. In 1997, Goldsmith and Clutterbuck studied how the world’s most successful companies stayed on top during turbulent times. According to them, companies aspiring to high performance should (in theory at least) be able to develop their own instinctive right balances and then manage the inevitable adjustments that these will need. Ten main demands and pressures that companies must confront are: control versus autonomy, long-term strategy versus short-term urgency, evolutionary versus revolutionary change, pride versus humility, focus versus breadth of vision, values versus rules, customer care versus customer count, challenging people versus

nurturing people, leaders versus managers; and gentle versus abrupt succession. According to them, such companies must have the ability to tackle and balance these conflicting demands and pressures to have a crucial edge in sustaining the success. Goldsmith and Clutterbuck based this on their explorations of the management practices of leading high performing companies such as Singapore Airlines, Granada, British Airways, IKEA, Asda, Reuters, Vodafone, Rentokil, Siebe, Carrefour, Atlas Copco, and Marks and Spencer. There has been continuous research in this area internationally by the research community to obtain deeper insights into research in excellence (Johnson et al., 1985, Zenger, 1985, Crane, 2006, Gargano, 2006, Geller, 2006, Grunig, 2006, Michalak and Stephenson, 2006, Dittmar, 2007).

The studies are continuing and while what makes an organization excel in performance have been scientifically enquired by a number of researchers—particularly with reference to motivation and attitudes, management and supervision, assessment, training and development, union-management relations and host of other things—how the achieved excellence is sustained or can be sustained has not been studied in depth by researchers in detail. Also, the focus of all or major studies have been in studying a large number of excellent/high performing organizations and identify attributes which helped them in achieving that excellence.

### **The Underlying Theories and Models for Studies in Public Enterprises**

Several studies have been carried out both internationally and nationally. Internationally, studies on excellence have studied different dimensions and different components within each dimension. Kotter and Rothbard (1991) examined the three factors critical to a company’s remarkable success in the high tech field: (i) powerful leadership, (ii) strong corporate culture or firm’s philosophy, and (iii) the company’s management systems. Kotter, in an experience of watching over 100 companies trying to become better, found that their basic goal was to make fundamental changes in how they had been conducting business to help cope with a new and more challenging market environment. The companies watched by him included large organizations (like Ford) and small ones (like Landmark Communications), companies based in the United States (General Motors) and elsewhere (British Airways), corporations that were on their knees (Eastern Airlines), and companies that were earning good money (Bristol-Myers Squibb). These efforts were under various banners such as total quality management, reengineering,

right sizing, restructuring, cultural change and turnaround (Kotter, 1995). A decade later, Hess (2007) rigorously studied 800 companies for two years to differentiate those with consistent organic growth from those with sudden and often short-lived growth spurts. According to him, in the long term, the companies that succeeded to a greater degree than their peers were found to follow an organic growth strategy. The prominent companies studied included SYSCO, Best Buy, Tiffany and Company, Outback Steakhouse, and Stryker Corporation. He found that growth generated internally through a commitment to customer satisfaction, employee engagement, and profitability resulted in consistent employee retention, stock value improvements, and better returns on investments.

Ganesh (2007) have studied different dimension in Indian organizations in pursuit of excellence. Ganesh (2007) developed a 6-S framework in terms of vital, essential and desirable actions of six essential dimensions—"survival, stability, strength, success, superiority and sustainability". In the present day context, therefore, a study on excellence must invariably address the following broad dimensions such as: organizational culture, transformational strategy, pioneering innovativeness, leadership processes and skills, performance management, job and life satisfaction, competency mapping, labour-management processes, training and development initiatives, team working, boundary-less behaviours, organizational learning, corporate sustainability, and change programmes and initiatives.

The studies referred to as above have been carried out based on premise of various organizational theories related to organizational effectiveness, which also had formed the basis of the various researches mentioned thus far. There is no theory of organizational excellence available in the literature. However, to carry out the study successfully, a reference has been made to some approaches to organizational effectiveness found in the literature of organizational theories having a bearing on various organizational researches being carried out based on them for successfully managing organizations. The present study uses the constructs of 'organizational effectiveness' to have deeper insights into the constructs of 'organizational excellence' as propounded by different researchers on organizational excellence. Peters and Waterman used the constructs of organizational effectiveness and the present study also uses a mix of theories and approaches of organizational effectiveness (OE) as given by contemporary strategy-structure theory

of Chandler (1962), Greiner (1972), Miles and Snow (1978), Porter's competitive strategy (1980), and Cameron (1984, 1986a, 1986b), and combined with the developing definitions of organizational excellence as given by Peters and Waterman (1982), Khandwalla (1990), Ganesh (1980, 2007), Ahmad and Chopra (2004).

The literature has been strongly accepting the belief that OE is difficult to define (Robbins, 1999). According to Cameron (1986a), inspite of supposed problems by researchers to define OE, all provide some or the other operational definition. In fact, OE requires multiple criteria that different organizational functions have to be evaluated using different characteristics and that OE must consider both means (process) and ends (outcomes) and as Cameron (1986b) puts it, if the search was to find out a single and universal criterion of OE, then disappointment would bound to be there. Therefore according to him, since organizations do many things and their success depends on adequate performance in a number of areas, the definition of OE must reflect this complexity. The Cameron's (1984, cited in Robbins 1999) scheme of OE that provides four approaches to OE. They relate to goal attainment, systems approaches, strategic constituencies and competing values. The goal attainment approach to OE focuses on accomplishment of ends; the systems approach focuses on ability to acquire inputs, process the inputs, channel the outputs, and maintain stability and balance in the system; the strategic-constituencies approach focuses on satisfying the demands of the constituencies in the environment from which the organization requires support for its continued existence and success – the ability to placate those individuals, groups and institutions upon which the individual depends for its continued operation; and the competing values approach to OE seeks to synthesise the large number of OE criteria into four models – human-relations model, open-systems model, rational-goal model and internal-process model (Robbins, 1999). Each of these are based on a given set of values and preferred depending on where an organization is in its life cycle.

The classic work on the relationship between an organization strategy and its structure has been done by Harvard historian Alfred Chandler and published in the early 1960s based on his study of close to a hundred of America's largest firms to trace the development of these organizations from 1909 to 1959 and has influenced all the subsequent works on the strategy-structure relationships including the framework developed by Peters Waterman for studying organizational Excellence.

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According to Chandler (1962, cited in Robbins, 1999, p.126), "a new strategy required a new or at least refashioned structure if the enlarged enterprise was to be operated efficiently....unless structure follows strategy, inefficiency results". Each stage of evolution or growth creates its own crisis, whose resolution creates a new evolutionary phase. The five phase model consists of creativity, direction, delegation, coordination and collaboration. According to him, success creates its own problems, as organization grows, it faces new crisis and management of each crisis requires management to make adjustment in coordination devices, control systems and organization design for higher effectiveness and excellence. Raymond Miles and Charles Snow (1978) classified organizations based on the rate at which they change their products or markets into one of four strategic types: defenders, prospectors, analyzers and reactors. Management perceives little or no change and uncertainty under defender and reactor strategies. Those pursuing analyzer strategies perceive a considerable degree of change and uncertainty but wait until competitors develop viable response. Prospector strategies require greatest degree of structural flexibility due to lot of change and uncertainty requiring highly adaptive structures. Porter (1980) proposed three competitive strategies—cost leadership, differentiation and focus to have a competitive advantage.

Excellence relates to best companies which have surpassed the best of the performance standards set by an organization in an industry. Three major approaches to organizational effectiveness got developed in the West, namely organization development (OD), socio-technical systems, and human relations. All three have made inroads in developing societies; they integrate high organizational performance with the well-being of the employees. The socio-technical systems approach seeks to relate and harmonize the social and technical aspects of the work. This approach originated at the Tavistock Institute in Britain, wherein the organization is viewed as an 'open system', that is open to external environmental influences. Changes within the organization are accomplished through action research. Organization development is both an approach to organizational functioning and a kit of tools designed to increase the effectiveness of organizations (Beckhard, 1969; Golembiewski, 1988).

The term 'excellence' came to prominence with the book, "In Search of Excellence" by Thomas J. Peters and Robert H. Waterman in 1982, to which the *New York Wall Street Journal* cited as "one of the rare books on

management". Peters and Waterman, while they were project leaders on organizational effectiveness, way back in 1977, set up two internal task forces at McKinsey and Company—one to review thinking on strategy and the other to go back to the drawing board on organizational effectiveness. Their work was initially borrowed from the idea expressed by Alfred Chandler, a business historian, who in 1962 said that structure follows strategy. In other words, a proper strategic plan evolves from the right structure. In the period following World War II till about 1970, Chandler's advice was enough to cause (or maintain) a revolution in management practice that was directionally correct. However, Peters and Waterman later discovered that strategy rarely dictated structural solutions. In fact, crucial problems in strategy were that of execution and continuous adaptation: getting things done, staying flexible.

Peters and Waterman worked to expand their diagnostic and remedial kit beyond traditional tools for business problem solving, which largely concentrated on strategy and structural approaches and focused to build some sort of major corporate capability—that is, to become more innovative, to be better marketers, to permanently improve labor relations, or to build some other skills that the corporation did not possess then. They finally concluded that any intelligent approach to organizing had to encompass, and treat as interdependent, at least seven variables: structure, strategy, people, management styles, systems and procedures, guiding concepts and shared values (i.e. culture). Subsequently, this popularly came to be known as the McKinsey 7-S Framework, where all seven variables starting with the letter 'S'. Pascale and Athos (1981) assisted Peters and Waterman in their concept and also used it as the conceptual understanding for "The Art of Japanese Management". Peters and Waterman after strengthening the conceptual understanding for the study of organizational excellence undertook a full-blown research on the subject of excellence—which was defined by them as "continuously innovating big companies" — funded by McKinsey on an initially chosen 75 highly regarded companies. Finally, in-depth studies were carried out in more than 20 companies and in which eight attributes were identified that characterized excellent and innovative companies. They are (i) a bias for action, (ii) close to customer, (iii) autonomy and entrepreneurship, (iv) productivity through people, (v) hands-on value driven, (vi) stick to the knitting, (vii) simple form, lean staff, and (viii) simultaneous loose-tight properties. The companies that were studied by Peters and Waterman (1982) had a



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preponderance of almost all eight attributes in some form or the other and were clearly visible and distinct. However, these eight attributes are conspicuously absent in most large companies today (Peters and Waterman, 2005).<sup>1</sup>

In another study, Waterman (1994) subsequently focused on fewer organizations and looked at greater depths than looking on a large number of organizations and relying on the perspective of top managers for determining attributes of excellence. A lot of time in this study was also spent in interviewing middle managers and frontline people. Many stories and quotes were generated from interviews, and these, along with observations and discussions helped in getting insights about inside realities. According to this study, organizational arrangements made a difference in top performing companies. Heller (1997) reports that in business, Europe has lagged behind America and Asia. European companies have been slow to exploit new technologies and philosophies of organization and achievement. However, despite these shortcomings, these companies are fast on their feet, be they Finnish, British, German, French, Dutch, Swiss or cross-national. These are also flexible, adventurous, responsive and constantly improving. Leadership is being devolved, the management of radical change is taking centerstage, cultures are being reshaped and corporations subdivided. Organizations are becoming more fluid in the pursuit of maximum motivation, effective team working and constant renewal. Best companies, according to Tushman and Nadler (1996 p.136, cited in Common 2004), 'constantly innovate and change and the most innovative organization are highly effective learning systems'. It can be said to be beyond organizational effectiveness. Cameron (1980) lists four important categories for assessing organizational effectiveness: achieving goals, increasing resourcefulness, satisfying clients, and improving internal processes (modified by Bramley 1986).

### **Studies on Excellence in Public Enterprises in India**

Public sector enterprises in India evinced interest in a study on excellence during the mid-1980s and the then Bureau of Public Enterprises (now Department of Public Enterprises) sponsored a research on the "Management Excellence in Public Enterprises" which was conducted by the IIPA, New Delhi, in 1985. Studies on Organizational

Excellence in public enterprises have been carried out in terms of three distinct aspects of management such as— General Management Excellence, Human Resource Management Excellence and Operational Management Excellence.

The Department of Public Enterprises commissioned a study on 'Management Excellence in Public Enterprises' to the IIPA, New Delhi. The study was nothing more than a sort of replication of the pioneering study on excellence carried out by Tom Peters and Robert Waterman in 1982 and had used the McKinseys 7S Model for studying excellence. A massive study carried out on 20 high performing enterprises, 10 low performing enterprises, and one turnaround public sector (Neyveli Lignite Corporation) from among the then 312 central public enterprises based on 10 years' performance data from 1974 through 1984 and ranking them based on the composite scores based on financial indicators of performance. It found out that through proper attention to men and organization, companies have been able to get best results in output, quality, cost and optimal utilization of resources and become highly regarded.

Khandwalla (1990) in another study of 'excellent management in the public sector', provided interesting insights into the working of the Indian public sector and the findings challenge many of the stereotype views held about the public sector, viz., that it is over-regulated, that it is incapable of professional management, or that it is destined to be sick. Khandwalla reported several examples of corporate excellence in the public sector besides also reporting growing rate of loss-making public enterprises beset with sloppy quality, rampant inefficiency, low productivity and government bureaucracy around the same time. Thus, in the late 1980s, Indian Petrochemicals Corporation Ltd. (IPCL), owned by the Gol was the largest petrochemical company in the country, with a dominant market share in ethylene (basic material for petrochemical products) with high performance. Other examples of excellence included the State Bank of India (SBI), Petrofils Cooperative Ltd., etc. Examples of excellence among social development organizations included the Comprehensive Rural Health Project, National Dairy Development Board (NDDB), Rural Education Programmes, Forestry, etc.

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<sup>1</sup>Author's note: Excellence 2003 maintains that 'they continue to stick to the identified eight attributes, though also fully aware that another researcher, looking at the same data may pick up a different set'. According to them, these eight clearly describe what's different about top performers and the excellent companies live in their commitment to people and also seem to have developed cultures that have incorporated the values and practices of great leaders and sharing and living with them. All the growth in excellent companies has been internally generated and home-grown.

Earlier, Maheshwari studied the decision-making styles of a dozen Indian corporations—half in the public sector and half in the private sector—and tried to relate decision styles to performance. Organizations that employed a participatory as well as an entrepreneurial mode of decision making were found to be performing better than those employing authoritarian and conservative mode of decision making. Paul (1982) studied six large, successful developmental programmes and found that successful programmes invested heavily in a learning strategy. They started with one rather than many goals and later diversified and expanded in a phased manner. The organization structure was found to be flexible to adapt to the overall strategy of the programmes. Ganesh (1980) studied six Indian academic institutions, all teaching management, with a view to finding out the relationship between institution-building processes and the performance of the institution. The study revealed that different groups of processes contributed to excellence on different performance indicators. For instance, strong recruitment, enculturation, regeneration, and redefinition processes resulted in superior performance on capability development; strong processes vis-à-vis choice of model, decision making, structure, etc., led to excellence in innovative thrust; and strong processes concerning choice of early leadership, leadership style, dissemination of information about the institution led to excellence in market or domain penetration.

The common measures of effectiveness, both within organizations and the organization as a whole, focus on the extent to which targets or goals are met, e.g., sales achieved, units produced, profit generated, quality parameters achieved, etc. In well-run organizations, well developed processes are in place, such as those related to individual performance appraisals, periodic reviews by sections, departments, functions, etc. Assessment criteria can be elements like low labour/employee turnover, good teamwork, high job satisfaction, high motivation, high commitment, low absenteeism, low grievances, less disciplinary actions (Cameron, 1980; Bramley, 1986; Redshaw, 2000), low attrition, high engagement, etc.

Khandwalla (1992a) cited shining examples of excellence in the public sector. Interestingly, the then identified excellent organizations in the public sector, such as National Thermal Power Corporation, Gas Authority of India Ltd., Oil and Natural Gas Commission (ONGC), Bharat Heavy Electricals Ltd., Hindustan Petroleum, Indian Oil, and RITES have been continuously excelling in

performance and maintaining the leadership. There has also been a constant endeavor in government departments such as the police, railways, health, forestry, etc. to continuously excel. Indian businesses or MNCs or the public sector undertakings (PSUs), have to adapt, adjust and reorient to the increased and unprecedented rate and pace of change due to unanticipated increasing turbulent environment.

Dhar (2005) based on a study in a public sector steel unit in Bhilai identified basic beliefs and values of leadership, team working, leadership, and people as the main driving force for achieving high performance at workplace. Srivastava and Bhattacharya (2007) based on their experiences of Team work and leadership development initiatives to improve the performance of Indian nuclear power plants in the public sector concluded firmly that significant improvements in performance of public sector enterprises are possible.

Over a period of time, public sector behaviour has been assuming dynamic forms to meet the challenges of global developments. The main drive, in many a case, has been to expand and grow with speed through joint ventures, mergers, acquisitions, etc. These have resulted due to paradigm shifts in government policies, competitive and growth strategies of organizations, economic liberalization, newer technological developments, increasing market shares, unpredictable price structures, changing market conditions, etc. Through the process of responding to these, organizations have acquired varied organizational experiences and the thrust has been to becoming big in the shortest possible time, becoming a global player, and achieving the highest levels of self esteem. organizations, therefore, have no choice but to become more dynamic, more competitive and high-performing. Continuous organization development through excellence is becoming the central goal of all organizations in the public sector. It will not be out of place to mention here that the experiences of public sector enterprises have helped private sector enterprises on a strong footing and therefore private sector enterprises too can benefit a lot from the experiences and insights of the public sectors.

A person who could lead a 'Navaratna'—a status accorded by Gol to nine leading PSEs in India—would be very different from the kind of person who could turn around an ailing company. Spencer et al. (2007) point out that the first factor is grounded in two outstanding strengths of Indian leaders: their well-developed intellect and their competitive focus on achievement. Outstanding Indian

CEOs stand head and shoulders above their peers in other countries, when it comes to their ability to think both analytically and strategically. Also, in case of Indian business leaders, there is a dark side to their strongly developed intellects and achievement drives—a relative absence of tuning into other people. At times they are so focused on entrepreneurship and strategy, that they neglect the task of energizing their teams. When they energize their teams they get much better results. There is also a lack of attention to others, especially as individuals. Indian CEOs need to shift from strongly entrepreneurial energy to a more balanced style of leadership.

According to Spencer et al. (2007), inner strength is an important leadership quality to guide, lead and drive organizations during turbulent times. P.M. Sinha (ex-CEO of Pepsico India) points out, "Value-based leadership and a culture that promotes integrity are the most important elements which the CEO should build around the goals of the organization and bond the team through sustaining values". According to V.N. Kaul (CAG of India), "It is the personal courage and conviction on the part of the CEO which leads him to success".

Excellence is important in public enterprises because it is highly needed to move ahead amidst myriad of competitive forces. Literature review revealed that in recent years, organizational excellence has assumed paramount importance in organizations. The pioneering work on excellence by Peters and Waterman (1982) proliferated research on excellence at all levels. Their work on excellent companies, in which they studied both high and low performing organizations, identified eight important attributes for achieving excellence, such as—a bias for action, closeness to customers, autonomy and entrepreneurship, productivity through people, hands on value driven, sticking to the knitting, simple form and lean staff, and simultaneous loose tight properties. The work sent waves of further research in the area both nationally and internationally. Internationally, among other works on excellence were by Hickman and Silva (1984); Johnson, Natarajan and Rappaport (1985); Goldsmith and Clutterbuck (1985, 1997); Zenger (1985); Elsubbaugh et al. 2004; Gargano (2006); Geller (2006); Bhatt et al. (2006); Grunig (2006); Michalak and Stephenson (2006); Crane (2006) and Dittmar (2007).

Two-thirds of the 43 companies that were chosen and described as models of excellence in the Peters and Waterman's study become non-excellent organizations

within five years of their research and most of them faced crisis and disappeared. The major question was of studying the sustainability and not only of discovering the secret of excellence. The study reflects on some important essential issues as to how business organizations can become outstanding organizations by achieving superior performance and competitive ability relative to others, sustain these over a long period of time and become globally competitive organizations.

The path breaking research study by Ahmad and Chopra (2004) on: "Passion to Win" has evolved models of how winning companies develop and sustain competitive edge. Though their work is an extension of Peters and Waterman's work on search for excellence, it is not just another search for excellence, but a search for sustainability of excellence in the Indian context. Ganesh (2007) developed a 6-S framework in terms of vital, essential and desirable actions of six essential dimensions – 'survival, stability, strength, success, superiority and sustainability'.

According to Styhre (2007), 'powerful leadership' is possible through effective coaching by appropriately blending theoretical knowledge and practical skills in onsite training. Kotter and Rothbard (1991) examined the three factors critical to the company's remarkable success in the high tech field, the first as the powerful leadership, second as the strong corporate culture or firm's philosophy and the third as the company's management systems. Powerful leaders eventually emerge out as global leaders. In the context of the present study, though it is a PSU, powerful leadership is taken as one of the independent variables with three sub variables: globalization issues, vision mission and strategies and leaders style dynamism. Dhar (2005) identified basic beliefs and values of leadership, team working, leadership, people the main driving force for achieving high performance workplace. Team work and leadership development has been the major theme in a team work training intervention to improve performance of Indian Nuclear Power Plants (Srivastava and Bhattacharya, 2007). The performance culture of public sectors can be summarized in terms of three sub concepts such as HR policies, competency mapping and team working.

### **A Glimpse of the Public Enterprises Pursuit of Excellence**

Public enterprises increased to 312 in number by 1990 and after the period of globalization, with the trend towards privatization, the present number is around 250.

The public sector enterprises are categorized into three main groups – Maharatna, Navaratna and Miniratna companies. The Maharatna companies can be called as highly excellent, Navaratnas as excellent and Miniratnas as somewhat excellent and striving to be excellent. These categorizations are based on the performance levels achieved by the public enterprises as agreed upon by the administrative ministry in which the particular enterprise is functioning. The companies in Maharatna category include Indian Oil Corporation, ONGC, SAIL, NTPC, CIL, BHEL, etc. The companies in the Navaratna category are HPCL, BPCL, RITES, MMTC, etc and companies in Miniratna are NHPC, etc.

The Maharatna and Navaratna companies became excellent and have come to be recognized as leaders in public enterprises. The interesting case is of two companies in the power sector, both incorporated as an undertaking of Gol (as a public sector company) in 1975 – one in the thermal power generation (NTPC Ltd.) and other in the hydropower generation (NHPC Ltd.). NTPC's growth has been phenomenal and is currently generating more than 30000 Mwe generation as compared to NHPC which today stands to generate about 10000 Mwe. Though according to what Tom Peters and Robert Waterman (1982) in their book on: "In Search for Excellence" have said that continuous increasing growth and profits are important indicators of achieving excellence besides the halo of esteem, we can not say that out of these two enterprises, definitely NTPC is a better one and not NHPC. The government too looks upon NTPC as a better enterprise and that is why it is today categorized as a Navaratna company and NHPC as a Miniratna company. To understand the degree of excellence in true sense of the term, however, one would need to go to greater depths than make a blunt, vague and less guiding conclusions regarding degree of excellence. For example, in the examples being cited upon, it is pertinent to note, that barring a single common factor (year of establishment as 1975), which does exist in these two cases, the two enterprises are non comparable particularly in terms of the ease with which a large sized generating units can be set up. In case of NTPC, which is in the business of producing thermal power, very large sized single units as large as 2000–3000 MW can be set up, whereas in case of NHPC, the maximum single unit size can be as large as 500 MW. The time of commissioning, the ease with which the two can be commissioned does also significantly differ. The two have huge non comparabilities. But all these are not to defend the failures and/or the lapses of NHPC for a

lower organic growth and provide discredits to NTPC for easily winning the race.

There is a need to look at the issues of 'Organizational Excellence in Public Enterprise' little differently and appreciate the standards and degree of excellence achieved amidst operational constraints. Individual interviews, focus group discussions and non participant observations across the organizations and at different levels is likely to throw light and insights on the degree and standards of excellence achieved by the public enterprise. Public enterprises in India have moved through a saga of different and changing industrial policies and economic upheavals. The beginning of the public enterprises was during the time of Nehruvian regime which emphasized on the mixed pattern of economic / national growth through a role by the state to be undertaken by public enterprises for development of infrastructures such as power, railways, communication, airways, bridges, dams, etc and infrastructure development related products such as steel, coal, oil, minerals, chemicals, fertilizers, cement, etc. The private sector was responsible largely for consumer goods and companies such as Hindustan Lever, Tatas, Birlas, Dabur and several others producing tyres and tubes, paper, etc. came up during the period. Till 1964 there has been a high emphasis on this pattern. Setting up of industries by private sector required procuring industrial licences and where the private industries managed to obtain licences for production of even goods and services in the infrastructure sector, private enterprises also came up such as Tatas producing steel. After this during the time of the late Prime Minister, Mrs. Indira Gandhi the pure socialist pattern emerged with a high emphasis of making a high performance by the public sector. A paradigm shift occurred and a series of industries were nationalized such as banks, coal, mining, etc. and large public enterprises emerged. Being a large country with high population, public sectors were also expected to generate large employment opportunities and for quite a long time and an unwritten philosophy of the public sector as one for generating employment came to be felt by people all across. Public sectors in the process landed up with massive overemployments. Steel Authority at one time having more than 2,50,000 people on its rolls as against around 1,50,000 people at present. Coal India had around 6,50,000 people, Hindustan Fertilisers having around 14000 people as against 8000 that was actually needed then. Rampant unproductivity marked the culture of public enterprises and several enterprises were then incurring huge losses. In one of the public sector studies in 1984, out of 312 public

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enterprises, only 20 odd enterprises were found to be giving profits and they also were in profits not because of better performance but because of administered prices (cost plus pricing). They were operating under high protection.

A shift in their functioning again was found after removal / reduction of protection after 1990s, when the economy was liberalized and a trend towards structural adjustments and privatization began. Many public enterprises such as BALCO, HZL, IPCL were privatized. The emphasis on growth, production and productivity became the order of the day and public enterprises changed a lot after this period. They no longer looked upon themselves as enterprise that could work in any way they wanted. Continuously improving performance became the order of the day. The 1990–1995 was the phase of taking stock of where they were and where they wanted to go. Leadership was an issue as it was not certain how long a particular leader would stay on. For example, in case of two enterprises in the power sector, though NTPC had only 6–7 leaders since beginning, NHPC had almost more than 16–17 leaders. This also made a distinct difference in public enterprises. These were some inherent drawbacks in management of public enterprises, but these were not looked upon as constraints and they continued to operate to the best of their capacities and competencies. Even, if we look at NHPC, a Miniratna company, it has been devoted to the planning, development and implementation of an integrated and efficient network of hydroelectric projects in India. It developed in itself, the prime and core competency and capability to execute all aspects of the development of hydroelectric projects, from concept to commissioning. Though at present, NHPC is a schedule 'A' enterprise of the Gol, with an authorized share capital of Rs.15,000 crores and an investment base of about Rs. 24,000 crores, it is ranked as a premier organization in the country for the development of hydropower. It aims to become a 12000 MW plus company by the year 2014. At present, it is among the top 10 companies in the country in terms of investment.

The history of NHPC dates back to the process of transfer of Salal Hydroelectric Power project (initiated in 1932) to NHPC. It has been one of the first hydropower projects to be transferred to the NHPC in 1975. Earlier, it was with the Central Electricity Authority of the Ministry of Energy. People from all over the the country have contributed to this project and have become local people now. Making a small beginning in 1975 to commission

projects (180 MW project in Himachal Pradesh, 105 MW in Manipur and 345 MW Stage I in Jammu and Kashmir), it is ranked as a premier organization in the country for development of hydropower today. The beginning was small, the operating conditions were difficult and has continuously strived to achieve excellence. The best part has been that it has developed highest levels of skills in hydropower engineering which has helped become a hydropower leader. All about excellence of public enterprise is excellence in technology which it has mastered over a period of time. It is in fact an extremely essential prerequisite for achieving organizational excellence. Achieving excellence in technology is 'technological excellence'. Some Indian public enterprises have a record of achieving this kind of technological excellence and that eventually became the central factor for achieving high organic growth and thus 'general management excellence'. Nuclear Power Corporation had the distinction of excelling in nuclear power technology including excellence in operating and maintaining nuclear power plants. Indian Nuclear Power plants today have high confidence in nuclear power projects commissioning and operating and maintaining. Bharat Heavy Electricals Ltd. (BHEL) too have achieved excellence in technological excellence and that is a single critical factor based on which it have achieved a high organic growth and also an overall organizational excellence.

Even the Miniratana company, NHPC which had several challenges before itself, achieved technological excellence in Hydropower Engineering. To begin with it took over three most difficult and almost abandoned projects in geologically active Himalayan Ranges from the erstwhile Central Hydroelectric Projects Control Board. The initial mandate given to the Corporation to complete these three projects was fulfilled with the commissioning of these three projects. Successfully completing these projects alone helped in achieving core competence in hydropower engineering and with a steady pace took upon itself the task of steadily completing projects in any kind of a terrain. Completion of these projects in most difficult areas and their operation has helped move towards a zone of a hydropower leader and any organization today to even think of setting up projects in hydropower sector has no way but to think of NHPC to set up hydropower successfully. Though since 1975, it has executed only 13 projects with an installed capacity of 4275 MW on an ownership basis, including Joint Ventures (JVs), as against another power sector company (NTPC), which has achieved more than 28000 MW in power generation. NHPC also executed five projects with an installed capacity of

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89.35 MW on a turnkey basis out of which, two of these projects were commissioned in the neighboring countries of Nepal and Bhutan.

NTPC on the contrary, became a Maharatna company with power generating capacity of more than 28000 Mwe. The investment base of NTPC too at present is very high. Public sector undertakings have made a significant mark in the Indian economy, particularly for creating infrastructures for the economic and national development of the country. Towards that end, massive investments have been made ever since the first industrial policy (in 1956) and are continuing to be made even today. Investments in PSUs continuously increased till announcement of globalization and liberalization by the Government of India in 1991. This resulted in structural adjustments, privatization and a sea-change in the growth and composition of PSUs who once enjoyed a monopoly position and were major players as regards installed capacities, investments, size, employee strength, turnover and outreach of its products and services. Keeping in view of the changed needs, PSUs have changed their ways of functioning in trying to achieve excellence. Some PSUs in the oil and power sector such as ONGC and NTPC have also become blue-chip companies. The state of public sector enterprises is also dependent on changing economic situations. Thermal power companies for example are all in trouble as running their plants are dependent more on import of coal, which is at a much higher price. The result is that these enterprises are likely to face productivity crisis due to lower operating levels that will not be able to offset the high establishment costs.

Government of India started categorising public sector enterprises into distinct categories such as: 'Miniratna', 'Navaratna' and 'Maharatna' company based on achievements made by them, i.e. the degree of excellence achieved. Some companies became Maharatna companies. The companies that came to be known as 'Maharatna' company included companies like GAIL, SAIL, BHEL, NTPC, IOC to name but a few. Similarly some public sector companies got classified as 'Navaratna' and 'Miniratna' companies. A large number of companies do not fall into any of these companies, but continue to exist, some in a pitiable financial state, such as Air India for example. While there are several others which are though in profit, but not classified as such into excellent or striving to be excellent companies. An in-depth study of a public enterprise was carried out in a public sector enterprise in

the power sector which had been striving to achieve excellence which has been indicated by a track record of its performance to be having a continuous improvement in performance. It has also been striving to get a 'Miniratna' or the 'Navaratna' status from the last 7 – 8 years and came to be recognized as a company continuously improving in performance. It has successfully controlled attrition, employee engagement is appreciated and has a more satisfied employee force, as evidenced by the majority of the employees' willingness to continue in the organization till they achieve superannuation. It has been continuously on the road to achieve excellence.

It has been doing extremely well in both financial and operational sides, particularly in its internal processes, innovation and learning, strategy and growth, and customer satisfaction and has been doing excellently well from last 10–12 years. It has been achieving continuous increases in its installed capacities in terms of generation of power, achieving a high capacity index and increasing gross and net profits. Several milestones set up to undertake initiatives such as "Business-Process Re-engineering", "Certification in Project Management for its Executives" were also achieved by the company. It also had been appreciated widely for its endeavors to be a good corporate citizen through incorporation of the best practices of good corporate governance, employee welfare, strong environmental commitments and smooth industrial relations. It has been, on various occasions been commended for initiatives like Creation of Herbal Parks, Butterfly Parks, Bio-Diversity Conservations, large-scale afforestations, development of tourism in the region, and more importantly for empowering the surrounding communities through education, vocational training programmes, adult education programmes, health care, promoting sport and culture, etc which have led to the large scale socio-economic development in the vicinity of its various units across the country at various locations. The company is among the top 10 companies in the country in terms of investments. An in-depth study of the company carried out qualitatively on the important frontiers of organizational excellence – general management, human resource management and operational management excellence, which collectively would contribute to "organizational excellence". The study though has been carried out in a single organization, it has been carried out to such depths, that the conclusions have also applicability in other public enterprises.

## Public Enterprise Excellence through Innovative HR Approaches

CPSE has been toying with several approaches for turnaround of organizations in the name of innovative strategies. It introduced CSR initiatives and the journey towards reforming CSR initiatives has started achieving new heights. Similar is the scene on the front of Performance Management System. A lot has happened in CPSE in this front, however, a lot more is needed to be done and after due conceptual clarity. Interestingly, even Maharatna companies of India today, such as GAIL, SAIL, CIL even have inadequate conceptual clarity and understanding to the extent of calling PAS as PMS which is precisely not so. PSUs need to be made to understand they are different. The onus lies on premier consultants and leading management institutes in the country and probably the right conceptual indoctrination has not taken place and therefore not much of results. The other initiatives such as competency mapping, employee engagement and last but not the least, the Training and Development are on its forefront strategies.

### Conclusion

The studies on excellence are highly needed in public enterprises to focus on the measures needed (HR and non-HR measures) for achieving excellence. While many public enterprises are way ahead, many are way behind and are often found resorting to some or the other austerity measures. It is possible, that some focused measures, specific to the enterprises needs to be taken and for that again, a study in-depth is called for. Some good results can be achieved once a holistic finding is on the table of the board.

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*Innovation is the central issue in economic prosperity.*

— Michael Porter



# Marketing Mix Strategies and Business Models: Innovating for Rural India

SUPRATIM PRATI HAR

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*About three-fourth of the total population of India resides in the rural areas. The development of the nation is inter-linked with the development of the rural population. To be successful in the rural market, companies will have to be innovative and sensitive while devising marketing strategies. Traditional urban marketing strategies will have to be localized as per the demands of the rural market. Marketers make consistent attempts to innovate tools and strategies to overcome the challenges they face in the business arena. Marketers need to design creative solutions to overcome challenges typical of the rural environment such as physical distribution, channel management, promotion and communication. The author in this paper attempts to discuss the innovative marketing mix strategies adopted by marketers to enhance their sales in the mystic rural markets of India. Focus of the current paper is on business models adapted by HUL, DSCL, Godrej and ITC characterized by various peculiarities in terms of nature of markets, products and processes. This paper also examines how corporates like Dabur and Tata Motors with their innovation and creativity are tapping the Indian rural market with their retail marketing strategies.*

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The rural scene is transforming at an accelerating pace. Retail outlets have sprung up practically in all the villages. In interior villages retailing is a part time chore unlike the case of the retailer in town. In a part of their house, the villagers make retail counter. Retailing in India is slowly on the rise with changing consumer preferences and tastes and evolution of a global structure. Rural markets are relatively virgin markets, which have evolved on their own with very little direct contact with them by the corporate world, but their size is compelling and attractive. Retail sector offers opportunities for exploration and investment in rural areas, with corporate and entrepreneurs having made a foray in the past. India's largely rural population has caught the eye of retailers looking for new areas of growth.

## Objectives of the Study

The objective of the present study is to find out:

1. Marketing Mix Innovations for rural customers
2. Innovations in the Rural retailing models
3. Strategies adopted by Corporates like *Dabur* and *Tata Motors* in Rural India

## Review of Literature

R.V. Badi and N.V. Badi (2004) are of the opinion that rural market development in India will help the process of activating factors of production leading to higher rate of economic growth, dispersal of economic activities, development of rural and tribal areas, employment opportunities, improvement of living standards of rural masses by empowerment and their active involvement in the process of growth.

Awdesh Kumar Singh and Satya Prakash Pandey (2005) feel that Indian rural market can be called a "sleeping giant" since it holds vast untapped potential and rural market environment has changed along with the rural

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consumer who has become conscious regarding quality and price.

Prof. C.K. Prahlad (2007) enumerates that the future lies with those companies who see the poor as their customers. He further explains that what is needed is a better approach to help the poor, an approach that involves partnering with them to innovate and achieve sustainable win-win scenarios where the poor are actively engaged and, at the same time, the companies providing products and services to them are profitable.

Suvadip Chakraborty (2010) feels that India's rural market is a gold mine, but largely remains untapped by the Indian corporate sector. He opines that only in the recent past, some companies and organizations have implemented innovative projects to tap the rural market and deliver value added services to the doorsteps of the rural people through Internet-based marketing initiatives.

### **Rural Retailing in India**

The word "retail" originates from a French-Italian word. Retailer is someone who cuts off or sheds a small piece from something. Retailing is the set of activities that markets products or services to final consumers for their own personal or household-use. It does this by organizing their availability on a relatively large scale and supplying them to customers on a relatively small scale. With several states in the country permitting retailers to purchase produce directly from farmers, the farmers too are adapting to the new opportunity to cultivate assigned crops and take special care of the same. This gets them instant credit at higher prices than what they received from the erstwhile traders or middlemen. Corporate retailers like *ITC*, *Godrej*, *Reliance*, *AV Birla* and many others have already established the farm linkages. Indian farmers are finally making good money, after centuries of social and economic exploitation. The Indian government too has chipped in with a massive loan waiver worth Rs.60,000 crore to lighten the farmers' debt burden.

### **Marketing Mix Strategies in Rural Markets**

Marketers need to research the rural market thoroughly and then customize the marketing mix for the rural market. Rigorous marketing research efforts and investment need to be undertaken to understand the distinct needs of rural market.

### **Product Mix Strategies (Acceptability)**

Product is the most vital element in the marketing-mix planning which begins with formulating an offering to satisfy the demand of the target consumer. A fair amount of research is required to understand the latent needs and desires of rural customers and provide suitable products. Rural requirements may be quite different from the urban ones. *Philips* launched their Free Power Radio priced at Rs. 995, which required neither batteries nor electricity for operation. With a one-minute winding of the spring, like the winding in a mechanical wristwatch, the consumer has access to 30 minutes of listening time. Research indicated that in rural India, an average household expenditure on batteries for a radio set was Rs. 1,000 and the strategic pricing of Free Power radio will save money on battery costs, the radio will pay for itself in one year and the consumer will manage to save more than Rs. 1,000 every year thereafter. Packaging is also defining paradigm shift in rural marketing. Use of easy to recognize and remember symbols like, muscle man for *MRF*, rhino for *CEAT*, lightening for *Rin*, elephant for *Gemini Tea* and tortoise for *Tortoise* mosquito coils help the rural consumers to identify brands at the time of purchase.

### **Price Mix Strategies (Affordability)**

An aggressive cost restructuring is required in case of rural market. Re-designing of products for the rural market should be done in a manner to maintain low cost of the products. Pricing strategy in case of rural consumer should be done keeping in mind the source of income as the consumers are daily wage earners or farmers who get major income during harvest season. Rural population has limited access to institutional finance. Solution lies in low unit packs at low price points or equated monthly installments offered by market. Chennai-based personal care products manufacturer, *CavinKare* succeeded in popularizing its regional shampoo brand *Chik* in South India in the 1980s by offering it in small sachets of 8 ml, priced at 50 paise (half a rupee), which was lowest in the market compared to 8 ml sachets of leading shampoo brands priced at Rs. 2.50 per sachet. While a 100 ml bottle of shampoo of other players was priced between Rs. 40 and Rs. 50, *Chik* brand was priced at Rs. 17 for 100 ml. As a result of this pricing strategy *Chik* emerged the largest player in the shampoo category in the rural market. This affordable pricing also helped in converting the shampoo non-users who were otherwise, using bath soaps to wash their hair into users.

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### **Promotion Mix Strategies (Awareness)**

About 40 per cent of the population in the country is illiterate while 50 per cent live in areas with no or little access to media. There are several languages and numerous dialects. To achieve success, brands will have to build an association with the rural people which is possible by utilizing the various rural folk media to reach them in their own language and in large numbers. Appropriate mix of conventional and non-conventional media - mix like television, radio, audio - visual vans, cinema commercials, wall paintings, intensive door-to-door campaigns, live demonstrations, distribution of samples etc. can be used as an effective media to drive up sales. *Colgate- Palmolive* distributed free tubes of its herbal toothpaste in the Kumbh Mela festival, where millions of people assemble for over a one month span. Roti, a principal constituent of Indian meal and a staple food item, suddenly assumed space in popular media during the Maha Kumbh Mela at Allahabad due to the unique ad campaign run by *Hindustan Unilever*. The ubiquitous food item became a tool of delivering message to the pilgrims at Kumbh Mela. Besides attracting the people across the board, this Roti Reminder became the food for thought among international media houses as well. The advertiser targeted 100 dhabas for 30 days in the Kumbh Mela and started making impression through a special heat stamp on Rotis, "Lifebuoy se haath dhoye kya?" (Did you wash your hands with Lifebuoy?). Hand washing with soap has been cited as one of the most cost-effective interventions to prevent diarrheal related deaths and disease. It has the potential to significantly reduce incidents of stomach infections and respiratory problems. The Maha Kumbh Mela is the largest congregation of humanity on Earth. The mela conducted for over 56 days and visited by over 100 million people, who come here to pray, live and eat together. Most of them are from small towns and rural areas. *HUL* saw this as the perfect opportunity to reach out to a large group of inaccessible sections of the society and to convey the message across. The brand awareness company instructed the dhabas and hotels to make impression on 2.5 million fresh rotis with this message. As millions of people settle down to have their meal, they were greeted by a Roti that reminds them to wash their hands before they start eating. Moreover, free soaps were provided in these hotels to further encourage the habit of hand washing with soap before eating. Integrated

campaigns which are low in cost, scalable, offer multiple contacts, are interactive in nature, aid in enhancing brand penetration and frequency of usage are required to be developed for the rural market.

### **Place Mix Strategies (Availability)**

Melas, haats and fairs have contributed significantly in rural sales. Video van concept started with the political parties who were not getting access on National Channel (*Doordarshan*) to have contact with the rural masses. The video van is one of the very effective means of reaching out physically to the rural consumers and providing them with touch and feel of product and the brand. A few multinational companies have overcome the cost involved in sales and distribution network by forming distribution alliances with local players. For example, *Procter and Gamble* collaborated with the *Godrej Group* to utilize their well established sales and distribution network in the rural market. Recently, *SBI* and *Bharti Airtel* entered into a joint venture to provide affordable banking services to the unbanked. *Airtel's* 1.5 million retailers and distributors across India will play a key role in taking these services upcountry. *Coca-Cola* has evolved a hub and spoke distribution model for effectively reaching and serving the rural markets. To ensure continuous supply to the rural heartlands of the country, the company depot supplies large distributors who act as hubs twice a week, who in turn appoint and supply small distributors once a week. Because of lack of electricity and refrigerators in the rural market, *Coca-Cola* provides low-cost ice boxes- a tin box for new outlets and thermocol box for seasonal outlets.

### **Business Models in Rural India**

The retail market in rural India is highly fragmented and mainly dominated by small and independent traditional shops. To tap the vast potential of rural India, the models of marketing which is for the urban markets will not be fruitful. Innovative models are required to tap the potential of the rural India. Some proved innovative models which are being used by the corporates in the rural India are discussed below.

#### ***HUL 'Project Shakti'***

*HUL* launched 'Project Shakti' in the year 2001, in keeping with the purpose of integrating business interests with national interests. The model was piloted in Nalgonda district of Andhra Pradesh in 50 villages in the year 2000. The Government of Andhra Pradesh took the pioneering

step of supporting the initiative by enabling linkages with the network of *DIWACRA Groups of rural women set up* for their development and self-employment. Most SHG women view Project Shakti as a powerful business proposition and are keen participants in it. It has since been extended to in Andhra Pradesh, Bihar, Chattisgarh, Gujarat, Haryana, Jharkhand, Karnataka, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Tamilnadu, Uttar Pradesh and West Bengal with the total strength of over 39,880 Shakti Entrepreneurs.

#### **DSCL 'Hariyali Kisaan Bazaar'**

It is the division of *DCM Shriram Consolidated Limited (DSCL)*'s Agri-Business. The company (*DSCL*) operates in two lines of business—Agri/Rural, Chemicals and polymers. Their Agri-business offerings comprise agricultural inputs, both manufactured and merchandised, outputs, distribution and services. The company initiated a 'Rural Retailing' initiative with the objective to move towards providing total solutions to the farmers. Hence, it can be said one-stop shop for meeting farming and family needs of the rural population. It has 264 outlets in many villages of eight different states – Haryana, Punjab, Uttar Pradesh, Rajasthan, Uttarakhand, Madhya Pradesh, Maharashtra and Andhra Pradesh. It serves approximately 4 million rural families in catchment area of around 2.2 million square feet. Each 'Hariyali Kisaan Bazaar' store offers multiple products and services to the rural and farming community and each of its centres operates in a catchment of about 20 kms. A typical centre caters to agricultural land of about 50,000-70,000 acres and impacts the life of approx. 15000 farmers.

#### **Godrej Agrovet 'Aadhaar'**

Started in December 2003, 'Aadhaar Retailing' was *Godrej Agrovet's* rural retail initiative catering to the growing consumption demand in rural India. *Godrej Agrovet Ltd.*, a part of the *Godrej Group*, is a market leader in animal feeds, branded chicken, innovative agri-products & oil palm development in India. In March 2008, Aadhaar Retailing entered into a joint-venture between *Future Ventures India Limited (FVIL)* which held 70 per cent stake and *Godrej Agrovet* which held rest of the 30 per cent stake in Aadhaar Retailing Limited. *FVIL* is part of *Future Group* – an established leader in Indian retail sector. It had purchased the stake for Rs 30.18 crore from its promoter *Godrej Agrovet*. Aadhaar

is a rural and semi-urban retailer of agricultural products and consumer products. Besides retailing, it provides Agri-services in rural area and operating through 51 exclusive outlets (as of February, 2011). The combined entity is expected to create more value that is driven by *Future Group's* excellent knowledge in retailing and *Godrej's* reach of rural consumers as well as vast experience in rural marketing in the country.

#### **ITC 'Choupal Saagar'**

*ITC* launched the 'Choupal Saagar' in 2004 and it is one of the first organized retail forays into the hinterland. Choupal Sagar is a rural hypermarket which is managed by *ITC's* agri-business division. Farmers can sell their commodities and can buy almost everything including cosmetics, garments, electronics, appliances and even tractors. Currently, there are 24 Choupal Saagars: 11 in Madhya Pradesh, 5 in Maharashtra and 8 in Uttar Pradesh. With the success of e-Choupal (world's largest rural digital infrastructure), *ITC* is engaged in scaling up the rural retailing initiative to establish a chain of 100 Choupal Saagars in the near future. Local sourcing of vegetables and fruits allows the company to deliver fresh and save on the expense of a cold chain. Moreover, *ITC's* procurement centers functions to provide farmers the option of selling their produce directly to *ITC* instead of bringing it to the mandi. *ITC's* Agri Business Division conceived e-Choupal as a more efficient supply chain aimed at delivering value to its customers around the world on a sustainable basis. It is an initiative to link directly with rural farmers for procurement of agricultural /aquaculture produce like soybeans, wheat, coffee and prawns. Launched in June 2000, 'e-Choupal', has already become the largest initiative among all Internet-based interventions in rural India.

#### **Innovating for Rural India: The Case of Dabur and Tata Motors**

##### **Case 1: Dabur - Deploying Technology To Extend Reach**

###### *Introduction*

*Dabur* is the world's largest Ayurveda and natural healthcare company. With annual revenues in excess of US\$1 billion and market capitalization of US\$4 billion, it is India's fourth largest fast-moving consumer goods enterprise. *Dabur's* offerings are very popular in rural markets. Products such as Chyawanprash, Amla Hair

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*Oil and Hajmola Digestives* were developed based on insights the company gleaned about rural consumers.

Sales in rural regions are particularly important to *Dabur*. In fact, about 47 per cent of its sales in terms of consumption comes from rural markets with populations smaller than 50,000. Although the company ranks third among rural players, only 31 per cent of its rural sales come through direct distributor networks. *Dabur* needed to increase its direct reach to boost rural market revenue and build distribution for higher margin categories including fruit juice, oral care and home care.

To expand its reach, *Dabur* launched Project Double in 2010. The project's goals were to double rural market revenue and increase penetration of non-passive distributed categories. The initiative targeted villages with more than 3,000 inhabitants, a market no other FMCG company was reaching directly. To begin, *Dabur* focused on high-potential districts of 10 focus states, including Uttar Pradesh and Maharashtra, which contributed 72 per cent of rural FMCG potential.

#### *Barriers to Scale*

*Inadequate distribution structure:* *Dabur's* organization and distribution structure for urban markets was inadequate for rural distribution. The company was structured into three broad verticals—home and personal care, healthcare and foods—with a dedicated sales team for each in urban markets. For rural distribution, the structure would dilute economies of scale, since multiple salespeople from the company would be approaching the same rural outlet. Reaching the local level through local operators rather than service providers from outside was another challenge. Rural trade ecosystems were so locally specific that a local distributor was necessary, even though their use in large numbers would be costly.

*Pressure to generate incremental revenues:* India's rural landscape is dispersed, and economic potential differs significantly across that landscape. Southern Maharashtra is quite prosperous, for example. From historical sales, however, *Dabur* knew that some districts in that state would never deliver the expected return on investment. A one-size-fits-all approach for a state would never work. The company had to be selective about areas within each state. *Dabur* also had to generate incremental revenue through rural outlets, where it was already a strong player. The company had to increase village-level consumption to boost outlet sales beyond what current efforts were

achieving without Project Double. *Dabur* also had to recruit employees willing to work and travel in remote areas.

*Limited demand for high-margin categories:* Another hurdle the company faced was the need to successfully market high-margin categories to justify the additional cost of a direct rural sales channel.

#### *Strategies for Success*

*Prioritizing markets through GIS technologies:* Project Double was divided into two phases. Phase 1 was launched in UP and Maharashtra to validate the sustainability of the idea. In Phase 2, *Dabur* focused on the remaining eight states it had targeted and used lessons from Phase 1 to guide efforts. The initiative began by prioritizing 287 districts. Using a GIS tool, the team could select districts based on characteristics such as presence of a bank, per-capita income and population. Each month, the distribution network received a fresh cluster of new targets, and route-planning software optimized work across geographies.

*Modifying distribution structure to improve reach:* To structure its distribution and avoid multiple company contacts at a single outlet, *Dabur* decided to use one umbrella for all its categories and developed a two-layer distribution structure. Super-stockists operated from a key town in a district and a feeder sub-stockist covered smaller areas. Super-stockists received inventory directly from *Dabur* and did not carry out any local distribution. Local distribution was done by sub-stockists who reached villages with populations up to 3,000. To avoid parallel distribution, super-stockists were allowed to supply sub-stockists only through the use of company-provided transaction software. In larger towns, stockists served retail outlets. A rural district manager oversaw the system, managing all three categories and stock.

*Recruiting local sales representatives and offering unique career paths:* To facilitate direct contact with the markets at the front end and generate incremental sales, *Dabur* recruited a large number of rural sales representatives (RSRs) on third-party payrolls. These executives cover villages in a 60-mile radius from their headquarters location and are responsible for taking orders and ensuring fulfillment by stockists. *Dabur* created separate career paths for RSRs to keep them motivated and provided them with guidance and training.

*Using technology to great advantage:* To monitor its

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huge work forces, *Dabur* uses mobile app technology. RSRs are supplied with an inexpensive tablet that tracks activity on a daily basis. The variable pay structure is dependent on RSRs' giving updates. The tablets also provide information on van routes, work schedules and order status. The apps also offer access to sales history and inventory at the sub-stockist level.

*Incubating demand:* To generate sales for categories with less penetration, *Dabur* needed to increase village demand. After conducting customer insight research, the company discovered that rural customers wanted quality-value messages that stress functionality. The messages needed to address benefits, solve issues and, most important, involve people. Symbols, colors and logos were the most common form of brand identification. *Dabur* piloted rural customer connection programs across haats and melas to provide consumers with the opportunity to experience *Dabur* products first hand. The company also turned to opinion leaders, such as healthcare workers, to generate awareness and increase the penetration in categories such as Chywanprash and baby oil. In addition, *Dabur* offered mobile health camps that provided medical examinations and advice.

#### *Impact*

Within a year and a half, Project Double has reached 24,000 of the targeted 33,000 villages with populations of more than 3,000 in the top 10 states. In a mature state such as Maharashtra, the programme has garnered 100 per cent coverage in villages with more than 3,000 residents and has made inroads into villages with less than 3,000 in high-potential districts. In the current year, the rural business for Maharashtra is growing at a rate more than 50 per cent higher than urban markets and has been outperforming urban markets for three consecutive years. Expanding coverage in villages with 3,000-plus residents has driven fast-paced growth. Rural growth indexed to urban growth was 135 versus 100. Planned sales revenue has more than doubled, and gross margins have improved through a significantly better product mix.

### **Case 2: Tata Motors - Rapid Scale Up Of Rural Commercial Vehicle Business Through A Predominantly Variable Cost Model**

#### *Introduction*

In 2010, *Tata Motors Limited (TML)*, India's largest automobile company, identified the need to target rural

markets aggressively, to accelerate sales growth, as well as maintain its leadership position in the commercial vehicles segment. With over 70 per cent of Indian population residing in rural markets, they are clearly the 'battleground' of future for *TML* as well as most other marketing companies in India.

The timing was right. Investments by Government of India, in creating rural infrastructure and employment, leading to rise in rural incomes and consumption, made rural markets an attractive opportunity for *TML*. To effectively tap this emerging segment, *TML* launched Project Neev (literally means 'foundation' in Sanskrit), with an eye on gaining a first-mover advantage in these markets.

#### *Barriers to Scale*

*Meaningful Access to Rural Markets:* While *TML* Small Commercial Vehicle (SCV) portfolio was seen as an ideal fit for rural markets with their attractive price points and employment generation potential, the company's dealer network, which was pre-dominantly urban and semi-urban in nature (located typically in towns/ habitations with population of 100,000+), was seen as a key bottleneck for growth in these rural markets.

*Limited understanding of rural customer:* Lack of direct access also meant, there were limited structured attempts to understand, define and educate target customer segments in rural geographies, on either the value proposition or business potential of investing in an SCV. From a customer point of view, lack of dealer proximity and absence of 'trusted' advisors meant, they could never really explore the option of evaluating an SCV as a means of livelihood/ business opportunity.

*Cost of access:* Given wide dispersion of rural populace and the high cost of accessing these geographies, dealer coverage was historically limited to towns/ habitations where the dealer had presence and at best about 50 km around them.

*Financing concerns:* NBFCs and banks too had been wary of financing commercial vehicles in these geographies, on account of poor availability of relevant documentation, high cost of reach and 'collections' related challenges.

#### *Strategies for Success*

All the above factors, which historically made rural markets an unprofitable segment to tap, necessitated development

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of an innovative approach for TML's rural go-to-market strategy, rather than just modifying the existing urban model.

The key objective being, to penetrate rural markets fast and at the same time make the venture viable by keeping costs low for TML as well as its dealers. The solution focused on the following areas:

*Improved understanding of the rural customer:* TML conducted face-to-face interviews with more than 2,000 existing rural SCV users to gain a better understanding of their needs, preferences and buying behaviour. Armed with insights from these conversations, the project team identified three key target customer segments:

- Underemployed and unemployed youth aged between age group 21 and 30, who saw running an SCV as a viable means of self-employment
- Large agricultural families, who could invest in an SCV, as a second source of income for the family
- Shopkeepers, small businesses and schools that could use these vehicles for captive and third-party transport of goods, students or people within a 10–50 km radius.

*Access to remote rural locations:* Dealer reach into rural habitations, was extended through two indirect channels. A 'Feet-on-Street' network was built through local level engagement with government & non-government bodies involved in rural development. This helped provide access to rural talent pool, they were christened 'Tata Gram Mitras' (TGMs) and acted as 'trusted' advisors to rural customers. They were provided extensive training, to work with TML as an extension of the dealer sales team, on a commission basis to generate leads from their respective tehsils and talukas. This channel was complemented with an outlet network of corporate partners with established rural reach. This served as the second major channel feeding the TML direct dealer network and were manned by 'Tata Kisan Mitras' (TKMs). Building these two forms of indirect channels, to complement the direct dealer channel helped establish micro-presence for TML at sub-district (tehsil/ taluka) level in an accelerated timeframe.

*Rural demand activation:* The manpower in the indirect channels was trained to deliver a customized sales pitch for each target customer segment. Demand activation typically focused on using the 'self-employment' plank,

and positioning TML's SCV portfolio as an alternate means of livelihood for rural youth.

*Cost of rural reach:* Compensation for above indirect channels were structured to ensure fixed costs for TML & dealers were limited to a minimum and a larger part of the cost of the channel was funded through vehicle sales driven incentives. This in turn, ensured rural sales generated incremental profitability right from inception and were not seen as just long term investments.

*Rural vehicle finance:* To ensure availability of vehicle finance at the rural level, the project team established relationships with district-level banks, NBFCs, national lenders and government agencies. At the same time, TML's in-house finance arm introduced new schemes which accelerated the finance approval process.

*Rural organization and technology:* To effectively mentor, train and manage the above rural network and its requirements, TML dealerships appointed a District Rural Manager (DRM) for each district. TML invested in appointing a Rural Business Coordinator (RBC) and Territory Sales Manager to nurture the rural network components. Sales and CRM technology systems too were aligned within TML to capture and support the rural sales processes. Over time, with development of demand at local level and confidence of business viability, dealer branches are being opened to sustain the entire model for the long term.

#### *Impact*

*Speed to rural market:* The results have been significant and fast. Building and leveraging a network of rural youth and existing network of rural corporates provided quick access to rural markets. Currently deployed in six states, the rural business has seen addition of over 20 per cent to TML's SCV vehicle volumes. This is now being rolled out nationally and has an incremental annual potential of over 70,000 vehicles and US\$500 million in revenue.

*Furthering social agenda:* While the primary purpose of the program was to look at rural markets as a profitable business proposition, leveraging rural youth as sales agents and creation of rural entrepreneurship opportunities through vehicle ownership as well as cascading impact on the rural economy through demand for service, mechanics, fuel have helped further the social agenda as well.

Project Neev has contributed immensely to furthering

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the long term strategy of *TML*. While the most significant benefit has been the creation of a first mover advantage for its Commercial Vehicles in rural benefits, other benefits include more competitive channel partners with an extended network and access to a large talent pool for future employment within *TML* and its dealers.

### Conclusion

We can safely suggest that the future drivers of growth are the rural markets. The world is changing like never before. This change is more attributed to the way business practices and strategies are changing across the globe. Business organizations are rapidly changing their domain and strategy to take benefit of this emerging global order. Rural marketing endeavors have to be seen and implemented as investment for better tomorrow. Thus successful company will be one which meets consumer's expectations through products offered at affordable cost

and still is in position to earn a decent return on investment because of its strong, efficient and intelligent distribution channel.

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*I believe in innovation and that the way you get innovation is you fund research and you learn the basic facts.*

— **Bill Gates**



# Industrial Development and Regional Disparities in Andhra Pradesh Pre and Post Economic Reform Period (1980-81 through 2008-09)

G. ALIVELU

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*The present study makes an attempt to study the regional (Coastal Andhra, Telangana, Rayalaseema) disparities in industrial activity in Andhra Pradesh during the period 1980-81 through 2008-09. At the state level, growth rate of industry increased while that of the manufacturing sector registered a decline in the post-reform period compared to pre-reform period. In all the three regions, DDP from industry registered an increase in post-reform period with the increase being the highest in Rayalaseema. However, registered manufacturing accounted for a negative growth rate in Rayalaseema in post-reform period compared to the pre-reform period. Labour productivity increased in all the three regions in the post-reform period and the increase is the highest in Coastal Andhra. Net value added by the agro-based industries is the lowest in Rayalaseema in 2008-09 compared to 1982-83. The non-metallic mineral industries contribute highest share of employment in Rayalaseema. Of the three regions, Rayalaseema has the narrowest industrial base.*

According to dominant theory of modern economic development, industry is expected to play a major role in creating as well as mitigating disparities among different regions. Industry is seen as the main engine of growth (Kaldor, 1967) and industrial development is subject to cumulative causation to a larger degree than development of other sectors (Myrdal, 1957). Industrial development, and consequently overall economic development of different regions, according to the typical conventional theory of regional development, is expected to take a path that finally leads to a convergence (Barro and Sala-i-Martin, 1992 and 1995). To begin with, industrial development takes place as a result of developed infrastructure, agglomeration and linkages, but subsequently, when diminishing returns set in—in the more industrialized regions—it shifts to less developed regions. The historical experience of development, as a result, has revealed inverted U-shaped behaviour of disparities in the long period development (Williamson, 1965, Barro and Sala-i-Martin, 1990, Kuznets, 1955).

Contrary to the convergence hypothesis there is an equally strong outlook that puts forward increasing divergence because of technology and agglomeration externalities which make increasing returns possible over long periods. Different regions not only grow differentially due to internal factors, but differences get reinforced through interaction among them through the mechanism of “back-wash effects” (Myrdal, 1957; Hirschman, 1958; Kaldor, 1967). Differences arise and get perpetuated often by what are called the ‘core-periphery’ and ‘dependency’ relationships that apply both internationally and inter regionally (Baran, 1957). Technological change, new forms of organization and transaction costs is also seen as factors leading to widening of disparities (Piore and Sebel, 1984).

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While Myrdal (1957) refers to the forces of convergence and of divergence as spread and backwash effects, Hirschman (1961) describes these as trickling-down and polarization effects. There are at least three different hypotheses in this regard and these differ on the emphasis given to the relative importance over time of the forces of convergence and of divergence. One of these is the self-perpetuation hypothesis propounded by Hughes (1961) and found empirically valid by Booth (1964) for the USA. According to this view, the forces of divergence dominate over those of convergence and as a result, inter-regional differences in the levels of economic development keep on widening over time. A completely opposite view is the convergence hypothesis propounded and found empirically valid by Hanna (1959) that the rate of economic growth is inversely related to the level of per capita income and hence given identical technologies, preferences and rates of population growth, differences in per capita incomes between any two regions will be transitory. Considerable evidence to support the hypothesis empirically is provided by Hanna (1959), Perloff et al (1960) and by Sala-i-Martin (1996). The third hypothesis, combination of these two opposite views is the concentration cycle hypothesis propounded by Williamson (1965). The proponents of this view show that inter-regional economic differentials diverge initially to converge later on and thus trace out the famous Kuznetsian inverted U shaped curve over time in the process of national economic development. Considerable empirical evidence in support of such a view emerged as a result of a detailed international study of regional development experiences by Williamson (1965). According to Nair (1982), pattern of regional change depends upon indicator of development being considered, with different indicators demonstrating different patterns of regional change.

What then has been the experience in Andhra Pradesh? Have inter-regional disparities in industrial activity increased or declined especially since early 1990s when economic reforms are introduced and the state adopted the path of globalization? There is a view that post-reform regional development is likely to be more evenly balanced (Elizondo and Krugman, 1992), as a free flow of goods, services and factors of production would have strengthened spread effects thus reducing inter-regional disparities. A study using ASI data found that the new investments are spatially more concentrated in the post-reform than in the pre-reform period (Chakravorty and Lall, 2007). It is, therefore, interesting to study the pattern of disparities in the post-reform period when most of the interventionist

measures have been removed in comparison with pre-reform period when they were in place.

Broadly, the study seeks to answer the following questions:

- How is industry distributed across the different regions of AP?
- What has been the performance of different regions in the growth of industry during the study period?
- How does the structure of industries — agro-based and non-agro based differ among regions?
- How do technical ratios like output-labour, capital-output and capital-labour differ among regions?
- How do the location quotients and specialization coefficients differ among regions?

Andhra Pradesh is divided into three regions on the basis of cultural, socio-economic and region specific resource base: Coastal Andhra (CA), Telangana (TEL) and Rayalaseema (RS). In this paper, we primarily stick to this standard regional classification. We bring in the issue of the state as a whole mainly to contrast different regions in the context of AP.

This paper is organized in six sections. The next section deals with issues related to data. This is followed by a detailed discussion of industrial development as a whole, along with the service sector, in Telangana, Coastal Andhra and Rayalaseema. We bring out some contrasts between the development of the service sector and the performance of industry in different regions of AP. As registered manufacturing plays the most important role within the industrial sector, the fourth section is devoted to an analysis of the features of this sector in the three regions of AP. Section five looks at the performance of the agro-based and non-agro based sectors of the registered manufacturing sector. The overall features of the state will be used as a meaningful benchmark for all the three sections dealing with hard facts. The last section provides the conclusions.

### **Data and Methodology**

In order to capture the regional performance of the industrial sector in AP we have to look mainly at two crucial variables relating to this sector, employment and output. The industrial sector comprises mining, manufacturing, electricity, gas and construction. The National Accounts Statistics (NAS) published by the Central Statistical Organization (CSO) provide time series data for gross state

domestic product (GSDP) in terms of broad industrial classifications at the single digit level. From this source it is easy to get the industrial output figures at the state level.

The period of analysis chosen for SDP is 1980-81 to 2010-11, for District Domestic Product (DDP), period of study is from 1993-94 to 2006-07, as at the district level, this data is available only from 1993-94 onwards. Since, we make an attempt to understand the regional dimensions of industrial development in AP in the perspective of the foremost changes in macroeconomic policy regime of the country, we work with two periods: the initial phase of liberalization/pre-economic reform from 1980-81 to 1992-93 and the later phase of liberalization/post-economic reform from 1993-94 to 2010-11 with 1999-2000 as base: we expect to capture changes through relevant comparisons. Considering the significance of the manufacturing sector within the industrial sector in general and registered manufacturing in particular, we decided to narrow down our focus. Another reason behind this decision is the availability of a rich data set for the registered manufacturing sector provided by the Annual Survey of Industries (ASI). 2008-09 is the latest year for which data are available for the districts of Andhra Pradesh. The wholesale price index numbers with 1981-82 as base for the first period and with 1993-94 as base for the second period are used for deflating the net value added (NVA) and the emoluments. We have deflated the fixed capital figures by a composite index of electrical and non-electrical machinery. In order to calculate the trend growth rates we have fitted a semi-log equation.

In order to arrive at the distribution of industry across the three regions of the state, it becomes essential to analyze the growth rates of industry and the manufacturing sectors over a period of time. Further, an in depth analysis of the performance of the registered and unregistered manufacturing sector across the state over the last two decades period helps us in knowing the extent of regional disparities in industry. A close look at the performance of NVA and employment of agro and non-agro based industries reveals which industries play a major role in a particular region. Location quotients and specialization coefficients help in identifying whether a particular industry group is concentrated in one region or not. This is arrived at by examining the pattern of employment created by different industry product groups in different regions for the latest year for which the data is available. We also look at the structural ratios – capital output ratio, labour productivity and also the capital intensities to understand

the performance of various industries of each of the three regions.

### Industrial Development in Andhra Pradesh

This section aims at giving a broad sketch of the production performance of the industrial sector in AP. Here, we look at the performances of the manufacturing sector, both registered and unregistered, and of the service sector in some detail during 1980-81 to 2010-11. This is subdivided into two periods – i.e., 1980-81 to 1992-93 (pre-reform) and 1993-94 to 2010-11 (post-reform).

Sectoral growth rates of SDP are given in table 1. It may be seen that in AP, industrial growth rate registered an increase of nearly 4 percentage points while that of the

**Table 1: Trend Rate of Growth of State Domestic Product from Industries and Services in AP during 1980-81 - 2010-11 (percent per annum) (1999-2000 prices)**

Sector	1980-81 to 1992-93	1993-94 to 2010-11
Industry	6.9*(0.004)	7.3*(0.003)
Manufacturing	8.3*(0.005)	5.8*(0.002)
Registered Manufacturing	9.3*(0.005)	6.0*(0.003)
Unregistered Manufacturing	6.1*(0.005)	5.4*(0.003)
Services	7.2*(0.002)	7.8*(0.001)

Note: Figures in the parenthesis indicate standard errors; \* indicates 5% level of significance.

Source: National Account Statistics.

manufacturing sector declined by around 2.5 percentage points during post-economic reform period. Within the manufacturing sector, growth rates of both registered and unregistered sectors decreased with the decline being the highest for the registered manufacturing again in the post-reform period.

Since data are available at the district level only from 1993-94 onwards, percentage shares of industry, manufacturing and service sectors in DDP are analyzed for two points of time: early 1990s (1993-94) and mid-2000s (2006-07) for the regional analysis. Average annual growth rates are analyzed for two periods - 1993-94 to 1998-99 and 1999-2000 to 2006-07.

If we look at the state as a whole, there is an increase (13 percentage points) in the share of industry in SDP, while the share of the manufacturing sector in SDP remained more or less the same in 2006-07 over 1993-94 (Table 2). The increase in the share of industries in SDP in 2006-07 over 1993-94 can be attributed to the

increase in the mining and construction activity in the state. Within the manufacturing sector, at the state level, share of registered sector increased while that of the unregistered sector in SDP declined in 2006-07 as compared to 1993-94 (Table 3). On the other hand, share of services in SDP registered an increase of nearly 15 percentage points in mid-2000s over the early nineties at the state level (Table 2).

Across the regions of the state, share of the manufacturing sector (registered and unregistered) in SDP declined in 2006-07 vis-à-vis 1993-94 in Telangana and Rayalaseema (Table 3). In CA, share of registered manufacturing sector increased marginally and that of unregistered sector decreased by one percentage point

in 2006-07 compared to 1993-94. Share of service sector in SDP increased in all the three regions in 2006-07 over 1993-94 (Table 2).

We now take a look at the average annual growth rates of industry, manufacturing and services in total domestic product in regions and the state as a whole.

The average annual growth rates of industry and manufacturing in SDP increased in CA while it registered a negative growth rate in Rayalaseema in the post-economic reform period. The average annual growth rate of industry in SDP increased by more than double in Rayalaseema, while that of the manufacturing sector accounted for a negative growth rate (-2.0) in the same

**Table 2: Percentage Shares of Industry, Manufacturing and Services in Total Domestic Product in Regions and AP 1993-94 and 2006-07 (1999-2000 prices)**

Regions	Percentage shares in DDP (1993-94)			Percentage shares in DDP (2006-07)		
	Industry	Manuf.	Services	Industry	Manuf.	Services
Coastal Andhra	17.9	12.6	44.3	23.1	12.0	47.7
Telangana	16.1	16.5	37.4	28.0	13.0	53.7
Rayalaseema	26.2	17.0	53.4	24.0	7.8	46.2
AP	18.3	14.2	25.4	31.3	14.1	40.4

Source: State Domestic Product and District Domestic Product, AP, Several Years

**Table 3: Percentage Shares of Registered and Unregistered Manufacturing Sectors in Total Domestic Product in Regions, and AP in 1993-94 and 2006-07 (1999-2000 prices)**

Region	1993-94			2006-07		
	Manuf.	Registered	Unregistered	Manuf.	Registered	Unregistered
Coastal Andhra	12.6	7.8	4.8	12.0	8.2	3.8
Telangana	16.5	11.5	4.9	13.0	10.7	2.4
Rayalaseema	17.0	7.7	9.3	7.8	2.3	5.5
AP	14.2	8.7	5.4	14.1	10.0	4.1

Source: State Domestic Product and District Domestic Product, AP, Several Years

**Table 4: Average Annual Growth Rates of Industry, Manufacturing and Services in Total Domestic Product in Regions and AP during 1993-94 to 2000-01 and 2001-02 to 2006-07 (percent) (1999-2000 prices)**

Regions/DDP	1993-94 to 2000-01			2001-02 to 2006-07		
	Industry	Manuf.	Services	Industry	Manuf.	Services
Coastal Andhra	6.4	5.9	7.3	11.9	11.0	8.0
Telangana	6.1	5.5	7.7	9.8	8.5	10.2
Rayalaseema	6.2	4.8	6.4	17.8	(- )2.0	7.2
AP	6.1	5.1	7.5	11.5	7.7	9.4

Source: State Domestic Product and District Domestic Product, AP, Several Years

period (Table 4). The increase in the growth rate of industry in SDP in this region during the post-economic reform period is because of the increase in the mining activity in Kadapa district especially during the period 2005-07. For the manufacturing sector, data clearly shows that except Rayalaseema, in the other two regions, average annual growth rates of registered manufacturing sector in DDP increased in the second period over the first period (Table 5).

Rayalaseema has seen the slowest transformation of the economy. Over a period of time, contribution of

industry, manufacturing and the services sector to the total domestic product registered a decline. Its growth rate, especially that of the manufacturing sector has been the lowest in fact it has been negative (-2.0).

### The Registered Manufacturing Sector

The analysis of the growth rates in the previous section shows that the structural transformation has not been in favour of the manufacturing sector at the state level. It is in this context, it becomes crucial to look at the performance of the registered manufacturing sector. The period chosen

**Table 5: Average Annual Growth Rates of Registered Manufacturing Sector in Total Domestic Product in Regions and AP during 1993-94 to 2000-01 and 2001-02 to 2006-07 (percent) (1999-2000 prices)**

Regions	1993-94 to 2000-01		2001-02 to 2006-07	
	Manuf.	Registered	Manuf.	Registered
Coastal Andhra	5.9	6.7	11.0	12.8
Telangana	5.5	5.4	8.5	8.7
Rayalaseema	4.8	3.6	(-)2.0	0.1
AP	5.1	4.5	7.7	9.0

Source: State Domestic Product and District Domestic Product, AP, Several Years

for analysis is 1980-81 to 2008-09. 2008-09 is the latest year for which the Annual Survey of Industries (ASI) data are available at the district level. 1980-81 to 1992-93 is taken as the initial phase of liberalization and 1993-94 to 2008-09 as the later phase of liberalization. Structural ratios like per worker productivity (O/L), capital output ratio (K/O) and capital intensity (K/L) are analyzed to look at the performance of the registered manufacturing sector.

the state as whole during the post-reform period. The increase in labour productivity is the highest in Coastal Andhra (from 0.1 in pre-reform period to 0.7 in post-reform period) (Table 6).

A comparative investigation of the behaviour of the critical structural ratios reveal that per-worker productivity/labour productivity (O/L) of the registered manufacturing sector remained constant at 0.1 during the pre-economic reform period and it increased in all the three regions and

Case of capital output ratio (K/O) reveals that it registered a decline in Telangana in the post-reform period as compared to the pre-reform period. On the basis of this evidence we can say that in Coastal Andhra and Rayalaseema more of capital has been used to produce a unit of output in the post-reform period compared to pre-reform period. The reason for this could be that capital innovations on balance served more to replace other factor inputs rather than the output (Table 6).

**Table 6: Capital-Output Ratio and Labour Productivity (O/L) for Different Regions of AP (labour productivity is in Rs. lakhs) 1980-81 through 2008-09**

Regions	K/O		O/L	
	Period I 1980-81 to 1992-93	Period II 1993-94 to 2008-09	Period I 1980-81 to 1992-93	Period II 1993-94 to 2008-09
Coastal Andhra	3.0	4.0	0.1	0.7
Rayalaseema	3.2	3.3	0.1	0.5
Telangana	2.3	1.8	0.1	0.5
Andhra Pradesh	2.5	2.5	0.1	0.5

Source: Calculations based on ASI data

Does technological variation explain the above mentioned inter-regional differences in labour productivity of registered manufacturing sector? Taking capital intensity, measured in terms of capital per worker as the indicator of technology, we attempt to examine this question.

It is a well-known fact that different industries use different levels of technology in production. Simultaneously, it could also be reasonably assumed that a high technology industry would be, so, irrespective of its location in one region or the other. Nevertheless, there could be

**Table 7: Capital-Labour Ratios for Different Regions 1980-81 through 2008-09**

Regions	Capital / Labour	
	Period I 1980-81 to 1992-93	Period II 1993-94 to 2008-09
Coastal Andhra	0.4	2.3
Rayalaseema	0.3	1.8
Telangana	0.3	0.7
Andhra Pradesh	0.3	1.2

Source: Calculations based on ASI data

differences from region to region due to, firstly, the factors within the same product growth that a region specializes in production, and secondly, perhaps because of the choice of technology – capital intensive vs. labour – that the entrepreneur may decide to adopt depending on the labour market situation. Thus regions with high capital intensity accounted for an increase in labour productivity in the post-reform period. Coastal Andhra is a case in point to illustrate the above explanation (Table 7).

#### Agro-based and Non-agro Based Industries

Since registered segment now comprises of a considerably large part of total manufacturing in the state (accounting for 71 per cent) and also a huge part of the unregistered

sector is found to be linked with the registered sector, it would be significant at this juncture to go into some added particulars as regards the product structure of this sector. This is taken care here in respect of two features of the product groups. In the first case, we try to broadly classify industries into two groups—agro-based and non agro-based, the former consisting of product group 15 to 25 and later 26 to 37<sup>1</sup>, according to the National Industrial Classification (NIC) 1998. Subsequently, we try to identify major product groups (at 2-digit level) of different regions and growth centres in order to examine industrial diversification and specialization across the regions. We make use of the location quotients and coefficients of specialization/diversification to further sharpen our analysis.

Agro-based products have always dominated the Indian as well as the states' manufacturing industry in terms of employment, employing majority of workers working in the sector. Around 61 per cent of the workers are employed in agro-based industries in 2008-09 at the state level. Though the shares of employment declined in 2008-09 when compared to 1982-83 in CA, Telangana and RS, we still observe that the major chunk of employment is created by agro-based industries. Rayalaseema witnessed a huge decline in the share of workers in 2008-09; it declined by almost half in 2008-09 compared to 1982-83 (Table 8).

When we take a close look at the NVA of the agro-based industries at the state level, we find that their share in gross value added in manufacturing has, however, declined to less than half in 2008-09 compared to 1982-83. Share of NVA of agro-based industries declined in all the three regions in 2008-09 compared to 1982-83 and the decline is highest in Rayalaseema (declined by nearly 18 percentage points) (Table 8). In aggregate, we can conclude that agro-based industries contribute less to gross value added (25 per cent) than to employment (61 per cent) in 2008-09 compared to 1982-83 reflecting lower productivity.

**Table 8: Share of Agro-based Industries in Registered Manufacturing Sector (Number of Workers and NVA)**

Regions	No of workers				NVA			
	1982-83	1993-94	2000-01	2008-09	1982-83	1993-94	2000-01	2008-09
CA	82.53	64.80	65.32	63.33	49.07	45.27	47.56	27.96
Telangana	72.45	69.32	69.42	63.55	30.45	34.32	27.40	24.65
Rayalaseema	74.15	56.85	50.80	35.38	68.93	44.17	22.37	16.11
AP	76.61	67.00	67.14	61.17	38.98	38.95	34.31	25.28

In case of non agro-based industries, Rayalaseema stood first amongst the regions in the share of number of workers in 2008-09, while Rangareddy topped within the growth centres in the same year. Interestingly, Rayalaseema has the highest share of NVA in 2008-09 and it increased by almost two and a half times when compared to 1982-83 (Table 9).

### **Inter-Regional Differences in Structure and Specialization: Top 5 Industries**

Just like the case of the composition of manufacturing industry in terms of agro-based and non agro-based groups, industrial structure of regions differs in terms of product groups at more disaggregated (2-digit) level. We look here at the top five industry groups with regard to

**Table 9: Share of Non Agro-based Industries in Registered Manufacturing Sector (Number of Workers and NVA)**

Regions	No of workers			NVA				
	1982-83	1993-94	2000-01	2008-09	1982-83	1993-94	2000-01	2008-09
CA	17.47	35.20	36.68	36.67	50.53	54.73	52.44	72.04
Telangana	27.55	30.68	30.56	36.45	69.55	65.68	72.60	75.36
Rayalaseema	25.85	43.15	49.20	64.62	31.07	55.83	72.63	83.89
AP	23.38	33.00	32.86	38.83	61.02	61.04	65.69	74.72

Source: Calculations based on ASI data

their contribution to employment in registered manufacturing in Andhra Pradesh to see to what degree the product groups featuring in this group differ from region to region. We also work out to see the degree of specialization or diversification of the manufacturing sector in the state, as represented by the percentage of employment asserted by the five top industries. We carried out this analysis for the year 2008-09.

The regions show diverse patterns as far as the largest product group is concerned. At the state level, manufacture of food products and beverages (15), manufacture of tobacco (16) and manufacture of non-metallic mineral products account (26) account for a major share of employment. Out of these product groups, nearly

76 percent of employment comes from the manufacture of food products and beverages, followed by non-metallic and mineral products (around 63 per cent). Thus in CA, food products and beverages dominate with 41 per cent respectively. The same group dominates in Rayalaseema and Telangana though with a smaller share. Telangana has 42 per cent respectively of registered manufacturing sector employment in manufacture of tobacco products. Non-metallic mineral products are the largest industry in Rayalaseema with nearly 44 per cent of employment. Industries with significant domination though with smaller proportion are of total employment are non-metallic mineral products in CA (11 per cent) and in Telangana (7.7 per cent) (Table 10).

**Table 10: Top Five Industries in Terms of Workers in Registered Manufacturing (2008-09)**

Regions/Industry	15	16	24	26	27	Total of five
CA	41.05	4.58	1.04	11.22	9.63	67.52
Telangana	11.40	42.38	2.04	7.69	2.39	65.90
Rayalaseema	23.06	1.65	3.57	43.91	3.98	76.17
AP	75.52	48.61	10.54	62.82	16.00	

Source: Calculations based on ASI data, AP, 2008-09

The above features advocate a high degree of specialization in the product structure of the three regions. The same is also revealed by the high proportion of total employment accounted for by the largest five industry groups. Among the three regions, Rayalaseema had over 75 percent of their registered manufacturing employment concentrated in top five groups –

- (i) manufacture of food products and beverages,
- (ii) manufacture of tobacco and tobacco products
- (iii) manufacture of basic metals
- (iv) manufacture of chemicals
- (v) manufacture of non-metallic mineral products.

CA comes close to Rayalaseema with 67 per cent and Telangana with 66 per cent of the employment. As such no region shows diversified industrial employment structure. Interestingly, the largest group which accounted for similar share in total employment in registered manufacturing in the state is food products.

### Industrial Base and Specialization

Industrial base of a state has been identified in terms of the group of industries which claim a higher share in the region's industrial structure than in the industrial structure of the state as a whole and is measured by location quotients of individual industries. Location quotient is one for an industry if its share in the region is the same as in the state, is less than one if this share is lower and more than one if it is higher than in Andhra Pradesh. Industries having quotient value of one or higher are considered to constitute the industrial base of the state/region or growth centre.

At this juncture, it must be noted that the location quotients measure industrial base of a region only relative to the industrial structure of the state. Those industries which have a higher share in the region does than in the state's industrial structure constitute this base and these industries need not necessarily be the largest in the region. Location quotient, in fact, reflects the region's relative specialization vis-à-vis the industrial structure of the state and is acknowledged in terms of value of the quotients, and defines industrial base in a relative and not in absolute sense. In other words, it also means that more industrialized regions would have a wider industrial base in terms of having a larger number of industries with value of location quotients higher than one.

Industrial base of Coastal Andhra is comparatively wide consisting of 8 out of 12 industries having location quotient more than one. Telangana comes next with 6 industry group having a higher than one location quotient. Rayalaseema has the narrowest industrial base with only

Table 11: Location Quotient of Different Product Groups in Different Regions (2008-09)

Regions/Industry	15	16	17	20	21	24	25	26	27	28	29	35
CA	1.63	0.28	1.38	1.72	1.45	0.30	1.28	0.54	1.81	0.60	1.33	1.75
Telangana	0.45	2.62	0.67	1.21	1.31	1.69	0.64	0.37	0.45	1.89	1.38	0.77
Rayalaseema	0.92	0.10	0.96	0.08	0.24	1.02	1.08	2.10	0.75	0.51	0.29	0.49

Source: Calculations based on ASI data, AP, 2008-09

3 product groups having a location quotient greater than one (Table 11).

Let us now see how similar or different the industrial structure of a region is vis-à-vis that of the state as a whole. To arrive at this, shares of different industries in the total industrial employment in a region are compared with the corresponding shares at the state level. We make use of coefficient of specialization to sum up the differences between the two. When the value of this coefficient is zero, then the industrial structure of the region is exactly similarly diversified as that of the state as a whole. If it is

one, then that region has one industry which is present in that region only. In between, values of coefficient show the degrees of specialization of regions in relation to the industrial structure of the state.

When we consider specialization coefficient, we observe that Rayalaseema has the lowest specialization coefficient for almost all the product groups excepting manufacture of tobacco products and manufacture of non-metallic mineral products. Telangana has the highest specialization coefficient of 0.32 for manufacture of rubber and plastic products followed by a specialization coefficient

Table 12: Coefficient of Specialization of Different Product Groups in Different Regions (2008-09)

Regions/Industry	15	16	17	20	21	24	25	26	27	28	29	31	35
CA	0.16	0.12	0.04	0.00	0.01	0.02	0.01	0.10	0.04	0.01	0.01	0.00	0.01
Telangana	0.14	0.26	0.04	0.00	0.01	0.02	0.32	0.13	0.03	0.02	0.02	0.01	0.00
Rayalaseema	0.02	0.15	0.00	0.00	0.01	0.00	0.02	0.23	0.01	0.01	0.01	0.01	0.00

Source: Calculations based on ASI data, AP, 2008-09



of 0.26 for manufacture of tobacco. Interestingly, CA has specialization coefficients of 0.16 and 0.12 only for two product groups – manufacture of food products and beverages and manufacture of tobacco products. It is surprising to note that basic metals have a specialization coefficient of only 0.04 (Table 12). This implies that no forward linkages are taking place in CA despite the presence of the large scale Iron and Steel industry in Visakhapatnam.

## Conclusions

Amidst various findings, as mentioned above, regions have performed differently in terms of growth of manufacturing industries and changes in their structure. It is quite clear from the analysis that there are regional inequalities. Even after a decade of economic reforms, we find that industrial activity is concentrated and divergent in few product groups; industrial base is narrow, high degree of specialization takes place only in five product groups, i) manufacture of food products and beverages, (ii) manufacture of tobacco and tobacco products (iii) manufacture of basic metals (iv) manufacture of chemicals (v) manufacture of non-metallic mineral products. Within the regions, Rayalaseema has the narrowest industrial base and also the lowest specialisation coefficient. Telangana has the highest specialization coefficient for manufacture of rubber and plastic products followed by manufacture of tobacco. CA has higher specialization coefficients for manufacture of food products and beverages and manufacture of tobacco products. In Rayalaseema, it is observed that the registered manufacturing accounts for a negative growth rate in the post-reform period while the growth rate of industry registered the highest increase during this period. The increase in the growth rate of industry in this region is due to the increase in the mining activity in Kadapa district during recent years.

The shares of industry, manufacturing and services in DDP are highest in Telangana in 2006-07 compared to 1993-94. Among the three regions, Coastal Andhra registered an increase in the growth rate of manufacturing sector in the post-reform period as compared to the pre-reform period. As far as the structural ratios are concerned, Telangana performed better in post-reform period in capital-output ratio, while, Coastal Andhra performed better in terms of labour productivity and capital intensity.

Overall it can be concluded that the regional inequalities in industrial activities have increased in the

post-reform period when compared to the pre-reform period. Within the regions while Telangana, Coastal Andhra and Rayalaseema have performed reasonably well in industrial activities, the manufacturing and the registered manufacturing sector fared well in Coastal Andhra. Rayalaseema witnessed poor performance in the registered manufacturing activity in the post-reform period. The increase in the growth rates of SDP from industry both in CA and Telangana can be attributed to the increase in the construction activities while it is due to the increase in mining activity in Rayalaseema.

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*For good ideas and true innovation, you need human interaction conflict argument, debate.*

— **Margaret Heffernan**

APPENDIX 1

Classification at 2 digit level (NIC 1998)

Division Classification at 2 digit level (NIC 1998)

15	Manufacture of Food Products and Beverages
16	Manufacture of Tobacco Products
17	Manufacture of Textiles
18	Manufacture of Wearing Apparel Dressing and Dyeing of Fur
19	Tanning and Dressing of Leather Manufacture of Luggage, Handbags, Saddler, Harness and Footwear
20	Manufacture of Wood and Products of Wood and Cork, Except Furniture. Manufacture of Articles of Straw and Plating Materials
21	Manufacture of Paper and Paper Products
22	Publishing, Printing and Reproduction of Recorded Media
23	Manufacture of Coke. Refined Petroleum Products and Nuclear Fuel
24	Manufacture of Chemicals and 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 and Equipments
29	Manufacture of Machinery and Equipments 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 Communication Equipments and Apparatus
33	Manufacture of Medical, Precision and Optical Instruments, Watches and Clocks
34	Manufacture of Motor Vehicles, Trailers and Semi Trailers
35	Manufacture of Other Transport Equipment
36	Manufacture of Furniture, Manufacturing N.E.C.
37	Recycling

# E-governance and its Impact on Decentralized Planning

V. NAGARAJAN NAIDU AND S.P. KUMAR

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*The process of E-governance made the service delivery by the government to citizen more efficient, transparent, responsible, accountable, participative and socially inclusive for accomplishing a good governance environment. Among the various layers of administration, the efforts of E-governance has a greater impacts at the local level planning units since local governments are the closest to citizens, and constitute for many, the main interface with upper tiers of government. The E-governance initiatives not only improved the real impact of decentralized planning efforts at local level, but also reduced the inequality in the distribution of fruits of governance among various socio-economic groups in the country. Identification and provision of needed critical success factors of E-governance particularly the development of infrastructure for the required institutional change is the need of the hour.*

## Introduction

The application of Information and Communication Technologies (ICTs) in governance stylised as E-governance is being used as a mesmerizing tool for good governance. Technically, E-governance refers "to the use by government agencies of information technologies that have the ability to transform relations with citizens, businesses, and other arms of government. These technologies can serve a variety of different ends: better delivery of government services to citizens, improved interactions with business and industry, citizen empowerment through access to information, or more efficient government management. The resulting benefits can be less corruption, increased transparency, greater convenience, revenue growth, and/or cost reductions." (World Bank, 2005). India, being the largest democracy in the world, has much to gain from E-Governance, especially when citizen participation in governance is one of the features of the fully evolved stage of E-government. E-governance needs to transform all levels of Government but the focus should be on local governments since local governments are the closest to citizens, and constitute for many, the main interface with upper tiers of government. The relationship of citizens and local authorities tends to be one based on proximity as the interests at stake for both parties are closely intertwined concerning issues such as public services, local development, education etc. Thus, E-governance based administrative reforms in local governments can have maximum impact on citizens.

The present study is structured into five parts. The first part gives the objectives and methodology of the study. The second part explains the relationship between

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E-governance and 'good' governance and the need of E-governance initiatives at local level administration. The third part empirically evaluates the impact of E-governance initiatives in selected Panchayats in Thiruvananthapuram district in Kerala on various aspects of good governance. The fourth part tries to identify the important critical success factors for the successful implementation of E-governance initiatives at Local Self Government (LSG) level in the context of Kerala. The last part summarises the study with broad suggestions to revamp the E-governance initiatives at LSG level.

## PART I

### Objectives

The important objectives of the paper are as follows.

- (1) To assess the need and relevance of E-governance at local level planning in the context of Kerala
- (2) Evaluate the status of E-governance initiatives implemented at local level planning in Kerala
- (3) To assess the impact of E-governance initiatives at Panchayat level for fulfilling the objectives of decentralized governance planning
- (4) To identify the critical success factors in strengthening the E-governance initiatives at LSG level in Kerala.

### Methodology

The empirical investigation on the effectiveness of E-governance on decentralized planning is done based on detailed opinion survey conducted among customers of various Panchayats with the help of structured questionnaire. Initially Panchayats are classified based on progress in E-governance as developed, moderately developed and less developed and out of each category, one Panchayat each is selected for further study. The important decentralized planning dimensions covered in the survey schedule are the efficiency, transparency, responsiveness, participation, accountability and equity aspects. The Panchayats selected from less developed, moderately developed, and highly developed categories are respectively Perumkadavila, Vellanad and Karakulam Panchayats. The empirical estimation on the impact of E-governance on various dimensions of decentralized planning is based on a detailed structured schedule targeting clients of various services provided by Panchayats. Total number of sample customers collected was 225 and from each Panchayat, 75 samples were collected randomly. The changes in satisfaction level of

customers on the above mentioned dimensions due to the E-governance initiatives are assessed based on five point Likert scale. The scaled value obtained for various individuals are used for estimating impact index. The first step for the procedure is sum up the scaled values for every individual. The following formula is used for deriving the index.

$$I_i = [X_i - \text{Min}(X_i)] / [\text{Max}(X_i) - \text{Min}(X_i)]$$

Here,  $I_i$  is the index value of the  $i^{\text{th}}$  dimension of decentralized planning (such as efficiency) for  $i^{\text{th}}$  individual.

$X_i$  = the actual score obtained to  $i^{\text{th}}$  person.

$\text{Min}(X_i)$  = the minimum score with in the entire sample population for the specific dimension.

$\text{Max}(X_i)$  = the maximum score with in the entire sample population for the specific dimension.

Along with index for individual dimensions, an aggregate E-governance impact index is also calculated. Different dimensions of E-governance development exert varying influence on the overall development of decentralized planning. Towards this end, the Principal Component Technique of Factor Analysis is used to extricate the percentage variations explained by various components.

In addition to the evaluation of the impacts of E-governance initiatives on decentralized governance, the Critical Success Factors (CSF) of E-governance in the state at local level planning are identified and evaluated. A group of fifty academic and policy level experts in E-governance have identified for enlisting the critical success factors. A procedure has developed for the identification and evaluation of the important critical success factors. The critical success factors identified covers institutional, technical, managerial, people, employees and cultural factors.

## PART II

### E-governance and 'good' governance

E-governance is the implementation and delivery of government services through the ICT to provide transparent, efficient, responsible and accountable governance to the society. It transforms the government from being a 'procedure and power centered' mechanism to a 'citizen and service- centered platform'. The advancement in E-governance not only acts as an engine for economic growth, it also enhances the potential for the delivery of social services and the effectiveness of government

administration for good governance to maximize the welfare of people in an inclusive way. Today, it is being used for various types of transactions such as from government to citizen (G2C), consumer to government (C2G), government to government (G2G), government to business (G2B) and government to NGOs (G2N). E-governance has evolved through various stages from providing static information to citizen through websites (Information), to linking public to access various archival information of government (Interaction), to delivery of online services like renewal of licences (Transaction) and finally to interaction of people with government in an integrated manner at one virtual counter during 24 hours in seven days in a week (Transformation). Different countries are in different stages of the above stages of E-governance.

### **E-governance and Decentralized Planning**

Theoretically E-governance is akin to good governance which is closely linked to democratic decentralized planning. The important dimensions of good governance are efficiency, transparency, responsiveness, participation, accountability and equitable and inclusive. These said elements of good governance are dimensions of decentralization of governance. Hence decentralization means good governance which can be materialized through the effective implementation of e-governance initiatives.

The impact of E-governance is felt in all layers of governance from village level to national and global level. As local governance is a directly experienced reality of citizens and decentralized planning is its fundamental building block, any change in the mode of interaction and exchange of information and services at this level between individuals and state will have greater ramifications. There is direct and close interlink exists between decentralized planning and application of E-governance initiatives. The degree of success of Decentralized planning highly depends on E-governance operation of the Local Self Governments. The rapid development of E-governance has become imperative for smoothening public service delivery. The theories focus on attaining new governance paradigm and aims to establish good governance which incorporates decentralization as one of its principal elements. The E-governance initiatives in decentralized planning made the service delivery more smooth, improved the efficiency and transparency, rationalization and simplification of regulation and procedures, provided the people an opportunity for participating in the decision making process of administration. However, not much empirical research has been done in the Indian context to understand the relation

between E-governance and decentralized planning. The empirical and theoretical studies in other parts of the globe asserted that various objectives of decentralized planning like enhancement of efficiency, improvement of transparency by avoiding corruption, more responsibility and accountability, higher participation and equity can be made possible through the better application of E-governance.

### **Need of E-governance at Panchayat Level**

Even though, the state of Kerala witnessed several setbacks in the evolutionary process of decentralized planning, it is one of the prominent states in India that has evolved a methodology of decentralized planning and sought to implement it after the enactment of the Kerala Panchayat Act and the Kerala Municipality Act in 1994 consequent to the 73<sup>rd</sup> and 74<sup>th</sup> Constitutional Amendments in 1992. Most of the first generation problems such as the difficulty in convincing the political and administrative elites for the need of decentralization, and transfer of resources to local governments, clarity in functional domain of various layers of decentralized governance have been sorted out to a great extent in Kerala. Now the vexing issue is resolving the second generation problems of improving efficiency and effectiveness, designing of incentives for stakeholders to align their interests with those of society as a whole and ultimately of creating institutions that lead to sustainable welfare of local people.

The rationale for e-governance at LSG level is:

- The Panchayats are assigned more functions and responsibilities as part of Panchayat Raj Act and a set of reliable data is needed for improving the task of building, monitoring and managing plans. The required data and information can be mobilized only through e-governance initiatives.
- LSGs are endowed with large amount of funds, both as a part of devolution from state budget in the form of grants in aid. The timely utilization of grants through the implementation of local level programmes is possible through e-governance programmes.
- E-governance initiatives are needed for better integration, better targeting, hassle free collection and enhanced revenue.
- The scientific fixing of criteria and plugging of loop holes of evasion are prerequisite for taxation. In the present context, the e-governance initiative in the form of the application of GIS data helps to assess the property tax on the basis of plinth area, type of construction and locations effectively.

- Professional tax in case of traders, professionals, legal practitioners, consultants and similar category, the assessments are not made in full. A data bank of these persons at local level by visiting them door-by-door and enlist all persons without omission can be done with e-governance program. The list can be upgraded periodically. The data bank can be used for assessing the professional tax from these groups.
- The IT is very much needed for the civil registration data at LSG level. This can be used for generating vital statistics which shall be very useful in demographic and public health research on fertility, mortality etc.
- A demographic surveillance system could easily be built up based on this.
- Till very recently majority of Panchayats resorted the accounting work manually. Accounting is at present in the form of realized and cash basis. Accounting should be on accrual and double entry basis. This is possible by computerizing all Panchayat activities. The introduction of programs such as Sahatha and Sankhya are towards this direction of Accounting Reforms.
- Upholding of spirit of right to information, LSGs must be equipped for providing all necessary information connected to local level administration, planning and implementation. This is possible only through the introduction of IT in governance or e-governance.
- In the present democratic decentralized planning environment, proper vertical and horizontal integration among all layers of planning is needed. This type of integration is possible only by effective introduction of e-governance programs.

#### Progress of E-governance at LSG Level in Kerala

Compared to any other layers of governance, large scale initiatives on E-governance have been mooted in LSGs for efficient decentralized governance. Information Kerala Mission (IKM) is the instrumental agency for implementing various E-governance initiatives in Kerala. In addition to the development of infrastructural facilities of E-governance, IMK has developed and installed a large number of softwares covering all aspects of decentralized governance. The important softwares and objectives of these are summarized in the following table.

The objectives of these initiatives are to improve the efficiency, transparency, responsiveness, accountability

Table 1: IKM's Software Programmes

Sl. No	Names	Objectives
1	Sulekha	Monitoring Plan Projects
2	Sevana	Interface for transactions between local bodies and citizens
3	Sanchita	CD based information repository of legislations, executive orders, promulgations, judgments etc
4	Saaphalya	Employment information system
5	Sahatha	Revenue collection at the local bodies
6	Sanchaya	Revenue management at local body level
7	Soochika	Work Flow Based File Tracking Software
8	Sankhya	Accounts & Finance Management Software
9	Sthapana	HR Management Software
10	Sakarma	Decision Support System
11	Sugama	MIS for Purchase & Works
12	Samhoya	Integrated Citizen database

Source: Compiled from Various Publications of IKM, Kerala.

and equity aspects of local level planning. However, many of these programmes are not installed in full scale in many Panchayats and different Panchayats are at different levels of E-governance initiatives. Among these Sevana, Sulekha, Sankhya, Stapana and Sanchaya are implemented in majority of Panchayats in Kerala either on online or offline mode under the supervision of IKM. These E-governance programmes play an important role in achieving the decentralized planning by a vertical and horizontal integration of various administrative layers of planning. The important criteria used for selecting the Panchayat to evaluate the impact of E-governance on decentralized administration are: the availability of computer nodes; number of services provided through Sevana; whether the plan monitoring system by way of Sulekha software is online or offline mode; whether the Sevana dealing with pensions and other social welfare system is online or offline mode; the extent of utilization of the Sankhya software installed for assessing property tax; whether the Stapana, establishment software for employees is online or offline; whether the Sanchaya, the accounting package is online or offline; and percentage of total employees trained in E-governance programme at Panchayat level. Based on evaluation of these criteria in connection with E-governance initiatives in Thiruvananthapuram district, three Panchayats, Karakulam, Vellanad and Peringadavila are

selected for further study for assessing the impact of E-governance on decentralized planning mechanism. Karakulam, Vellanad and Perumkadavila Panchayats represent the highly developed, medium developed and less developed Panchayats in E-governance initiatives respectively.

### PART III

## E-governance and Its Impact on Decentralized Planning

### Perception on E-governance

The perception of local people on E-governance is critical for the successful implementation of E-governance

initiatives. It is assessed based on people's response on the extent of E-governance helpful to avail services. The Table 2 summarizes the perception of people on E-governance. The usefulness of E-governance as perceived by local people is assessed with five points scale. A sizeable percentage of respondents in all selected Panchayats responded that the E-governance is 'much helpful' for availing the services from Panchayats. The largest percentage of respondents expressing either 'much' or 'very much' level of usefulness of E-governance belongs in Karakulam Panchayat followed by Perumkadavila Panchayat. The respondents have varying perception on the quality of existing E-governance initiatives at the Panchayat level. The largest percentage of respondents

Table 2: Perception on E-governance (%)

Response Items	Name of Panchayat	Not at all	Not much	Normal	Much	Very much
Extent of E-governance helpful to avail services	Karakulam	0.0	2.7	32.0	46.7	18.7
	Vellanad	1.3	5.3	45.3	34.7	13.3
	Perumkadavila	0.0	1.3	37.3	46.7	14.7
Perception about quality of E-governance	Karakulam	0.0	1.3	28.0	60.0	10.7
	Vellanad	0.0	6.7	29.3	54.7	9.3
	Perumkadavila	1.3	5.3	38.7	46.7	8.0

Source: Tabulated from the survey result, 2011.

from Karakulam Panchayat has very high satisfaction on the existing E-governance quality compared to other Panchayats. As the E-governance status is very high in Karakulam Panchayat, the above inference clearly indicates that the quality of services improves in accordance with the progress in E-governance.

### General Assessment of E-governance

The following Table 3 summarizes certain general assessment on the existing E-governance system at Panchayat level. The Table summarises the percentage of people expressed affirmative answers on various items listed in the Table. One of the objectives of E-governance

Table 3: General Assessment of E-governance

Items	Name of the Panchayat		
	Karakulam	Vellanad	Perumkadavila
Impersonalization of services	56(43.10)	43(33.0)	32(24.6)
Improve the images of government administration	65(42.5)	47(30.7)	41(26.8)
Functionaries are courteous and friendly	58(44.3)	41(31.3)	32(24.4)
Making more investment on E-governance by government	72(40.0)	56(31.1)	52(28.9)
Trust between govt. and citizens increases through E-governance	57(37.0)	51(33.1)	46(29.9)
Paper work is minimized	57(41.0)	36(25.9)	46(33.1)
Reducing employment opportunities	28(30.4)	29(31.5)	35(38.0)
Building of school, dispensaries and roads is more beneficial than E-governance investment	16(24.6)	21(32.3)	28(43.1)
Computerization helpful for rich and influential	15(30.6)	13(26.5)	21(42.9)
E-governance improves the welfare of rural people	52(69.3)	56(74.7)	40(58.7)

Source: Tabulated from the survey result, 2011.

Note: The figures shown in the parentheses are the corresponding percentage.



in service administration is providing services in an impersonalized manner. Other factors considered are whether the E-governance initiatives improves the image of LSGs; the courteous and friendly behaviour of functionaries; the opinion on more investment in E-governance initiatives; the improvement in trust between government and citizens; minimisation of paper work; reduction of employment opportunities through computerisation; opportunity cost of investment in E-governance; and the skewed beneficial advantage of E-governance to rich and influential.

More personalization of service implies increased possibility of corruption which can be reduced by the impersonalization of service through E-governance initiatives. The differences in the degree of impersonalization between Panchayat are vivid from the above Table. About 43 per cent of responses asserted the existence of impersonalization of office in Karakulam Panchayat while it is only 33 per cent and 24.6 per cent respectively for Vellanad and Perumkadavila Panchayats. Out of the total responses 42.5 per cent from Karakulam Panchayat, 30.7 per cent from Vellanad Panchayat and 26.8 per cent from Perumkadavila Panchayat opined that images of the government increased due to E-governance. The above table also reveals that employees' attitude changed to become more courteous and friendly. Majority of respondents are favouring more investment on E-governance in Panchayat and advccated for the installation of computers in more government departments. Majority of the respondents opined that trust between people and employees increased recently due to increased computerisation. Minimisation of paper work is one of the major objectives of E-governance and it could be seen from the table that the response from Karakulam Panchayat is overwhelming as compared to other Panchayats.

Only a few responses from Karakulam Panchayat indicate that the computerisation of Panchayat is a waste of resources. The response on this matter is very high in Perumkadavila Panchayat, which indicates the less effective implementation of these programmes in the Panchayat. The apprehension of the reduction of employment opportunities due to computerisation is high in Perumkadavila Panchayat (38.0%) and lowest in Karakulam Panchayat (30.40%). As the Karakulam Panchayat has a higher level of E-governance initiatives, the progress of E-governance reduces the apprehension of job loss. This inference can be interpreted as the less opportunity cost of E-governance in Karakulam Panchayat

compared to other sample Panchayats. Also the apprehension of computerisation that it would help only the rich and influential, could find a place among a sizeable percentage of respondents. This apprehension is high in Perumkadavila Panchayat where the E-governance pace is much lower as compared to other selected Panchayats. The majority of sample respondents are unanimous that E-governance improves the welfare of rural folk to a great extent.

### Impacts of E-governance on Decentralized Governance

The important objectives of decentralized governance are to improve efficiency, transparency, responsiveness, participation, accountability and ensuring equity both social and gender equity in local level planning. The impact of E-governance on local level development is assessed based on these dimensions. The criteria used for assessing the development of these dimensions due to the implementation of E-governance initiatives are summarized in the Table 4.

Table 4: Selected Parameters for Assessing the Impact of E governance

	Dimensions	Indicators	
I	Efficiency	1	Quickness
		2	Accuracy
		3	Reliability
		4	Cost
		5	Promptness
		6	Easiness
		7	Monitoring
		8	Direct Contact
		9	Flexibility of time
		10	Timely Reporting
II	Transparency	1	Clarity and simplicity
		2	Complaint handling
		3	Citizen chart
		4	Front office management
		5	Decision of Grama Sabha
		6	Social auditing
		7	Access to budget information
		8	Identification of projects
		9	Identification of beneficiaries
		10	Identification of beneficiary committee

To be continued...

... Continuation...

	Dimensions	Indicators
		11 Monitoring and evaluation of projects
		12 Assessment of taxes and penalties
III	Responsiveness	1 Giving feedback
		2 Suggestion to error correction
		3 Acceptance of E-governance initiatives
		4 Initiatives towards e-literacy
		5 Safety of E-governance
		6 Follow up action based on feedback
		7 Helping authorities' E-governance initiatives
		8 Following the present rules and regulations of Panchayats
		9 Correctly following rules and regulation of Panchayats
		10 Updating Panchayats information
		11 Providing correct and true information to the Panchayat
		12 Panchayat cooperation
IV	Participation	1 Enhances peoples participation
		2 Satisfied with decision making process of Grama Sabha
		3 Participatory attitude of elected representatives of Panchayats
		4 Project identification and selection
		5 Beneficiary identification and selection
		6 Implementation of project
		7 Monitoring and evaluation of development of projects
		8 Fixing of various types of taxes and fines at local level
		9 Progress of Kudumbasree
		10 Participation in formulating and modifying draft plan
		11 Quality of Grama Sabha discussion
		12 Participation in Grama Sabha meeting
		13 Women participation in Grama Sabha
		14 Performance about neighbourhood groups
		15 Participation of SC/ST and other marginalized sections in the society
		16 Assessing the contribution done by E-governance to the working of taskforce

Dimensions	Indicators
V Accountability	1 Confidentiality of Data
	2 Security of data
	3 Social auditing
	4 Environmental auditing
	5 Disaster management
	6 Stake holders accountability
	7 Sevana accountability
	8 Monitoring committee
	9 Budget preparation
	10 Updating the data base
	11 Accountability in revising the rules and procedure as per the changed situation
	12 Accountability in correct fixation of taxes and fines
	13 Publishing the list of selected projects
	14 Reducing the waste of resources
VI Social equity	1 Improvement of decision making of SC/ST and other weaker sections
	2 Improvement in timely distribution of financial benefits to SC/ST and other marginalized sections
	3 Improvement in the monitoring mechanism of programmes implemented for the welfare of weaker sections
	4 Improvement in selection of SC/ST and weaker section for various welfare programmes
	5 Improvement in the disbursement of pension to weaker section after the introduction of E-governance
	6 Improvement in the participation of SC/ST and other weaker sections in the Grama Sabha after the implementation of E-governance
	7 Change in the fund utilization of SCP and TSP
	8 Fund of weaker section utilized exclusively for the given purpose
	9 Increase in transparency in financial assistance given to weaker sections
	10 Improvement in financial inclusion among women after e-govt. initiatives
	11 Improvement in E-awareness/legal awareness among the SC/ST and other weaker sections

To be continued...

... Continuation...

Dimensions		Indicators	
VII	Gender equity	1	Reduction in gender discrimination in accessing services provided by Panchayat
		2	Improvement in gender budgeting at Panchayat level
		3	Improvement in financial inclusion among women after implementation of E-governance
		4	Improvement in saving and thrift habit among women
		5	Improvement in e-awareness/legal awareness among women
		6	Improvement in participation of women in the Grama Sabha meeting
		7	Improvement in fund utilization of women's development

The estimated results of the status of various dimensions of decentralizing planning after the initiation of E-governance at local level are summarized in the Table 5.

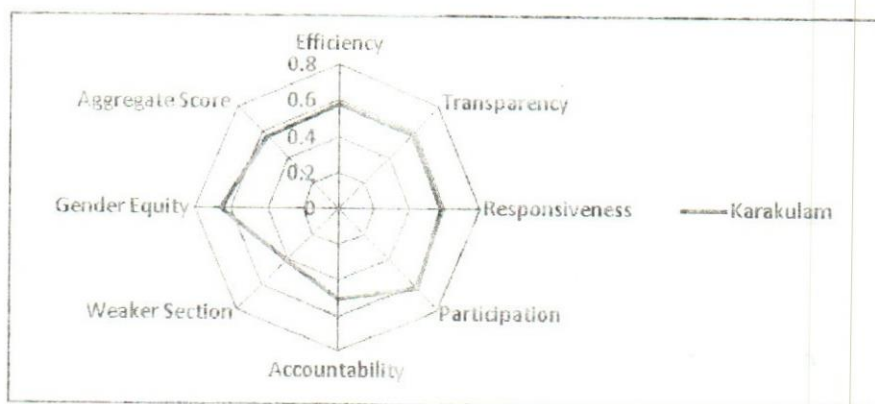
**Table 5: Aggregate and Individual Dimensions of E-governance Impacts among Panchayats**

Dimensions	Karakulam	Vellanad	Perumkadavila
Efficiency	0.5811	0.4719	0.4537
Transparency	0.5841	0.4344	0.4444
Responsiveness	0.5787	0.4432	0.4733
Participation	0.6298	0.5094	0.4842
Accountability	0.5086	0.4049	0.3735
Weaker Section	0.413	0.4019	0.3676
Gender Equity	0.6533	0.6405	0.6421
Aggregate Score	0.5638	0.4722	0.4626

Source: Computed from the Field Survey, 2011

The implementation of E-governance influences the performance of decentralized planning in a multi-faceted manner. The improvement in the efficiency of decentralized planning is the sum total of improvement in the efficiency in service delivery, transparency and accountability in administration, enhancement of responsiveness of citizens and improvement in social equity and women empowerment. An aggregate index is also prepared for assessing the overall impact of E-governance on decentralized planning. The mean value of aggregate index is high in Karakulam Panchayat followed by Vellanad and Perumkadavila Panchayats. The aggregate index of improvement of decentralized planning due to E-governance is not only high in Karakulam Panchayat, the level of variation of this index among various socio-economic groups is also not very significant as compared to other Panchayats that are backward in the implementation of E-governance initiatives. Karakulam Panchayat which is highly developed in E-governance initiative is not only developed at aggregate level but also with respect all individual dimensions of decentralized governance.

Among the indices of impact of E-governance, gender equity index is highest in all Panchayats. It implies that one of the important factors, which influence the aggregate index value of E-governance impact, is the level of achievement in gender equity aspects. After gender equity, the improvement in participation is another significant factor influencing the overall impact level of E-governance. The lowest achievement among various components of E-governance impact is in the field of accountability and social equity. Thus compared to other dimensions of decentralization, more stress may be given for the improvement of accountability and social equity among weaker sections in all Panchayats. Chart 1, 2 and 3 pictorially reveals the extent of progress in various



**Chart 1: Index Values of Decentralised Planning Dimensions in Karakulam**

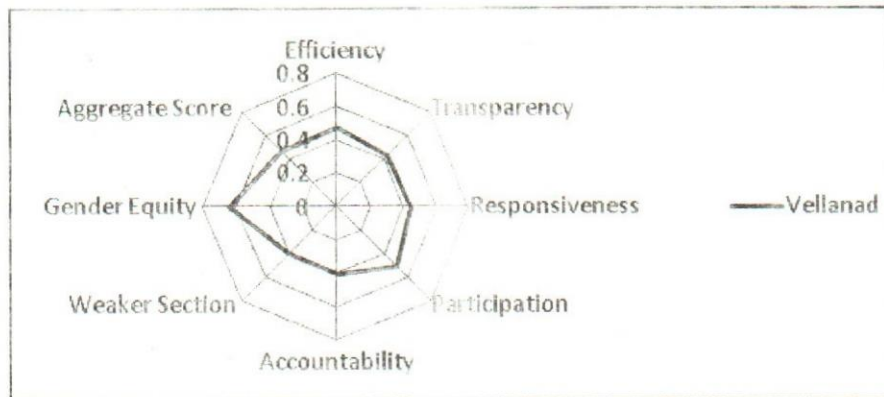


Chart 2: Index Values of Decentralised Planning Dimensions in Vellanad

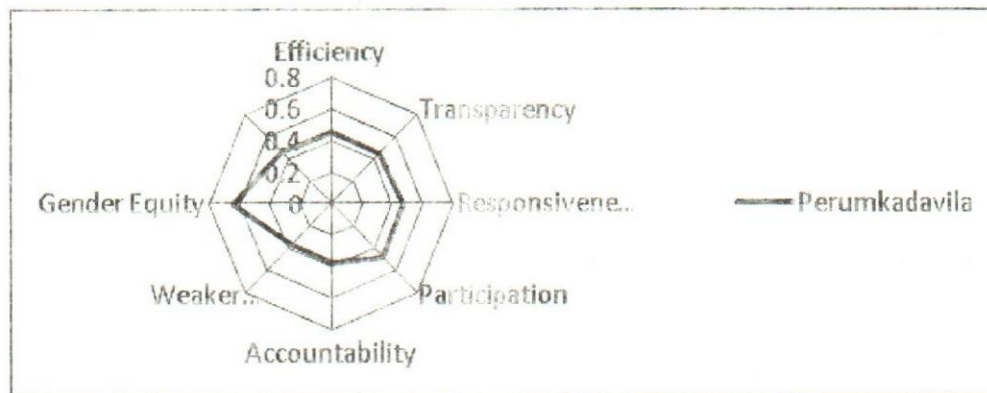


Chart 3: Index Values of Decentralised Planning Dimensions in Perumkadavila

Table 6: Summary Table of Principal Components Factors

Principal Factors	Karakulam		Vellanad		Perumkadavilla	
	Factor characteristic	% of variation explained	Factor characteristic	% of variation explained	Factor characteristic	% of variation explained
Factor 1	Overall progress	27.08	Overall progress	34.28	Overall progress	22.01
Factor 2	Social and gender equities	15.93	Social and gender equities	9.75	Social and gender equities	13.15
Factor 3	Accountability	10.05	Efficiency	6.62	Efficiency	7.36
Factor 4	Efficiency	7.46	Accountability	4.76	Accountability	5.65
Factor 5	Responsiveness	5	Participation	4.36	Transparency	5.28
	Total variation explained (%)	65.52		59.77		53.45

Source: Estimated Results

dimensions of E-governance initiatives in the selected Panchayats.

The Principal Component Analysis to extricate the relative importance of various dimensions of E-governance initiatives also highlight the fact that apart from overall development in E-governance initiatives the development of gender dimensions contributes highest share of

E-governance development. The following Table 6 shows the result of Principal Component Technique.

#### Variation among Panchayats in E-governance Impacts

The ANOVA result given in the Table 7 evaluates the variation of E-governance impact indices among various Panchayats. It shows that except in the case of social and gender equity, there exists significant differences in

Table 7: ANOVA Result on Variability of E-governance Indices Among Various Panchayats

Factors		Sum of Squares	df	Mean Square	F	Sig.
Efficiency	Between Groups(Combined)	0.712	2	0.356	14.755	0.000
	Within Groups	5.353	222	0.024		
	Total	6.065	224			
Transparency	Between Groups(Combined)	1.050	2	0.525	15.661	0.000
	Within Groups	7.445	222	0.034		
	Total	8.495	224			
Responsiveness	Between Groups (Combined)	0.760	2	0.380	11.745	0.000
	Within Groups	7.181	222	0.032		
	Total	7.941	224			
Participation	Between Groups (Combined)	0.908	2	0.454	17.627	0.000
	Within Groups	5.721	222	0.026		
	Total	6.629	224			
Accountability	Between Groups (Combined)	0.750	2	0.375	19.824	0.000
	Within Groups	4.199	222	0.019		
	Total	4.949	224			
Social equity	Between Groups (Combined)	0.084	2	0.042	1.598	0.205
	Within Groups	5.835	222	0.026		
	Total	5.919	224			
Gender equity	Between Groups (Combined)	0.007	2	0.004	.200	0.819
	Within Groups	4.074	222	0.018		
	Total	4.081	224			
Aggregate efficiency score	Between Groups (Combined)	0.468	2	0.234	16.794	0.000
	Within Groups	3.095	222	0.014		
	Total	3.563	224			

Source: Computed from the Field Survey, 2011

the values of all E-governance impact indices between Panchayats. Also, it is noted that the value of E-governance indices are higher in the Panchayat where E-governance initiatives are on a higher level. This reveals the fact that one of the critical factors, which determine the differences in the achievement of decentralized planning goals at Panchayat level, is the variation in the successful implementation of E-governance initiatives.

#### Differences in Perception on E-Governance Impact among Various Socio-Economic Groups

There may be differences in perception on E-governance impact among various socio-economic groups. The selected socio-economic parameters identified for evaluating the varying impact perceptions among the sample population are given in Table 8.

Table 8: Socio-economic Parameters and Their Corresponding Variables Socio-economic Parameters

SOCIO ECONOMIC PARAMETERS					
Sex	Caste	education	Age	Income	Land holding
Male	Forward	Primary	Up to 35 years	Up to 1500	Up to 6 cents
Female	Backward	Secondary	36-45	1501-3000	7-10 cents
	SC/ST	Degree or Diploma	46-50	3001-6000	11-22 cents
		PG and above	Above 50	Above 6000	Above 22 cents

**Table 9: F-ratio of Aggregate Efficiency Index among Various Socio-Economic Groups**

Factors	Karakulam			Vellanad			Perumkadavila		
	F-ratio	DF	Sig.	F-ratio	DF	Sig.	F-ratio	DF	Sig.
Sex	0.045	(1),(73)	.832	0.366	(1),(73)	.547	21.688	(1),(73)	.000
Caste	0.444	(2),(72)	.643	4.175	(2),(72)	.019	1.103	(2),(72)	.337
Education	2.860	(4),(70)	.030	2.176	(4),(70)	.081	6.465	(4),(70)	.001
Age	0.712	(3),(70)	.548	0.978	(3),(70)	.408	0.645	(3),(70)	.589
Income	1.494	(3),(70)	.224	7.483	(3),(70)	.000	0.111	(3),(70)	.953
Land Holding	0.844	(3),(71)	.474	4.046	(3),(71)	.010	0.329	(3),(71)	.804

The differences in perception of E-governance impact on decentralized governance among various socio-economic groups are evaluated based on F-ratio and the same result is summarized in Table 9.

In Karakulam Panchayat which is highly developed with respect to E-governance initiative has no significant differences in perception on impact of E-governance among various socio-economic groups except education groups. However, there exist significant differences among various caste groups, income and landholding groups in Vellanad Panchayat. In Perumkada Panchayat, there exist significant differences between gender and education groups on their perception on the impact of E-governance on improving the decentralized planning governance. This analysis implies that E-governance initiatives at LSG level not only improve the quality of decentralized planning process but also reduce disparity in the spread of benefit of decentralization of planning process among local people in different socio-economic hierarchies.

#### PART IV

##### Critical Success Factors of E-governance at LSG Level

The critical success factors and their performance are considered as key indicators to measure the degree of success of E-governance. Critical success factors refer to those factors responsible for the successful implementation of E-governance. The identified critical success factors are institutional, technical, managerial, people, employee and cultural factors. The Table 10 summarizes the important indicators of various critical success factors and their respective mean score.

The comparative status in the development of various critical success factors of E-governance initiative at local level in Kerala shows that among the various factors, the positive change in cultural attitude and employees' factors are more pronounced as compared to others. The role played by these factors is highly responsible for the present

successful implementation of E-governance in Kerala at local level. The least developed critical success factor is the needed institutional change including infrastructure improvements.

#### PART V

##### Summary and Conclusions

The empirical result of the impact of E-governance initiatives on decentralized planning reveals that there has been an increase in the level of various dimensions of decentralized planning such as efficiency, transparency, participation, responsiveness, accountability, social equity and gender equity. The improvement in decentralized governance is noticed in all Panchayats as a consequence of the introduction of E-governance.

Even though the E-governance initiatives improved the decentralized governance in all Panchayats, there has been a significant difference in this impact between Panchayats. The empirical result shows that the improvement in the status due to E-governance as represented by the various dimensional indices are higher for Karakulam Panchayat followed by Vellanad and Perumkadavila Panchayats. It highlights the fact that those Panchayats which have attained a higher progress in E-governance implementation also witnessed a higher achievement in decentralized planning goals. In addition to that, the degree of equitable spread of the benefits of the decentralized governance among the various socio-economic groups is high in those Panchayats which are developed in E-governance initiatives.

The identification and progress in evaluating the critical success factors are considered as important steps for future successful implementation of E-governance initiatives in the state. Among the various critical factors, the positive change in cultural attitude and employees' factors are more developed compared to other factors. The least developed critical success factor is the needed institutional change including infrastructure improvements.

**Table10: Indicators of Critical Success Factors for Factor Analysis**

Variable list	Dimension	Indicators	Mean value
1	Institutional	Commitment from the government to implement E-governance programme	3.18
2		Commitment to spread E-governance initiative to entire administrative units	2.92
3		Internal political desire drive	3.00
4		Enterprise approach	3.02
5		Robust and reliable infrastructure	3.20
		<b>Average value</b>	<b>3.064</b>
6		Technical	Availability of sufficient hardware equipments
7		The available hardware having required quality	3.18
8		Availability of other infrastructure facilities	3.19
9		Lower processing time due to front end validation	3.88
10		Effective sharing of E-governance information	3.64
		<b>Average value</b>	<b>3.43</b>
11	Managerial	Quick and timely decision making	4.00
12		The decision making process are based on data processed through E-governance	3.66
13		Adaptability and flexibility in decision making approach	3.70
14		Systematic assessment of quality standards	3.76
15		Regular monitoring and evaluation of critical key process	3.82
		<b>Average value</b>	<b>3.788</b>
16	People	Reduce the cost of obtaining services	3.82
17		Protect the confidentiality	3.76
18		Customers receive a fair and friendly treatment from employees	3.70
19		Growth of general literacy and e-literacy	3.94
20		The improved accountability and responsibility	3.70
		<b>Average value</b>	<b>3.784</b>
21	Employee	Positive attitude of employees	4.10
22		The degree to which the employees are trained	3.70
23		Training in developing communication skill	3.82
24		Training in team building and group dynamics	3.92
25		Employees ability to correct errors and bugs	3.98
		<b>Average value</b>	<b>3.904</b>
26	Cultural	Trust and openness among employees and customers	3.82
27		Clear vision on the role and responsibilities of employees	4.04
28		Employees accept quality and timely provision of services	3.94
29		Existence of organizational structure to minimize bureaucratic redtapism	4.04
30		Positive and constructive attitude of policy makers	4.46
	<b>Average value</b>	<b>4.06</b>	

Source: Estimated Results

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*Business has only two functions — marketing and innovation.*

— *Milan Kundera*



# Are the Garchmodels Still Best in Out-of-Sample Predictive Performance When Estimated for Gold Bullion Return?

PRASANT SARANGI

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*India as a fast growing prospective economy requires strong future markets like any other developed economics. Bullion trading, more particularly, gold is of high interest for analysts, researchers, more particularly to investors as it will pave them a way with an opportunity to benefit financially by investing their limited resources. Gold is considered by many, to be the best investment one can make to protect self and family during stock market declines and inflation. But the greatest confusion is when to invest? One alternative may lie with a search of an appropriate forecasting model. In this light, this paper is an attempt to make a selection between the most successful and widely used GARCH types of models with that of Artificial Neural Networks (ANN) and regression models. For this twenty various specifications of GARCH types of models, same numbers of ANN models and one multiple regression model are constructed to predict gold return series by using 2962 days daily data ranging from 11 January 2003 to 20 August 2013. Forecasting errors when calculated by using six forecasting error measures, GARCH (3,3) model emerges as the best suitable model for forecasting gold series. MSE is found to be best suitable for estimating forecasting errors.*

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In the last three decades, particularly, since the great depression of the world in 2007, investing community and academicians are interested in investigating the movement of price indices of stock markets. In this context, many researchers have tried to find out various influences of domestic stock markets within its internal operations in the country and also with the other overseas countries. These secondary markets usually reveal elevated levels of price volatility leading to unpredictable impulsive results, which makes it an important phenomenon to examine the dynamics of volatility. The measurement of swing and movement of a price series is said to be the volatility of the series. Intuitively, a series that fluctuates a lot or has high volatility imparts more risk. Hence, volatility becomes a major market parameter to which key concepts in risk management and derivatives pricing are based upon.

The past few years trend shows that the preferences for gold are continuously going up irrespective of the increase in inflation more particularly in India. The price of gold saw a massive correction in 2013 in the global as well as domestic markets. The secular rise in the last 12 years lured stakeholders to book profit on the exchanges. Global price tanked under US\$1200 per ounce, their three-year low, in June 2013. It fell to Rs. 25500 per 10 gram in the local market subsequently. However, the local futures reversed direction as the Indian rupee tumbled to a fresh all time low near 69 per US dollar. This is again pushing up the yellow metal to Rs 35000/- per 10 gm even as the global market is remaining soft towards December, 2013. The massive fall in the rupee almost throughout the year 2013 and the trend is still continuing triggering hectic spell of volatility in gold metal trade and confusing the traders either to stay sideline or should continue investing. It is considered as a chaos system by implying the behavioural traits of its prices which are unpredictable and uncertain.

To make some sort of sense of this chaotic behaviour, researchers were forced to find a technique which can estimate the effect of this uncertainty to the flow of the expected uncertain prices. If estimated accurately, this can be beneficial for investors and financiers and that can positively contribute to the economy. Bullion gold market volatility is clearly forecastable. The debate is on how far ahead one could accurately forecast and to what extent

could volatility changes be predicted. This conclusion does not violate market efficiency since accurate volatility forecast is not in conflict with underlying asset and option prices being correct.

#### REVIEW OF RELATED LITERATURES:

The literature on bullion return prediction is very scarce. Several related literatures are presented in table 1.

Table 1: Review of Literatures

Year	Researchers	Description of the Research Work
1982	Engle	Proposed time varying conditional variance with the ARCH process that uses past disturbances to model the variances of the series and allows the variances of the error term to vary over time.
1983	Beckers	Regressed the value of the estimator for a period of time (classical= $f$ (high-low). Used the constant and slope coefficients to estimate the suggested estimator.
1986	Bollersleve	Found evidences of conditional leptokurtosis in monthly S&P 500 composite index returns and advocated for the use of 't'-distribution. Non-normal GARCH models are recommended.
1990	Lamoureux and Lastrapes	Demonstrated volatility as a structural change and GARCH model estimates lower values of persistence when a structural change occurs.
1992	Cao & Tsay	With monthly excess return for S&P, VW,EW indices between 1928-89 with EGARCH, ARMA(1,1), GARCH(1,1) proved that EGARCH was better suited for long horizon forecast and there is leverage effect.
1993	Day & Lewis	Used crude oil future options (14/11/86-15/3/94) and future data (8/4/83-18/3/91). With GARCH, EGARCH, AR(1) opined that implied performed extremely well. GARCH was good as it. EGARCH was proved to be inferior. Used ME, RMSE, MAE, R <sup>2</sup> for error calculation.
1994	Noh et al.	Used daily data of S&P 500 index options for Oct., 85-Feb., 92. Regression predicted next day data.
1996	Vasilellis & Meade	Taken weekly stock options of 12 UK stocks (LIFFE) for 28/6/86-25/3/88. With RMSE found that 5 days moving average performs better than one lag implied volatility estimators.
1999	Ferreira	With weekly French & German inter-bank IM mid rate estimated volatility with GARCH, GJR models for Jan., 81 to Dec., 89 (in) & Jan., 90-Dec., 97 (out). Found French market as more volatile & German market as stable.
2001	Rahman	Applied the GARCH model to estimate conditional volatility of intraday returns on the Dow Jones Industrial Average (DJIA) and found no structural change in volatility.
2005	Karmakar	Estimated ARCH and GARCH(1,1) models in S&P CNX Nifty and BSE sensex data. GARCH proved to be best forecasting model of volatility.
2006	Ghahramani & Thavaneswaran	The problem of hypothesis testing for stationary ARMA(p,q) with GARCH errors were studied. GARCH was shown to be superior to the least square approach for forecasting.
2007	Dacha	NN and multiple regression techniques were employed to model and forecast stock market. Forecasting ability was assessed by using MAPE, MSE and RMSE. It was found that NN when trained with large data and proper inputs could predict stock market prices better than regression technique.
2008	Kumar, Singh & Pandey	Examined the nature of volatility in the BSE by using 16 years of daily data. Concluded that GARCH (1,1) model explained volatility clustering and its high persistence.
2010	Dutta	Studied daily return of S&P CNX NIFTY from 1/6/2000-30/1/2004 data. Experienced volatility clustering in NSE. Observed that the asymmetric GARCH models provided better than the symmetric GARCH models and confirmed the presence of leverage effect in the estimated data series.
2011	Altaf & Nasser	Between finite mixture of ARMA-GARCH and BP models, ARMA-GARCH model performs better in forecasting out-of-sample data of daily stock return.
2013	Sarangi & Dublish	Studied the gold bullion return by using the GARCH family of models and ANN models in India. Found that ANN is better than GARCH models.

Note: Compiled matters.

## OBJECTIVES OF THE STUDY:

This study aims to examine the following objectives:

1. It offers a critical assessment of the twelve different specifications of GARCH models, four different specifications of EGARCH models and four specifications of GJR models which are estimated together with the closing value of gold return series to find out the suitability in estimation of volatility and future predictive ability.
2. To develop different ANN architectures for forecasting with changing numbers of hidden neurons, learning rate and momentum value with gold index series.
3. A multiple regression model has been developed to estimate the influences of independent variables and to forecast the future prices.
4. To examine the capacity of the finite mixture of ARMA-

GARCH types of models compared with the standard ANN models and regression model as this comparison between the three categories of models are expected to bring a new dimension in forecasting gold return/index.

5. To examine the capacity of a suitable forecasting error measures. The advantage of using many forecasting measures resides in the robustness in choosing an optimal predictor model that will be better suitable for that specific return series.

## METHODOLOGY:

The methodology adopted are explained with following sub-sections

### Data:

The detailed descriptions of the data used for three categories of models are derived in the table 2.

Table 2: Detailed Data Description

No. of Observations	Data Range	No. of Observations	Data Range
For GARCH Type & Regression Models		For ANN Models	
2877	11 <sup>th</sup> October, 2003- 11 <sup>th</sup> May, 2013	2500(Training)	11 <sup>th</sup> October, 2003- 18 <sup>th</sup> February, 2012
85(Forecasting)	13 <sup>th</sup> May, 2013 - 20 <sup>th</sup> August, 2013	377(Validation)	20 <sup>th</sup> February, 2012- 11 <sup>th</sup> May, 2013
		85 (Forecasting)	13 <sup>th</sup> May, 2013- 20 <sup>th</sup> August, 2013

Source: [www.mcxindia.com/sitespages/realtimedata.aspx](http://www.mcxindia.com/sitespages/realtimedata.aspx) and [www.mcxindia.com/sitepage/bhavcopy.aspx](http://www.mcxindia.com/sitepage/bhavcopy.aspx)

## The Models:

Volatility has been measured as standard deviation of the rates of return. The rates of returns have been computed by taking a logarithmic difference of prices between two successive periods. Symbolically, it is:

$$y_t = \log \frac{P_{t+1}}{P_t} = \log P_{t+1} - \log P_t \quad (1)$$

Where successive price observations made at time 't' and 't+1' as  $P_t$  and  $P_{t+1}$ , respectively and  $y_t$  is the return series.

### The GARCH Types of Models

The key point that sets forth in volatility research is that the volatility of gold bullion market shows a high time-dependence. The volatility dependency of the returns of the financial assets also appears in clusters of different sizes at different periods, that gives the strong proof that the risk in those markets cannot be measured by the unconditional volatility which is given by sample variance

and is constant over time. The initial measurement of time-varying volatility is the method that measures historical volatility by calculating the standard deviation of the return price for a short-period. However, the drawback of historical volatility is that this measurement is 'noisy' because it accumulates a limited number of observations.

Thanks to the introduction of the ARCH model by Engle (1982) and the GARCH model by Bollerslev (1986), the time-varying volatilities of financial assets and financial markets can be explained rigorously in a formal background. However, the greatest limitation of the ARCH model is that, it typically requires 5-8 lags of the squared shock to adequately model conditional variance. Bollerslev (1986) extended the Engle's (1982) original work by developing a technique that allows the conditional variance to be an ARCH process.

### The GARCH Model

This is the breakthrough in financial econometrics as the ARCH/GARCH model provides profound background in

modeling the volatility of financial markets. The model can be of the form as:

$$\begin{aligned} \epsilon_t &= b_t \sqrt{h_t} \\ \text{and } h_t &= k + \sum_{i=1}^p G_i h_{t-i} + \sum_{j=1}^q A_j \epsilon_{t-j}^2 \end{aligned} \quad (2)$$

Since  $\{\epsilon_t\}$  is a white-noise process which is independent of past realizations of  $\{\epsilon_{t-j}\}$ , the conditional and unconditional means of  $\{\epsilon_t\}$  are equal to zero. By taking the expected value of  $\{\epsilon_t\}$ , it is easy to verify that:

$$E \epsilon_t = E b_t \sqrt{h_t} = 0 \quad (3)$$

The point here is most important, hence, needs to be noted that the conditional variance of  $\{\epsilon_t\}$  is given by  $\{\epsilon_{t-1} \epsilon_t^2 = h_t\}$ . Thus, the 'conditional variance' of  $\{\epsilon_t\}$  is given by  $h_t$  derived in equation (3) derived above.

This generalized ARCH (p,q) model, popularly known as GARCH (p,q), allows for both autoregressive and moving average components in the heteroskedastic variance. When 'p' is set to be zero i.e., p=0 and q=1, it is a clear case of first order ARCH model and is simply a GARCH (0,1) model. When all  $G_i$  are equal to zero, the GARCH (p, q) model is an equivalent to an ARCH (q) model. Thus, the benefits of the GARCH (p, q) model reflect a clear vision. A higher order ARCH model may have a more parsimonious GARCH representation that is much higher to identify and estimate. This is particularly true since all co-efficient developed in equation (2) must lie inside the unit circle. Hence, clearly the more parsimonious model will entail fewer coefficient restrictions.

#### The EGARCH Model

Since the GARCH model is developed, huge extensions of such models are proposed by various researchers. Each undertook the limitations of the model and tried to develop a new one with slide or moderate modifications with the existing one. Mostly the differences among the models are on the manner under which ' $h_t$ ' evolves over time. Nelson (1991) proposed the Exponential Generalized Autoregressive Conditional Heteroskedasticity (EGARCH) model. The most important contribution was to propose a model, EGARCH, to test the hypothesis that the variance of the return was influenced directly by positive and negative excess returns. The Nelson's model can be of the form as:

$$\begin{aligned} r_t &= \mu_t + \epsilon_t \\ \mu_t &= \phi_0 + \phi_1 r_{t-1} + \dots + \phi_s r_{t-s} \\ \ln(h_t) &= k + \sum_{i=1}^p G_i \sigma_{t-i}^2 + \sum_{i=1}^p \gamma_i \frac{\epsilon_{t-i}}{\sigma_{t-i}} + \sum_{j=1}^q A_j \left( \left| \frac{\epsilon_{t-j}}{\sigma_{t-j}} \right| - \sqrt{\frac{2}{\pi}} \right) \end{aligned} \quad (4)$$

#### The GJR-GARCH Model

The GJR-GARCH model was introduced by a group of authors Glosten, Jagannathan, and Runkle (1993) and was named with the first letter of each author. It extends the standard GARCH (p, q) model to include asymmetric terms that capture an important phenomenon in the conditional variance of equities: the propensity for the volatility to rise more subsequent to large negative shocks than to large positive shocks which is popularly known as 'leverage effect'. A GJR-GARCH (p, q) process is defined as:

$$\begin{aligned} r_t &= \mu_t + \epsilon_t \\ \mu_t &= \phi_0 + \phi_1 r_{t-1} + \dots + \phi_s r_{t-s} \\ h_t &= k + \sum_{i=1}^p G_i \sigma_{t-i}^2 + \sum_{i=1}^p \gamma_i \epsilon_{t-i}^2 I_{[\epsilon_{t-i} < 0]} + \sum_{j=1}^q A_j \epsilon_{t-j}^2 \end{aligned} \quad (5)$$

#### The ANN and Regression Models

The basic objective of using ANN is to reach at a conclusion from the estimated samples when unknown variables are modelled. Here it is anticipated to infer the expected variable from these unseen variables.

Following are the methodologies adopted to implement ANN architecture:

1. Construction of four ANN architectures having four neurons in input layers, one neuron in the output layer and varying the number of neurons in single hidden layer from 3 to 6 (i.e., 4-3-1 to 4-6-1).
2. Training of the networks using back propagation algorithm with different learning rates ' $\epsilon$ ' (0.7 to 0.9), momentum value ' $\alpha$ ' (0.7 to 0.9) and keeping the tolerance ratio at 0.001 as constant (see table 5 for details on models). The tolerance value is the amount of accuracy that the network is required to achieve during its learning stage on the training data set and determine the predictive result at the test data set.
3. Learning rate coefficient ( $\epsilon$ ) determines the size of the weight adjustments are made at each iteration and, hence, influences the rate of convergence. There is another way possible to improve the rate of convergence by adding a momentum to the gradient

expression. Besides the considered values, other values of 'ε' and 'α' are also experimented with all the four architectures, but are not included for inferences in this study because of their inappropriateness.

- The architectures have been constructed for the validation.
- The forecasted values of models have been observed and the errors are calculated.

Following are the steps adopted for implementation of the architectures:

- A total of 2962 days data has been divided into three patterns. The first set is training pattern and the second set is validation pattern. In the third set, next 85 days data (beside 2877 days) is used to test the forecasting efficiency of the constructed models.
- With the four architectures, twenty models are formulated both for training and validation with various combinations of 'ε' and 'α' values. The inputs are new on each trial and are presented cyclically until weights stabilize. Here, the gold index values of Open (O), High (H), Low (L) of previous day and closing value of preceding day (Cn) are inputs of day-1. The Close (C) value of day-1 is target value of the same day.
- The training node consists of 2500 data patterns. The basic structure is arranged as below:

Days	Input				Target
Day-1	O <sub>t-1</sub>	H <sub>t-1</sub>	L <sub>t-1</sub>	C <sub>n+1</sub>	C <sub>t</sub>
Day-2	O <sub>t</sub>	H <sub>t</sub>	L <sub>t</sub>	C <sub>n+2</sub>	C <sub>t+1</sub>
Day-3	O <sub>t+1</sub>	H <sub>t+1</sub>	L <sub>t+1</sub>	C <sub>n+3</sub>	C <sub>t+2</sub>
⋮	⋮	⋮	⋮	⋮	⋮
Day-2500	O <sub>t+2499</sub>	H <sub>t+2499</sub>	L <sub>t+2499</sub>	C <sub>n+2501</sub>	C <sub>t+2500</sub>

- The twenty models are estimated with 377 patterns for validation. Data of day-2501 consists of first validation pattern and the validation pattern ends with day-2877 data. The above derived procedures are implemented for validation of the models.
- After validation, 85 days further are forecasted. These constitute the desire output of our research. The neural network architecture used as the predictor is the Sigmoid Diagonal Recurrent Neural Network (SDRNN) to calculate output at hidden layers. This architecture has been proved by number of experts as better for

reducing the error and increasing the accuracy (Sarangi & Dublish, 2013).

A multiple regression model with Open (O), High (H), Low (L) of previous day and closing value of preceding day (Cn) as the independent variables and Close (C) value of day-1 as the dependent variable has been formulated and estimated. The estimated model is derived in equation-6.

### Validating the Formulated Models

All predictions are subject to errors and these errors arise for many reasons. Some are called as specification errors and others are called measurement errors. Because it is not possible to know all the potential sources of error, the actual size of the error is unknown. Therefore, the econometrician, for lack of a better alternative, makes some assumptions about the error term. One of the important assumptions is that it is not possible to observe all values of the variables and therefore, to calculate the true parameters. However, the residuals (which are measurable) can be calculated and analyzed. These residuals can then be used to estimate the models and predict the future values that are desired. Here, the errors are calculated by using the following formulas:

1. Mean Error (ME): $ME = \frac{1}{h} \sum_{i=1}^h (\hat{\sigma}_i^2 - \sigma_i^2)$	4. Mean Absolute Percentage Error (MAPE): $MAPE = \frac{1}{h+1} \sum_{i=1}^h \left  \frac{\hat{\sigma}_i^2 - \sigma_i^2}{\sigma_i^2} \right $
2. Mean Absolute Error (MAE): $MAE = \frac{1}{h} \sum_{i=1}^h  \hat{\sigma}_i^2 - \sigma_i^2 $	5. Theil's Inequality coefficient (TIC): $TIC = \frac{\sum_{i=1}^h (\hat{\sigma}_i - \sigma_i)^2}{\sum_{i=1}^h (\hat{\sigma}_{i-1} - \sigma_i)^2}$
3. Root Mean Square Error (RMSE): $RMSE = \sqrt{\frac{1}{h} \sum_{i=1}^h (\hat{\sigma}_i^2 - \sigma_i^2)^2}$	6. Mean Square Error (MSE): $MSE = \frac{1}{h+1} \sum_{i=1}^h (\hat{\sigma}_i^2 - \sigma_i^2)^2$

Where 'h' is the number of day's forecasts. In this study h=69. Symbol '' stands for 'forecasted value' and '' for 'actual value'.

### Software Used

All the models are separately developed in MATLAB 7.0 software and are estimated.

### Empirical Findings

The empirical results are analyzed in three following sub-sections:

#### Estimating Volatility from GARCH Types of Models

The use of GARCH type of models necessitates the fulfilment of three steps like the (a) pre-fit analysis, (b) estimation of the models and (c) post estimation analysis.

These three steps are necessary to counteract the possibility of convergence problems, if any, of course by selecting the best appropriate model that will explain the true nature of data. The pre-fit analysis necessitates plotting of the Auto Correlation Function (ACF) and Partial Auto Correlation Function (PACF) of the return series and performing the Engle's ARCH test or the Q-test. The ACF and PACF results for the gold bullion return series when displayed with graphs indicates the presence of little autocorrelation. The ACF shows significant auto correlation and is more accentuated for smaller lags (almost upto 3rd and 4th lags) and die out slowly, showing the possibility of a variance process close to being non-stationary. The LBP Q-test results reveals 'H' value called as 'Boolean decision flag' is equal to one estimated with 3, 5 and 7 lags and significant p-value (zero). The static values for all the three lags are observed to be greater than respective critical

values. More over, the Engle's test static also reveals significant evidence in favour of GARCH type of models i.e., presence of heteroskedasticity with the significant 'H' values (one) estimated for all the three lags. Further, the p-values are observed to be zero and estimated static values are observed to be higher than respective critical values. These justifies the partial usefulness of GARCH models in the estimated series.

In the next step to the judgment, the GARCH coefficients are calculated and the obtained results are presented in the table 3 derived. From the table, the  $G_i$ 's (GARCH lag coefficients) estimated for GARCH, EGARCH and GJR specifications are observed to be very close to one indicating that the shocks to conditional variance take a long time to die out. This proves the persistence in volatility as very long and explosive suggestive of an integrated

**Table 3: Estimated Co-efficient of GARCH Type of Models**

Parameter/ Variance	C	K	$G_1$	$G_2$	$G_3$	$A_1$	$A_2$	$A_3$	$O_1$	$O_2$
GARCH(1,1)	0.00046	8.53e-007	0.93764			0.05508				
GARCH(0,1)	0.00099	6.81e-005				0.36828				
GARCH(0,2)	0.00113	5.77e-005				0.24881	0.19811			
GARCH(0,3)	0.00100	4.79e-005				0.21645	0.16913	0.17531		
GARCH(1,2)	0.00028	8.8e-007	0.93708			0.05525	0.00000			
GARCH(1,3)	0.00040	8.47e-007	0.93782			0.05492	0.00000	0.00000		
GARCH(2,1)	0.00026	9.58e-007	0.78254	0.14648		0.062827				
GARCH(2,2)	0.00026	1.65e-006	0.00000	0.87954		0.057557	0.04871			
GARCH(2,3)	0.00026	1.65e-006	0.00000	0.87958		0.05754	0.04863	0.00000		
GARCH(3,1)	0.00026	1.65e-006	0.00000	0.68456	0.24326	0.051265				
GARCH(3,2)	0.00035	1.54e-006	0.46743	0.00000	0.41796	0.057421	0.04365			
GARCH(3,3)	0.02224	1.53e-006	0.47203	0.00000	0.41401	0.05798	0.04256	0.00000		
EGARCH(1,1)	0.00115	-0.09669	0.98836			0.12418			0.02658	
EGARCH(1,2)	0.00054	-0.09089	0.98902			0.19199	-0.0726		-0.0376	0.06678
EGARCH(2,2)	0.00119	-0.18951	-0.0016	0.97871		0.13965	0.11126		0.0252	0.025857
EGARCH(2,1)	1.8e-005	-0.11352	0.84159	0.14483		0.14345			0.02613	
GJR(1,1)	0.00089	7.3e-007	0.9439			0.07031			-0.03838	
GJR(2,2)	0.00078	1.25e-006	0.15771	0.74711		0.06717	0.05547		-0.05950	-0.01328
GJR(1,2)	0.0003	7.02e-007	0.94453			0.06968	6.6e-005		-0.03773	-6.6e-005
GJR(2,1)	0.00058	7.5e-007	0.86898	0.07153		0.07448			-0.03989	

Note: Estimated value from the models.

process. Similarly, the small values of error coefficients  $A_j$ 's (0.05 to 0.06) for all the twelve GARCH specifications and also low values for EGARCH (0.0.12 to 0.19) and GJR specifications suggests that market surprises has possibility of relatively small revisions in future volatility. Again, except EGARCH (1, 2) model the leverage effects ( $\gamma$ ) are found to be positive for all other three models. These positive values in the coefficients of ' $\gamma$ ' may be considered as an exception. However, the positive sign of leverage effect implies that positive innovations are more destabilizing than negative innovations in gold return, hence, gold trading. Whereas the ' $\gamma$ ' estimate calculated for GJR specifications are observed to be negative. The corresponding t-values are also found to be insignificant. This indicates that there is no leverage effect is observed for the gold return series.

As the final and third step of the process, the post estimation ARCH test results confirm the presence of

explanatory power of the estimated model and also the existence of the GARCH effects with zero 'H' values and the estimated static values are less than their respective critical values estimated for the three lags.

#### Forecasting Efficiencies of GARCH Type of Models

The error value calculated across twenty GARCH type of models for gold return series along with their ranks are presented in the table 4 below. From the table it can be seen that among the twenty models estimated, GARCH (3,3) specification of model is having the minimum error value in the respective error measures and hence, ranks one (Rank-1) by all the six forecasting error measures. The negative error values indicates the under prediction of the index than the actual value. The error values calculated by both GJR and EGARCH models are much higher than the values calculated by GARCH specifications. The higher

Table 4: Forecasting Errors of GARCH Type of Models

GARCH Type of Models	ME	RANK	MAE	RANK	RMSE	RANK	MAPE	RANK	THEIL'S	RANK	MSE	RANK
GARCH(1,1)	0.0173	13	0.00334	15	0.1316	13	1.3322	16	1.00916	16	6.6e-06	13
GARCH(0,1)	-0.0087	18	0.0021	13	-	-	0.6696	11	0.9964	07	-4.8e-07	20
GARCH(0,2)	-0.0008	20	0.0019	12	-	-	0.6360	10	1.0076	15	-5.05e-07	19
GARCH(0,3)	-0.0076	19	0.0017	11	-	-	0.5898	09	0.9969	08	-5.2e-07	18
GARCH(1,2)	0.0099	09	0.0016	09	0.0999	09	0.7691	12	0.99796	10	3.05e-06	09
GARCH(1,3)	0.0103	03	0.0017	10	0.1019	10	0.7999	03	0.9974	06	3.3e-06	05
GARCH(2,1)	0.0071	06	0.0012	07	0.0848	06	0.5535	06	0.9831	02	1.9e-06	06
GARCH(2,2)	0.0065	05	0.0011	03	0.0809	04	0.5041	04	0.9932	04	1.6e-06	03
GARCH (1,3)	0.0063	10	0.0011	04	0.0799	03	0.4919	13	0.9933	09	1.7e-06	10
GARCH(2,3)	0.0065	04	0.0011	02	0.0811	05	0.5064	05	0.9933	05	1.7e-06	04
GARCH(3,2)	0.0063	02	0.0063	16	0.0799	02	0.4919	02	0.9931	03	1.6e-06	02
<b>GARCH(3,3)</b>	<b>0.0036</b>	<b>01</b>	<b>0.0006</b>	<b>01</b>	<b>0.0607</b>	<b>01</b>	<b>0.2837</b>	<b>01</b>	<b>0.9828</b>	<b>01</b>	<b>8.06e-07</b>	<b>01</b>
EGARCH(1,1)	0.1501	16	0.0125	20	0.3875	16	11.5517	19	0.9996	13	0.00041	16
EGARCH(1,2)	0.1125	14	0.0101	18	0.3354	14	8.6557	17	0.9995	11	0.00023	14
EGARCH(2,2)	0.1139	15	0.0094	17	0.3375	15	8.7643	18	0.9996	12	0.00024	15
EGARCH(2,1)	0.1693	17	0.0123	19	0.4114	17	13.025	20	0.9997	14	0.00049	17
GJR (1,1)	0.0124	12	0.0025	14	0.11137	12	0.9541	15	1.0101	19	4.17e-06	12
GJR (2,2)	0.0073	07	0.0012	05	0.08561	07	0.56389	08	1.0097	17	1.98e-06	07
GJR (2,1)	0.0073	08	0.0012	06	0.08561	08	0.5638	07	1.0097	18	1.98e-06	08
GJR (1,2)	0.0105	11	0.0016	08	0.10246	11	0.8078	14	1.0187	20	3.32e-06	11

Note: Calculated by using GARCH types of models. 2. Bold cells indicate rank-1 models.zx

error values indicate that the models over estimates the return values than the actual value.

From the table it can be seen that among the six forecasting error measured, the error value calculated by MSE measure for all the twenty models are minimum. It is hence, can be said that MSE best suits to gold return series.

### Forecasting Efficiencies of ANN models

The forecasting error values calculated with the use of twenty ANN models/architectures for gold index are presented in the table 5 derived. In a close observation, it can be seen that model-10 (4-5-1) among the twenty models calculated is ranked first (Rank-1) by all the six forecasting measures.

Table 5: Forecasting Errors of ANN Models

ANN Models	ME	RANK	MAE	RANK	RMSE	RANK	MAPE	RANK	THEIL'S	RANK	MSE	RANK
$\alpha=0.9, \epsilon=0.9;$ 4-6-1 (Model-1)	-0.02104	10	0.01093	14	-		0.08789	16	0.69787	18	-0.00768	05
4-5-1 (Model-2)	-0.02133	07	0.010429	10	-		0.08505	10	0.64925	13	-0.007553	08
4-4-1 (Model-3)	-0.01514	15	0.009748	08	-		0.080462	05	0.520713	08	-0.006083	12
4-3-1 (Model-4)	-0.00695	17	0.008597	06	-		0.080785	07	0.27718	05	-0.003078	15
$\alpha=0.8, \epsilon=0.8;$ 4-6-1 (Model-5)	-0.02131	09	0.01093	15	-		0.087619	15	0.69323	16	-0.00776	04
4-5-1 (Model-6)	-0.0066	19	0.007419	02	-		0.070392	04	0.23409	04	-0.00299	17
4-4-1 (Model-7)	0.008109	03	0.01713	20	-		0.101938	20	0.64748	12	-0.00079	20
4-3-1 (Model-8)	-0.02338	05	0.010996	19	-		0.101436	19	0.741484	20	0.00282	02
$\alpha=0.9, \epsilon=0.8;$ 4-6-1 (Model-9)	-0.01841	12	0.01099	17	-		0.08632	14	0.685561	15	-0.00705	10
<b>4-5-1 (Model-10)</b>	<b>0.00225</b>	<b>01</b>	<b>0.0031</b>	<b>01</b>	<b>0.0701</b>	<b>01</b>	<b>0.062323</b>	<b>01</b>	<b>0.188841</b>	<b>01</b>	<b>0.00082</b>	<b>01</b>
4-4-1 (Model-11)	-0.01236	16	0.00835	05	-		0.08575	13	0.401035	06	-0.00487	14
8; 4-3-1 (Model-12)	-0.02133	08	0.01043	11	-		0.08505	11	0.64925	14	-0.00756	07
$\alpha=0.7, \epsilon=0.7;$ 4-6-1 (Model-13)	-0.00196	20	0.00792	04	-		0.06745	02	0.201103	02	-0.00208	19
4-5-1 (Model-14)	-0.01999	11	0.01015	09	-		0.08361	08	0.62507	09	-0.00708	09
4-4-1 (Model-15)	-0.01554	14	0.00951	07	-		0.08051	06	0.50165	07	-0.00602	13
4-3-1 (Model-16)	-0.01625	13	0.01052	12	-		0.08503	09	0.64471	11	-0.00647	11
$\alpha=0.8, \epsilon=0.9;$ 4-6-1 (Model-17)	0.02072	04	0.01095	16	-		0.08561	12	0.69406	17	-0.00758	06
4-5-1 (Model-18)	-0.00661	18	0.00747	03	-		0.07016	03	0.23295	03	-0.00299	18
4-4-1 (Model-19)	0.00763	02	0.011709	19	0.08734	02	0.100653	18	0.64372	10	-0.002999	16
4-3-1 (Model-20)	-0.0231	06	0.01085	13	-		0.100128	17	0.740565	19	-0.00812	03

Note: 1. Calculated value from ANN models.

2. Bold cells indicate rank-1 models.

The minimum value calculated by all the measures among the twenty ANN architectures is observed at MSE (0.000818) for model-10 followed by ME for the same model as 0.0023. MSE is the more appropriate measure to calculate the forecasting error among the six measures discussed in the study for the gold index values when calculated by using ANN architectures.

### Forecasting Efficiencies of Regression Model

The estimated partial regression coefficients for gold return series is modelled and presented in the equation derived below:

$$\hat{C}_t = 0.19224 - 0.63285\hat{O}_t + 0.573799\hat{H}_t + 0.72863\hat{L}_t - 0.00069\hat{C}_{nt} \\ (28.7017)(-53.4467) (55.8064) (64.1948) (-0.17714) \dots (6) \\ F - value = 1963.176 (p - VALUE = 0.0000) \bar{R}^2 = 0.829639$$

Equation-6 derived above present's estimated partial regression coefficients, F-value and adjusted  $\bar{R}^2$  and their t-values in the parenthesis. The value of  $\bar{R}^2$  estimated for gold return series is reported to be 0.8296 indicating that 82.96 per cent of the variation in the dependent variable (C) is explained by the variation in the independent variables (O, H, L and Cn). The intercept value estimated to be 0.19224 indicates a minimum variation in the dependent



variable when all other independent variables are kept constant. The first quantitative relationship between (C) and previous day open price (O) is presented by partial regression coefficient as -0.03285 and indicate the existence of inverse relationship between the two variables. Whereas the static of previous day High (H) to that of closing (C) is reported to be +0.57379 indicates the existence of a direct relationship between the variables. Similarly, the relationship between Low (L) to that of closing (C) is observed to be positive with a value of +0.72863. Furthermore, the relationship between next day closing value (Cn) and previous day closing value (C) is found to be 'negative'. Hence, the equation shows the existence of positive relationship with (H) and (L) and negative relationships with (O) and Cn between the dependent variable Close (C) estimated in the study.

Further, the t-values calculated for all the four independent variables including the intercept are greater than 2.576 (critical value). This indicates that all the four independent variables are within the acceptable reason and hence, are statistically significant. Similarly, the F-value for the model is estimated to be 1963.176 which validate the model and also the overall fit level of the parameters estimated. With the estimated model, the next 85 days are predicted. The forecasting errors calculated by all six measures are presented in the table 6 derived. From the table the minimum values are estimated by MSE followed by MAE as 0.00159 and 0.00815 respectively.

### Examining the Suitability of a Model

The table 6 derived below presents the forecasting error derived by the first ranked models from each three

Table 6: Comparison among First Rank Models for Gold Index

Models	ME	MAE	RMSE	MAPE	THEIL'S	MSE
GARCH (3,3)	0.0036	0.0006	0.0607	0.2837	0.9828	8.06E-07
Model-10	0.0023	0.0033	0.0701	0.0623	0.1888	0.0008
Regression	-0.0015	0.0081	—	0.0649	0.1314	0.0016

Note: Extracted from table 4 and 5.

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categories of models (regression has no rank). From the table it can be seen that GARCH (3,3) has the lowest value i.e., 8.06E-07 (0.0000) as reflected by MSE measure. For ANN models, the minimum value is estimated at MSE. However, the error value calculated by ANN and regression is much higher than the value calculated by GARCH (3,3) model. A close look to the table reveals that the over all error values calculated by the six measures for GARCH (3, 3) specification are more consistent than the error values calculated by other two models. Among the six forecasting error measures considered in the study, undoubtedly MSE is found to be best performer.

### Conclusion

It can be concluded that both EGARCH specifications and GJR specifications of models are not appropriate for estimating the incidence of volatility in gold return series. The forecasting ability of GARCH (3, 3) is concluded to be more suitable rather than ANN and regression models. This shows that ANN and regression are not at all suitable measures for predicting gold return series. Furthermore, the GARCH type of models are capable to measure volatility of a return series. Whereas both ANN and regression models are quite inefficient while measuring the volatility of a return series. MSE is observed to be efficient and more suitable while calculating the forecasting error by all the three categories of models estimated in the study. Hence, the above findings answers to the emerged question at the beginning of this research by conforming that irrespective of the developments of numerous out-of-sample forecasting measures in the literature, GARCH specifications are still having their superiority over the frequent models.

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*Innovation is the whim of an elite before it becomes a need of the public.*

— Ludwig von Mises

# Analysis of Indian Coal Industry's Technological Progress

RAJIV KUMAR, CHANDAN BHAR AND DEBASISH BASAK

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*In this paper, the Total Factor Productivity Growth (TFPG) rate has been calculated for Indian coal industry to judge its technological progress using Solow Residual method. As it is known that the Solow Residual has a direct interpretation as a measure of technical change on aggregate basis. A translog variable cost function is used for variable cost model of Indian coal industry. The total variable cost is decreasing by 1.8 per cent annually. Solow residuals of past 10 years are calculated and it has been found that the average percentage of technical growth is near about 1.4 per cent under ideal conditions.*

## Introduction

Energy is the prime need of any country, especially when it comes to India where population is increasing rapidly. The demand of quality-wise and quantity-wise reliable and affordable source of energy is a great challenge. India is the third largest coal producer country in the world with an annual production of 595 million tonnes in 2012<sup>[1]</sup>. In India, coal is the main source of energy, which accounts for 55 per cent of country's energy need<sup>[2]</sup>. 70 per cent of the electricity generated comes from coal based thermal power plant<sup>[3]</sup>. Coal contributes to about more than 1.5 per cent of the GDP of the country<sup>[4]</sup>. Today coal is not only used as fuel but also in gasification, in liquefaction, as a coking coal, in industrial process, in Production of chemicals and much more. This show how important is the Indian coal industry.

The Coal India Limited (CIL) is the world's largest coal mining company with seven owned coal producing subsidiaries, one mine planning and Consultancy Company in India and one mining company in Mozambique. CIL also manages 200 other establishments like workshops, hospitals etc. Further, it also owns 26 technical and management training institutes and 102 Vocational Training Institutes Centers. Indian Institute of Coal Management (IICM) as a state-of-the-art Management Training 'Centre of Excellence' - the largest Corporate Training Institute in India - operates under CIL and conducts multi disciplinary management development programmes. CIL having fulfilled the financial and other prerequisites was granted the Maharatna recognition in April 2011. It is a privileged status conferred by Government of India to select state owned enterprises in order to empower them to expand their operations and emerge as global giants. It encompasses the whole gamut of identification of coal reserves, detailed exploration followed by design and implementation and optimizing operations for coal extraction in its mines. CIL contribute 81 percent to the total

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Indian coal production [6]. Coal present in 14 out of 28 states. Indian coal contains generally high ash (4500 GCV) & low sulphur. Type of coal produced in India is Non-coking coal (93.2%) and Coking coal (6.8%). Opencast mines accounts for 90 per cent of total production and UG accounts for 10 per cent of total production.

One of the most important milestones in case of the Indian coal sector is the nationalization of coal mines. In 1970s, growing need of systematic exploitation of coal reserves, unscientific mining practices by private coal owners and poor working condition of workers in private colliery became matter of concern for government. Due to that Indian government took a decision for nationalisation of all private coal mines. Hence, Coal Mines (Nationalisation) Act 1973 came into existence which brought all the coal mines under the control of government. Because of this, it can be argued that coal is still under a strictly controlled regime. But after 1991 economic policy, a reform in mining policy of India which might be accounted for modernisation of coal mines is felt. Hence, with the 1993 amendment in the Coal Mines (Nationalisation) Act 1973, some exceptions to the mining policy were introduced. Now, government was able to selectively allow coal mining for captive consumption of any industries through notifications. Hence, the captive coal mining is allowed for the production of iron and steel, power generation, cement and washing of coal [6].

Solow defines "technical change" as a short hand expression for any kind of shift in production function. Thus slowdowns, speedups, improvements in the education of

the labour force, and all sorts of things will appear as technical change [7]. Our objective is to find out the technological progress of Indian coal sector during 2000-2009. As it is known that the diffusion of technical innovations is often referred to as the most important driving force behind economic growth. In case of mining sector, technical progress can improve productivity and safety [8].

## 2. Literature Review

The basis for improvement in revenue earning capacity of any organisation is the productivity growth. The total factor productivity (TFP) gained importance and appeal when it was recognized that output growth could not be fuelled by continuous input growth in the long run due to the nature of diminishing returns for input use. That is, as more and more inputs are used, less and less extra output can be expected from an extra unit of input used. For sustained output growth, TFP growth is essential, and hence total factor productivity growth became synonymous with long term growth as it reflects the potential for growth. Productivity is also measured partially i.e. partial productivity. Here productivity is measured with respect to a particular input factor i.e. net output per unit of that input. Problem with partial productivity is that it does not consider other inputs whereas net output produced depends on all its input not on a single input. Hence, partial productivity may results to a misleading conclusion in case of overall productivity planning of an organisation.

According to Renuka Mahadevan, Technical Progress of an entity is represented by Non-frontier Total

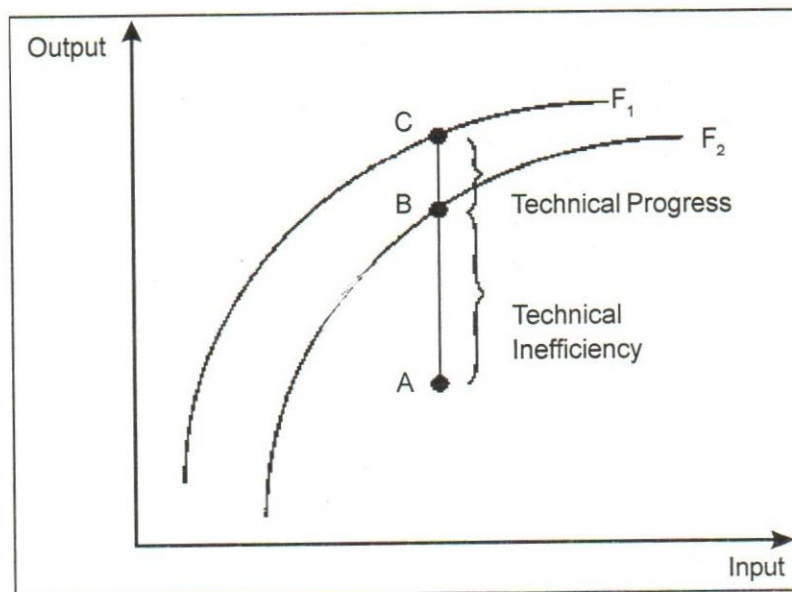


Figure 1. Production Frontier

Factor Productivity (TFP) Growth<sup>[9]</sup>. So we can say that Technological progress can be measured in terms of Total Factor Productivity Growth (TFPG) rate. The concept of TFP growth dates back to the work of Tinbergen (1942), Abramovitz (1956), Solow (1957), and Griliches and Jorgenson (1966) among many others. While these and a significant number of studies thereafter have often focused on the non-frontier approach to calculating TFP growth. The literature on TFP growth measurement can be broadly categorized into the frontier and non-frontier approach. The frontier and non-frontier categorization is of methodological importance since the frontier approach identifies the role of technical efficiency in overall firm performance while the non-frontier approach assumes that firms are technically efficient. Figure-1 illustrates this idea.

In the figure-1,  $F_1$  and  $F_2$  are production frontiers in period 1 and 2. The non-frontier TFP growth measure is only made up of the movement from B to C, which represents technical progress due to technological improvements incorporated in inputs. Hence, technical progress and TFP growth are used synonymously when the non-frontier approach is used. The frontier TFP growth measure, on the other hand, consists of outward shifts of the production function resulting from technical progress as well as technical efficiency related to movements toward the production frontier.

Non-frontier TFP Growth = Output Growth - Input Growth

Since real data on output and input are available, TFP growth in above Equation is estimated as a residual measuring 'everything and anything' of output growth that is not accounted for by input growth. Another difference between the frontier and non-frontier approach is that the frontier method is best suited for benchmarking. While the non-frontier approach, which is used to obtain estimates of aggregate TFP growth measure for the entire economy or entity.

As far as question of earlier work in this field for Indian coal sector, its M. Kulshreshtha & J. K. Parikh<sup>[10]</sup>, they used data envelopment analysis (DEA) for performance analysis of different coal mining regions and Malmquist index for TFPG. This is frontier approach, used for benchmarking and not for the aggregate TFP growth measure. DEA is a non-parametric approach, which is based on mathematical programming.

In 1957, Solow<sup>[7]</sup> used a scientific method to measure the technical progress contribution to the economic growth. The Solow residual accurately measures TFP growth if

there is perfect competition in factor markets, and the growth rates of the inputs are measured accurately. In this paper, Solow residual is calculated considering ideal condition i.e. perfect market condition and constant return to scale.

### 3. Measurement of Technical Progress of an Economic Entity

Any index of TFP can be computed either from indexes of the quantity of total output and total input (which show that the relationship between TFP and shift in production function) or from the corresponding price indexes<sup>[11]</sup>.

Divisia indexes, which are widely used in the analysis of productivity, measure the growth rate of an aggregate. For this purpose, the growth rates of the components of the aggregate are weighted by the share of each component in the aggregate and summed. For a multiple-output technology, a Divisia index of aggregate output ( $\dot{Q}$ ) can be written as:

$$\dot{Q} = \sum_j \frac{P_j Q_j}{R} \dot{Q}_j$$

where  $Q_j$  is the quantity of the  $j^{\text{th}}$  output,  $P_j$  is the price of

the  $j^{\text{th}}$  output,  $R = \sum_j P_j Q_j$  is total revenue and  $\dot{Q}_j = \frac{dQ_j}{dt} / Q_j$

the growth rate of the  $j^{\text{th}}$  output. Likewise, the Divisia index of aggregate input ( $\dot{X}$ ) can be written as:

$$\dot{X} = \sum_i \frac{P_i X_i}{C} \dot{X}_i$$

where  $X_i$  is the quantity of the  $i^{\text{th}}$  input,  $P_i$  is the price of

the  $i^{\text{th}}$  input,  $C = \sum_i P_i X_i$  is total cost and  $\dot{X}_i = \frac{dX_i}{dt} / X_i$  the

growth rate of the  $i^{\text{th}}$  input. Finally, the Divisia index of Total Factor Productivity growth can be obtained as:

$$TFP = \dot{Q} - \dot{X}$$

this index measures the changes in the output aggregate not explained by changes in the input aggregate. Solow (1957)<sup>[7]</sup> proves that, under constant returns to scale, in a long run competitive equilibrium the above index can be interpreted as a measure of technical change. Hence is the measure of technological progress.

### 4. Estimation of TFP Growth for Mining Industry

Coal extraction directly affected by labour force employed, machineries used, energy consumed, materials consumed and technology. So it could be said that the coal output is the function of these variables.

$$Q = f(L, E, M, K, t)$$

where Q is the coal output, L is labour employed, K is capital (here machineries are taken as capital as it quasi-fixed input), E is energy consumed, M is materials consumed (like explosives, detonators, etc.) and t is technology or time variable.

Similarly, the variable cost of coal extraction depend on labour price, energy price or fuel price, material price, number of machineries available (taken as level of capital), quantity of output to be extracted and technology available. Here, in case of variable cost only variables directly related to coal extraction is included and others (e.g. marketing costs) are excluded. Since, it is believed that extraction costs are more likely to be affected by changes in productivity than non-extractive costs. Now variable cost can be represented as:  $V.C = g(P_L, P_E, P_M, K, Q, t)$

where V.C denotes variable cost and  $P_L, P_E$  and  $P_M$  are the input prices of labour, energy and materials. The total cost function can be written as:

$$T.C = C = g(P_L, P_E, P_M, K, Q, t) + P_K K$$

where  $P_K$  is the cost of capital.

So, now we have,

$$T\dot{F}P = \dot{Q} - \dot{F}$$

$$Q = f(L, E, M, K, t)$$

$$V.C = g(P_L, P_E, P_M, K, Q, t)$$

$$T.C = C = g(P_L, P_E, P_M, K, Q, t) + P_K K$$

$$\dot{F} = \sum_{i,I} \frac{P_i I}{C} \dot{I} = \sum_{i,I} S_i \dot{I} \quad i, I = L, E, M, K$$

$$\text{Where } S_i = \frac{P_i I}{C}$$

Now, the total cost identity can be written as:

$$C = \sum_{i,I} I P_i \quad i, I = L, E, M, K$$

Differentiating the cost identity w.r.t time we have,

$$\frac{\partial C}{\partial t} = \sum_{i,I} I \frac{\partial P_i}{\partial t} + \sum_{i,I} P_i \frac{\partial I}{\partial t}$$

$$i, I = L, E, M, K$$

$$\text{so, } \dot{C} = \frac{\partial C}{\partial t} = \sum_{i,I} \frac{I P_i}{C} \frac{\partial P_i}{\partial t} + \sum_{i,I} \frac{P_i I}{C} \frac{\partial I}{\partial t}$$

$$\text{so, } \dot{C} = \sum_i S_i \dot{P}_i + \sum_{i,I} S_i \dot{I} = \sum_i S_i \dot{P}_i + \dot{F} \quad (1)$$

$$\text{Where } i, I = L, E, M, K$$

Now, we have also,

$$C = g(P_L, P_E, P_M, K, Q, t) + P_K K$$

Differentiating this cost identity w.r.t time we have,

$$\frac{\partial C}{\partial t} = \sum_i \frac{\partial g}{\partial P_i} \cdot \frac{\partial P_i}{\partial t} + \frac{\partial g}{\partial K} \cdot \frac{\partial K}{\partial t} + \frac{\partial g}{\partial Q} \cdot \frac{\partial Q}{\partial t} + \frac{\partial g}{\partial t} +$$

$$K \frac{\partial P_K}{\partial t} + P_K \frac{\partial K}{\partial t} \quad i, I = L, E, M$$

applying shepherd's lemma in above expression and rearranging terms we have,

$$\frac{\partial C}{\partial t} = \sum_{i,I} I \frac{\partial P_i}{\partial t} - (Z_K - P_K) \frac{\partial K}{\partial t} + \frac{\partial g}{\partial Q} \cdot \frac{\partial Q}{\partial t} + \frac{\partial g}{\partial t}$$

$$i, I = L, E, M, K$$

{Where  $Z_K = -\frac{\partial g}{\partial K}$  is the shadow price of capital;

$\frac{\partial g}{\partial P_i} = I$ , the derivative of the expenditure function w.r.t

that price is equal to demand.}

$$\text{Now, } \dot{C} = \frac{\partial C}{\partial t} = \sum_i S_i \dot{P}_i - (Z_K - P_K) \frac{K}{C} \cdot \dot{K} +$$

$$\varepsilon_{CQ} \dot{Q} + \frac{1}{C} \cdot \frac{\partial g}{\partial t} \quad (2)$$

$$i = L, E, M, K$$

where  $\varepsilon_{CQ} = \frac{Q}{C} \frac{\partial g}{\partial Q}$ ; cost elasticity

Using equation (1) & (2), we have

$$\dot{F} = - (Z_K - P_K) \frac{K}{C} \cdot \dot{K} + \varepsilon_{CQ} \dot{Q} + \frac{1}{C} \cdot \frac{\partial g}{\partial t}$$

$$\text{So, } T\dot{F}P = \dot{Q} - \dot{F} = - \frac{1}{C} \cdot \frac{\partial g}{\partial t} + (Z_K - P_K) \frac{K}{C} \cdot \dot{K} +$$

$$(1 - \varepsilon_{CQ}) \dot{Q}$$

in a competitive equilibrium when the shadow value of the fixed factor ( $Z_K$ ) is equal to its market price ( $P_K$ ) and when there are constant returns to scale, cost elasticity is equal to one. Considering the perfect market competition and constant return to scale of production,

$$Z_K = P_K \quad \text{And } 1 = \varepsilon_{CQ}$$

$$\text{Finally, we have, } T\dot{F}P = - \frac{1}{C} \cdot \frac{\partial g}{\partial t}$$

## 5. Description of Variables used for Computing TFPG

As earlier mentioned in this paper those only costs directly related to coal extraction is included, thus only those

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variables related to these cost are used in analysis. Below are the descriptions of the followings.

### **Labours**

Coal industry is a labour intensive sector. They play different roles in opencast as well as in underground mines like miner, foreman, Mechanical fitter, driller, Conveyor operator, Winder operator, Onsetter, Banksman, Air compressor operator, Pumping station operator, blasting technician, loader, etc. They are categorised into three categories: Skilled labour, Semi-skilled labour and Un-skilled labour. In this paper labour variables are taken in hours i.e. how many labour hours used each year. Here labours directly involved in coal mining are considered. Statistics department of DGMS keep a record of total manshifts worked in the coal mines. In this paper each year manshift is multiplied by eight as one manshift in Indian coal mines is of eight hours. Due to increased mechanization in coal mines total manshift worked is decreasing, in 2000 total manshift worked in Coal India Limited was 115990522 whereas in 2009 it was 90449769.

### **Price of Labour**

Labour cost is the total expense on the workers involved in coal mining. Welfare expense like housing, medical, educational facilities, sports, cultural facilities expenses are not included in it. This is calculated dividing total wages expenditures by total labour hours. Total wages expenditure is the product of average weekly cash earning per worker, average daily employment (Number of Labour) and number of weeks in a year. Price of labour increased from Rs 38.015 (in year 2000) to Rs 102.008 (in year 2009).

### **Energy**

Energy is consumed in mining, transportation and processing of coal in coal mines. Coal miners use giant machine to dig coal from opencast as well as from underground coal mines. These machines run on diesel or electricity. Here the energy variables are taken in mega joules i.e. how many mega joules of energy are used each year. Energy consumption increases from 41 billion mega joules (in year 2000) to 43 billion mega joules (in year 2009).

### **Price of Energy**

Energy cost is the total expenditures on the electricity and fuel consumed. Here unit for it is taken as rupees spend for per mega joules of energy. From the financial sheets the expenditures on energy is taken to calculate the price of energy consumed. The price of energy increased from Rs

0.33 (in year 2000) to Rs 0.40 (in year 2009).

### **Materials**

In case of coal mining activity, the materials used are explosives, detonators, timbers, etc. The prime material consumed in mining activity is the explosives. In this paper, unit for material consumed is the tonne i.e. number of tonnes of explosive used for mining activity. Explosive consumption increases from 290513.16 tonnes (in year 2000) to 353135.04 tonnes (in year 2009). This increased explosive use show the increased mining activity especially in case of opencast mining as 90 percent coal production comes from opencast coal mines.

### **Price of Materials**

Material cost is the total expenditure on the materials consumed. Here unit for it is taken as rupees per tonnes. From the financial sheets the expenditures on materials is taken to calculate the price of materials consumed. The price of materials increased from Rs 15041.68 (in year 2000) to Rs 22125.17 (in year 2009).

### **Capital**

Mining industry is a capital intensive sector, where capital investment is needed from exploration of ores to dispatch of ores. In this paper all the capital is not considered. Here only directly related capital to coal extraction is taken as it is earlier said in this paper extraction costs are more likely to be affected by changes in productivity than non-extractive costs. So, here machineries and equipments are the directly related capital. Machineries and equipments used are coal cutting machines, mechanical loader, mechanical cutter, rope haulages, conveyors, drills, shuttle cars, locomotives, shovels, dumpers, dozers, cranes, scrapers, draglines, loaders, graders, haulage, ventilator, winding engines, pumps, coal handling plants, workshop machineries, etc. Nowadays mines are more mechanized and technology oriented. Manual coal extraction is not used anywhere. In this paper, unit for capital is the machinery hour used i.e. the total number of machinery hours used for coal extraction. The total number of machines used decreases from 23440 (in year 2000) to 20110 (in year 2009). This decreased number of machinery used is due to advance in mining methodology and more sophisticated or it could be said more enhanced type of machines are used nowadays.

### **Cost of Capital**

Cost of capital in case of mining industry is the return that could be earned on an investment with similar risk in any other entity. It is cost of procuring capital for the entity.

Here the cost is the total depreciations, total impairments and expected interest on net capital used in each year.

So, Total capital cost = Net depreciations and impairments + Expected interest on Net capital used

The net depreciations and impairments of a year is calculated by subtracting previous year depreciation and impairment account from current year depreciation and impairment account. The net block of capital used in a year is the sum of net addition to the gross assets and previous year net fixed assets. The net addition to the gross assets is calculated by subtracting previous year gross fixed assets account from current year gross fixed assets account of financial reports. For calculation of expected interest on net capital used in a year, interest rate on central government securities from RBI website is used. This is the weighted average interest rates on central government securities of each year. Since the interest rate on central government securities is assumed as risk free return on any investment so it could be said that it represent minimum or insured expected interest on the net capital used. Here, unit for cost of capital is rupees per hour used i.e. cost for each machinery hour used. The cost of capital decreases from 333.78 rupees (in year 2000) to 227.76 rupees (in year 2009) per hour.

### Output

Variable cost also depends on amount of coal to be extracted. Since size of coal seam affect the various factors or inputs needed for extraction of that coal block. The targeted output in a particular time limit decides the number of workers, machineries, materials, etc. So coal output is

also one of the significant variables used for analysis for production. In this paper, unit for coal output is tonne i.e. how many tonnes of coal are extracted in a year. Coal extraction has increased from 270.4 million tonnes (in year 2000) to 420 million tonnes (in year 2009). This increased coal output show the increased mining activity in India.

### Output Price

Output price is the amount of revenue received for per unit coal output. Although coal has different grade, each one is sold on different price and it is not necessary that whatever the coal output is extracted in a year is sold in that year. In each year the amount of coal extracted and amount of coal dispatch is different. Here in this paper output price of coal is calculated on average basis i.e. total coal value raised by dispatching the coal is divided by the amount of coal dispatched. Unit of output price is taken as rupees per tonne i.e. amount of revenue received for selling one tonne of coal on overall basis. The output coal price has increased from 708 rupees per tonne (in year 2000) to 1060 rupees per tonne (in year 2009).

### Variable Cost

Variable cost includes all the varying costs spend for coal extraction. Variable cost depends on the labour price, energy price, material price, number of machineries available, quantity of output to be extracted and technology available. Here, unit of variable cost is taken in rupees i.e. amount of rupees spend on varying factors. The variable cost of coal extraction has increased from 53 billion rupees (in year 2000) to 99 billion rupees per tonne (in year 2009).

Table 1: Descriptive Statistics (2000-2009) of Variables

Variables	Units	Mean	Standard deviation
Labour (L)	Hours (thousands)	808198.80	64850.79
Price of Labour ( $P_L$ )	Rupees per hour	63.38	19.86
Capital (K)	Hours (thousands)	74131.31	3776.38
Cost of capital ( $P_K$ )	Rupees per hour	283.64	39.39
Materials (M)	Tonnes	275415.93	37576.29
Price of Materials ( $P_M$ )	Rupees per Tonne	21566.59	3709.66
Energy (E)	Mega joule (thousands)	41729938.52	1873109.73
Price of Energy ( $P_E$ )	Rupees per Mega joules	0.365	0.029
Output (Q)	Tonnes	331894605.1	49508742.53
Output price (P)	Rupees per Tonne	831.29	100.41
Variable cost (VC)	Rupees (thousands)	71316952.94	14220970.9
Total Cost (C)	Rupees (thousands)	92408544.82	11841507.78



## Total Cost

Total cost includes all type of cost spend for coal extraction i.e. varying cost as well as fixed cost. Here, unit of total cost is taken in rupees. The total cost of coal extraction has increased from 80 billion rupees (in year 2000) to 115 billion rupees per tonne (in year 2009).

Variable cost function is estimated using data on coal production, input prices and quantities reported in Statistics of mines in India [5, 12-20], an annual publication of the Directorate General of Mines Safety, Dhanbad, Ministry of Labour, Government of India and various issues of annual report of CIL [21]. The dataset contains aggregate data on coal mining operations in India from 2000 to 2009. The coal mining industry includes all three types of mines i.e. opencast, underground and mix type mining. Some derived descriptive statistics of the variables used for the estimation are shown in Table 1.

## 6. Result and Discussion

The Cobb-Douglas functional form of production functions is widely used to represent the relationship of an output to inputs [22]. The Cobb-Douglas production function is still today the most ubiquitous form in theoretical and empirical analyses of growth and productivity. The translog function is an attractive flexible function. This function has both linear and quadratic terms with the ability of using more than two factor inputs [23]. The purpose of the translog cost function is to identify a specific functional form for a cost function that embodies all of the assumptions and results of our cost minimization model. Here variable cost is a function of labour force employed, energy consumed, materials consumed, machineries used, output and technology. So the four-input translog production function could be used. This function is approximated by second order Taylor series. The translog variable cost function can be written as:

$$\begin{aligned} \ln VC = & \alpha_0 + \alpha_Q \ln Q + \frac{1}{2} \alpha_{QQ} (\ln Q)^2 + \\ & \sum_i \alpha_i \ln P_i + \beta_K \ln K + \frac{1}{2} \beta_{KK} (\ln K)^2 + \alpha_t t + \\ & \frac{1}{2} \alpha_{tt} t^2 + \alpha_{Qt} \ln Q t + \frac{1}{2} \sum_i \sum_j \alpha_{ij} \ln P_i \ln P_j + \\ & \sum_i \alpha_{iQ} \ln P_i \ln Q + \sum_i \delta_{iK} \ln P_i \ln K + \\ & \sum_i \alpha_{it} \ln P_i t \end{aligned}$$

Where, i and j stand for three input variables - Labour, Energy and Materials.  $\alpha_0$  is the intercept or the constant term  $\alpha_Q, \alpha_i, \beta_K$  and  $\alpha_t$  are the first derivatives.  $\alpha_Q, \alpha_i, \beta_K$

and  $\alpha_{QQ}, \beta_{KK}$  and  $\alpha_{tt}$  are own second derivatives.  $\alpha_{Qt}, \alpha_{ij}, \alpha_{iQ}, \delta_{iK}$  and  $\alpha_{it}$  are cross second derivative. These coefficients represent elasticity of variable cost with respect to inputs.

After imposing parametric restrictions of symmetry and homogeneity of degree one on inputs;  $\alpha_{ij} = \alpha_{ji}$  and  $\alpha_{QQ}, \beta_{KK} = \alpha_{tt} = \alpha_{Qt} = \alpha_{ij} = \alpha_{iQ} = \delta_{iK} = \alpha_{it} = 0$

Now, the translog form would be as follow:

$$\ln VC = \alpha_0 + \alpha_Q \ln Q + \sum_i \alpha_i \ln P_i + \beta_K \ln K + \alpha_t t \quad \text{Where } i = L, E, M$$

**Table 2: Coefficients of Restricted Translog Variable Cost Function**

Parameters	Estimate	Standard Error	t-statistics	Probability (2 Tail)
$\alpha_0$	13.3706	4.0148	3.3303	0.0447
$\alpha_L$	0.6914	0.0541	12.7812	0.001
$\alpha_E$	0.1753	0.1862	0.9417	0.4158
$\alpha_M$	-0.0121	0.0331	-0.3643	0.7398
$\alpha_Q$	0.2476	0.2444	1.013	0.3857
$\alpha_K$	0.2375	0.2152	1.1035	0.3504
$\alpha_t$	-0.01805	0.0109	-1.6532	0.1968

Coefficients of the above system are estimated using ordinary least square estimation [24]. The final result of estimation is shown in the Table 2.

The R-squared of the estimated equation is 0.99 for the Variable Cost function. We have used SYSTAT version 8.0 software for estimation of above equation.

The coefficient of the time trend ( $\alpha_t$ ) is negative and significantly different from zero. The negative value

**Table 3: Technological Progress of Each Year**

Year	Solow residual
2009	0.0155
2008	0.0150
2007	0.0142
2006	0.0144
2005	0.0140
2004	0.0137
2003	0.0140
2002	0.0129
2001	0.0128
2000	0.0119

(-0.01805) can be interpreted as the average annual growth rate of total variable cost. In other words, total variable cost decreases by 1.8 per cent annually, keeping all other

explanatory variables constant. Now the technical change (solow residual) of each year are shown in Table 3:

## 7. Conclusion

The mining technical progress of Indian coal sector has been studied in this paper. The result shows that the technical progress has an effective influence on the output of coal industry in the present situation that technical progress is developing. In India, Public Undertaking Sectors (especially fully government owned) are occasionally questioned about their performance. Here in case of coal sector, this is still under a strict controlled regime and the average total factor growth rate is 1.4 percent and in all the period under study, it is positive and increasing figure.

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*People acting in their own self-interest is the fuel for all the discovery, innovation, and prosperity that powers the world.*

— John Stossel

# Success Story of a White Revolution – The Case of Gowardhan Dairy

SANGEETA SHROFF AND JAYANTI KAJALE

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*The growth rate of agriculture and allied activities always lags behind that of other sectors and the overall economy. Allied activities such as dairy can promote growth rate in the primary sector and thus pull up the overall growth rate of the economy. A success story of Gowardhan dairy (the brand name for Parag Milk Foods Pvt. Ltd.), located in Manchar village, about 60 km from Pune in the state of Maharashtra has been highlighted in this paper.*

*The company started its operations in a small way in 1993, but presently procures milk from 1.25 lakh farmers in the unorganized sector and operates with 1.2 million litres of milk per day. A wide range of milk products are produced with the help of fully automated plants. The company also brought about backward linkage in 2005 and has a herd of 3000 cows of the Holstein Friesian breed. The average milk yield per cow in this farm is 23 litres and the company hopes to increase it to 36 litres per day. Information Technology and scientific farm practices have made Gowardhan not just an ordinary cow shed but the success story of a white revolution.*

## Backdrop

Agriculture and rural development have always invited the attention of planners and policy makers of the country because improving agricultural performance is the key to enhancing food and nutrition security. Further, growth in the agricultural and allied sector will serve as a catalyst for growth in the secondary and tertiary sector not only by providing raw materials and opportunities for rural non-farm employment, but also by creating demand for consumer goods and services produced in these sectors. This in turn will stimulate overall growth of the economy. In the recent past, the growth rate of the agricultural and allied sector was far behind that of other sectors, as well as overall growth rate of the economy. Infact, during the Eleventh Plan period (2007-08 to 2011-12), the data (Economic Survey, 2011-12, Government of India) show that growth rate of gross domestic product for the economy was 7.75 per cent per annum, industrial sector was 6.6 per cent per annum, service sector was 9.8 per cent per annum, while that of agriculture and allied activities was a miniscule 2.97 per cent and below the targeted growth rate of 4 per cent. The agricultural and allied sector is plagued by low productivity which is the main cause of deceleration and underperformance of this sector. No doubt, the success of the green revolution in attaining self sufficiency in foodgrains and the Operation Flood Programme which ushered the white revolution in milk have addressed major problems for solving India's food and nutrition problem, soon after independence. However, it is now time for another round of revolutions to meet the rising demand of food to feed a population of 1.2 billion. Besides, over the years, there is a shift in dietary pattern towards high value products such as milk and milk products, horticultural products, etc. and these issues are now an integral part of policy.

It is clear that area under cultivation has ceased to be a source of growth for Indian agriculture and technology has now to be the main engine of growth to cope up with the food requirements of the population. Keeping this in mind, an attempt is made in this paper to explain how scientific technology and appropriate extension services can promote development in the agricultural as well as allied sector. The allied sector plays an important role in boosting the primary sector which is showing signs of deceleration. Dairy farming plays a major role among allied activities in Indian agriculture and with increase in demand for milk, this sector has immense potential. A success story of Gowardhan dairy (the brand name for Parag Milk Foods Pvt. Ltd.), located in Manchar village, about 60 km from Pune in the state of Maharashtra has been highlighted in this paper. This company, involved in the packaging of procured milk and producing milk products, started its operations in a small way in 1993, but today is operating on a large scale. Their associate concern Bhagyalakshmi farms, which is a backward linkage, is a 35 acre cow farm and this farm by using scientific technology and sound agricultural practices is now reaping rich dividends. Milk production increased by leaps and bounds in Bhagyalakshmi farms and starting with 50 cows in 2005, today the herd is about 3000 cows.

After discussing the status in milk production and consumption in India, and constraints in yield, the paper uses qualitative data to explain how Gowardhan began its operations in small way by procuring milk for producing its milk products but over time increased the scale of its operations and also introduced backward linkage by starting its own dairy farms. The paper also explains how a farm-firm like Gowardhan can serve as catalyst for growth in the dairy sector by involving the unorganized sector. Finally some policy suggestions are also discussed.

### Status of Milk Production in India

The institution of planning soon after independence in 1950-51, saw milk production at only 17 million tonnes, with a per capita availability of 124 gram per day, which declined to 112 grams per day in 1970-71. However, from chronic shortage of milk, India has today emerged as one of the largest producers of milk in the world with a production of 112.5 million tonnes (Government of India, 2011) and per capita milk availability has shown a gradual rise over the decades and is presently about 252 grams. Millions of smallholder producers have been behind this commendable achievement of increase in milk production, coupled by *operation flood*, one of the world's largest dairy

development programmes which provided market access by creating a strong network and linkages among millions of producers, processors and urban consumers. These farmers provided incentive to producers to produce more milk.

The per capita availability of milk has increased over the years and is presently about 263 grams per day, which is only 6 per cent lower than world average. These figures however mask the true picture of India's per capita consumption which translates to about 96 kg per annum. However developed countries such as Finland have a per capita annual consumption of 361.19 kg per annum which is the highest in the world and 376 per cent higher than that of India. About 85 countries in the world have annual per capita consumption higher than India (<http://en.wikipedia.org/w/index.php>). Further, within the country, there are wide regional differences on per capita availability of milk. Only nine states (mostly in the north) have per capita availability above ICMR recommendations of 220 grams per day. The per capita availability in eastern states is very low, barely 70 grams in Assam, 102 grams in Orissa, and 123 grams in West Bengal (Dholakia & Datta, 2010).

In view of the above, it is clear that it is necessary to increase milk production to cater to the fast changing dietary pattern of the rising population. Rapid urbanization, increased disposable incomes of households, availability of a large variety of milk products in the market and growing food processing facilities in the country are some of the major factors towards increasing the demand for milk and milk products. Table 1 below shows the quantity of milk consumed over the years according to the National sample Survey (NSSO) Rounds.

**Table 1: Per Capita Consumption of Milk**

NSSO Round	Quantity (Litres per month)	
	Rural	Urban
43 <sup>rd</sup> Round (1987-88)	4.33	3.23
50 <sup>th</sup> Round (1993-94)	4.89	3.87
55 <sup>th</sup> Round(1999-2000)	5.10	3.79
61 <sup>st</sup> Round (2004-05)	5.11	3.94
66 <sup>th</sup> Round (2009-10)	5.36	4.12

Source: NSSO Rounds on Consumer Expenditure

It can be observed from Table 1 that over the different rounds of NSSO, there has been an increase in quantity of consumption of milk in both rural and urban areas. In rural areas, the consumption increased by 24 per cent, while in urban areas it increased by 27 per cent between

1987-88 and 2009-10. Besides, there is also a growing demand for milk products, with more processing facilities being available.

Further, a study by Praduman Kumar and others (2011), using unit level data on dietary pattern and consumer expenditures collected by NSSO, indicated that the annual per capita consumption of milk of the sample population falling in "very poor class," increased from 10.3 kg in 1983 to 13.3 kg in 1993 and further to 14.1 kg in 2004, per person per annum. This indicates a 37 per cent increase in milk consumption between 1983 and 2004 of the very poor class. As we know India has a huge population below poverty line which indicates the potential demand for milk. The study also showed that the budgetary share of milk in total food expenditure, by and large, increased across almost all income groups belonging to different levels of 'poor'. An attempt was also made in the study to estimate the income and price elasticity of demand for different food items such as foodgrains and high value agricultural commodities. The income and price elasticity of demand for milk is as indicated in Table 2.

**Table 2: Income and Price Elasticity of Demand for Milk in India**

Milk	Very Poor	Moderately Poor	Non-Poor lower	Non-Poor higher	All
Income elasticity	2.342	2.018	1.773	1.556	1.640
Price elasticity	-0.820	-.923	-0.999	-1.076	-1.035

Source: Praduman Kumar and others, 2011, p 11.

Note: The "very poor" comprised households which have income level below 75 percent of the poverty line (PL), between 75 percent of PL to PL were defined as "moderately poor", between PL and 150 percent of PL were grouped as "Non-Poor lower", and households having per capita income above 150 percent of PL were categorized as "Non-Poor higher".

It can be observed from Table 2 that milk has a positive income elasticity of demand and hence increase in income would increase the consumption of milk. The price elasticity of demand also shows that with fall in price of milk, demand for milk would increase. This clearly indicates that there is a shift in dietary pattern and there is need to increase the production of milk to meet huge potential demand.

As per the assessment made by the Planning Commission, the domestic demand for milk by 2021-22 is expected to be 172.20 million tonnes. However, the country

has not been able to keep pace with the domestic demand for milk. While the domestic demand for milk is growing at about six million tonnes per year, the incremental production over the last ten years has been about 3.5 million tonnes per year. Further, urban centres will demand more and more processed and packaged dairy products (Economic Survey, 2010-11).

In view of the above, it is necessary to increase the production of milk in the country. The white revolution brought about a dramatic increase in milk production mainly by increasing the number of dairy animals. Yield of milk however played a minimal role in increasing production.

### Low Productivity of Milk in Dairy Animals

As discussed above, India has made a commendable progress in production of milk and is the largest producer of milk in the world. However, milk productivity which should be the main driver of growth in the dairy sector, has been greatly neglected. The number of in-milk animals which were 59.11 million in 1997-98 gradually increased over the years to 74.41 million in 2009-10. However, the milk yield during the corresponding period marginally increased from 3.14 litres per day to 3.94 litres per day. The details on milch animals and their yield are indicated in Table 3.

**Table 3: Number of In Milk Animals and Yield of Milk (litres per day) (2009-10)**

In milk animals	Crossbred cows	Local cows	Buffaloes
Number (million)	10.1	28.8	35.5
Yield of milk (litres per day)	6.9	2.1	4.6

Source: National Dairy Development Board

Out of the total in -milk animals, the share of buffaloes is 47.7 per cent, local cows is 38.7 per cent, while that of crossbred cows is only 13.6 per cent. The milk yield of buffaloes is 4.6 litres per day, local cows is 2.1 litres per day while that of cross bred cows is 6.9 litres per day. Although the yield of cross bred cows is highest as compared to other milch animals, there is hardly any increase over the years and also the share of these cows for milk production is very low. Local cows which yield barely 2 litres of milk per day constitute about 75 per cent of the cow population.

A number of factors are responsible for low yield of milk from milch animals. The dairy sector in India is characterized by low yielding nondescript milch animals,

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widely dispersed, small scale and unorganized milch animal holders, limited availability and affordability of quality feed and fodder, improper veterinary infrastructure, lack of backward and forward linkage in this sector and overall lack of professional management. All these factors are responsible for low yield of milk.

The yield of milk is dismally low and India cannot afford to have a policy of extensive dairy farming which will increase production of milk through increase in number of dairy animals. Land and water resources are scarce and there is competition to use the same for human food or animal fodder. It is these small holders who provide milk to firms such as Gowardhan for producing a wide variety of milk products. However, such firms do not blindly procure milk from unorganized sector, but provide dairy farmers in this sector with appropriate extension services so that farmers can maximize on yield without much increase in cost and also produce milk in a hygienic manner.

#### **Gowardhan – A Success Story**

Parag Milk Foods Private Limited was established in 1993 and began its operations in a very small way, by only procuring milk from local farmers and packaging it. The firm as mentioned earlier is located in a village-*Manchar*, in Ambegaon taluka, in Pune-Nasik road in Maharashtra. In this taluka, daily 3.5 lakh litres of milk are produced as every farmer in this taluka maintains dairy animals. Around the period 1990, there was a crisis in the dairy farming community due to surplus of milk. Procurement of milk was the monopoly of state agencies and cooperatives, which were shut for two days a week due to "milk holidays". There was no facility to process it and the government also did not have appropriate storage facilities. The farmers were thus forced to throw their milk which caused them huge losses. At this point of time, with new economic policies and onset of globalization, Gowardhan opened a small unit and merely procured the milk from farmers and sold it in pouches to nearby urban centres such as Mumbai and Pune. Therefore the monopoly of cooperatives which procured milk from farmers was broken and farmers had an alternative market for their milk which they produced. Gowardhan began procuring their milk which increased the demand for milk. Gradually since 1993, the company made all round efforts to add momentum to its growth and diversified to a very large number of milk products.

The company now procures milk from 1.25 lakh farmers and has a village level procurement centre. It has invested in bulk coolers, chilling centres and milk

processing units. The company has invested in technology and equipment to produce different milk products, which as mentioned earlier are sold under the brand name of *Gowardhan*. The products of the company are certified under various systems and is the first company to obtain ISO 15161 certification from New Zealand. The company therefore has proven credentials in all its operations. For marketing of its products, the company maintains its own distribution network and, over a period of time, the company has strategically integrated itself to encompass the entire value chain.

In view of the diversified product portfolio of the company, from a modest collection and processing of 30,000 litres of milk per day, the company today operates with 1.2 million litres of milk, per day which includes its own production as well as that procured from its collection centre. Further, the company is in the process of opening up new plants in Ahmednagar district of Maharashtra as well as on the outskirts of Bangalore. The company maintains grass level interaction with farmers and its partner farmers are scrutinized regularly to ensure that hygiene and safety standards are maintained and strictly adhered. Farmers are regularly trained and advised on the latest Cow Farming Techniques and cattle feeds to boost milk quality and quantity.

It was mentioned earlier that dairy farming in India is characterized by small scale, widely dispersed and unorganized milch animals holders. The main characteristic feature of such a dairy sector is the predominance of mixed crop-livestock farms and feeding the milch animals with crop by-products and crop residues. This naturally results in very low productivity of milch animals. It is in this context that firms such as Gowardhan can play a major role in revitalizing the dairy sector. The firm has started backward linkage and has accordingly set up a dairy farm which has adopted state of the art technology. This farm has achieved very high milk yields, produced in a very hygienic manner.

#### **Backward Linkage-Bhagyalakshmi Dairy Farm**

As mentioned above, Gowardhan has brought about backward linkage in its operations and started a dairy farm named Bhagyalakshmi farms in 2005 with the twin objective of increasing the milk producing capacity of cows which is still very low in India and also make a cow farm of international standards. This farm is spread over 35 acres in a village named Manchar which is about 60 km from Pune in Maharashtra state. Through the use of Rotary Milking Parlour machinery, which can house 50 cows at a

time, and other latest farm practices, this farm excels in breeding, nurturing and farming of cows. This special machinery mechanizes the milking process and maximizes hygiene in milk production. Gowardhan dairy, houses about 3000 cows and apart from being the first cow farm on this scale in India, the company is the first to install a Rotary Parlour in India, which mechanizes the milking process, thus saving time and ensuring hygiene. The cows are milked three times a day, and in 7 minutes milk is extracted from 50 cows, totally free from human touch and loaded in tanks. As soon as the cow enters the Rotary Parlour, the computerized chip fitted to the cow is connected to the computer and all data related to the cow is available on the computer and hence it is easy to identify a sick cow. Further, all practices related to cow farming, even the minutest details are taken care of which have enabled the company to reap rich dividends.

The cows in Bhagyalaxmi farms are the Holstein Friesian variety. The farm is well equipped with every facility from breeding to milking stage. Right from birth, every calf has a bar coded tag that records all its details, i.e feed, produce, health details, etc. The computer chip in each cow enables identification and monitoring of health. The entire history of the cow is easily available through this device. This device also enables meter reading of milk weights at each milking during the day and also contains a heat detector which indicates when the cow is ready for milking.

The health of the cow is most important to ensure higher milk yields, and thus an extensive vaccination schedule is adhered, in order to prevent any infection from taking root. Therefore along with a proper immunization programme, top priority is given to nutrition. Since milk productivity largely depends upon the quality of feed given to the animal, perfect feed is administered so as to maximize on milk production. The farm receives fresh alfalfa which is then mixed with green maize, minerals, vitamins, yeast extract, etc. in a Total Mixed Ration machine and fed to the cows upto four times a day. It may be noted that generally the yield of milk is very low because dairy farmers in unorganized sector do not provide the animal with appropriate feed but only crop residues. Infact maize is an important ingredient for milch animals, but farmers often remove the corn from the stalk and feed the animals with only the residue which is more of a waste product. The animal is therefore deprived of appropriate nutrients and hence its milk yielding capacity is reduced. However, discussion with production and maintenance officials of Bhagyalakshmi dairy farm, revealed that not

only is the feed mixture ideal for the milking cows but also depending upon the health of the cow, the appropriate quantity is fed to them. This amount is also determined by technology and the feed is programmed according weight gain and lactation stage.

Besides, vaccination and feed, efforts are made to ensure that cows are reared in total comfort. Appropriate temperature is maintained and the overall environment is soothing, which eventually leads to higher milk yields.

The Rotary Parlour allows the entire milking process to be fully automated. The cows have a very short walking distance into the milking stall and the platform operates at a constant speed which controls the pace of operations. The milking time is reduced, labor costs are minimized and milking is made very easy. The milking process is fully automated and a multi-stage control programme is rigorously implemented. The cows undergo regular check-ups and are thoroughly screened for any infections or diseases. The fodder and cattle feed are constantly monitored to facilitate milk yields of high quality. The yield of milk per cow in Bhagyalaxmi farms is therefore very encouraging. The technical officer stated that the average yield per cow is about 23 litres per day, but there are certain cows which have sometimes yielded as much as 53 litres per day. However, by and large, the potential of each cow to yield milk is about 36 litres per day and efforts are being made by Gowardhan to achieve this target. High levels of hygiene are maintained as the milk is collected and tested before being further processed. The milk is sold at a premium price to meet a very niche demand.

#### **Lessons to be Learnt from Gowardhan Dairy**

An important outcome of the economic development which India is experiencing in recent years is a marked structural shift in the dietary pattern of its population. It is very clear from NSSO data that dietary diversification is shifting towards high value products such as milk and milk products. As demand for such products is likely to keep increasing in future, it is necessary to increase the supply, so that the demand requirements can be met without any adverse impact on prices. If supply of these products does not increase with corresponding increase in demand, inflation may reverse the demand for these products, thus contributing to malnutrition of the population.

It was earlier noted that crossbred cows in India, yield 6.9 litres of milk which is about one-fifth of the yield potential of Gowardhan dairy and one-third of its actual yield. India is a country constrained by land resources and cannot have the luxury of extensive farming and

increasing the number of dairy animals to produce larger quantity of milk. The only solution to the problem lies in increasing milk yields. The case of Gowardhan has proved that with appropriate farm management practices, the average milk yield of their cows per day is 23 litres. The company is making full fledged attempts to increase this average which was 15 litres per day about 5 years ago, as mentioned by their technical officer. While the company hopes to increase the productivity to 36 litres per day, there are some cows which have at times yielded 53 litres per day. If partner farmers of Gowardhan are able to learn appropriate dairy practices from Gowardhan, and improve their milk yields, it will certainly give a big boost to milk production and the country may be able to meet its milk requirements without any inflationary impact. With substantial increase in milk yields, the number of dairy animals can be reduced, and with agro processing of milk, non-farm employment can be generated. Also as milk production increases, diversification to milk products will increase which will meet the needs of the fast rising urban population. Therefore a big firm like Gowardhan can serve as a catalyst for growth through forward and backward linkage. Investment in technology is possible only for a big company like Gowardhan, and out of reach for unorganized dairy sector. However, Gowardhan by establishing a strong rapport with the villagers and dairy farmers, educates them on feeding their animals a balanced ration which not only decrease feed costs, but also increases their yield and therefore improves their economic status. Proper management practices, without any additional costs, are disseminated to farmers by Gowardhan, which have helped to increase their milk yields and therefore increase returns. Such practices of linking with unorganized sector are also incorporated in the National Dairy Plan of the government.

Gowardhan has maintained a herd of Holstein Friesian variety of cows which is a breed of dairy cattle originating in North America and having high milk yielding potential. However, this firm is aware of the fact that cows have to be tuned to Indian conditions. The firm therefore plans to cross breed these cows with local varieties so that the cross bred variety which emerges will have greater immunity like the indigenous ones and also have high milk yielding capacity like the international ones. These cows then will be distributed to farmers who in turn will use them for dairy farming and sell their produce to the company. A proper synergy would thus be created by the organized sector and the unorganized sector. Since the farmers in the unorganized dairy sector are mainly small

holders, they are resource poor and not in a position to make investment. A firm like Gowardhan, has the capacity to make investment and by improving the genetic potential of the animal, they can greatly contribute to increasing milk production. When this happens, India will be able to tackle its problem of milk shortage.

Besides increasing milk yields, farmers are also taught to improve the quality of milk and produce it with utmost hygiene. Hence, such private sector initiatives can help to bring about a strong supply response with focus on productivity which will help to meet demand and streamline prices. Therefore Gowardhan is not an ordinary cow shed but the success story of a white revolution.

### **Government Initiatives in Dairy Sector and Policy Implications**

It is well known that India's dairy sector has taken a backseat due to a number of limitations such as ineffective breeding programmes, inavailability of poor quality fodder, inadequate veterinary services, poor supply chain and limited processing capacity. The National Dairy Development Board has therefore prepared a National Dairy Plan to bring about intervention in the required areas. The Plan aims at doubling milk production over a span of 15 years by improving productivity through genetic improvement of milch animals and optimal use of feed and fodder to fully realize the genetic potential in terms of increased milk yields. The Plan also aims to increase the proportion of milch animals bred through Artificial insemination to 35 per cent as against the present level of 20 per cent. Another important objective of the Plan is to provide India's 70 million small-holder rural milk producers with greater access to the organized milk-processing sector. As explained earlier, the activities of Gowardhan dairy are a step in this direction.

Besides government initiatives to promote the dairy sector to increase milk production, equally important are policy interventions which impact this sector.

The dairy sector is witnessing an increase in feed costs. Oil meals are an important ingredient in cattle feed. However, oil meals are a major item of export and quantity of oil meal exported is by and large increasing. In 2010-11, 6.79 million metric tonnes of oil meal was exported valued at Rs 10846 crores. This is obviously adding to the rise in price of cattle feed. Any increase in input cost may have an adverse impact on dairy activity and may even make it economically unviable. This again calls for a policy to increase productivity of oilseeds.



From chronic shortage of milk, India has today emerged as one of the largest producers of milk in the world with a production of 121 million tonnes. There was a policy intervention in February 2011, banning the export of milk powders (including skimmed milk powder, whole milk powder, dairy whitener and infant milk foods) casein and casein products. This notification was issued by the government in response to fall in domestic supply of milk and rising inflation. In April 2012 the government again allowed export of casein and casein products under license and in June it allowed export of skimmed milk powder. It may be noted that casein is a protein compound extracted from milk and about 30 to 35 litres of milk are required to produce one litre of casein.

The export policy has however been revised with the ban being lifted on 1 November 2012, on milk products, especially whole milk powder, dairy whitener, infant milk foods and other milk products. The ban was lifted because there was a stock of 1.12 lakh tonnes of milk powder in the country. The milk procurement was also more than sales. Hence sudden short term measures of the government to impose ban on exports of selected commodities end up having an adverse impact on the domestic economy. Although India is a leading milk producer in the world, the high production often disguises the country's low productivity and low genetic potential of milch animals. Efforts should therefore be made in this direction so as to satisfy domestic demand, rather than imposing sudden export bans.

Overall, the study concludes that the vision of the founders of Gowardhan to have a large scale modern dairy unit could be achieved mainly due to investment in modern technology, technical manpower and usage of machines such as Rotary Milking Parlour. The dairy unit maintained the Holstein-Friesian breed of cows which are known to be the highest milk yielding animals. The company aims at improving the genetic potential of the animals which will have greater immunity and high yielding capacity. The usage of Information Technology for identification, scientific practices for nurturing and Quality Control Laboratories

helped in hygienic production of milk. The dairy plant which produces a wide range of milk products is fully automated and equipped with the best European technology. A viable partnership with the unorganized sector and an efficient supply chain has created backward and forward linkages in the dairy sector. This has given a strong impetus to the local agricultural economy ultimately leading to a success story.

#### **Acknowledgements**

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*Innovation is the specific instrument of entrepreneurship. The act that endows resources with a new capacity to create wealth.*

**— Peter Drucker**

# Impact of Working Capital Management on Efficiency, Liquidity and Profitability of Lupin Limited: A Case Study

PRERNA JAIN AND ANURODH GODHA

*As the saying goes, 'If you make it in short term long enough, you don't need to work about the long term.' Management of working capital has close implications with the two important factors that judge the overall success of the business—profitability and solvency. Keeping in view the significance of working capital management as a gray area of corporate finance function, an attempt has been made to examine the working capital trends and its impact on efficiency, liquidity and profitability of Lupin Limited—an innovation-led transnational pharmaceutical company producing a wide range of quality, affordable generic and branded formulations and APIs. The study is based on secondary data collected and compiled from annual reports. The period of study is five years and various statistical methods like standard deviation, coefficient of variation and ratio analysis as tools of financial statement analysis have been adopted. The study reveals that the firm's position is sound from the point of view of liquidity, solvency and profitability. However, its activity ratios do not represent a satisfactory position. More information can be obtained by management in this area and further probing can be done before taking any corrective action.*

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## Introduction

As the saying goes, 'If you make it in short term long enough, you don't need to work about the long term.' With today's unsettling economic conditions, there is no more a challenging area in finance than working capital management. In trade and industry, the word 'working' with reference to capital means circulation of capital from one form to another form during day-to-day operations of the business, whereas, the word 'capital' refers to the monetary values of all assets of the business. Thus, 'working capital' means that part of the total assets of the business that changes from one form to another form in the ordinary course of business operations. Management of working capital plays a significant role in the organization as the blood plays its role in the human body. It not only provides energy to the business but is also simultaneously essential for the success of any business organization. Management of working capital has close implications with the two important factors that judge the overall success of the business—profitability and solvency. Working capital management, therefore, consists of (a) considering the trade-off between costs and benefits derived from alternative levels of investment in working capital and (b) managing for both and taking decisions regarding stock, debtors, cash etc. Nowadays, the major problem faced by every business organization is of finance because of the drastic changes in the size and scale of business and increased competition, which result in the increase in credit business and shortage of financial brackets. In such an environment, the working capital management has occupied one of the key positions in the business management.

## Corporate Overview

Headquartered in Mumbai, India, Lupin Limited (established in 1968) today is an innovation-led

transnational pharmaceutical company producing a wide range of quality, affordable generic and branded formulations and APIs.

Lupin first gained recognition when it became one of the world's largest manufacturers of Tuberculosis drugs. Today, Lupin has emerged as the fifth-largest and one of the fastest growing top five companies in the US (by prescription), the only Asian company to achieve that distinction. The company is one of the top 3 pharmaceutical players in India (ORG IMS) and the fastest growing top 10 generic players in Japan and South Africa. Lupin's consolidated revenues and profit after tax were Rs. 94,616 million (USD 1.74 billion) and Rs. 13,142 million (USD 242 million) for FY 2012–13.

### Review of Literature

The importance of working capital management is not new to the finance literature. An extensive survey of library and Internet resources has been done, which have been summarized and reviewed in the following paragraphs.

*Bana Abuzayed (2012)* found that profitability is affected positively with the cash conversion cycle. He suggested that policymakers in emerging markets need to motivate and encourage managers and shareholders to pay more attention to working capital through improving investors' awareness and improving information transparency.

*Maynard E. Rafuse (1996)* proposed that stock reduction will generate system-wise financial improvements and other important benefits. He suggested that organizations seeking concentrated working capital reduction strategies must focus on stock management strategies based on 'lean supply-chain' techniques.

*Greg Filbeck, Thomas M. Krueger (2005)* told that firms are able to reduce financing costs and/or increase the funds available for expansion by minimizing the amount of funds tied up in current assets.

*Omo Aregbeyen (2011)* investigated that efficiency of working capital management has implications for firm's profitability. He concluded that improvement in working capital management is essential and recommended that firm's should shorten their period of average collection period, average payment period and cash collection cycle.

*Thorsten Knauner, Arnt Wohrmann (2013)* explained that managing a firm's current assets and liabilities (working capital management) is highly relevant to the

success of that firm. To prove this, they consolidated the empirical literature on the association between working capital management and firm profitability.

*Khangah, Khosroshahi and Ebrati (2012)* told that working capital management is an essential part of the short-term finance of a firm. With an efficient working capital management, a firm can release capital for more strategic objectives, reduce the financial costs and improve profitability.

The proposed study will be carried out to put attention on the position of working capital in Lupin Limited and will discuss various aspects of working capital management in the company.

### Objectives

The study aims at analyzing the working capital management of Lupin Limited. The main objectives are as follows:

- To make a comparative analysis of different working capital ratios over a period of five years (Time Series Analysis).
- To make item-wise analysis of the elements or components of working capital to identify the items responsible for changes in working capital.
- To comprehensively review the efficiency, liquidity and financial soundness of the company by analyzing various ratios.

### Data and Methodology of the Study

The data of Lupin Limited for the years (from 2008–09 to 2012–13) used in this study have been taken from secondary sources, e.g., published annual reports of the company. Editing, classification and tabulation of the financial data have been done as per the requirement of the study. Many statistical techniques, such as average, standard deviation and coefficient of variation have been applied to assess and analyze the data. Financial ratios have been calculated to analyze the liquidity, profitability and solvency position of the company. For assessing the performance of the working capital position, the collected data have been analyzed in following ways:

- ❖ Analysis of liquidity, efficiency and structural position.
- ❖ Analysis of profitability ratio.
- ❖ Item-wise analysis of component of gross working capital.

## Importance

This study will help in resolving the different financial matters of the company, as it keeps a check over different financial issues of the company. One can gain insight about what changes are desirable and needed. Evaluation of working capital management helps in comparative analysis of a firm and different firms in the same industry.

The evaluation process also helps in formulating the financial policies and studies the different applications and sources of funds, as it reveals the performance of different current assets and current liabilities individually.

Ratio analysis will provide facts on a comparative basis and will enable us in drawing inferences regarding the performance of a firm. Liquidity position, overall profitability, structural health and operating efficiency will be judged, which can further be used by the company as well as other researchers for developing optimal growth model for the company and the industry. By doing trend analysis of ratios the analyst can know the direction of movement and can judge whether the movement is favourable or unfavourable.

Adequate working capital is a source of energy to any business organization. That is why, it has been said that no single error in financial planning can work greater harm to a corporation than a failure to provide for adequate working capital.

## Scope and Limitations of the Study

1. The study is limited to five years' (from 2008–09 to 2012–13) performance of the company.
2. The data used in this study have been taken from published annual reports only. As per the requirement and necessity, some data are grouped and sub-grouped.
3. For making a clear-cut opinion, ratio technique of financial management has been used.
4. Financial statements are based on accounting policies, which vary from enterprise to enterprise both within a single country and among countries, thus the user of financial statements cannot make reliable judgments unless the accounting policies are not disclosed.

## 1. Profile of Profitability of a Firm—Du Pont Analysis

The overall profitability of a firm comprises of two elements. These are:

- a. The profit margin on sales, i.e., how much the firm is earning on every rupee of sale made. This is also known as net profit ratio. It is calculated as:

$$\text{Profit Margin} = \frac{\text{Profit before Interest and Tax}}{\text{Sales}}$$

- b. The turnover of the firm, i.e., the total activities undertaken by the firm. It depends upon composition of total assets and their relationship with the sales of the firm. This can be expressed as:

$$\text{Investment or Assets Turnover} = \frac{\text{Sales}}{\text{Total Assets}}$$

These two factors interact and collectively determine the profitability of the firm. When the investment or capital turnover is multiplied by the profit margin, the product is known as Return on Investment (RoI; profile of profitability). This analysis is known as Du Pont Analysis. This analysis shows that the profitability depends not only on the profit margin but also on how efficiently the firm has used its assets to generate sales. It shows the operating efficiency, assets use efficiency and financial leverage of the firm. This relationship can be presented as follows:

$$\text{Return on Investment Turnover} = \frac{\text{Profit Margin}}{\text{Total Assets Turnover}}$$

## 2. Ratios to Analyze Liquidity of Working Capital Elements

The liquidity of working capital is an important aspect to be analyzed by the management for maintaining proper liquid resources to meet both operational requirements as well as financing commitment of repayment of borrowed funds. Liquid ratios as a group are intended to provide information about a firm's liquidity and the primary concern is the firm's ability to pay its current liabilities. Consequently, these ratios focus on current assets and current liabilities.

### A. Current Ratio

$$\text{Current ratio} = \frac{\text{Current Assets}}{\text{Current Liabilities}}$$

The total current assets include those assets, which are in the form of cash, near cash or convertible into cash within a period of one year. The current liabilities include all types of liabilities, which will mature for payment within a period of one year.



The current ratio as calculated above is to be compared within a standard ratio. Generally, a current ratio of 2:1 is considered to be satisfactory, though this value of current ratio is industry specific.

### B. Quick Ratio/Acid Test Ratio

This ratio establishes a relationship between quick/liquid assets and current liabilities. Current assets considered being liquid, if this is convertible into cash without loss of time and value. On the basis of this definition of liquid assets, inventory is singled out of the total current assets. The reason for keeping inventory out is that it may be obsolete, unsalable or out of fashion and always required time for realization into cash. Moreover, the inventories have tendency to fluctuate value. So the quick ratio looks for the ready availability or convertibility into cash. The quick ratio may be:

$$\text{Quick ratio} = \frac{\text{Liquid Assets}}{\text{Current Liabilities}}$$

Generally an ideal quick ratio is said to be 1:1. If it is more, it is considered to be better. The idea is that for every rupee of current liabilities, there should at least be one rupee of liquid assets. This ratio is a better test of short-term financial position or liquidity of the company than the current ratio, as it considers only those assets that can be easily and really converted into cash.

### C. Absolute Liquidity Ratio / Cash Ratio

It is the most rigorous test of the liquidity position of business unit. It can give significant insight into the liquidity position if used in conjunction with current and acid test ratio. It is calculated as:

$$\text{Absolute Liquidity Ratio} = \frac{\text{Cash and Marketable Securities}}{\text{Current Liabilities}}$$

## 3. Ratios to Analyze Efficiency of Working Capital

Efficiency ratios indicate the speed with which assets are being converted or turned into sales. Hence, these ratios are also known as 'turnover ratios' and 'assets management ratios'. The efficiency with which working capital is being used by the management can be analyzed in terms of overall working capital and/or its

constituent parts, viz. cash, inventory, receivables. Overall working capital and its elements are generally expressed as number of times they are converted into sales/cost of goods sold or number of days they are being held. While calculating these ratios a comparison is made between sales and investment in various assets.

### A. Working Capital Turnover Ratio

The efficient use of overall working capital in the firm can be gauged with the help of working capital turnover ratio. This ratio establishes the relationship between average working capital and net sales. Expressed as a formula:

$$\text{Working Capital Turnover Ratio} = \frac{\text{Net Sales}}{\text{Average Working Capital}}$$

In general, the term working capital refers to the amount of capital which is readily available to an organization. Working capital is the difference between resources in cash or readily convertible into cash (current assets) and organizational commitment for which cash will soon be required (current liabilities).

### B. Current Assets Turnover Ratio

This ratio expresses the relationship between current assets and net sales. It is calculated by using the following formula:

$$\text{Current Assets Turnover Ratio} = \frac{\text{Net Sales}}{\text{Average Current Assets}}$$

### C. Inventory Turnover Ratio

Inventory constitutes an important part of the total working capital. But if too much amount is invested in this for too long, it poses a serious threat to the profitability as well as solvency of the concern. So, inventory turnover ratio is calculated to consider the adequacy of the quantum of capital and its justification for investing in inventory. Generally, a higher turnover is considered good and a low turnover bad. The stock turnover ratio can be calculated by applying the following formula:

$$\text{Stock Turnover Ratio} = \frac{\text{Net Sales or Cost of Goods Sold}}{\text{Average Inventory}}$$

#### D. Debtors Turnover Ratio

Receivables normally include debtors and bills receivable and represent the uncollected portion of credit sales. This ratio establishes the relationship between net debtors and sales of the year. A low turnover ratio is an indicator of the firm's increased reliance on credit sales in its marketing efforts. If this is not backed up by timely and efficient collection of receivables, it may jeopardize the very solvency of the firm. The formula is used as:

$$\text{Debtors Turnover Ratio} = \frac{\text{Net Sales}}{\text{Average Receivables}}$$

#### E. Cash Turnover Ratio

Efficient management of cash requires that there should be proper relationship between cash needs of the concern to the average balance of cash held by it during the year. This is expressed by cash turnover ratio such as:

$$\text{Cash Turnover Ratio} = \frac{\text{Cash Operating Expenses}}{\text{Average Cash Balance}}$$

#### 4. Ratios to Analyze the Structural Health of Working Capital

The third set of ratio is used to study the structural health of working capital in the business. Working capital and its various elements should form a reasonable balance in the assets structure as well as financial structure. The structural health of the working capital in the business is generally studied by analyzing the shifts and changes between its various elements, i.e., cash, inventories, receivables and other items of current assets. Likewise, the proportion of current assets to total assets and proportion of short-term liabilities can be gauged with respect to total liabilities. This decomposition analysis can help the management to detect the occurrences and extent of such shifts and changes in a firm's resource allocation over a period of time. The following ratios are generally used to analyze the structure of working capital:

- a) Current Assets to Total Assets
- b) Current Liabilities to Total Liabilities
- c) Cash to Current Assets
- d) Receivables to Current Assets
- e) Inventory to Current Assets

### Findings and Conclusions

Table 1: Key components Related with the Study (from April 2008 to March 2013; Rs. in million)

Components	2008-09	2009-10	2010-11	2011-12	2012-13
Net Sales	37,949.9	47,736.3	57,068.2	69,597.0	94,616.3
Average Current Assets	21,374.95	25,031.6	31,349.25	40,900.05	50,679.5
Average Inventory	8,732.5	9,643.25	10,857.25	14,663.15	18,408.0
Average Receivables	8,309.35	10,222.7	11,911.05	15,178.25	19,835.0
Average Cash	1,759.75	1,396.5	3,108.35	4,113.05	4,186.75
Current Assets	22,308.7	27,754.5	34,944.0	46,856.1	54,502.9
Current Liabilities	10,334.8	9,663.4	11,779.3	16,730.5	17,836.4
Cash	777.7	2,015.3	4,201.4	4,024.7	4,348.8
Total Assets	40,172.5	50,854.6	61,243.6	79,822.2	89,138.6
Total Liabilities	25,781.8	24,921.4	27,917.7	38,970.4	36,502.3
Average Working Capital	13,198.15	15,032.5	20,627.9	26,645.15	33,396.05
PBIT	6,559	8,741.8	10,288.5	12,315.4	19,656.2

Source: Lupin Seven-years-financial-summary

Table 2: Profitability Ratios of Lupin Limited from April 2008 to March 2013

Ratios \ Years	2008-09	2009-10	2010-11	2011-12	2012-13	Average	S.D.	C.V.
Profit margin	17.28	18.31	18.02	17.7	20.77	18.416	1.2257	6.65
Capital or asset turnover	0.85	1.225	1.221	1.18	1.42	1.1792	0.1845	15.65
Return on Investment	14.69	22.43	22.002	20.89	29.5	21.9	4.71	21.5

Source: Author's estimates.

**Interpretation**

Profit margin of the firm is showing fluctuating trend from 2008-09 to 2011-12. In 2012-13, it has gained its momentum. Average profit margin is 18 per cent of sales. The utilization rate of capital as depicted by capital turnover

ratio is fluctuating over this period. If we assume that the achievement of goals of the organization is reflected in the RoI over time, this ratio in case of Lupin Limited is depicting a fluctuating trend up to 2011-12 but in last year it is showing an increase by 9.5 per cent, which seems to be satisfactory.

Table 3: Efficiency Ratios of Lupin Limited from April 2008 to March 2013

Ratios \ Years	2008-09	2009-10	2010-11	2011-12	2012-13	Average	S.D.	C.V.
Working capital turnover	2.875	3.175	2.766	2.61	2.83	2.8512	0.185	6.49
Current asset turnover	1.775	1.91	1.82	1.7	1.866	1.8142	0.073	4.01
Inventory turnover	4.345	4.95	5.256	4.746	5.14	4.8874	0.322	6.58
Receivables turnover	4.567	4.67	4.79	4.58	4.77	4.6754	0.0927	1.98
Cash turnover	17.77	27.83	14.93	13.71	17.61	18.37	4.98	27.1

Source: Author's estimates..

**Interpretation**

As far as Lupin Limited's activity and turnover ratios are concerned, nothing concrete can be said as the industry average figures are not available, but the utilization rate of net working capital or say that part of working capital which is financed from permanent sources, as depicted by working capital turnover ratio is fluctuating over this period. Though the receivable turnover shows a constant rate, the firm has a policy of extending credit of near about

80 days in all the years under study, which is very high. This means that the credit facility is being stretched a bit by the customers or the firm is following a liberal credit policy. Again if we look at the efficiency with which individual elements of working capital have been utilized the picture of inventory turnover is not very bright. Cash turnover ratio shows a fluctuating trend over this period. On the whole, the picture emerging is not very good at managerial and efficiency front.

Table 4: Liquidity Ratios of Lupin Limited from April 2008 to March 2013

Ratios \ Years	2008-09	2009-10	2010-11	2011-12	2012-13	Average	S.D.	C.V.
Current Ratio	2.16	2.87	2.97	2.80	3.07	2.774	0.32	11.55
Acid Test Ratio	1.23	1.87	1.95	1.765	1.96	1.755	0.27	15.48
Cash Ratio	-.075	0.208	0.356	0.241	0.244	0.2248	0.09	40.07

Source: Author's estimates..

### Interpretation

Liquidity is a precondition to insure that firms are able to meet their short-term obligations and their continued flow can be guaranteed for a profitable venture (Padachi, 2006). Table 4 reveals that short-term liquidity position of Lupin Limited is satisfactory. The current ratio for the period under study ranges between 2.16 and 3.07, which reflects that there is over investment in current assets and the portion of current assets is more than double of the current liabilities which are good and fairly acceptable in view of

the general standard of 2:1. The quick ratio of the firm is also good enough and far better than the normal standard of 1:1. Cash ratio (absolute liquidity) is fluctuating over this period and its coefficient of variation is also 40 per cent, which is quite high. Except in 2008–09, proportion of cash balance to current liabilities is more than 20 per cent in all the remaining years. So, all the liquidity ratios indicate a good short-term solvency/liquidity position of the firm.

Table 5: Structural Health of Working Capital of Lupin Limited from April 2008 to March 2013

Ratios \ Years	2008–09	2009–10	2010–11	2011–12	2012–13	Average	S.D.	C.V.
Current assets to total assets	0.56	0.55	0.571	0.59	0.61	0.5762	0.021	3.73
Current liabilities to total liabilities	0.40	0.39	0.42	0.43	0.49	0.426	0.035	8.21
Cash to current assets	0.034	0.073	0.12	0.086	0.079	0.0784	0.028	35.11
Receivables to current assets	0.41	0.41	0.36	0.38	0.40	0.392	0.019	4.95
Inventory to current assets	0.43	0.35	0.34	0.37	0.36	0.37	0.032	8.55

Source: Author's estimates..

### Interpretation

It can be observed from Table 5 that Lupin Limited is dealing with positive working capital. All the current assets are showing an increasing trend. It is observed that inventory followed by receivables have the largest share in gross working capital. Analysis of structural health shows that the proportion of current assets to total assets has been very high during this period. Current assets are more the 50 per cent of the total assets over the period under study, which is quite amazing. Of course, inter-firm comparison can give a picture of how this firm has fared vis-à-vis other similar firms. But it may be said here that more funds are deployed in current assets than is desirable. To identify under which component of current assets excess funds are deployed, other ratios hint at the area of inventory (average 37 per cent) and receivables (39 per cent) have a maximum contribution. Though the liquidity position of the firm is quite satisfactory, proportion of cash in total current assets is only 7 per cent and showing fluctuating trend over this period as coefficient of variation is 35 per cent. Current liabilities constitute an average of 42 per cent of total liabilities. The proportion of current liabilities is showing an increasing trend except in the year 2009–10.

On the basis of the above ratios, it can be said that the firm's position is sound from the point of view of liquidity,

solvency and profitability. However, its activity ratios do not represent a satisfactory position. Better position will be reflected only if these ratios are compared with the performance of other firms in the same industry. In view of the concluding remark, management of Lupin should try to reduce the lead time, inventory turnover days as well as debtor's turnover days for increasing working capital efficiency. More information can be obtained by management in this area and further probing can be done before taking any corrective action.

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*Mindless habitual behavior is the enemy of innovation.*

*— Rosabeth Moss Kanter*

# India's Competitiveness: Innovation Aspects

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The Global Competitiveness Report assesses the landscape of economies, providing insight into the drivers of their productivity and prosperity. The GCI scores are calculated by drawing together country-level data covering 12 categories— institutions, innovations, macroeconomic environment, health and primary education, higher education and training, goods market efficiency, labour market efficiency, financial market development, technological readiness, market size and business sophistication and innovation. Countries like Finland, France, Germany, Japan, Singapore, Switzerland, US and UK are innovation driven, while China is an efficiency driven country and India is a factor driven country.

According to the Global Competitiveness Report 2013–2014, excellent innovation and strong institutional environments are increasingly influencing economies' competitiveness. Among Asia's developing nations, Malaysia is the most competitive (24th). At 29th, China remains by far the best of the four largest emerging market economies, ahead of South Africa (53rd), Brazil (56th), India (60th) and Russia (64th). The gap between China and India has widened from just eight places in 2006 to 31 today.

India continues to be "penalised" for its very disappointing performance in the basic drivers underpinning competitiveness, the very ones that matter the most. "The country's supply of transport, Information and Communications Technology (ICTs), and energy infrastructure remains largely insufficient and ill-adapted to the needs of the economy. The WEF report further noted that "notwithstanding improvements across the board over the past few years, very poor public health and education levels remain a prime cause of India's low productivity".

Innovation and sophistication factor is an important component for a country's competitiveness. Particularly, the ability of a country to create new value-added products, processes, and business model through innovation would drive the future of economic growth. While other factors run into diminishing returns, it is by technological innovation that the standards of living could be largely enhanced.

Switzerland's top-notch scientific research institution, along with other factors, makes the country a top innovator.

Finland has caught up at a very fast rate. The strong focus on education has provided the workforce with the skills needed to adapt rapidly to a changing environment and laid the groundwork for high levels of innovation. Where Asian countries like Malaysia has more or less maintained its position and countries like Philippines has improved substantially moving from 99 in 2009 to 60 in 2013 in the innovation pillar. China although has maintained its position in GCI, it has fallen in the innovation sector slightly from 26 to 32 in the past 5 years.

India, on the other hand, is on the continuing downward trend that began in 2009. The GCI ranking has since plunged from 49 to 60 in 2013. While in the innovation sector, its ranking fell from 30 in 2009 to 41 in 2013.

Though countries like USA has too shown a decline in the past 5 years in both its GPI (from 2 to 5) and its innovation sector (from 1 to 7) yet, US companies are highly sophisticated and innovative, supported by an excellent university system that collaborates with the business sector in R&D.

India, hence, needs to focus on improving its GCI ranking, at the same time, not neglect innovation. Being in the first stage, India competes on the basis of factor endowments- primarily unskilled labours and natural resources. Of the 12 pillars of competitiveness, India has witnessed the maximum downfall in the sector of goods efficiency and labour market, falling from 70 to 85 and 81 to 99 respectively in the past 5 years.

Hence to improve its competitiveness, India needs to focus on its basic requirements subindex because the pillars in this particular category are of more relevance for the economy. Innovation, although, is not a major culprit in the falling rankings of India in GCI, it should not be sidelined. Focussing on these 4 pillars would no doubt improve its GCI ranking, but to remain competitive in the long run, India should also gradually start giving attention to improving its innovation capacity. Because, in the years to come, classifying countries on the basis of "developed" and "developing" would become less relevant, and instead would be differentiated on the basis of "innovation rich" or "innovation poor".

**Table 1: Overall Global Competitiveness Index: India's Rank**

Components	Pillars	2013-14	2012-13	2011-12	2010-11	2009-10
Basic Requirements	Institutions	72	70	69	58	54
	Infrastructure	85	84	89	86	76
	Macroeconomic environment	110	99	105	73	96
	Health & primary education	102	101	101	104	101
Efficiency Enhancers	Higher education & Training	91	86	87	85	66
	Goods market efficiency	85	75	70	71	48
	Labour market efficiency	99	82	81	92	83
	Financial market development	19	21	21	17	16
	Technological readiness	98	96	93	86	83
	Market size	3	3	3	4	4
Innovation and Sophistication Factors	Business sophistication	42	40	43	44	27
	Innovation	41	41	38	39	30
Global Competitiveness Index		60*	59**	56 <sup>e</sup>	51 <sup>†</sup>	49 <sup>®</sup>

Note: \*out of 148 countries, \*\*out of 144 countries, <sup>e</sup>out of 142 countries, <sup>†</sup>out of 139 countries  
<sup>®</sup>out of 133 countries

**Table 2: Overall Global Competitiveness Index: Select Countries**

Sr. No.	Countries	2009-10	2010-11	2011-12	2012-13	2013-14
1	U.S	2	4	5	7	5
2	U.K	13	12	10	8	10
3	Finland	6	7	4	3	3
4	France	16	15	18	21	23
5	Switzerland	1	1	1	1	1
6	Germany	7	5	6	6	4
7	India	49	51	56	59	60
8	Malaysia	24	26	21	25	24
9	Philippines	87	85	75	65	59
10	Japan	8	6	9	10	9
11	China	29	27	26	29	29
12	Singapore	3	3	2	2	2

**Table 3: Innovation and Sophistication Factors**

Sr. No.	Countries	2009-10	2010-11	2011-12	2012-13	2013-14
1	U.S	1	4	6	7	6
2	U.K	14	12	12	9	10
3	Finland	6	6	4	3	2
4	France	15	16	17	18	18
5	Switzerland	3	2	1	1	1
6	Germany	5	5	5	4	4
7	<b>India</b>	<b>28</b>	<b>42</b>	<b>40</b>	<b>43</b>	<b>41</b>
8	Malaysia	24	25	22	23	23
9	Philippines	74	75	74	64	58
10	Japan	2	1	3	2	3
11	<b>China</b>	<b>29</b>	<b>31</b>	<b>31</b>	<b>34</b>	<b>34</b>
12	Singapore	10	10	11	11	13

**Table 4: Innovation**

Sr. No.	Countries	2009-10	2010-11	2011-12	2012-13	2013-14
1	U.S	1	1	5	6	7
2	U.K	15	14	13	10	12
3	Finland	3	3	3	2	1
4	France	18	19	17	17	19
5	Switzerland	2	2	1	1	2
6	Germany	7	8	7	7	4
7	<b>India</b>	<b>30</b>	<b>39</b>	<b>38</b>	<b>41</b>	<b>41</b>
8	Malaysia	24	24	24	25	25
9	Philippines	99	111	108	94	69
10	Japan	4	4	4	5	5
11	<b>China</b>	<b>26</b>	<b>26</b>	<b>29</b>	<b>33</b>	<b>32</b>
12	Singapore	8	9	8	8	9

Source: Global Competitiveness Report, Various Issues

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