

---

---

Focus : Productivity and Agriculture

---

---

Information & Technology Policies in Indian Agriculture

Determinants of Milk Productivity

Growth, Instability and Shift in Agricultural Production

Performance of Rice Productivity

Rain Fed Agriculture in Semi Arid Tropical India

Creation of Non-Performing Assets in the Banking Sector

Productive Specialization and Regional Development

Structure and Performance of Small Scale Industries in India

Productive Visual Planning, Scheduling and Control

Status and Capacity Utilization in Small-Scale Industries



## Guidelines for Contributors

### Scope and Coverage

PRODUCTIVITY is the principal journal of the National Productivity Council of India. The Journal aims at disseminating information on concepts of and data on productivity and its growth in India and elsewhere. It also aims at disseminating knowledge on techniques and methods of productivity improvement through effective management of all types of resources. Thus, contributions from a large spectrum of disciplines are accepted for publication. Only those manuscripts that present the results of original research and analysis are acceptable to the Journal. The managerial/policy implications of the study should be highlighted separately towards the end of the paper.

### Format of Manuscript

Contributions should be of about 5,000 words length. Tables, illustrations, charts, figures, exhibits, etc., should be serially numbered and typed in separate pages and should not be mixed with the main text. The text should be addressed to the **Editor, PRODUCTIVITY, National Productivity Council, Utpadakata Bhawan, Lodi Road, New Delhi - 110003.**

### About the References

Only those references which are actually utilized in the text should be included in the reference list. In the text, references should be cited with the surname of the author(s) alongwith the year of publication and the page number, all in brackets. If there are more than one reference by the same author during any year, the year may be subscripted with 'a' or 'b'. For instance, reference may be given at the end of the sentence as: (Szendrovits, 1998a, p. 337). Sources of data need to be given below each table unless otherwise mentioned in the text. Reference list should be alphabetically arranged. Each reference should carry the surname of the author, followed by other names, the title of the paper in quotes, the name of the journal underlined, volume and issue numbers, and the year of publication. In the event of a book, the title should be followed by the publisher's name and year of publication. In the event of a report from an organization, the name of the organization may be cited in the place of the author.

### Accompanying Material

The manuscripts should be accompanied by:

1. An abstract of the paper not exceeding 100 words.
2. A declaration that the paper is original and has not been submitted elsewhere for publication.
3. A note about the author(s) not exceeding 50 words.

### Editorial Board

S. K. Chakravorty  
Abad Ahmed  
Isher Judge Ahluwalia  
N.M. Barot  
Vinay Bharat Ram  
Ram K. Iyengar  
T.S. Papola  
N.S. Randhawa

### Editor

K.P. Sunny

### Assistant Editor

Rajat Sharma

### Editorial Consultant

Payal Kumar

### Subscription :

Subscription and orders for the journal should be sent to the publisher: **MD Publications Pvt Ltd, New Delhi.**

*Annual Subscription rates for subscribers are :*

In India (Rs.)		In Other Countries (US\$)	
Print	1800.00	Print	180.00
Online	1400.00	Online	140.00
Print + Online	2000.00	Print + Online	200.00

Postal Charges : Rs. 150.00 (In India)  
(US\$ 60 (Rest of the World))

*All remittance must be paid in favour of :*

**MD Publications Pvt Ltd,**  
payable at New Delhi, India

*All business correspondence to be addressed to:*



### MD Publications Pvt Ltd

"MD House", 11, Darya Ganj,  
New Delhi-110 002

Phone : +91-11-45355555

E-mail : [contact@mdppl.com](mailto:contact@mdppl.com)

Website : [www.mdppl.com](http://www.mdppl.com)

ISSN : 0032-9924

e-ISSN: 0976-3902



# Productivity

---

A QUARTERLY JOURNAL OF THE NATIONAL PRODUCTIVITY COUNCIL

Vol. 51 • April - June 2010 • No. 1



**MD Publications Pvt Ltd**

**New Delhi**

**[www.mdppl.com](http://www.mdppl.com)**



Copyright © 2010-2011 by National Productivity Council

---

*Publishers & Distributors:*



**MD Publications Pvt Ltd**

"MD House", 11, Darya Ganj,  
New Delhi-110 002

Phone : +91-11-45355555

E-mail : [contact@mdppl.com](mailto:contact@mdppl.com)

Website : [www.mdppl.com](http://www.mdppl.com)

This book or any part thereof may not be reproduced in any form without the written permission of the publisher.

**ISSN : 0032-9924**  
**e-ISSN: 0976-3902**

Published and printed on behalf of National Productivity Council,  
by Mr. Pranav Gupta, **MD Publications Pvt Ltd**,  
at Printext, New Delhi, India.



# Contents

---

Information and Technology : Muddling Policies with Practices in Indian Agriculture – <i>Debasish Maitra and Kushankar Dey</i>	...	1
Determinants of Milk Productivity in India : An Empirical Analysis – <i>G. P. Reddy, P. C. Meena and Ananta Sarkar</i>	...	8
Growth, Instability and Shift in Agricultural Production of Andhra Pradesh – <i>B. Narayana</i>	...	16
Performance of Rice Production in India – <i>Yogesh Murariya and B. R. Garg</i>	...	23
Rain fed Agriculture In Semi-Arid Tropical India – <i>S. S. Kalamkar</i>	...	32
Productive Specialization and Regional Development at State Level in India – <i>Diniz Francisco and Vinod Kumar Upadhyay</i>	...	41
Creation of Non-Performing Assets in the Banking Sector – <i>Tamma Koti Reddy and Siddhartha Arora</i>	...	53
Structure and Performance of Small Scale Industries in India – <i>Nomita P. Kumar</i>	...	69
Productive Visual Planning, Scheduling and Control with Calendar Load charts: Two Case Implementations – <i>Nesa L'abbe Wu</i>	...	81
Status and Capacity Utilization in Small-Scale Industries : A Case Study of Selected Industrial Units in Udupi District – <i>Sureshramana Mayya, Bharath V and S. Mayya</i>	...	90
Annual Index of Productivity Vol. 50 (April, 2009 - March 2010)	...	99

---







# Information and Technology: Muddling Policies with Practices in Indian Agriculture

Debasish Maitra and Kushankur Dey

---

*Indian agriculture is at crossroads and one of the major hurdles is to turn around the deceleration in agricultural growth. Reasons behind the poor performance are due to less public–private participation in terms of bulk allocation, transport, procurement, and storage of agri-commodities besides the low productivity yielding from the tiny economic holding of Indian farming community. Despite intensifying the mono-cropping and managing buffer-stocks or making distortions caused by the government interventions in wheat market in the recent past, attention on fair price realization for the farmers is a concurrent issue. There is a school of thought saying that free-market approach to agricultural policy would be much more effective to improve the income of farmers. In the backdrop of much discussed and debatable issues on technology (genetically modified/GM crops) and information (commodity markets), this article has come out with three propositions with respect to sustainability issues and risk management. Hence, this article is an attempt to reiterate the concurrent issues, scope, and redefining the frontier in Indian agriculture by converging government, industry, and academia towards better policies followed by better practices.*

*Debasish Maitra is a third year doctoral participant and Kushankur Dey, a fourth year doctoral participant at Institute of Rural Management, Anand.*

## Introduction

Agriculture is considered to be mainstay of the Indian economy. At the same time, this statement needs to be examined with due diligence. Today, Indian agriculture is at crossroads with an approximate 2.5% all crop-output growth rates in 10<sup>th</sup> five year plan (FYP) as against estimated 4.0–4.5% growth rate earmarked by National Agriculture Policy in the year of 2000. With a significant contribution, 50% in 1950s to Indian GDP by agriculture and allied sectors has sharply declined to 25% in 1999 and further, has come down to a mere 17.5% in 2008–09. Infact, we try to correlate the workforce engagement with agriculture, which shows a dismal relationship. From 70% involvement of manpower in agriculture, it has decreased to 51% (approximately) as of now. Besides, Indian consuming classes show a strong tendency of “consumerism” towards packaged foods and ready to eat products after the resurgence of organized retailing in 2004–05.

Therefore, we can safely infer that agriculture and agri-food marketing system in India have been undergoing some fundamental changes since initiation of the economic reforms processes in 1991. Three notable, but interrelated changes are observed and reported by few agricultural economists, namely, a significant shift in the consumption pattern away from the staple foodgrains to high-valued crops, a strong tendency of diversification of agriculture towards high-value commodities as to meet their growing demand (Birthal and Joshi, 2007), and a transition in the food marketing system from traditional ad hoc transaction dominated by intermediaries towards institution-driven coordinated supply systems, like cooperatives, growers’ associations and contract farming that beside coordinating demand and supply also address consumer concerns regarding food safety and quality (Birthal et al., 2005; Birthal



et al., 2008; BIRTHAL and JOSHI, 2007; DELGADO, 2008; ROY and THORAT, 2008).

Further, we can envisage the diaspora of Indian agriculture and allied sectors, segregated into three heads, namely, production, marketing, and distribution, risk management. In nutshell, proper and integrated risk management is the need of hour. Many a time, few schools of thought argue that free-market approach to agricultural policy would be much more effective for improving income of farmers. Relating to it, market is often characterised by power-relations of market participants in which trading, physical, and facilitation are three key determinants influencing the transaction and pattern of trade (see, model of ITC-e Choupal for instance, 2005–06). In this backdrop, the major challenge is to bring the government, industry, and academia onto the epitome of the present crises in agriculture. In this article, we try to explore issues relating to present crisis in Indian agriculture and then, examine the utility and scope of information (commodity derivatives markets) and technology (GM crops) induced agriculture at length in sections I and II respectively. Three propositions are articulated in section II beneath the technology-information puzzle. The last section looks at the roadmap for implementation.

### Section I

#### *Sounding out for Declining Agricultural Growth*

2007, 2008, and 2009 are consecutive three years underwent turbulence, disappointingly, ended up with

serious concerns on stocking inflation of food prices, mainly cereals, oilseeds, and sugar. Wholesale Price Index (WPI) is not hiding the truth, 17.5% increase in food articles and steep increase of 41.5% in pulses (The Economic Times, 2010). Agreed, introduction of new partnership models or “barter” economy for sugar, oil in exchange of wheat and second green revolution for “pulses” are nothing but policy recommendations. But implementation is of daunting task. Adequate understanding of imbalance between demand and supply is somehow missing. Gulati and Fan (2008) argue that less institutional support in Indian agriculture would continue to weaken the sectoral growth with respect to agricultural marketing, say, APMC reforms, “restrictive land laws and license requirements on food processing units,” etc. As a result, less capital absorption (sharply declined to 2.8% in 2008–09 from 6.6% in 1990–91 at 1993–94 base prices) either in the form of public or private has made the sectoral growth stagnant to some extent. Farm size and operational efficiency in terms of cost of cultivation and yield are also embedded with seasonal trend of agriculture. Managing risk with adequate marketing facilities can address this issue and hence, output and growth.

#### *Agribusiness Potential and Realisations: A Reality Check*

It is evident that multinational and transnational companies have been trying to grab the untapped potential in India and contributions adding to their gross national product (GNP) are also made the sector “bandwagon.” Shah (2005) has come out with an incisively analytic report which shows

**Table 1:** Food and Agribusiness Market Potential

Value chain	Key sectors	Market Size (USD billion) 2005
Agricultural inputs	Fertilizers, pesticides, seeds, farm equipments	8
Non-food	Cotton, wool, jute, rubber	3
Food-unprocessed	Cereals, fruits, vegetables, milk, meat, poultry products	98
Food (primary processed)	Packed fruits and vegetables, packed milk, unbranded edible oil, milled rice, flour, tea, coffee, sugar, pulses, spices, salt	68
Food (value added)	Processed fruits and vegetables-juices (jam, pickles, squashes, concentrate), processed dairy products (ghee, paneer, cheese, butter, ethnic Indian products), branded edible oil, bread, biscuits, snack foods, pasta based foods, beverages and poultry and marine products	44
Food services	Out-of-home consumption	10
<b>Total</b>		<b>231</b>

Source: Shah, (2007)



231 billion USD opportunities in food and agribusiness sector (Table 1).

Table 1 shows the potential or estimate of demand in the sector. We need to bridge the gap providing adequate supply. Relating it to “principal-agent approach” in context of agriculture, it is ostensible that primary supply (farmer as principal) and primary demand (consumer as principal) are being influenced by market information and price signals mediating through a large number of intermediaries, acting as “agents” including wholesalers and retailers (Capps and Sherwell, 2007).

Table 2 shows clearly that medium and large size class holdings are able to maintain positive gaps (savings) between income and consumptions unlike others. Hence, there is a huge challenge to remove the plights of the poor unless and until a robust mechanism of interplay of the government, industry, and academia is pivoted in the system. Risk management should get adequate attention in this context so as to set aside the poor from distress sales.

**Table 2:** Monthly per Capita Income and Consumption by size-class of holding

Size-class (hectares)	Income (Rs)	Consumption (Rs)
<0.01	1,380	2,297
0.01–0.40	1,663	2,390
0.41–1.00	1,809	2,672
1.01–2.00	2,493	3,148
2.01–4.00	3,589	3,685
4.01–10.00	5,681	4,626
>10.00	9,667	6,418
<b>All Sizes</b>	<b>2,115</b>	<b>2,770</b>

Source: (Gaurav, 2009)

### **Genesis of the “Crisis”**

It is essential to look at the demand-supply side factors that are contributing to surges of recent foodgrains’ recent prices, which often is called factors behind the stoking inflation. Study by Chand (2008) and Bose (2009) argue that “the general upward pressure on prices has been strongly reinforced by a number of developments since 2006:”

- Unfavourable weather conditions reduced harvest yields in both 2006 and 2007 in an unusually large

number of countries. Wheat harvest, in particular, had been adversely affected, which led to a sharp bidding-up of wheat prices, with spillovers into close substitutes (particularly rice).

- Rising biofuel production in advanced economics, in response to higher oil prices, and, increasingly, generous policy support has boosted demand. In particular, rising corn-based ethanol production accounted for about three-fourths of the increase in global corn consumption in 2006–07. This has pushed up not only corn prices, but also the prices of other food crops, and to a lesser extent, edible oils (through consumption and acreage substitution effects), and poultry and meats (through feedstock costs).
- The rise in oil prices and energy prices more generally has boosted productions costs for food commodities, through the impact on transportation fuels and fertilizer prices (the latter have more than tripled since 2006) (Bose, 2009, p. 26; Chand, 2008, p. 115–122).

## **Section II**

### ***Demystifying the Recent Debate: Clubbing Technology and Information***

*Technology: Can it help to increase price realisation and yield?*

The recent debate is on GM or transgenic foods having an adverse impact on Indian farmers and their livelihoods. It is important to examine the issue and the effect of technology induced profit in agriculture. Perhaps, although GM crops combat against targeted pest, there is reportedly a move to argue that emergence or proliferation of other minor pests on the selective crop, say cotton is profound resulting into higher marginal cost with lower additional return.

Herring (2007) in his paper shows that there is consistent support of agronomic theory behind Bt cotton, which are improved yields, reduction in pesticide sprays against bollworms, and higher profits across five cotton-growing states, namely, Maharashtra, Madhya Pradesh, Andhra Pradesh, Karnataka, and Gujarat for the growing season of cotton, 2003–2004 (Table 3).

There is a discourse on the posterity of biotechnology in Indian agriculture and discussions engaged at policy level against the perils of engineered seeds or foods. Table 3



**Table 3: State-wise Comparison of MMBL (Bollgard) Bt Cotton Outcomes**

State	Bollworm Pesticide		Yield Increase		Increase in Net Profit	
	Reduction (%)	Cost (Rs)	%	qtl/acre	%	Rs/acre
AP	58	1,856	24	1.98	92	5,138
Karnataka	51	1,184	31	1.36	120	2,514
Maharashtra	71	1,047	26	1.48	66	2,388
Gujarat	70	1,392	18	1.20	164	3,460
MP	52	889	40	2.2	68	3,876
All India Weighted	60	1,294	29	1.72	78	3,126

Source: Herring (2007).

never reveals the truth about the number of employment or increased wages or number of farmers who committed suicide. Anyway, Herring (2007) tries to reveal and pose an onslaught against the profit motive of the corporate or industry:

All policymakers must be vigilant to the possibility of research data being manipulated by corporate bodies and of scientific colleagues being seduced by the material claims of industry. Trust is no defense against an aggressively deceptive corporate sector"...whose number count depends fundamentally on the field of power in which they are produced and into which they are inserted...Numbers that count in commercial ventures have generated overwhelming support for Bt cotton in India: the technology makes money for formal-sector firms, farmers and cottage industry entrepreneurs of illegal Bt seeds...but for the farmers, the evidence from Bt cotton suggests that the numbers that count are those of their neighbours and their own fields.

#### **Information: Price Discovery and Commodity Futures**

Another debatable issue is on whether commodity futures markets are responding to skyrocketing prices of agricultural commodities or are the interests of the corporates is to exploit the farmers or militate against the fair price realisation. These kinds of issues raise serious concerns on the parlance of policy and implications. Kaul (2007) examines and narrates this inconclusive debate following Abhijit Sen Committee recommendations (2008) which carries a fair amount of sensible issues to morph the synergistic framework:

#### **Commodity Futures and Food Price Inflation:**

Commodity futures trading, especially in agriculture commodities, however, continue to receive a fair amount of academic and media articulation. It has been forcefully argued that futures markets are dominated by speculative interests, that farmers are not direct participants, that price rise can be partially attributed to such trading, that it leads to high price volatility, and that on account of severe market limitations future markets neither give genuine price discovery nor do they provide a price risk management tool. These are all important concerns and there is need to look at both the theoretical as well as empirical literature in this area.

An examination of the issues is best begun by an objective examination of the physical market as they exist today and their limitations. It can be nobody's case that spot markets work well in the country. On the contrary, most would agree that spot markets in India are fragmented, opaque, and in many States under developed, severely limiting the choice to farmers although significant improvement has been witnessed by establishing National level Spot Exchanges (MCX and NCDEX) since 2007 onwards. Liquidity, transparency, and leverage are the three major benefits which are attributable to better price discovery and portfolio diversification in Indian commodity futures market (although less volume in agricultural commodities appeared). Participants in the exchange are able to control large quantity of a commodity with a comparatively small amount of capital, because of the small margin, normally set at 2–5% of the value of the commodity.

#### **Indian Commodity Derivatives Market-A**

**Recapitulation:** It is worth mentioning that 1875 is earmarked of having established Bombay Cotton Trade



Association (BCTA) at Mumbai and subsequently, ramification takes place at western and eastern parts of the country, namely, Uttar Pradesh, West Bengal, Maharashtra, etc. The idea behind articulates the need of price discovery and price risk management, say in the form of hedging. Almost 20 odd regional level exchanges are in existence with a minuscule trade history as of now. These exchanges' operations could not make the trade viable and far reaching because of low participation, less technical support, poor margining process, and opaque price discovery process (Thomas, 2003).

**Regulations Strengthening Trade:** The sum of argument has made it possible to envisage the foundation of national level commodity exchange. The discourse plays in and around to delimit spot price conundrum muddling with illiquid trade (Jagadharini and Putran, 2002). In turn, well articulated and conceptualised arguments have made the trading simpler and more acceptable gradually. 2003 by the way is considered to be a watershed year as three (recently another one is incorporated) national level demutualised, multi-commodity exchanges have laid the steppingstone under the aegis of Forward Markets Commission (FMC, 1953) to propel the commodity futures enviable. These are, National Multi Commodity Exchange, Ahmedabad (2002), National Commodity and Derivatives Exchange of India Limited, Mumbai (2003), and Multi Commodity Exchange, Mumbai (2003) and of late, India Commodity Exchange, New Delhi (2009). Recounting the commodity futures (option is still waiting) snapshot, trade volume is reached to more than 40.67 lakh crores (2007–08) despite the intermittent prohibition of trade in certain commodities, viz., rice, wheat, tur, urad, potato, chick pea, soyoil, sugar, etc. From 17 commodities to more than 100 which sets an epoch of commodity futures markets in post 2002–03, are allowed for trading under the stern-recommendations of many committees, namely, Khusro (1980), K.N. Kabra (1993), Shankarlal Guru (2001) and Habibullah (2003). Participation has been increased to more than 3,000 members including PCM, TCM, and ICM with a whopping 20,000 terminals covering 800 small towns or cities. Market microstructure, in order to facilitate the trading process, is also crafted after introducing technology driven architecture, Derivatives Trading and Settlement System (DTSS) which has to serve surveillance and monitoring activities. The technology is said to be a fool-proof measure of operational nuances, margining (gross) both on long (buy) and short (sell) position of respective trade, cap on initial and maintenance margin, daily settlement following mark-to-market (MTM), closing out or squaring off of the position, final settlement

(pay-in and pay-out) and finally delivery with three options, buyers, sellers, and both. Hence, today's commodity derivatives markets in India are an outcome of manmade innovation and empirically are more or less replacement of open outcry or pit trading process. Still, the experience of trading at international exchanges, namely, LME, NYBOT, CME, NYMEX, DME, CBOT, etc., shows that transparency in trading processes of "open outcry" is more legitimate to "secretive online trading" (Pavaskar, 2008).

**Bottlenecks in Commodity Futures Market:** Economists are in favor of Indian commodity markets putting forward that Indian markets are integrated with US markets of which, distinctively, price volatility is relatively less (Bose, 2009; Sekhar, 2004). At the same time, physical delivery constitutes hardly 1–2% of total trade being held at exchange platform in total of which three national level exchanges seem to grab and control more than 97% of total market share or trade volume in 2008–09. Lack of physical delivery throws a number of questions for a respectable trade which has limited answers to it. Utilities in the form of warehouse or warehouse receipt financing (WRF) are not meeting the assorted demand of diverse and discursive participants (Mor and Fernandes, 2009) or a huge responsibility is being accomplished by exchange or the objective of setting up of an exchange in post-liberalisation phase is likely to be lopsided (Sahadevan, 2002). Going into deeper, incisively, we can posit in crude and sophisticated way that adjustment in bid-ask price turns out to be a regular job of market makers against their hefty counts or commission. The noble objective is yet to be achieved by the way of introducing aggregator model on behalf of small and marginal farmers and overseeing the contract-design under contract purpose act in terms of lot size, multiplier unit, price band, tick size, delivery or location, timing option, etc. This augurs for a consensus amongst all participants.

### **Propositions for a Multilayered System**

We try to examine the present bottlenecks astoundingly and come out with the following propositions (Srijit, 2007; Kumar et al., 2007):

*P<sub>1</sub>: Considering the regional differences with uneven distribution of natural resources across the country, a proper demand-supply match amongst the output, price or income, input, credit and other issues should be achieved through mutually trusted, complementarities of skills coupled with cohesive works of the entities, namely, the government at policy level, industry as implementing agencies and academia at research and development level.*



**Table 4:** Emerging Opportunities and Indian Agriculture: A Synergistic Accomplishment

Agro Processing (identified scope and issues)	Potential Areas (requirement)	Few Best Practices
Economies of scale, improved integration, from commodity to brands, shorter supply chains leading to better prices.	Sugarcane, cotton, seed production, fruits and vegetables (F&V), gherkins, wine, dairy, poultry, flowers, organic products.	Contract farming, intervention of private and state (tripartite/multipartite) in Punjab, Andhra Pradesh, and Karnataka are some of them show best practices.
<b>Agricultural Marketing and Risk Management</b>		
Alternative wholesale markets/terminal markets, perishable cargo centers, rural primary mandis, grading and standardization, labeling and packaging, quality testing labs (NABL) or quality control units, warehousing and cold storages, revival of regional commodity exchanges and emergence of spot exchanges.	Green houses, micro irrigation equipments, minor irrigation, logistics support, processing plants and equipments, pre-cooling facilities, milk chilling plants, ICT networks (VSAT), refrigerated vehicles.	Weather insurance and other derivative products designed by ICICI Lombard and AIC, alternative price mechanism to MSP, modern format retail stores to cater the needs of the farmer.  Setting up of spot exchanges by MCX, NCDEX would serve better against fair price realization in spot.

*P<sub>2</sub>: Information and technology induced development should also take into account of social perspective for economic growth and thus, should achieve sustainability.*

*P<sub>3</sub>: Risk management would act as a catalyst for revitalizing the certainty factor amidst of uncertainties of price, yield, income, and credit also.*

### Section III

#### **Roadmap for Implementation: Extending to the Field**

Cogent analysis of the issues discussed above unveils the reality or fundamental changes which are occurring in agriculture of the so called India-2. Give a firm answer to the bonding of governance and growth is very difficult as the scenario takes account of many dimensions, social, political, economic, and technological. It is rhetoric to say that one framework would bring in “synergy” among the stated entities viz., government, industry, and academia to ensure the handshaking of policies formulated with practices followed at grass-root level. We strongly put forward assertions that the strategy is contingent upon the situation and varying dimensions of social structure and system. The following table narrates the essence of the alignment of policies with practices to accommodate with “paradigm shift” from traditional to high-tech agriculture. It would be sine qua non to articulate the emerging opportunities lying ahead in the gamut of agriculture based on the above discussions and the roadmap would be easier to portray considering the untapped potential observed in the recent past. We try to explore the opportunities in the two horizons, one is agro-processing (less than 2% processed of total harvest) and the other one is agricultural

marketing, the self-explanatory table contains some of these opportunities (Table 4).

#### **Summary and Conclusion**

It is apparent and unambiguous from the above discussion that agriculture is not a single activity; it is interwoven with many other facets too. Only production and protection would not heighten growth and development. Deceleration in agricultural growth is not exclusively due to either government or industry or academia fatigue. But it is because of the failure of convergence of interests of three entities. A comprehensive policy framework concerning government, industry and academia to match policies with practices is indispensable for reducing transaction costs, easy and favorable access to inputs, proper dissemination of information, and affordable technology to control price uncertainties which are preconditions for facilitating growth and sustainable development. Lastly, we conclude saying “what can be done” which proffers, “Experimentation with quick feedback is the only way to learn if one is concerned about guiding the evolution of the socio-technological-economic system through the use of the forum and government as a learning system” (Patricia, 2008, p.4).

#### **REFERENCES**

- Birthal, P.S. and Joshi, P.K. (2007). “Institutional Innovations for Improving Smallholder Participation in High-Value Agriculture: A Case of Fruit and Vegetable Growers’ Associations,” *Journal of International Agriculture*, 46(1): 49–68.



- Birthal, P.S., Jha, A.K., Tiongco, M., and Narrod, C.** (2008). "Improving farm-to-market linkages through contract farming: A case study of smallholder dairying in India," IFPRI Discussion Paper, Vol. 00814, International Food Policy Research Institute, Washington DC.
- Birthal, P.S., Joshi, P.K, and Ashok, G.** (2005). "Vertical coordination in high-value food commodities: Implications for smallholders," MTID Discussion Paper 85, International Food Policy Research Institute, Washington DC.
- Bose, Sushimita** (2009). "The Role of Futures Market in Aggravating Commodity Price Inflation and the Future of Commodity Futures in India," *ICRA bulletin, Money and Finance*, p. 1-28, retrieved from [www.indianjournals.com](http://www.indianjournals.com) on November 11, 2009.
- Chand, Ramesh, Raju, S.S., Pandey, L.M.** (2007). "Growth Crisis in Agriculture: Severity and Options at National and State Levels", *Economic and Political Weekly*, 42(30): 2528-2533.
- Capps, Jr., O. and Sherwell, P.** (2007). "Alternative Approaches in Detecting Asymmetry in Farm-Retail Price Transmission of Fluid Milk," *Agribusiness: An International Journal*.
- Delgado, C.** (2008). "The Global Food Crisis Response Program (GFRP)," Food & Energy Price Briefing, World Bank. *The Economic Times*, Feb 2, 2010.
- Diaz, Patricia** (2008). "Possibilities at the Convergence of Government, Industry, academia, and Society, Enabled by 21<sup>st</sup> Century ICT Policies". Available online at [www.patriciadiaz.org/DiazPatriciaManizalesEjeDelConocimie.pdf](http://www.patriciadiaz.org/DiazPatriciaManizalesEjeDelConocimie.pdf)
- Gaurav, Sarthak** (2009). "Risk Mitigation in Agriculture," presented by Gaurav, Sarthak (IGIDR); National Sample survey: 59<sup>th</sup> Round, Situation Assessment Survey of Farmers, IFMR-CMF Conference
- Herring** (2007). "Whose Numbers Count? Resolving Conflicting Evidence on Bt Cotton in India", Q-Squared Working Paper (WP/4), November, 2007.
- Kaul, Sanjay** (2007). "Commodity Futures Trading in India: Myths and Misconceptions," WP series, NCDEX Institute of Commodity Markets and Research (NICR), pp. 1-11. Available online at [www.ncdex.com](http://www.ncdex.com) (downloaded on October 29, 2009).
- Mor, N. and Fernandes, K.** (2009). "Commodity Insights Yearbook 2009," MCX & PWC.
- Mishra, Srijit** (2007). "Risks, Farmers' Suicide and Agrarian Crisis in India: Is There A Way Out", Working Paper, IGIDR, Mumbai.
- Pavaşkar, M.** (2008). "Ring System Required for Farm Futures," *Indian Journal of Agril. Economics*, 63(1).
- Roy, D. and Thorat, A.** (2008). "Success in high-value horticultural export markets for the small farmers: The case of Mahagrapes in India," *World Development*, 36(10): 1874-1890.
- Shah, Sonal** (2007). "Emerging Platforms for agricultural Marketing," presented by Yes Bank, FICCI Conference. *The Lancet*. Available online at <http://www.gmwatch.org/p1temp.asp?pid=1&page=1> (May 9, 2007).
- Sahadevan, K.G.** (2002). "Price discovery, return and market conditions: Evidence from commodity futures markets," *ICFAI Journal of Applied Finance*, 8(5): 25-39.
- Sekhar, C.S.** (2004). "Agricultural Price Volatility in International and Indian Markets," *Economic and Political Weekly*, XXXIX(43): 4729-4736.
- Taori, K.J.** (2007). "Emerging Platforms for agricultural Marketing", presented by, SBI official, FICCI Conference.
- Thomas, S.** (2003). "Agricultural commodity markets in India: Policy issues for growth; IGIDR." Available online at [http://www.igidr.ac.in/\\_susant](http://www.igidr.ac.in/_susant)

*Try not to become a man of success but rather try to become a man of value.*

— Albert Einstein



# Determinants of Milk Productivity in India: An Empirical Analysis

G. P. Reddy, P. C. Meena and Ananta Sarkar

*Milch cattle has always played a significant role in Indian culture and civilization from the days of old. As against the ease of raising cattle in earlier times, the scenario today differs due to factors like population explosion and shortage of land for the purpose of fodder. In spite of the large population of cattle and buffalo in India, the productivity is low. Yet, the last three decades have witnessed a significant growth in the Indian dairy sector mainly because of the production and marketing impetus given by the Operation Flood program. The present study attempts to elicit the extent to which different endogenous variables affect the milk productivity. The empirical analysis has been done using time series data for 30 years. The results of the study would be critical in understanding the importance of each of the endogenous factors, which affect milk productivity in future. Descriptive statistics reveal the following conclusions. Productivity of a milch animal varies widely in India. Similarly, growth of NDDB resource base is also fluctuating. In 1990s, there are no impressive improvements in the number of Farmers Associations, milch animals and NDDB resource base in our country. It strongly concludes, there is high degree of relationship between NDDB resource base versus productivity enhancement. Further, the study concluded with the robust combination among the alternative estimations that density of farmers association, growth of NDDB resource base, rural poverty ratio, rural women literacy and crossbred contributes significantly to the milk productivity enhancement of a milch animal in India.*

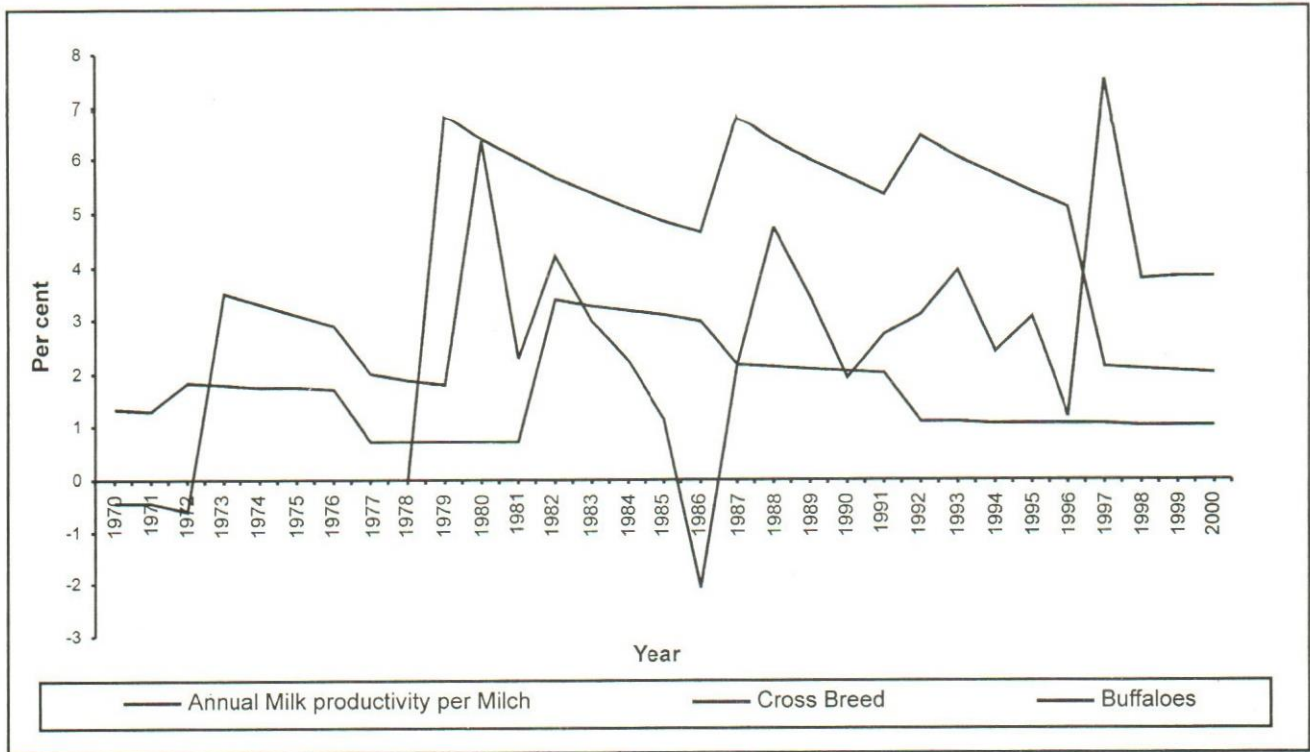
*G.P. Reddy, P.C. Meena and Ananta Sarkar are scientists at NAARM, Hyderabad, India.*

## Introduction

Milch cattle always formed an integral part of Indian culture and civilization from the ancient times. Our ancestors had recognized that cattle keeping would contribute toward the economic well being of the people in general and the poor in particular. It was easy to raise cattle in the past since there was a vast uncultivated land and less human population. As against that the scenario has changed drastically today due to population explosion and shortage of land for fodder since most of the land is used for food and cash crop. According to the 17<sup>th</sup> livestock census (2003), India is having 284 million animal population of which 96 million buffaloes (55% of the world) producing only 16% of world milk production. Even though India has large cattle and buffalo population but productivity is one of the lowest when compared to the developed countries. The approximate productivity for indigenous cows is around 1.7 LPD, crossbred 5.8 LPD and buffaloes 3.6 LPD (Dairy, 2001).

Nevertheless, last three decades have witnessed a significant growth in the Indian dairy sector. It is mainly because of the production and marketing impetus given by the Operation Flood program, which was designed to link rural milk sheds with urban consumption centers. The milk production registered 4.7% growth with a quantum jump from 22.5 million metric ton (MMT) in 1970–71 to 31.6 MMT in 1980–81, 53.9 MMT in 1990–91 and to 84.6 MMT in 2001–02, thus making India the largest producer of milk in the world. India is the world's largest and the fastest growing markets for milk and milk products. A major portion of the milk consumed is also in liquid form. The value of output from dairying, based on consumer prices, in the year 2001–02 was Rs 104 billion. However, growth of milk productivity per milch, XB and buffalo was volatile over the period except recent few years it remain stable (See Graph 1).





Graph 1: Annual growth of productivity per milch, XB and Buffaloes in India: 1970-2000

The dairy industry gained wide momentum as an organized industry through a cooperative dairy movement under the Operation Flood program. However, after two decades of success, the movement has given way to private investment in the sector. In the long run, irrespective of whether the past growth is driven by numbers of animal or productivity, the latter is crucial to sustain output growth. Productivity is mainly defined by the genetic constitution of the animal. The extent to which the genetic potential can be realised depends on quantity and quality of feeding, livestock management, health care, etc. At the existing level of technology and prevailing organization of production, there is considerable scope to raise productivity of the milch stock. This is manifested by the difference in actual and attainable yield. It varies across breeds, i.e., for crossbred cattle the attainable yield is about 3,686 kgs per lactation. Murrah and Nili Ravi are the important breeds of buffalo found in India with milk production potential of about 1,850 and 1,765 kgs per lactation. Further, there are interregional differences in the adoption of technology and performance of dairy animals. In spite of interregional differences in production performance, current mean yield of indigenous cattle is about three-fourths of the attainable yield for the predominant breeds in India. Yield gap for crossbred cattle is to the tune of 50 %. Similar amount of gap exists for buffaloes also in India.

NDDB's perspective 2010 and the 10th five-year plan emphasize on enhancing milk productivity, which is essential to increase per capita milk availability in our country. However, productivity is influenced by both exogenous and endogenous factors. Exogenous factors include rainfall, climate, etc., over which one does not have any control. Therefore, any effort to increase productivity would involve changing the endogenous variables, which include social, economical, cultural, political, scientific, and historical factors. Therefore, in the present study, attempt has been made to elicit the extent to which different endogenous variable affect the milk productivity. The empirical analysis has been done using time series data for thirty years. The results of the study would be critical in understanding the importance of each of the endogenous factors which affect milk productivity in future.

## Methodology

### Data

The present study determines various factors affecting milk productivity in India over a period of time. For this, different endogenous variables, i.e., factors affecting the productivity of milk included in the model are the number of milch animals, bovines (separately for cross-bred and buffaloes), milk production, land holdings, area under



irrigation, number of cooperative societies, NDDB resource base, rural poverty ratio, women literacy in rural India, and the geographic area. Thus time series data for all these variables has been collected for the period 1970 to 2001. The data required to estimate the model are not available at one place and have to be put together from a number of sources. The principal data sources included All India Dairy Business Directory, Database portal Indiastat.com. Both these database are compiled from the government of India data. Information relating to NDDB resource base has been taken from NDDB Annual Reports. Data has also been taken from Food and Agriculture Organization Corporate Statistical Database (FAOSTAT) and the websites of some of the relevant departments of the government of India.

Some of required time series information is not available; thus forcing to make simplifications and assumptions. Time trends were fitted to complete the series for some of the variables and spot values were assumed to hold for the entire time period under consideration in other cases. However, attempts have been made to maintain consistency with all the available information in each case and a significant amount of time and effort was spent on the data construction.

### Empirical Framework

The present study has used annual time-series data for the variables in nominal terms over the period 1970 to 2001. In the light of the above literature, the following model has been estimated with alternative combinations of exploratory variables to identify the determinants of average milk productivity per milch animal with the help of multiple regression, as specified below:

$$APMA_t = \beta_0 + \beta_1 ALH_{(t-1)} + \beta_2 APMA_{(t-1)} + \beta_3 BUFF_{(t-1)} + \beta_4 CINTEN_{(t-1)} + \beta_5 FA_{(t-1)} + \beta_6 GE_{(t-1)} + \beta_7 NDDB_{(t-1)} + \beta_8 RF_t + \beta_9 RPR_{(t-1)} + \beta_{10} RWLIT_{(t-1)} + \beta_{11} XB_{(t-2)} + \varepsilon_t \quad \dots(1)$$

Where t-1 shows the lag of one year and  $\varepsilon_t$  disturbance term.

### Variables for Estimation

To examine the factors that influence productivity of milch stock, the following variables are listed for final estimation.

#### Dependent Variable

To assess a shift in milk productivity of milch animal, annual productivity per milch animal is considered as the dependent variable in the estimations (APMA).

### Independent Variables

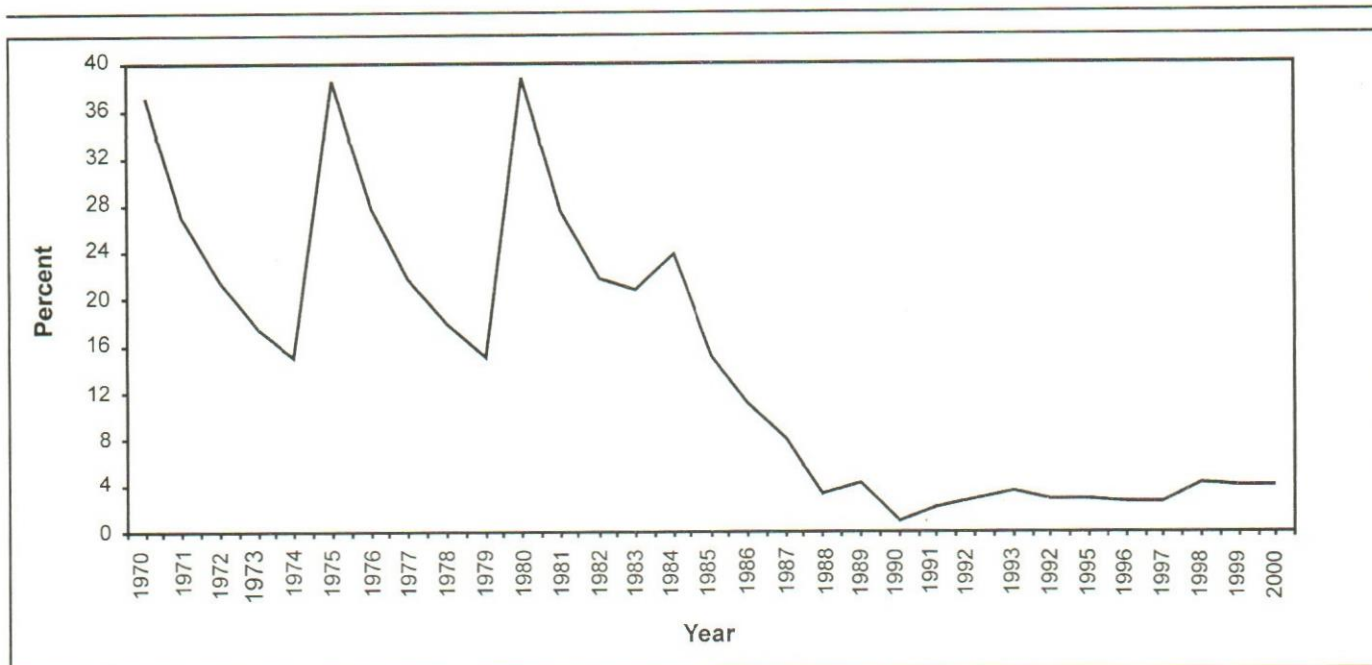
Breed improvement in cattle has been an important component of India's livestock development policy focused in the 10th five-year plan. Technological change is likely to have a crucial impact on the future structure of productivity growth. To measure this change, % age of crossbred in total milch cattle population (XB) has been taken, which serves as a good proxy for technological change in dairy sector. Similarly, buffalo population is growing faster than cattle in many parts of the country. Besides, milk yield of buffaloes is higher than that of indigenous cattle. Therefore, proportion of buffaloes to milch animals (BUFF) is considered as another explanatory variable for the estimation.

Optimum productivity cannot be realized with technology only, if inputs such as fodder are in short supply. Crop intensity (CINTEN) has been taken as a proxy for fodder availability. Fodder supplies however, vary across the land holdings. It is expected that the fodder constraint is more severe on small, medium, and marginal holdings (ALH). Further, 67 % of small, marginal, and landless farmers have as high as 70% of livestock. Therefore, the average of marginal and small land holdings in the total holdings is also included in the set of explanatory variables.

In India, Farmers Association' (FA) (also called as DCA or Dairy Cooperative Societies) have witnessed significant growth over the last few decades, which are likely to impact milk yield. FA has emerged as a powerful medium in transforming the dairy sector in the country. Consequentially, milk production increased by popularizing dairying as a profession. Further, marketing linkages between producers and consumers got strengthened in the process. While the role of FA in augmenting milk production is well recognized, their impact on productivity is unclear. Including density of dairy co-operatives in India in the analysis captures this. However, Graph 2 reveals that farmers associations are also decreased to its lowest in 1990s but its showing better during the last few years.

Rural poverty ratio (RPR) expected to have negative relationship since dairying involves financial involvement to provide good health and inputs for the milch animals. In addition, low poverty leads to unhygienic and unhealthy environment for both the animals and men. As against this, literacy of women in rural areas (RWLIT) increases animal rearing awareness and it leads to increase in productivity, and reduce the maintenance cost of the animals. Further, women (60%) provide livestock farming labour and more than 90% of work related to care of animals





Graph 2: Annual Growth of Farmers Association' in India: 1970-2000

is rendered by womenfolk of the family. Likewise, growth of NDDB resource base (NDDB) and government expenditure on dairying (GE) increases the networking; health infrastructure and awareness, which in turn increase productivity. It is evident that ever since the creation of the NDDB, the production of milk has increased tremendously, as has its distribution over most parts of the country (Mohan, 2004). In the estimation, to test whether reforms (RF) have positive or negative effect on the productivity it has been taken as a dummy variable 0 if it is before 1991 otherwise 1.

In short, above arguments can be summarized and presented as follows:

$$\begin{aligned}
 & \quad (+) \quad (+) \quad (+) \quad (+) \quad (+) \quad (+) \quad (+) \quad (-) \\
 APMA_t = & f(ALH_{t-1}, APMA_{t-1}, BUFF_{t-1}, CINTEN_{t-1}, GE, FA_{t-1}, NDDB_{t-1}, RF_t, \\
 & \quad (-) \quad (+) \quad (+) \\
 & RPR_{t-1}, RWLIT_{t-1}, XB_{t-2}, \dots \dots \dots (2)
 \end{aligned}$$

### Results and Discussion

Descriptive statistics, namely arithmetic mean, standard deviation, and minimum and maximum for the quantitative variables are presented in Table 1. It clearly indicates the nature and extent of dispersion of data of the variables. Few remarks on these results deserve special mention. First of all, the arithmetic mean and the degree of absolute

Table 1: Descriptive Statistics—Select Measures of Central Tendency and Dispersion

Variable	Description	Mean	Standard Deviation	Minimum	Maximum
APMA	Annual Productivity per Milch Animal (Liters)	1022.88	179.93	784.47	1386.18
ALH	Average Land Holding (Hectare)	1.52	0.10	1.49	1.84
BUFF	Proportion of Buffaloes to Milch Animal	44.10	5.95	35.42	54.61
FA	Density of farmer's association (Sq. km)	65.99	36.86	37.50	178.44
GE	Government expenditure on dairying (Lakh)	728	631	105	2393
CINTEN	Crop Intensity (Area)	131.90	3.04	126.94	137.42
NDDB	Growth of NDDB resource base (Lakh)	41.43	155.16	-87.37	706.06
RPR	Rural Poverty Ratio	36.93	6.67	25.60	48.17
RWLIT	Rural Women Literacy rate	32.50	7.84	21.70	46.70
XB	Proportion of Crossbreed to Milch Animal	8.19	2.75	4.59	12.86



dispersion or standard deviation for APMC (or ALH) are the highest (or lowest). Second, in terms of relative variation or coefficient of variation, the largest (or smallest) is evident for NDDDB (or ALH). Third, the range of observations varies widely as shown by the minimum and maximum values for different variables. Fourth, the minimum values for NDDDB are negative. This indicates that NDDDB resource base are falling down in a year. Fifth, APMC were the maximum in the recent past.

Table 2 reveals the nature and degree of linear relationship between the quantitative variables in the estimations in terms of simple correlation coefficients. In

particular, RPR is having relatively high degree of positively correlated coefficients. However, relative high (or low) degree of linear relationship is found between RPR and FA (or BUFF and APMC). In fact, the relationship is negative between many variables.

It is necessary for estimation that all the time-series data variables are stationary. A stationary series is one whose parameters (namely mean, variance and autocorrelations) is independent of time, or which exhibit constant mean and variance and has autocorrelations that are invariant through time. Econometric literature in the recent past has experienced an explosion of unit root tests

Table 2: Correlation Matrix

Variables	ALH	BUFF	CINTEN	FA	GE	NDDDB	RPR	RWLIT	XB
ALH	1.00								
BUFF	-0.97	1.00							
CINTEN	-0.91	0.95	1.00						
FA	0.68	-0.66	-0.79	1.00					
GE	0.28	0.42	0.34	.48	1.00				
NDDDB	0.23	-0.21	-0.16	0.09	0.42	1.00			
RPR	0.74	-0.97	-0.98	0.78	0.37	0.15	1.00		
RWLIT	-0.97	0.60	0.55	-0.67	0.41	-0.21	-0.98	1.00	
XB	-0.91	0.96	0.46	-0.75	0.35	-0.19	-0.98	0.37	1.00

Table 3: Test for Unit Root Statistics

Variable	Select Lag Length	Test-Statistics		
		DF	PP	KPSS
APMA	0	-3.1842**	-3.2492**	0.0542
ALH	1	-3.5462**	-3.5462**	0.0268
BUFF	0	-3.2158**	-3.0248**	0.0874
FA	1	-3.7812**	-3.5874**	0.0128
GE	1	-3.282**	-3.842**	0.0647
CINTEN	0	-3.5419**	-3.4830**	0.0542
NDDDB	0	-4.5812***	-3.9847**	0.0492
RPR	1	-3.8459**	-3.5487**	0.0165
RWLIT	1	-4.2541***	-4.5481***	0.0421
XB	0	5.2482***	-5.4892***	0.0421

Notes: 1. \*\* and \*\*\* refers to significant at 5% and 1% level.

2. PP test estimated with constant and trend and KPSS test with ETA (tau). ETA (tau) the null hypothesis is trend stationary.

3. In DF and PP tests, the estimated values are greater than the critical values to reject the null of unit root but in KPSS the estimated value are less than the critical values to accept the null of no unit root in the series.

4. DF stands for Dickey-Fuller, PP for Phillips, Perron and KPSS for Kwiatkoski, Phillips, Schmidt and Shit tests.



for testing the stationary of time series. Unit root tests are generally employed to establish the order of integration. Keeping in mind the problems of size distortion and low power of the conventionally used unit root tests like DF and ADF, this study employs tests to examine the stationary properties of all the series. If a unit root is present at levels, the variables are tested at first difference. Both the tests find variables such as APMA, BUFF, INTEN, GNDDDB and XB stationary at levels. Given the nature of the variables, tests for a unit root in the first difference ( $\Delta$ ) of all the variables is carried out. It is found that, first difference I(1) form is sufficient to induce stationary in all the variables. The results in Table 3 reveals that all the these variables are I(1).

As anticipated, XB has a positive and highly significant impact on APMA, endorsing our observation that future growth in milk production would be technology driven. Similarly, relationship between RWLIT and APMA is also positive and highly significant in all the estimations. Coefficient of CINTEN is positive and insignificant in both the models. This underscores the fact that adequacy of crop intensity would not be a critical factor in realizing the potential of the dairy sector. The impact however, varies across economic classes as the association between APMA and ALH is significant. Thus, yield improvements on marginal and small land holdings would not constrain by land holdings. It observed that milch stock owned by the landless and marginal farmers is also productive than those owned by others (Table 4).

**Table 4:** Determinants of Milk Productivity in India: 1970 to 2001

Dependent Variable—Annual Productivity per Milch Animal (APMA)

Variable	Model 1	Model 2	Model 3	Model 4	Model 5
ALH (-1)	1737.383 (2.147)**	1376.223 (4.184)***		1502.757 (2.739)**	
APMA (-1)		0.451 (2.208)**	0.507 (2.691)***		0.557 (3.053)***
BUFF (-1)	17.084 (2.577)**	8.888 (1.434)		12.029 (2.081)**	
CINTEN (-1)	3.237 (1.081)				0.298 (0.144)
FA (-1)	0.006 (350)		0.024 (2.826)***		0.028 (3.129)***
GE (-1)				0.482 (1.876)*	3.518 (1.342)
NDDB (-1)	0.034 (2.872)***	0.031 (3.648)***	0.023 (1.878)*	0.046 (6.272)***	
RF		-4.520 (0.413)	-18.455 (-2.118)**	-9.040 (-0.709)	-17.102 (-1.876)*
RPR (-1)			-4.821 (-1.929)*		-6.037 (-2.277)**
RWLIT (-1)	30.797 (6.106)***	17.165 (1.991)**	15.014 (3.043)***	28.598 (5.155)***	14.672 (2.911)***
XB (-2)	7.768 (4.135)***	5.304 (2.265)**	7.272 (2.904)***	8.894 (2.907)***	7.734 (3.098)***
Constant	2962.69 (2.525)**	2483.814 (4.4814)***	-174.249 (-1.083)	2878.535 (3.344)***	-303.447 (-0.807)
Adj-R <sup>2</sup>	0.9946	0.9961	0.9963	0.9949	0.9961
D-W	1.1484	1.8323	1.9086	1.1188	1.8304
SER	16.2663	13.8000	13.5436	15.7873	13.8845
F-Statistics	766.1519	1065.6930	1106.546	948.9594	1052.723

Notes: (1) Numbers in parentheses are t-statistics.

(2) \*, \*\*, and \*\*\* denote that coefficients are significant at 10%, 5%, and 1% level respectively.

(3) DW is the Durbin-Watson Statistic and SEE is the Standard Error of Regression.



The association between APMA and GNDDB is positive and significant. This is on expected lines. Development of animal health services in the country has been significantly contributed by the NDDB by reduced incidence of animal diseases and avoided yield loss and creates awareness among the farmers. In addition, it reveals that NDDB is effective in taking lab to land. Animal health services also influence milk production through dissemination of yield increasing technology and breeding services. In addition, NDDB not only adopted projected approach but also used a unique blending of techno-financial assistance to achieve the desired results. NDDB ushered in white revolution as result of focused attention to technology development, extension, provision of input supply, procurement, distribution, and marketing, along with corresponding appropriate institutional development. On the other hand, relationship between growth of government expenditure on dairying and APMA is insignificant. It may be due to the reason that government is spending about 92% under non-plan expenditure, which has been spent on building infrastructure than developmental activities.

The impact of density of farmers associations is positive on milk yield and significant. This can be explained by looking into the objectives and performance of farmers association. The primary objective of dairy cooperatives is to strengthen the vertical marketing linkages. Provision of inputs and other livestock related services to the farmers are incidental and a bonus. In this context, the existence of a good network of farmers association, their involvement in activities such as fodder development and input supply was rather moderate. Further, the performance of farmers association is encouraging.

Explanatory variables account for 99% of the variation in milk yield. The association between APMC and its previous year productivity is positive and highly significant, which highlights the role of previous potential in production systems. This has implications for production growth particularly in the short run suggesting that milk yields can be increased through past management and productivity status of an animal. In the cast of RF, a negative and significant relationship confirms that reforms have not made any impact on productivity of milk yield in India.

In fact, in all the estimations, the F-statistics is significant at 5% level. Of these estimations, the results

in Model 3 are more plausible than the other estimations for many reasons. First, satisfying the sign conditions of the coefficients. Second, having a large number of statistically significant coefficients. Third, having the highest explanatory power of the model in terms of  $R^2$  (0.9963) and the lowest standard error of regression. Fourth, no multicollinearity or autocorrelation in the model. In toto, results depict that density of FA; growth of NDDB resource base, rural poverty ratio, rural women literacy, and crossbreed contributes significantly to the productivity.

### Conclusions and Policy Implications

The main focus of this study is to estimate empirical determinants of the Milch animal milk productivity and to suggest few policy implications to attain the goal set by the NDDB' perspective 2010 and 10<sup>th</sup> five-year plan using annual data of the variables from the period 1970 to 2001. Data gaps have been filled using time trends to complete the series for some of the variables and spot values. The study has used descriptive statistics, stationary tests and multiple regressions for the estimation.

Descriptive statistics reveal the following conclusions. Productivity of a milch animal varies widely in India. Similarly, growth of NDDB resource base is also fluctuating. In 1990s, there are no impressive improvements in the number of FA, milch animals, and NDDB resource base in our country. It strongly concludes that there is high degree of relationship between NDDB resource base verses productivity enhancement. Further, the study concluded with the robust combination among the alternative estimations that density of farmers association; growth of NDDB resource base, rural poverty ratio, rural women literacy and crossbreed contributes significantly to the milk productivity enhancement of a milch animal in India.

To attain the goal of 10<sup>th</sup> five-year plan, the study suggests that the government (i) should spend or invest both state and center through NDDB than any other means, in other words enhance NDDB resource base (ii) transfer the infrastructure to NDDB for better control and functioning (iii) make women literacy in rural India (iv) make effects to induct high productive cross breed cows or upgrade cows in the place of indigenious cows (v) alleviate poverty through either employment or income generating programs. At the same time, the study also suggests NDDB (i) should increase density of FA in both

---

operation and non-operation flood areas. (ii) increase proportion of women membership in all the FA. (c) guide the farmers in upgrading or cross breeding the existing low productive milch animals.

#### REFERENCE

Economic survey 2010, Government of India

NDDB, Annual Reports

[www.indiaagroneet.com](http://www.indiaagroneet.com), 2004

*Excellence is the gradual result of always striving to do better.*

— Pat Riley



# Growth, Instability, and Shift in Agricultural Production of Andhra Pradesh

B. Narayana

---

*This paper seeks to examine the growth and instability in agriculture covering pre- and post-economic reform periods and also the impact of economic reforms on the productivity of agricultural crops in Andhra Pradesh state by using an interaction variable during 1974–75 to 2007–08. The results of the study show that economic reforms had negatively affected the growth rates of the area (except for maize crop) and the yield [except for jowar, maize, and sugarcane (gur)] and thereby the production either by making the growth rates into negative or by reducing the positive growth rates in post-economic reform period. The fluctuation in area was the main source of production variability in all the crops except for groundnut crop during post-economic reform period. As far as shift is concerned, there was an upward shift (increase) in the growth of productivity of jowar and gur crops only during the post-economic reform period.*

*B. Narayana is a Professor of Economics, Department of Economics, Nizam College, Hyderabad, Andhra Pradesh, India*

## Introduction

It is well-known that agriculture still plays an important role in the over all economic development of the Indian economy by providing employment, food security of the nation. Concerted efforts have been made by researchers and policy makers to step up the level of agricultural production since 1960s. In the process, economic reforms in the form of increased market incentives have been introduced in Indian agriculture in early 1990s. With the advent of liberalization, though output has been experiencing fluctuations, the output of agriculture has been lagging far behind actual requirements. The widening demand and supply gap has forced our country to resort to huge imports. The fluctuations in agriculture disturb the rhythm and the mutual balance among the interdependent processes in the economy and enhance the degree of uncertainty about future that is faced by policy makers, producers, and the consumers in the economy (Rao, 1986) and also adversely affect the production, employment and income distribution and thereby the economic growth of the country. The stability of agricultural output, in the sense of elimination of year to year fluctuations in output is an important aspect for sustainable growth in output over time. In order to achieve stability, sustained growth of agricultural production is highly essential. However, maintaining stability is not enough in order to fulfill the increased need of food and non-food grains in a growing populated country like India. In addition to stability, achieving efficiency in agriculture is essential along with the agricultural growth. Therefore, for promoting economic development, there is an urgent need to examine the growth trends and instability in area, production and productivity of agricultural crops and also scan the impact of economic reforms on the productivity of agricultural crops since 1991–92.

## Need for the Study

Most of the studies carried out on the growth, instability, and response of agricultural crops to the changes in lagged



prices mainly during pre- and post-green revolution periods only and the empirical information on the impact of economic reforms on the productivity of agricultural crops has not been generated both at national and state level (see references). As far as Andhra Pradesh state is concerned, there is a dearth of studies on the growth, instability in agriculture in Andhra Pradesh during the pre- and post-economic reform era and the shift/break in the growth of productivity of agricultural crops during the post-economic reform period. This study aims to fill this gap. Therefore, there is a need to generate empirical information of the growth performance, instability in agriculture and the impact of economic reforms on the growth of productivity of agricultural crops over the period of time would be very useful not only for a clear understanding of the performance of agriculture but also identifying factors responsible for such a performance and clearly understanding the magnitude of fluctuations in crop production, the shift/break/structural change in the growth of productivity of agricultural crops in Andhra Pradesh, for scientific planning and effective implementation of agricultural development programs and in evolving a suitable policy to step up the level of agricultural production. Keeping this in view, the present study has been carried out in this direction across the agricultural crops in the state of Andhra Pradesh using latest time series data for the period 1974–75 to 2007–08. The present study has been confined to nine selected agricultural crops namely, rice, jowar, maize, greengram, blackgram, groundnut, cotton, chillies and sugarcane (gur) as a large proportion of area under these crops (about more than 67%) has been brought under cultivation.

### Objectives

This study has three specific objectives:

1. To study the trends in the growth of area, production and yield of selected agricultural crops in Andhra Pradesh,
2. To measure the extent of instability in the area, production and yield of selected agricultural crops in Andhra Pradesh, and
3. To ascertain whether there is any shift/break/structural change in the growth of productivity of selected agricultural crops in Andhra Pradesh.

### Database

In order to analyse the growth and instability in agriculture and presence of shift/break in the growth of productivity of

selected agricultural crops in Andhra Pradesh, the required annual data of area, output and productivity of selected crops have been collected for the period 1974–75 to 2007–08 from the year wise “Statistical Abstract of Andhra Pradesh”, “Season & Crop Reports,” and “Five Decades of Andhra Pradesh-2006” published by Directorate of Economics and Statistics, Government of Andhra Pradesh, Hyderabad.

### Methodology

This study covers the period from 1974–75 to 2007–08, i.e., 34 years. For examining and comparing the impact of economic reforms on growth, instability, and shift, the study period has been divided into two sub periods, viz., 1974–75 to 1990–91, i.e., pre-economic reform period and 1991–92 to 2007–08, i.e., post-economic reform period. The present study has been carried out for three periods, i.e., two above mentioned sub-periods and for the total period, i.e., 1974–75 to 2007–08.

Keeping the above objectives in view, the following methodology has been adopted for effective analysis.

1. In this study, the growth performance of selected agricultural crops has been analyzed by estimating the trends and growth rates in the area, production, and productivity. The trends and growth rates in the area, production and productivity of agricultural crops have been analysed by using exponential form of equation. Exponential equation assumes that the growth rate would be constant over a period of time. Even then it is preferable since it accepts the change in area, production, and yield in a year would depend upon the area, production and yield in the preceding year.

Exponential form of equation:  $Y = ab^t$

where Y = Area, production and yield of crop concerned

a = intercept

b = regression coefficient (rate of change)

t = time period (years)

The compound growth rate (CGR) has been calculated as follows:

$$\text{CGR} = (\text{Anti-log of } b - 1) \times 100$$

2. To measure the extent of instability of area, production, and yield of selected agricultural crops in time series data (excess of departure from some normal level), the coefficient of instability (CI) as suggested by the Parthasarathy (1984) has been



used and estimated, because it is an appropriate measure in time series data so as to perceive the extent of variations around the trend values which vary from year to year. The measurement of extent of instability over a period of time is known as dynamic concept of instability. Therefore, the squares of residuals of actual values from the trend values have been considered for measuring the degree of instability.

$$CI = \frac{1}{\log \bar{Y}} \sqrt{\sum_{i=1}^n \frac{(\log Y - \log \hat{Y})^2}{n-k}} \times 100$$

Where,  $\hat{Y}$  = trend values of Y  
 $\bar{Y}$  = average  
 Y = actual values of area, production and Yield  
 n = sample size (years)  
 k = number of estimated parameters

- With a view to scan the impact of economic reforms on the productivity of agricultural crops or to search the shift/break/structural change in the growth of productivity of agricultural crops in Andhra Pradesh during post-economic reform period, the present study has been carried out by using interaction variable (product of dummy variable and time variable). The results of this study are aimed to shed light on the impact of economic reforms on the productivity of agricultural crops of Andhra Pradesh. The significant shift in the productivity of agricultural crops in Andhra Pradesh has been estimated by adopting the following procedure outlined by Upender (1999). A shift/break/structural change in the growth of productivity of agricultural crops has been examined by fitting the following form of equation to the time series points spread over 34 years.

$$\log Y = a + b_1 t + b_2 D + b_3 Dt$$

where,

Y = Yield of crop concerned  
 t = Time in years

D = Dummy variable, it takes "0" (zero) value during pre-economic reform period (1974–75 to 1990–91) and 1 (one) value during post-economic reform period (1991–92 to 2007–08).

$D_t$  = An interaction variable. It takes "0" (zero) value during pre-economic reform period and equal to "t" during post-economic reform period.

Here,  $b_1$  is the instantaneous growth rate per annum. If the regression coefficient of dummy variable ( $b_2$ ) is statistically significant and positive, the average yield of the crop will go up during post-economic reform period ( $D=1$ ). If it is significantly negative, the average yield of the crop will go down. If  $b_3$ , which is the regression coefficient of interaction variable, is statistically significant, then there will be a shift (an upward/ downward shift) in the yield of agricultural crops during post-economic reform period. If  $b_3$  is not statistically significant, then there will be no shift in the yield of the crops during post-economic reform period showing homogeneity or steady between the two periods under consideration. Since, the derivative of "Y" with respect to the interaction variable ( $Dt$ ) does not exist. Instead, the coefficient of the "Dt", subject to the statistical significance, measures the discontinuous effect of the presence of the factor ( $D=1$ ) represented by interaction variable on the "Y".

If  $b_3^* < 0$ , then there will be downward shift in the productivity of agricultural crops during post-economic reform period i.e.,  $b_1^* \pm b_3^* < b_1^*$

If  $b_3^* > 0$ , then there will be an upward shift in the productivity of agricultural crops during post-economic reform period i.e.,  $b_1^* \pm b_3^* > b_1^*$

where, \* shows the level of significance

## Results and Discussion

### Growth Rates of Area

Generally, the growth rates of production are decomposed into contributions of area and yield. Instead of going into the statistical problems of the contributions of these two factors to the total production, an attempt has been made here to study the growth rates of two factors independently for all crops.



**Table 1: Compound Growth Rates of Area, Production and Yield of Agricultural Crops of Andhra Pradesh**

Sl. No.	Crops	Pre-Economic Reform Period			Post-Economic Reform Period			Whole Period		
		Area	Production	Yield	Area	Production	Yield	Area	Production	Yield
1.	Rice	0.23	3.28	3.04	-- 0.23	1.39	1.62	-- 0.004	2.09	2.09
2.	Jowar	- 4.23	- 3.04	1.16	-- 6.90	-- 2.56	3.99	-- 5.92	-- 3.51	2.33
3.	Maize	- 0.013	1.86	1.86	6.66	10.41	3.51	2.56	6.41	3.51
4.	Greengram	- 0.02	1.39	1.39	-- 0.92	-- 1.39	- 0.46	-- 0.46	0.46	0.92
5.	Blackgram	6.90	13.24	5.92	-- 0.46	-- 0.46	0.03	3.75	4.71	0.92
6.	Groundnut	14.23	5.20	0.92	-- 3.04	-- 3.99	-- 0.92	1.16	0.92	-- 0.10
7.	Cotton	14.71	7.89	3.04	1.86	4.23	1.86	3.99	6.66	2.33
8.	Chillies	2.56	8.89	6.17	0.04	5.92	5.92	1.39	5.92	4.47
9.	Sugarcane (gur)	0.69	- 0.46	- 0.92	0.69	2.33	0.46	3.04	1.86	0.02

Jowar Maize Greengram Blackgram Groundnut Cotton Chillies Sugarcane(Gur)

Table 1 shows that compound growth rates of area were positive for all crops except rice, jowar and greengram crops during the whole period. Of all the crops under study, cotton was the only crop which showed around 4% growth. Bengalgram and sugarcane (gur) crops recorded more than 3% growth, whereas groundnut and chilly crops recorded more than 1% growth. The growth rate was more than 2% for maize.

There were impressive growth rates for blackgram, groundnut, cotton and chilly crops in pre-economic reform period. But, these growth rates became negative for blackgram and groundnut crops and declined for cotton and chillies. They declined around 13% for cotton, 2.5% for chillies in post- economic reform period. The negative growth rate of area of maize became positive in post-economic reform period. In the case of sugarcane (gur) crop, there was no change in growth between pre and post-economic reform period.

### Growth Rates of Production

Some of the crops such as rice, maize, cotton and chillies showed positive growth throughout the reference period. It was due to the per hectare net value which was higher compared to that of other crops. Compound growth rates of production were relatively high for maize, blackgram, cotton and chillies during the period 1974-75 to 2007-08. Of all the crops under consideration, cotton was the only crop which showed 6.7% growth. Sugarcane (gur) registered more than one percent

growth, whereas greengram and groundnut crops registered less than one percent growth. But growth rate was negative for jowar crop.

The growth rates of rice, blackgram, groundnut, cotton and chillies were positive and impressive. Maize and greengram crops registered more than 1% growth and the growth rates of jowar and sugarcane (gur) were negative during pre-economic reform period. The numerical values of positive compound rates of change for greengram, blackgram and groundnut crops became negative during post-economic reform period, which happened due to declining of both area and yield rates. These low value crops were substituted by the high valued crops in the areas of assured irrigation and these were cultivated mostly in the low rainfall and uphill areas. The positive values of rice, cotton and chilly crops declined in the same period. The decline in the growth rate of these crops was mainly dependent on the decline in the growth rate of both area and yield during post-economic reform period. It may be attributed that rice, cotton and chilly crops are considered as the major crops in the state and these were cultivated in most parts of the irrigated areas. However, the declining growth rates of rice, cotton and chillies over the sub-periods can be due to spread of irrigation induced water logging and salinity and disproportionate use of fertilizers.

The production of maize was the only crop which recorded high growth, i.e., 10.41% during post-economic



reform period. The increase in the growth rate of maize was mainly dependent on the increasing growth rate of area and yield during the same period. The production of sugarcane (gur) registered positive growth, i.e., 2.33% during post-economic reform period from a negative growth of production during pre-economic reform period. The main driving force for the positive growth of production of sugarcane (gur) during the post-economic reform period was the yield.

### Growth Rates of Yield

The production of all crops except groundnut recorded positive growth during the entire period. The growth rates were no more than 4% for chillies, 3% for maize, 2% for rice, jowar and cotton and 0.9% for greengram and blackgram crops.

The growth rates of productivity of all crops except sugar cane (gur) were positive in pre-economic reform period. These growth rates increased by 2.83% for jowar, 1.65% for maize and declined by 5.89% for blackgram, 1.18% for cotton, 1.42% for rice and 0.25% for chillies in post-economic reform period. The positive value of growth rate of greengram and groundnut crops became negative in post-economic reform period, whereas negative value of growth rate of sugarcane (gur) became positive in the same period.

The growth rates of yield of all selected crops except jowar, maize, greengram and sugarcane (gur) were lower than the growth rates of production. It was mainly due to extension of area and growth of yield also contributed for the impressive growth rates of production in pre-economic reform period. The growth rates of yield declined for rice, blackgram, cotton and chillies except for jowar and maize crops, became negative for greengram and groundnut and became positive for sugarcane (gur) in post-economic reform period. The worthy point to be mentioned here is that the economic reforms in the period 1991–92 to 2007–08 marginally helped the some selected crops reducing the negative or positive rate of change in the growth rate of production, area, and yield.

### Instability of Area

Instability of area, production and yield of agricultural crops in Andhra Pradesh State were presented in Table 2. The extent of instability of maize, blackgram, chillies and sugarcane (gur) crops was very high during the whole period due to increase in cultivated area during the same period. During the same period with better irrigation facilities, the competition for area was much higher. Therefore, the instability of area increased during the reference period.

**Table 2:** Instability of Area, Production and Yield of Agricultural Crops of Andhra Pradesh

Sl. No.	Crops	Pre-Economic Reform Period			Post-Economic Reform Period			Whole Period		
		Area	Production	Yield	Area	Production	Yield	Area	Production	Yield
1.	Rice	2.26	3.13	1.04	3.47	3.21	0.67	2.87	3.26	0.98
2.	Jowar	3.30	8.37	2.21	4.54	8.82	2.20	4.57	8.57	2.41
3.	Maize	4.46	14.75	2.90	6.40	5.58	1.61	139.38	13.08	2.37
4.	Greengram	4.94	6.35	4.34	7.66	37.87	3.12	6.36	48.79	3.76
5.	Blackgram	16.34	63.52	2.84	8.68	21.39	2.46	18.08	55.89	3.86
6.	Groundnut	4.35	9.43	2.38	3.52	13.46	4.28	7.42	14.21	3.42
7.	Cotton	9.51	19.59	5.79	6.67	7.12	3.78	8.79	12.47	4.71
8.	Chillies	18.82	38.62	3.13	16.88	11.72	1.78	19.75	21.36	2.68
9.	Sugarcane (gur)	24.53	7.14	1.04	14.89	4.94	1.12	23.11	6.68	1.12



In pre-economic reform period, the instability of area of blackgram, chillies and sugarcane (gur) crops was high as compared to post-economic reform period. The degree of variations of area of rice, jowar, maize and greengram crops was slightly increased in post-economic reform period. This instability may have been caused by fluctuations of farm harvest prices and competition for area from other profitable crops.

### Instability of Production

The variation of crop output is more in rainfed area than the irrigated area. The instability of production of maize, greengram and blackgram was higher in the entire period, because instability of area of these crops was quite high and these crops grown in mostly rainfed condition. The instability of chillies was also higher, because this crop is grown in irrigated condition, whereas, instability of maize, groundnut and cotton crops was moderate, because these crops consumes less water and are grown in irrigated conditions. Most of the rice cultivated areas are under irrigation, the degree of variation of this crop estimated around 3% which was lower than all other crops in the state in the same period, because the amount of water consumption of this crop is higher compared to that of other crops. The variation of production of sugarcane crop was also lower in the total period, because it consumes more

water and grown up in irrigated areas and irrigation has been substantially able to control the instability.

### Instability of Yield

The instability of yield of rice and sugarcane was very lower as compared to all other crops during the entire period under consideration.

The coefficient of variation of yield of all crops was in the range of 0.67 to 4.28% during the post-economic reform period. However, the instability of rice, maize, greengram, blackgram, cotton and chillies slightly declined during the same period. During the same period, the instability of yield of jowar and sugarcane was almost same as in the pre-economic reform period and yield instability in rice, maize, greengram, groundnut, chillies, and sugarcane was much lower than the production instability. It indicated that area variability was highly contributed to production variability in these crops except for groundnut crop.

### Shift in the Growth of Productivity of Agricultural Crops

The results of shift in the growth of productivity of agricultural crops in Andhra Pradesh were reported in Table 3. It was clear from the table that there was an upward shift (increase) in the productivity of jowar and

Table 3: Shift in the Growth of Productivity of Agricultural Crops of Andhra Pradesh during 1974--75 to 2007--08

Sl. No.	Regression Results/ Crops	Regression Coefficients of						Durbin Watson Statistic
		a	t	D	Dt	R <sup>2</sup>	R <sup>2</sup>	
1	Rice	3.183	0.013* (-8.894)	0.086** (-2.089)	- 0.006* (- 3.044)	0.91	0.90	1.896
2	Jowar	2.738	0.005 (-1.477)	- 0.239** (- 2.697)	0.012* (-2.810)	0.75	0.72	1.996
3	Maize	3.138	0.008* (-2.152)	- 0.032 (- 0.298)	0.007 (-1.232)	0.81	0.80	1.876
4	Greengram	2.453	0.006 (-1.352)	0.194 (-1.444)	- 0.009 (- 1.296)	0.2	0.12	1.982
5	Blackgram	2.522	0.025* (6.818)	0.235** (-2.295)	- 0.025* (- 4.796)	0.61	0.57	1.631
6	Groundnut	2.894	0.004 (-0.787)	0.131 (-0.921)	- 0.008 (- 1.125)	0.04	- 0.05	2.483
7	Cotton	2.181	0.013** (-2.341)	0.072 (-0.448)	- 0.005 (- 0.649)	0.45	0.40	1.254
8	Chillies	2.822	0.026* (-6.562)	- 0.136 (- 1.216)	- 0.0001 (- 0.095)	0.87	0.85	2.113
9	Sugarcane (Gur)	3.912	-0.004*** (- 1.737)	- 0.086 (- 1.461)	0.006** (-2.023)	0.13	0.04	1.492



sugarcane crops during post-economic reform period, showing that productivity during post-economic reform period was relatively higher as compared to pre-economic reform period. With regard to rice and blackgram crops, a downward shift in the growth of productivity was observed. Remaining all other crops in the state, did not show an upward increase/shift in the growth of productivity, indicating a steady growth both in pre- and post-economic reform period. Thus, economic reforms could not bring a breakthrough in the productivity of all agricultural crops under consideration in the Andhra Pradesh state.

### CONCLUSION

The empirical findings of the study showed that the fluctuation in area was the main source of production variability in all the crops except for groundnut crop during post-economic period. The contribution of yield to the growth of agricultural production was less than the area in blackgram, groundnut and cotton crops under the study during pre-economic reform period. During same period, the growth rates of yield of all selected crops except jowar, maize, greengram and sugarcane were lower than the growth rates of production. It was mainly due to extension of area and growth of yield that contributed for the impressive growth rates of production. The growth rates of yield declined for rice, blackgram, cotton and chillies except for jowar and maize crops, becoming negative for greengram and groundnut and positive for sugarcane crop during post-economic reform period. On the whole, one can conclude that economic reforms had negatively affected the growth rates of area (except for maize crop) and yield (except for jowar, maize and sugarcane) and thereby production either by making the growth rates into negative or by reducing the positive growth rates in post-economic reform period.

An overall view of the instability measure through co-efficient of instability for selected agricultural crops in the state showed that the instability was higher in the yield of maize, greengram, cotton and chillies during pre-economic reform period as compared to post-economic reform period, whereas the yield of groundnut registered high degree of instability during post-economic reform period. Moreover, the study revealed that mere extension of area under the crops will not solve the problem of increasing the level of production, but adequate attention has to be paid towards increasing the productivity of the agricultural crops in the state.

As far as shift is concerned, there was an upward shift (increase) in the growth of productivity of jowar and sugarcane crops only during the post-economic reform period showing that productivity of these crops was relatively higher as compared to pre-economic period. Further, it also indicates the positive impact of post-economic reform period. Therefore, there is a need to investigate and explore the reasons as to why the economic reforms could not bring a breakthrough in the growth of productivity of all agricultural crops under consideration in Andhra Pradesh state. Such exercises have to be carried out with the help of cross sectional farm data to be collected from the growers of the crops in the state. Otherwise, the downward trend in the growth of productivity would further be intensified if this situation is being continued.

### References

- Parthasarathy, G. (1984). "Growth and Fluctuations of Agricultural Production: A District-wise Analysis in Andhra Pradesh," *Economic and Political Weekly*, 19(26): A-83.
- Rao, M.V. (1986). "Agricultural Production: Peace and Pattern of Growth," *Indian Agricultural Development Since Independence*, New Delhi: Oxford & IBH.
- Uppender, M. (1999). "A Shift in the Buoyancy of the Indian Tax System: An Empirical Search," *Prajnan*, 28(1).

*Agriculture not only gives riches to a nation, but the only riches she can call her own.*

— Samuel Johnson



# Performance of Rice Production in India

Yogesh Murariya and B.R. Garg

India, well known for its diversity in cultural and food habits, is basically a rice fed economy. Demand for rice, the staple food, is growing geometrically with rapid growth in population over time. In India, rice cultivation has a long history marked in a series of technological breakthrough. Green revolution technology has been most effective not only in expanding area under this crop but also in increasing its production and productivity. Rice is one of the major foodgrain crops in India occupying 43.70 million hectares of gross cropped area (2006–07), which is largest in the world among all the rice growing countries. The total production of rice in the country was 91.05 MT in the year 2006–07, second largest in the world after China. Increasing production efficiency is one of the big tasks through which rice output can be increased. Under these circumstances, reducing the inefficiencies in the production process is the best option to enhance productivity (Reddy and Sen, 2004). Rice crop has played a leading role in improving food security in the country. Rice production in the country increased by over three times during the last four decades but in terms of yield, the performance of rice is quite dismal which is just above 2 tons per hectare. A rapid increase in rice yield is needed as there exists not much scope for bringing more area under rice cultivation.

The present study has been contemplated to examine the spatial growth in rice production over time in India.

Yogesh Murariya is a Research Scholar and B.R. Garg is a Senior Farm Economist, Department of Economics & Sociology, Punjab Agricultural University, Ludhiana

## Methodology

The rice producing states of India namely Andhra Pradesh, Assam, Bihar, Madhya Pradesh, Orissa, Punjab, Tamil Nadu, Uttar Pradesh, and West Bengal were considered as the locale of the study in order to study the performance and potential of rice production in India. These states contributed more than 85% of the total rice production in India and, thus, were considered as the major rice producing states of India. The study was based on secondary data pertaining to the rice crop in the major rice producing states of India. To examine growth performance of rice production over time, data were obtained on area, production, and productivity of rice in the major rice producing states of India from the website [www.indiastat.com](http://www.indiastat.com) for the period 1971–72 to 2005–06.

## Analysis of Data

The objective of the study envisaged working out the temporal changes in area, production, and yield in the major rice producing states of India. To achieve this objective, growth rates for area, production, and productivity could be worked out using the following semi-log function.

$$\text{Log } Y_t = a + bt$$

However, it had a limitation that it assumed a uniform rate of growth over the entire period under consideration, which may not be true in reality. To study the changes in growth, therefore, the entire study period was divided into two sub-periods such that more realistic and stable estimates of parameters of growth behaviour in the sub-periods may be obtained. The piece-wise procedure divides the range of independent variable into segments and fit an appropriate curve for each segment. The sub-periods are determined using statistical criteria of optimization (Smith, 1979). This approach was very well illustrated by Reddy et al. (1998).



The deterministic part of the piece-wise regression equation is a simple extension of the equation

$$\text{Log } Y_t = a + bt \quad (1)$$

with two straight lines having different slope meeting at  $k^{\text{th}}$  year, i.e., the transitional year is as follows:

$$\text{Log } Y_t = a + b_1 t + b_2 (t-k) d_t \quad (2)$$

where

$$d_t = 1 \text{ if } t > k;$$

$$d_t = 0 \text{ if } t \leq k$$

This gives

$$\text{Log } Y_t = a + b_1 t \text{ for } t \leq k$$

and

$$\begin{aligned} \text{Log } Y_t &= a + b_1 t + b_2 (t-k) \text{ for } t > k \\ &= (a - b_2 k) + (b_1 + b_2) t \end{aligned}$$

For the first equation with  $t \leq k$ , the slope is  $b_1$  and for the second line with  $t > k$ , the slope is  $(b_1 + b_2)$  and the intercept is  $(a - b_2 k)$ .

The equation (2) can be modified as

$$\text{Log } Y_t = a + b_1 t_1 + B_2 (t-k) d_t \quad (3)$$

where

$$t_1 = t \text{ for } t \leq k; \quad k+1 \text{ for } t > k$$

$$\text{Log } Y_t = a + b_1 t \text{ for } t \leq k$$

$$= (a + b_1 k + b_1 - B_2 k) + B_2 t \text{ for } t > k$$

where the slope of second line is  $B_2$  and the intercept is  $(a + b_1 k + b_1 - B_2 k)$ . This equation represents two straight lines with slope  $b_1$  and  $B_2$  and continuous at the  $k^{\text{th}}$  year where they meet. But in many situations, the change from one period to another period may not be that smooth so that the lines are continuous at the transitional year. Hence, one more parameter, which helps in quantifying the sudden change at the transitional year, needs to be included in the above equation. The equation after including this parameter in equation (2) is as given below:

$$\text{Log } Y_t = a + b_1 t + c_2 (t-k-1) d_t + b_3 d_t \quad (4)$$

where the sum of the parameters  $b_1$  and  $b_3$  quantifies the sudden change in variable under study from  $k^{\text{th}}$  to  $(k+1)^{\text{th}}$  year. Equation (4) is an extension of equation (3) where,

$$\text{Log } Y_t = a + b_1 t \quad \text{for } t \leq k$$

$$= a + b_1 (k+1) + b_3 \quad \text{for } t = k + 1$$

$$= [a - c_2 (k+1) + b_3] + (b_1 + c_2) t \quad \text{for } t > k$$

Thus, the final form of the semi-log function fitted as discontinuous piece-wise regression equation (DCP) to work out growth rate is

$$\text{Log } Y_t = a + b_1 t + c_2 (t-k-1) d_t + b_3 d_t$$

The parameters in the above equation can be estimated by Ordinary Least Square (OLS) method. The slope  $b_1$  and  $c_2$  represents the fractional rates of growth in the first and second period, namely Phase-I and Phase-II respectively and the compound rates of growth (percent per annum)  $r_1$  and  $r_2$  for the first and the second period (phase), respectively can be obtained as

$$r_1 = [\exp (b_1) - 1] \times 100$$

$$r_2 = [\exp (b_1 + c_2) - 1] \times 100$$

The compound growth rate for the transitional year can be obtained as

$$r_k = [\exp (b_1 + b_3) - 1] \times 100$$

The values of Residual Sum of Square (RSS) estimated by changing the values of  $k$  aid in arriving at the optimum value of  $k$  thereby dividing the entire time period into two optimum sub-periods (Phases). The optimum division is the one with the smallest RSS.

## Result and Discussion

The discontinuous piece-wise regression approach enabled to divide the time series data on area, production, and productivity into two optimum sub-periods and fit an appropriate curve of homogenous change for each segment. Table 1 shows the regression results of discontinuous piece-wise regression equations. Compound growth rates were worked out to account for temporal changes in area, production, and productivity of major rice producing states of India during each sub-period for the rice crop.

### Temporal change in Area, Production, and Productivity of Rice

The discontinuous piece-wise regression equations for area, production and yield of rice for major rice producing states of India were fitted for the period 1971–72 to 2005–2006 (Table 1). The Compound Growth Rates (CGR) showing per annum percent growth in area, production and yield of rice for major rice producing states of India were worked out using



**Table 1:** Discontinuous piece-wise regression equations for area, production, and yield of rice for the major rice producing states of India, 1971–1972 to 2005–2006

Parameters	Andhra Pradesh			Assam			Bihar		
	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield
a	3.53*** (0.013)	3.7*** (0.019)	3.197*** (0.022)	3.317*** (0.005)	3.291*** (0.014)	2.979*** (0.01)	3.724*** (0.009)	3.648*** (0.029)	2.895*** (0.022)
b <sub>1</sub>	0.002*** (0.001)	0.012*** (0.001)	-0.002 <sup>NS</sup> (0.005)	0.003*** (0.000)	0.007*** (0.001)	0.004*** (0.001)	0.001* (0.001)	0.005*** (0.002)	0.008*** (0.001)
(phase-I)	(1971–72 to 2001–02)	(1971–72 to 2001–02)	(1971–72 to 1977–78)	(1971–72 to 2000–01)	(1971–72 to 1989–90)	(1971–72 to 1989–90)	(1971–72 to 1999–2000)	(1971–72 to 2003–04)	(1971–72 to 2003–04)
c <sub>2</sub>	0.044** (0.016)	0.052** (0.023)	0.01* (0.005)	-0.01** (0.004)	-0.003 <sup>NS</sup> (0.002)	0.001 <sup>NS</sup> (0.001)	-0.011* (0.006)	0.146 <sup>NS</sup> (0.116)	0.125 <sup>NS</sup> (0.088)
(phase-II)	(2002–03 to 2005–06)	(2002–03 to 2005–06)	(1978–79 to 2005–06)	(2001–02 to 2005–06)	(1990–91 to 2005–06)	(1990–91 to 2005–06)	(2000–01 to 2005–06)	(2004–05 to 2005–06)	(2004–05 to 2005–06)
b <sub>3</sub>	-0.172** (0.033)	-0.217*** (0.048)	0.096*** (0.024)	-0.012 <sup>NS</sup> (0.011)	0.069*** (0.02)	0.056*** (0.015)	-0.129*** (0.019)	-0.412*** (0.087)	-0.274*** (0.066)
(Transitional Year)	(2001–02 to 2002–03)	(2001–02 to 2002–03)	(1977–78 to 1978–79)	(2000–01 to 2001–02)	(1989–90 to 1990–91)	(1989–90 to 1990–91)	(1999–2000 to 2000–01)	(2003–04 to 2004–05)	(2003–04 to 2004–05)
R <sub>A</sub> <sup>2</sup>	0.445	0.809	0.934	0.827	0.912	0.91	0.892	0.441	0.611
RDOF	31	31	31	31	31	31	31	31	31
RSS	0.04	0.085	0.02	0.005	0.027	0.015	0.017	0.209	0.119
RMS	0.001	0.003	0.001	0.000	0.001	0.000	0.001	0.007	0.004
F-statistic	10.098***	49.129***	160.778***	55.299***	118.911***	115.179***	94.985***	9.925***	18.783***
Parameters	Madhya Pradesh			Orissa			Punjab		
	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield
a	3.652*** (0.002)	3.461*** (0.035)	2.809*** (0.034)	3.677*** (0.007)	3.541*** (0.03)	2.899*** (0.027)	2.58*** (0.016)	2.89*** (0.045)	3.274*** (0.023)
b <sub>1</sub>	0.003*** (0.000)	0.011*** (0.002)	0.008*** (0.002)	-0.005*** (0.001)	0.008*** (0.002)	0.008*** (0.001)	0.047*** (0.002)	0.055*** (0.012)	0.022*** (0.006)
(phase-I)	1971–72 to 1999–2000	1971–72 to 1999–2000	1971–72 to 1999–2000	1971–72 to 1982–83	1971–72 to 2001–02	1971–72 to 2001–02	1971–72 to 1983–84	1971–72 to 1976–77	1971–72 to 1976–77
c <sub>2</sub>	-0.008*** (0.002)	0.014 <sup>NS</sup> (0.022)	0.022 <sup>NS</sup> (0.021)	0.006*** (0.001)	0.086** (0.037)	0.081** (0.033)	-0.037*** (0.002)	-0.036*** (0.012)	-0.018*** (0.006)
(phase-II)	(2000–01 to 2005–06)	(2000–01 to 2005–06)	(2000–01 to 2005–06)	(1983–84 to 2005–06)	(2002–03 to 2005–06)	(2002–03 to 2005–06)	(1984–85 to 2005–06)	(1977–78 to 2005–06)	(1977–78 to 2005–06)
b <sub>3</sub>	-0.499*** (0.005)	-0.735*** (0.074)	-0.237*** (0.072)	0.031*** (0.008)	-0.195** (0.075)	-0.186** (0.068)	-0.015 <sup>NS</sup> (0.019)	0.240*** (0.049)	0.026*** (0.025)



Parameters	Madhya Pradesh			Orissa			Punjab		
	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield
(Transitional Year)	(1999-00 to 2000-01)	(1999-00 to 2000-01)	(1999-00 to 2000-01)	(1982-83 to 1983-84)	(2001-02 to 2002-03)	(2001-02 to 2002-03)	(1983-84 to 1984-85)	(1976-77 to 1977-78)	(1976-77 to 1977-78)
R <sub>A</sub> <sup>2</sup>	0.999	0.843	0.346	0.536	0.475	0.518	0.988	0.976	0.889
RDOF	31	31	31	31	31	31	31	31	31
RSS	0.001	0.256	0.243	0.004	0.211	0.169	0.022	0.073	0.019
RMS	0.000	0.008	0.008	0.000	0.007	0.005	0.001	0.002	0.001
F-statistic	9219.113***	61.795***	7.005***	14.076***	11.262***	13.191***	929.549***	460.566***	91.417***
Parameters	Tamil Nadu			Uttar Pradesh			West Bengal		
	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield
a	3.416*** (0.017)	3.65*** (0.024)	3.234*** (0.017)	3.639*** (0.01)	3.501*** (0.036)	2.853*** (0.032)	3.712*** (0.008)	3.811*** (0.024)	3.091*** (0.02)
b <sub>1</sub>	-0.004*** (0.001)	0.006*** (0.001)	0.01*** (0.001)	0.007*** (0.001)	0.022*** (0.003)	0.017*** (0.003)	0.0000958 <sup>NS</sup> (0.001)	-0.002 <sup>NS</sup> (0.003)	0.001 <sup>NS</sup> (0.003)
(phase-I)	(1971-72 to 2001-02)	(1971-72 to 2001-02)	(1971-72 to 2001-02)	(1971-72 to 1986-87)	(1971-72 to 1987-88)	(1971-72 to 1987-88)	(1971-72 to 1986-87)	(1971-72 to 1982-83)	1971-72 to 1982-83
c <sub>2</sub>	0.056** (0.02)	0.063** (0.03)	0.007 <sup>NS</sup> (0.021)	-0.005*** (0.001)	-0.017*** (0.005)	-0.013*** (0.004)	0.001 <sup>NS</sup> (0.001)	0.015*** (0.004)	0.011*** (0.003)
(phase-II)	(2002-03 to 2005-06)	(2002-03 to 2005-06)	(2002-03 to 2005-06)	(1987-88 to 2005-06)	(1988-89 to 2005-06)	(1988-89 to 2005-06)	(1987-88 to 2005-06)	(1983-84 to 2005-06)	1983-84 to 2005-06
b <sub>3</sub>	-0.147*** (0.042)	-0.337*** (0.061)	-0.189*** (0.043)	-0.033** (0.013)	0.084* (0.048)	0.093** (0.043)	0.04*** (0.011)	0.143*** (0.029)	0.112*** (0.024)
(Transitional Year)	(2001-02 to 2002-03)	(2001-02 to 2002-03)	(2001-02 to 2002-03)	(1986-87 to 1987-88)	(1987-88 to 1988-89)	(1987-88 to 1988-89)	(1986-87 to 1987-88)	(1982-83 to 1983-84)	1982-83 to 1983-84
R <sub>A</sub> <sup>2</sup>	0.59	0.533	0.768	0.761	0.871	0.852	0.722	0.932	0.934
RDOF	31	31	31	31	31	31	31	31	31
RSS	0.064	0.137	0.069	0.011	0.155	0.125	0.008	0.048	0.032
RMS	0.002	0.004	0.002	0.000	0.005	0.004	0.000	0.002	0.001
F-statistic	17.3***	13.961***	38.454***	37.144***	77.826***	66.404	30.474***	156.959***	161.992***

Notes: Figures in parenthesis denote the standard error of the estimates.

NS, \*\*\*, \*\*, \*, denotes non-significance and significance at 1, 5 and 10% level, respectively.

R<sup>2</sup>, RDOF, RSS, RMS, denote adjusted R<sup>2</sup>, residual degree of freedom, residual sum of square and residual mean square, respectively.



**Table 2:** Compound Growth Rates of area, production and yield of rice in the major rice producing states of India, 1971-72 to 2005-06 (per cent per annum)

Parameters	Andhra Pradesh			Assam			Bihar		
	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield
I	0.20***	1.21***	-0.19 <sup>NS</sup>	0.30***	0.70***	0.40***	0.10*	0.50***	0.80***
	(1971-72 to 2001-02)	(1971-72 to 2001-02)	(1971-72 to 1977-78)	(1971-72 to 2000-01)	(1971-72 to 1989-90)	(1971-72 to 1989-90)	(1971-72 to 1999-2000)	(1971-72 to 2003-04)	(1971-72 to 2003-04)
Transitional year	-15.63**	-18.53***	9.85***	-0.89 <sup>NS</sup>	7.89***	6.18***	-12.01***	-33.43***	-23.35***
	(2001-02 to 2002-03)	(2001-02 to 2002-03)	(1977-78 to 1978-79)	(2000-01 to 2001-02)	(1989-90 to 1990-91)	(1989-90 to 1990-91)	(1999-2000 to 2000-01)	(2003-04 to 2004-05)	(2003-04 to 2004-05)
II	4.71**	6.61**	0.803*	-0.69**	0.40 <sup>NS</sup>	0.501 <sup>NS</sup>	-0.99*	16.29 <sup>NS</sup>	14.22 <sup>NS</sup>
	(2002-03 to 2005-06)	(2002-03 to 2005-06)	(1978-79 to 2005-06)	(2001-02 to 2005-06)	(1990-91 to 2005-06)	(1990-91 to 2005-06)	(2000-01 to 2005-06)	(2004-05 to 2005-06)	(2004-05 to 2005-06)
Phase	Madhya Pradesh			Orissa			Punjab		
	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield
I	0.30***	1.11***	0.80***	-0.49***	0.08***	0.80***	4.81***	5.65***	2.224***
	(1971-72 to 1999-2000)	(1971-72 to 1999-2000)	(1971-72 to 1999-2000)	(1971-72 to 1982-83)	(1971-72 to 2001-02)	(1971-72 to 2001-02)	(1971-72 to 1983-84)	(1971-72 to 1976-77)	(1971-72 to 1976-77)
Transitional year	-39.10***	-51.51***	-20.46***	0.263***	-17.05**	-16.31**	3.25 <sup>NS</sup>	34.31***	4.917***
	(1999-2000 to 2000-01)	(1999-2000 to 2000-01)	(1999-2000 to 2000-01)	(1982-83 to 1983-84)	(2001-02 to 2002-03)	(2001-02 to 2002-03)	(1983-84 to 1984-85)	(1976-77 to 1977-78)	(1976-77 to 1977-78)
II	-0.49***	2.53 <sup>NS</sup>	3.04 <sup>NS</sup>	-0.09***	9.85**	1.09**	1.0051***	1.91***	0.41***
	(2000-01 to 2005-06)	(2000-01 to 2005-06)	(2000-01 to 2005-06)	(1983-84 to 2005-06)	(2002-03 to 2005-06)	(2002-03 to 2005-06)	(1984-85 to 2005-06)	(1977-78 to 2005-06)	(1977-78 to 2005-06)
Phase	Tamil Nadu			Uttar Pradesh			West Bengal		
	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield
I	-0.39***	0.61***	1.005***	0.702***	2.22***	1.71***	0.0095 <sup>NS</sup>	-0.19 <sup>NS</sup>	0.10 <sup>NS</sup>
	(1971-72 to 2001-02)	(1971-72 to 2001-02)	(1971-72 to 2001-02)	(1971-72 to 1986-87)	(1971-72 to 1987-88)	(1971-72 to 1987-88)	(1971-72 to 1986-87)	(1971-72 to 1982-83)	(1971-72 to 1982-83)
Transitional year	-14.015***	-28.18***	-16.38***	-2.56**	11.18*	11.63**	4.09***	15.14***	11.96***
	(2001-02 to 2002-03)	(2001-02 to 2002-03)	(2001-02 to 2002-03)	(1986-87 to 1987-88)	(1987-88 to 1988-89)	(1987-88 to 1988-89)	(1986-87 to 1987-88)	(1982-83 to 1983-84)	(1982-83 to 1983-84)
II	5.337**	7.14**	1.714 <sup>NS</sup>	0.20***	0.501***	0.40***	0.11 <sup>NS</sup>	1.31***	1.21***
	(2002-03 to 2005-06)	(2002-03 to 2005-06)	(2002-03 to 2005-06)	(1987-88 to 2005-06)	(1988-89 to 2005-06)	(1988-89 to 2005-06)	(1987-88 to 2005-06)	(1983-84 to 2005-06)	(1983-84 to 2005-06)

Note: Figures in parentheses denote the time period indicating a particular phase of homogenous growth.

NS, \*\*\*, \*\* and \* denotes the non-significance and significance at 1, 5 and 10% level, respectively.

these regression equations. The same have been presented in Table 2.

#### Andhra Pradesh

It may be observed from Table 2 that area under rice increased significantly at a compound growth rate of 0.20%

in phase-I, i.e., from 1971-72 to 2001-02 and declined abruptly in the transitional year, i.e., from 2001-02 to 2002-03 at a CGR of 15.63% and in phase-II, i.e., 2002-03 to 2005-06, again, it shifted significantly upwards at the growth rate of 4.71%. Like wise, the CGR of production in first phase was estimated at 1.21% which



was significant at 1%. There was a significant quantum decline in rice production by 18.53% in the transitional year, i.e., 2001–02 to 2002–03. In phase-II, the CGR of production was 6.61% and significant at 5%. As far as productivity of rice in Andhra Pradesh was concerned, it was non-significant in phase-I, i.e., during 1971–72 to 1977–78. However, it suddenly showed a significant quantum jump by 9.85% in the year 1978–79. After that, it had a CGR of 0.803% which was significant at 10%.

Thus it can be concluded from the results that production of rice in Andhra Pradesh increased significantly in both the phases. In phase-I, i.e., from 1971–72 to 2001–02, it was growth in area that contributed much to the growth in production, and in phase-II, it was growth in both area as well as rice productivity that contributed to growth in production. However, there was a significant quantum decline in production during the transitional year, i.e. 2001–02 to 2002–03 due to significant abrupt decline in area during the same year.

#### *Assam*

Area under rice in Assam state increased significantly at a CGR of 0.30% in phase-I, i.e., from 1971–72 to 2000–01 and in the transitional year, i.e., 2000–01 to 2001–02, CGR was non-significant. In phase-II, i.e., from 2001–02 to 2005–06 it declined significantly at a CGR of 0.69%. In case of production, its CGR in first phase, i.e., 1971–72 to 1989–90 was estimated at 0.70% which was significant at 1%. There was significant quantum jump in rice production by 7.89% in the transitional year, i.e., 1989–90 to 1990–91. In phase-II, the CGR was 0.40% and found to be non-significant. In case of productivity of rice in Assam, the compound growth rate was found to be 0.40% which was significant at 1% in phase-I, i.e., from 1971–72 to 1989–90. It suddenly showed a significant quantum jump by 6.18% in the year 1990–91. After that, it had a CGR of 0.501% which was non-significant.

It can be concluded from the above mentioned results that production of rice in Assam increased significantly in phase-I only. It can be attributed to growth in both area under rice and its productivity in phase-I. Rice production increased abruptly in the year 1990–91 due to significant increase in productivity of rice in the same year. However, in phase-II, there was no significant growth in production, perhaps because there was observed no significant growth in area as well as productivity of rice during the same period.

#### *Bihar*

Area under rice increased significantly in Bihar state at CGR of 0.10% in phase-I, i.e., from 1971–72 to 1999–2000. It declined abruptly in the transitional year, i.e., from 1999–2000 to 2000–2001 at a CGR of 12.01% and in phase-II, i.e., from 2000–01 to 2005–06, again, there was observed a significant decline in rice area at CGR of 0.99%. The CGR of production in first phase was estimated at 0.50% which was significant at 1%. There was a significant quantum decline in rice production by 33.43% in the transitional year, i.e., from 2003–04 to 2004–05. In phase-II, the CGR was found to be non-significant. The productivity of rice in Bihar increased significantly at a CGR of 0.80% at 1% in phase-I, i.e., from 1971–72 to 2003–04. It suddenly showed a significant quantum decline by 23.35% in the year 2004–05. After that the rise in productivity was found to be non-significant.

The results thus showed that production of rice in Bihar increased significantly in phase-I only. It declined abruptly in the year 2004–05 due to significant decline in productivity of rice in the same year. There was observed no increase in production in phase-II. This may be attributed to significant decline in rice area after 1999–2000 and non-significant increase in productivity thereafter.

#### *Madhya Pradesh*

The table further revealed that in Madhya Pradesh, area under rice increased significantly at a compound growth rate of 0.30% in phase-I, i.e., from 1971–72 to 1999–2000 and declined abruptly from 1999–2000 to 2000–01 at 39.10%. In phase-II, i.e., from 2000–01 to 2005–06, again, there was a decline in rice area at CGR of 0.49%. The compound growth in rice production in first phase was estimated at 1.11% which was significant at 1%. There was a significant quantum decline in rice production by 51.51% during 1999–2000 to 2000–01. In phase-II, i.e., after 2000–01, production increased at a CGR of 2.53% which was non-significant. The productivity of rice in Madhya Pradesh increased at CGR of 0.80% significantly at 1% in phase-I, i.e., from 1971–72 to 1999–2000. It suddenly showed a significant quantum decline by 20.46% in the year 2000–01. After that, it had a CGR of 3.04% which was non-significant.

Thus, significant increase in production of rice in Madhya Pradesh in the first phase can be attributed to both significant rise in area as well as productivity of rice



in phase-I. There was a significant decline in production in the year 2000–01 due to significant decline in rice area as well as productivity in the same year. After 2000–01, there was non-significant rise in production due to non-significant rise in productivity and significant decline in rice area.

#### *Orissa*

Area under rice in Orissa declined significantly at a CGR of 0.49% in phase-I, i.e., from 1971–72 to 1982–83. There was observed an abrupt increase in the area from 1982–83 to 1983–84 at 0.263% but it again started declining after 1983–84 significantly though at a lower CGR of 0.09%. The production and productivity of rice both had positive significant growth in the two periods. The CGR of production in phase-I was estimated at 0.08% during 1971–72 to 2001–02. It was higher in phase-II, i.e., after 2002–03 estimated at 9.85%. There was a significant quantum decline in rice production by 17.05% in the transitional year, i.e., from 2001–02 to 2002–03. The productivity of rice in Orissa was found to have a CGR of 0.80% in phase-I (1971–72 to 2001–02) and 1.09% after 2002–03 though there was a significant quantum decline in rice productivity by 16.31% in the year 2002–03.

Thus, it can be concluded that production and productivity of rice in Orissa increased significantly in both the phases besides the fact that area under rice remained declining though at a lower pace throughout the period of study except in the transitional year, i.e., 1982–83 to 1983–84. However, there was an abrupt decline in rice production in the year 2002–03 due to significant decline in rice productivity in the same year.

#### *Punjab*

It may be further observed from the table that area under rice in Punjab increased significantly at a CGR of 4.81% in phase-I, i.e., from 1971–72 to 1983–84 and at a significant CGR of 1.00% in phase-II, i.e., from 1984–85 to 2005–06. There was a non-significant increase in area under rice during the transitional year, i.e., 1983–84 to 1984–85 at a CGR of 3.25%. The production of rice in the state in phase-I, i.e., from 1971–72 to 1976–77 increased significantly at a quite high CGR of 5.65%. It had a significant quantum jump by 34.31% in the transitional year, i.e., from 1976–77 to 1977–78. In phase-II, i.e., from 1977–78 to 2005–06, the CGR was relatively lower at 1.91%, but significant at 1%. Similarly, productivity of rice in Punjab was observed to rise significantly at a CGR of

2.224% in phase-I. It suddenly showed a significant quantum jump by 4.917% in the year 1977–78. After that, it had a CGR of only 0.41% which was significant at 1%.

Thus, it can be concluded that production of rice in Punjab increased significantly in both the phases. However, there was an abrupt increase in the year 1977–78 which may be attributed to significant increase in rice productivity and high growth rate of rice area in the same year. The CGR of rice productivity and that for rice area was observed to be lower in phase-II than that experienced in phase-I.

#### *Tamil Nadu*

Area under rice declined significantly at a CGR of 0.39% in phase-I, i.e., from 1971–72 to 2001–02 and declined abruptly in the transitional year, i.e., from 2001–02 to 2002–03 at a CGR of 14.015% and during phase-II, i.e., 2002–03 to 2005–06, it shifted upwards significantly at CGR of 5.337%. Likewise, the CGR of production in phase-I was estimated at 0.61% which was significant at 1%. There was significant quantum decline in rice production by 28.18% in the transitional year, i.e., from 2001–02 to 2002–03. In phase-II, the CGR was 7.14% and significant at 5%. As far as productivity of rice in Tamil Nadu was concerned, the CGR was estimated at 1.005% which was significant at 1% in phase-I, i.e., from 1971–72 to 2001–02. It suddenly showed a significant quantum decline by 16.38% in the year 2002–03. After that, there was a non-significant growth in rice productivity.

Thus it can be concluded that production of rice in Tamil Nadu increased significantly in both phases. It declined abruptly in the year 2002–03 due to significant decline in area under rice as well as productivity of rice in the same year. However, it was significant growth in productivity in phase-I and significant growth in area in phase-II that contributed to the growth in rice production.

#### *Uttar Pradesh*

In the state of Uttar Pradesh, the area under rice increased significantly at a CGR of 0.702% in phase-I, i.e., from 1971–72 to 1986–87. It declined abruptly in the transitional year, i.e., from 1986–87 to 1987–88 at a CGR of 2.56% and in phase-II, i.e., from 1987–88 to 2005–06, rice area increased significantly at 0.20%. Likewise, the CGR of production in first phase was estimated at 2.22% which was significant at 1%. There was a significant quantum jump in rice production by 11.18% in the transitional year, i.e., from 1987–88 to 1988–89. In phase-II, the CGR was



0.501% and significant at 1%. As far as productivity of rice in Uttar Pradesh was concerned, it was found that the CGR was 1.71% and significant at 1% in phase-I, i.e., from the year 1971–72 to 1987–88. It suddenly showed a significant quantum jump by 11.63% in the year 1988–89. After that, it had a CGR of 0.40% which was significant at 1%.

Thus, it was observed that production of rice in Uttar Pradesh increased significantly in both the phases. It increased abruptly in the year 1988–89 due to significant increase in rice productivity in the same year. However, it was rice productivity that contributed much to the growth in rice production followed by area under rice in both the periods.

### *West Bengal*

Area under rice in West Bengal was found to be non-significant in phase-I, i.e., from 1971–72 to 1986–87. It increased abruptly in the transitional year, i.e., from 1986–87 to 1987–88 at a CGR of 4.09% and in phase-II, i.e., from 1987–88 to 2005–06, growth in rice area was non-significant. The CGR of production in phase-I was estimated at 0.19% which was found to be non-significant. There was a significant quantum jump in rice production by 15.14% in the transitional year i.e., from 1982–83 to 1983–84. In phase-II, the CGR was 1.31% and significant at 1%. The CGR of rice productivity in the state was 0.10% and non-significant in phase-I, i.e., from 1971–72 to 1982–83. It suddenly showed a significant quantum jump by 11.96% in the year 1983–84. After that, it had a CGR of 1.21% which was significant at 1%.

It can be concluded from the results that production of rice in West Bengal increased significantly in phase-II. It increased abruptly in the year 1983–84 due to the significant increase in rice productivity during the same year. So, it was rice productivity that contributed to the growth in rice production.

The results given in Table 1 and 2 thus brought out that area under rice increased significantly in both phases of the study period in the states of Andhra Pradesh, Punjab, and Uttar Pradesh. In Andhra Pradesh, however, growth in area was observed to be higher in phase-II as compared to that in phase-I while in case of Punjab and Uttar Pradesh, the percent growth in rice area was lower in phase-II as compared to that in phase-I. The states of Assam, Bihar, and Madhya Pradesh witnessed positive

and significant growth in rice area in phase-I and significant but negative growth in phase-II of the study period in the respective states. There was a significant but negative growth in area in Orissa in both the phases. West Bengal had non-significant growth in area throughout the study period except in the transitional year. But, in Tamil Nadu besides negative and significant growth in area under rice up to 2002–03, there was a significant and high positive growth in area after that.

Looking at production of rice, it was found that the states of Andhra Pradesh, Orissa, Punjab, Tamil Nadu, and Uttar Pradesh had a significant positive growth in both the phases. The percentage growth in rice production in phase-II was observed to be higher as compared to that in phase-I in case of Andhra Pradesh, Orissa, and Tamil Nadu while in case of Punjab, the percentage growth was lower in phase-II as compared to that in phase-I. The states of Assam, Bihar, and Madhya Pradesh witnessed positive and significant growth in rice production in phase-I while in case of West Bengal, significant and positive growth was found in phase-II.

In case of rice productivity, the states which showed a significant positive trend in both the phases were Orissa, Punjab, and Uttar Pradesh. The percentage growth in rice productivity in phase-II was observed to be higher as compared to that in phase-I only in case of Orissa while in case of Punjab and Uttar Pradesh, the percentage growth was lower in phase-II as compared to that in phase-I. Andhra Pradesh and West Bengal witnessed significant and positive growth of rice productivity only in phase-II while Assam, Bihar, Madhya Pradesh, and Tamil Nadu witnessed significant and positive growth only in phase-I.

Overall, it was observed that the scope of increase in area under rice crop was limited as it was declining over time almost in all the states. The production of rice crop in phase-II was not that much encouraging as that was in phase-I, of course, with a few exceptions. This was due to the fact that the productivity of rice crop was declining over time in most of the states. Hence, one long term solution to food security for India is to develop improved technology in rice production along with strengthening farm planning and management practices in different states of India.

### **References**

- Jain K.K. and B.R. Garg. (1995). "Potential & Competitiveness of India Rice in Asia," *Productivity*, 36(1): 148–159.



- 
- Reddy A.R. and C. Sen. (2004). "Technical Inefficiency in Rice Production and its Relationship with Farm-Specific Socio-Economic Characteristics," *Indian Journal of Agricultural Economics*, 59(2): 260–267.
- Reddy M.N., J.C. Katyal, Y.V.R. Reddy, and C.A.R. Rao. (1998). "Estimating agricultural growth—a piecewise regression approach," *Indian Journal of Agricultural Economics*, 53(2): 155–162.
- Sharma V.P. and P.K. Joshi. (1995). "Performance of rice production and factors affecting acreage under rice in coastal regions of India," *Indian Journal of Agricultural Economics*, 50(2): 153–139.
- Singh N.P., R. Kumar, R.P. Singh, and P.K. Jain. (2005). "Rice economy in India: Development and trade prospects," *Agricultural Situation in India*, 62(6): 427–435.
- Smith P.S. (1979). "Splines as a useful and convenient statistical tool," *The American Statistician*, 33(2): 57–62.

*An agricultural life is one eminently calculated for human happiness and human virtue.*

— Josiah Quiney



# Rainfed Agriculture in Semi-Arid Tropical India

S.S. Kalamkar

---

*Indian agriculture in general has shown a spectacular growth in terms of both production and productivity during the last five decades of planned development. The rainfed agriculture plays an important role in Indian economy and significantly contributes in country's development. Despite significant contribution in agricultural output, rainfed agriculture is seriously lagging in the development as compared to irrigated agriculture. With productivity levels of staple crops in the irrigated areas plateauing off and factor productivity declining, it is clear that unless food production in the rainfed areas increases significantly, food security may be adversely affected. If the target of over 4% annual growth in agriculture sector is to be achieved, all areas where rainfed farming is predominant will need to contribute substantially to incremental output and augment food security by producing marketable surpluses more reliably by improving productivity and promoting the agri-business activities in rainfed areas.*

*S.S. Kalamkar works at Gokhale Institute of Politics and Economics (Deemed University), Pune.*

## Introduction

Indian agriculture in general has shown a spectacular growth in terms of both production and productivity during the last five decades of planned development. The long term growth rate of agricultural production during the period 1950–51 to 2007–2008 has been of the order of around 2.6% per annum, which is higher than the rate of growth of population. The rate of growth of production of foodgrains during the same period was also significantly higher being 2.4% per annum (GOI, 2008). However, it is well recognised that there are large variations in terms of growth of agricultural production and productivity across the regions/states and amongst the crops. The impact of green revolution technology adopted in mid 1960s was initially confined to wheat and rice only and the regions with good irrigation facilities. As a consequence, much of the growth, which took place after introduction of the high yielding variety seeds (HYVs) was confined to a limited number of states like Punjab, Haryana, Uttar Pradesh and coastal Andhra Pradesh (Bhalla and Singh, 2001; Dantwala, 1986), which led to high growth in agricultural output in selected regions while the other regions suffered from stagnancy or poor growth in agricultural output (Chand and Chauhan, 1999). Therefore, it is often argued that new technology of HYVs which is based on high doses of water and fertilizer is not suitable for rainfed agriculture in general and for semi-arid tropics (SAT) in particular. Also the development of rainfed technology and its adoption has been generally slow and therefore, agriculture in these conditions is reported to be progressing very slow or even stagnating (Bhatia, 2005).

The rainfed agriculture plays an important role in Indian economy and significantly contributes in the country's development. Rainfed agriculture accounts for nearly half of the total value of agricultural output and hundreds of millions of poor rural people depend on the rainfed agriculture as the primary sources of their livelihood (Kerr, 1996). The rainfed/dry land region is the largest, covering 53% of the country's geographical area, 60% of the net cropped area (NCA) and 53% of gross cropped area (GCA). Lower share in GCA as compared to NCA



may be attributed to lower cropping intensity because of lack of irrigation. Currently, almost 60% of the net sown area in rainfed contributing about 40% of the total production and rainfed areas plays an important role in providing livelihood to a large segment of population (Jharwal, 2008). Rainfed crops account for 48% area under food crops and 68% of the area under non-food crops. After five decades of agricultural development, 72% of oilseeds, 85% of pulses and about 55% of foodgrains are still produced under rainfed agriculture (GOI, 2008). Also, nearly 50% of the total rural workforce and 60% of livestock in the country are concentrated in the dry districts (Dhan Foundation, 2006). But uncertainty in production due to fluctuations in total rainfall and widening gaps in two successive rainfalls, low productivity in rainfed lands affect the livelihoods of many poor and marginalised farmers. Going by past trends the average spread of irrigation is around four million hectares every five years. Extrapolating this trend, it is projected that about 20 million additional hectares area is likely to be brought under irrigation in the next 25 years. This will still leave nearly 65 million hectares under rainfed conditions.

As mentioned earlier, the green revolution technology, considered the cornerstone of India's agricultural growth by-passed the rainfed areas, remaining confined primarily to the irrigated tracts. In addition to that, the development strategies have shifted resources away from dry land to irrigated production and from rural to urban areas (Ramakrishna and Rao, 2008). Moreover, the normal professionalism of agricultural research and extension served the irrigated areas better, but was not as responsive to the needs and priorities of rainfed agriculture. Since the dry land farmers are poorer and politically less influential, the effect of adverse macroeconomic policies fall disproportionately on them in spite of the fact that they are often the primary producers of food crops (Ramakrishna and Rao, 2008). With productivity levels of staple crops in the irrigated areas plateauing off and factor productivity declining, it is clear that unless food production in the rainfed areas increases significantly, food security may be adversely affected. As envisaged in the National Agriculture Policy 2002, if the target of over 4% annual growth in agriculture sector during the 11<sup>th</sup> five-year plan period is to be achieved, all areas where rainfed farming is predominant whether in the central plain, hill, semi-arid or coastal lands will need to contribute substantially to incremental output and augment food security by producing marketable surpluses more reliably by improving productivity and promoting the agri-business activities in rainfed areas.

## Data and Methodology

The main objective of the present study is to analyze the trends in production and productivity of principal crops in rainfed areas, particularly in semi-arid tropical India. The study is based on secondary data mainly collected from government publications, reports, and related websites. The methodology used by Bhatia (2005) in analyzing viability of rainfed agriculture is used in this study. The data for the study has been mainly compiled from *Agriculture 2009* published by the Centre for Monitoring Indian Economy, Mumbai.

## Results and Discussion

Rainfed agriculture as such refers to crop production in a farming system which depends entirely on rainfall but may include supplementary irrigation from small dams or tanks fed from rainfall and associated run-off on a particular land holding. However, all rainfed areas are not of the same characteristics. High and assured rainfed areas are relatively advantaged regions where as less and erratic rainfall areas are highly volatile in terms of production and productivity. Amongst all the rainfed areas, semi-arid tropics (SAT) areas are supposed to be most fragile. SAT is home to one of every six people on earth. This region includes parts of 48 developing countries in Africa, Asia, and Latin America (Gulati and Kelley, 1999). Technical Advisory Committee, FAO defined SAT based on length of the growing period of crops as 75–180 days and where all months have a mean temperature as greater than 18°C and daily mean temperature during the growing period about 20°C. Troll (1964) defines it as those tropical regions where rainfall exceeds potential evapo-transpiration ratio for two to seven months a year.

Rainfed areas land of SAT are low in productivity. Often rains are received in short periods and soils are low in infiltration either due to soil characteristics or to the soil type and severe run off and water erosion hazards are common. Though the holding size in the region may be reasonable but fields are small and yields are low. The farmers in general have small capital assets and thus, both ecologically and economically are at disadvantages. In India, semi-arid tropics fall in the states of Andhra Pradesh, Gujarat, Karnataka, Madhya Pradesh (including Chattishgarh), Maharashtra, Rajasthan, and Tamil Nadu. A few districts of Bihar, Orissa, and Uttar Pradesh also fall under the SAT category. Since the irrigational facility have considerable improved over years, area/districts under rainfed agriculture in SAT regions have declined from about



175 districts in 1990s to about 140 districts at present, of which 126 are located in seven states and remaining 14 in other states, as presented in Table 1.

**Table 1:** Districts under Semi-Arid Tropics (SAT)

Sr. No.	State	No. of districts
1	Andhra Pradesh	16
2	Gujarat	16
3	Karnataka	16
4	Madhya Pradesh	34
5	Maharashtra	21
6	Rajasthan	13
7	Tamil Nadu	10
	<b>Total SAT</b>	<b>126</b>
8	Bihar/Jharkhand, Orissa and U.P.	14

Source: Bhatia, 2005.

### Rainfed Agriculture in SAT states

The depending upon quantum of rainfall, the problems of rainfed agriculture varies from region to region and district to district. The states/regions with high and assured rainfall has better performance in agriculture, such as Kerala, Bihar, part of Orissa, Assam, and Himachal Pradesh. The semi-arid tropics region is where rainfall in most of the months falls short of evapo-transpiration, the problem of rainfed agriculture is severe and is associated with great degree of uncertainty. As mentioned earlier, the states which are falling under semi-arid tropics are Andhra Pradesh, Gujarat, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan, and Tamil Nadu (Bhatia, 2005). It can be seen from the Table 2 that net rainfed area (% to net sown area) in these states is relatively much higher (67.45%) than non-SAT states (45.21%). Among the SAT states, about 83% of GCA was rainfed in Maharashtra, followed by Karnataka (73.51%) and Rajasthan (65.71%)

**Table 2:** Rainfed Areas and Cropping Intensity in SAT and Non SAT States in India –TE 2005-06

(Area in '000 ha)

Sr. No	State	Net Sown Area	Net Irrigated Area	Gross Cropped Area	Gross Irrigated	Net rainfed area	% of net rainfed to net area sown area	Cropping Intensity (%)	Irrigation Intensity (%)
1	Andhra Pradesh	10397	3969	12749	5255	6427	61.82	122.63	132.38
2	Gujarat	9852	3388	11245	4169	6464	65.61	114.14	123.06
3	Karnataka	10285	2725	12428	3221	7560	73.51	120.84	118.20
4	Madhya Pradesh	14954	5785	19866	5949	9169	61.32	132.85	102.84
5	Maharashtra	17465	3061	21435	3845	14404	82.47	122.73	125.61
6	Rajasthan	16926	5804	21475	7101	11122	65.71	126.87	122.35
7	Tamil Nadu	5010	2902	5746	2988	2108	42.08	114.69	102.96
	<b>Total SAT</b>	<b>84889</b>	<b>27634</b>	<b>104944</b>	<b>32528</b>	<b>57255</b>	<b>67.45</b>	<b>123.63</b>	<b>117.71</b>
1	Assam	2774	56	3815	113	2718	97.98	137.53	201.79
2	Bihar	5619	3167	7562	4328	2452	43.63	134.59	136.67
3	Haryana	3495	2953	6368	5408	542	15.52	182.20	183.12
4	Himachal Pradesh	541	105	960	181	436	80.59	177.45	172.06
5	J & K	750	310	1098	451	441	58.73	146.33	145.64
6	Kerala	2159	393	2979	447	1766	81.81	137.97	113.84
7	Orissa	5758	1810	8690	2632	3948	68.57	150.93	145.44
8	Punjab	4243	4038	8046	7772	205	4.83	189.64	192.46
9	Uttar Pradesh	16705	13192	25036	18241	3513	21.03	149.87	138.27
10	West Bengal	5366	3086	9572	5483	2279	42.48	178.40	177.65
11	Others	9035	1817	12068	2623	7218	79.89	133.57	144.40
	<b>Total Non SAT</b>	<b>56445</b>	<b>30926</b>	<b>86195</b>	<b>47679</b>	<b>25519</b>	<b>45.21</b>	<b>152.71</b>	<b>154.17</b>
	<b>Total</b>	<b>141334</b>	<b>58560</b>	<b>191139</b>	<b>80207</b>	<b>82773</b>	<b>58.57</b>	<b>135.24</b>	<b>136.96</b>

Source: CMIE, 2009.

Note: TE – Triennium Endings.



and lowest was in Tamil Nadu (42.08%). Both cropping intensity and irrigation intensity in SAT states was not only lower than non-SAT states but also of national average, which is mainly because of lack of irrigation facilities. Therefore, the crop production and productivity in these low rainfall areas under SAT rainfed conditions is generally low and more prone to risk and uncertainty.

### Cropping Pattern under Rainfed Agriculture of SAT States

The acreage allocation under different crops of a region is largely influenced by the magnitude and pattern of rainfall along with the availability of irrigation water. The shifts in cropping pattern with the extension of irrigation towards high value crops are well recognized. In case of heavy and longer rainfall season, paddy crop is generally grown and in case of low short duration rainfall regions, short duration less water duty crops are cultivated. The cropping pattern of rainfed sector is presented in Table 3. It can be seen from the table that jowar, bajra, maize, and ragi are the most important crops grown in SAT area and together account for 22% of total cropped area. However, same accounts for only 6% in a non-SAT area. Generally, coarse cereals are grown in a SAT area. Jowar is a major coarse cereal grown in Maharashtra accounting for about 22% of gross cropped area of the state. The pulses and oilseeds are the other important crops in SAT regions. Groundnut is generally grown in rainfed areas, which accounts together for about 6% of GCA in SAT. Cotton is also an important cash crop grown in rainfed agriculture, accounting together for about 7% of GCA of SAT states.

### Acreage Allocation Under Major Crops

The statewide and cropwise acreage allocation under major crops in rainfed areas is presented in Table 4. As mentioned earlier, it is also clear from the table that coarse cereals are the major crops grown in rainfed area. Jowar, bajra, and ragi account together in SAT states for more than 80% of the total area under that crop in the country during TE 2005–06, followed by maize (60%). Among oilseeds, groundnut accounts together for more than 95% area followed by rapeseed mustard (62.3%). Cotton accounts for 86.2% of total area in the country. The agriculture in irrigated area is dominated by heavy duty crops such as paddy and wheat, and because of less significance of irrigated sector, rainfed areas are dominated by coarse cereals, pulses, and oilseeds. Maharashtra accounts for more than half of the area under jowar crop and 33.8% area under cotton in the country. Andhra Pradesh and Gujarat are the largest groundnut growing states; while ragi, grown on a large scale in Karnataka, accounts for about 60% area of the country. Bajra and rapeseed mustard are the important crops in Rajasthan. Thus, less water intensive crops are generally grown under rainfed agriculture and these crops dominate the sector both in area and production in the majority of crops.

### Share of Rainfed Sector in Production of Major Crops

We have seen in the above section that rainfed sector dominated in area under coarse cereals crops mainly jowar and bajra. It can be seen from the Table 5 that about 96% of jowar, 78% of bajra, 64% of maize, 88% of ragi, 81% of

Table 3: Cropping Pattern under Rainfed Agriculture: TE 2005-06 (Percent to GCA)

States	Rice	Jowar	Bajra	Maize	Ragi	Wheat	Gram	Tur	Gr.nut	R & M	Cotton
Andhra Pradesh	26.3	4.2	0.8	5.6	0.6	0.1	3.0	3.9	13.6	0.0	8.0
Gujarat	6.0	1.4	8.6	4.3	0.2	7.1	1.3	2.4	17.7	2.7	16.2
Karnataka	10.4	13.1	3.2	6.4	7.6	1.9	3.6	4.5	7.6	0.0	3.4
Madhya Pradesh	8.4	3.4	0.9	4.5	0.0	20.0	13.7	1.6	1.1	3.4	3.0
Maharashtra	7.1	21.7	6.7	2.0	0.7	3.7	4.2	5.0	2.0	0.0	13.2
Rajasthan	0.5	2.9	23.9	4.9	0.0	9.7	5.1	0.1	1.3	14.7	1.9
Tamil Nadu	30.9	6.3	2.0	3.2	2.1	0.0	0.1	0.7	10.6	0.0	2.1
SAT States	9.9	8.2	7.9	4.3	1.2	7.5	5.4	2.7	5.9	4.0	6.9
Non-SAT States	37.5	0.5	1.7	3.4	0.3	21.6	1.4	0.9	0.3	2.9	1.3
All India	22.4	4.7	5.1	3.9	0.8	13.9	3.6	1.9	3.4	3.5	4.4

Source: CMIE, 2009.

Notes: Figures are %age to GCA, GCA- Gross Cropped Area, R&M- Rapeseed Mustard.



Table 4: Acreage allocation under major crops in SAT states: TE 2005-06

(Area on '000 ha)

States	Rice	Jowar	Bajra	Maize	Ragi	Wheat	Gram	Tur	Gr.nut	R & M	Cotton
A.P.	3348 (7.8)	531 (5.9)	104 (1.1)	712 (9.6)	71 (4.5)	11 (0.0)	384 (5.6)	498 (14.0)	1737 (26.9)	0 (0.0)	1016 (12.2)
Gujarat	676 (1.6)	161 (1.8)	971 (9.9)	481 (6.4)	23 (1.5)	801 (3.0)	147 (2.1)	268 (7.6)	1987 (30.8)	300 (4.5)	1818 (21.8)
Karnataka	1289 (3.0)	1627 (18.0)	398 (4.1)	801 (10.8)	943 (59.5)	242 (0.9)	443 (6.4)	565 (15.9)	942 (14.6)	6 (0.1)	417 (5.0)
M.P.	1666 (3.9)	674 (7.5)	187 (1.9)	889 (11.9)	0 (0.0)	3973 (15.0)	2723 (39.3)	322 (9.1)	212 (3.3)	676 (10.1)	587 (7.0)
Maharashtra	1521 (3.6)	4645 (51.4)	1429 (14.6)	423 (5.7)	143 (9.0)	785 (3.0)	900 (13.0)	1077 (30.3)	418 (6.5)	11 (0.2)	2826 (33.8)
Raj.	103 (0.2)	634 (7.0)	5128 (52.3)	1053 (14.1)	0 (0.0)	2079 (7.8)	1097 (15.8)	19 (0.5)	272 (4.2)	3163 (47.4)	418 (5.0)
T.N.	1773 (4.2)	365 (4.0)	113 (1.1)	184 (2.5)	118 (7.4)	0 (0.0)	7 (0.1)	41 (1.2)	609 (9.4)	0 (0.0)	123 (1.5)
SAT States	10376 (24.3)	8636 (95.6)	8331 (84.9)	4543 (61.0)	1298 (81.9)	7891 (29.8)	5698 (82.3)	2790 (78.5)	6177 (95.7)	4155 (62.3)	7203 (86.2)
Non-SAT States	32344 (75.7)	394 (4.4)	1478 (15.1)	2911 (39.0)	286 (18.1)	18596 (70.2)	1224 (17.7)	763 (21.5)	277 (4.3)	2519 (37.7)	1150 (13.8)
All India	42720 (100.0)	9030 (100.0)	9809 (100.0)	7454 (100.0)	1584 (100.0)	26487 (100.0)	6922 (100.0)	3553 (100.0)	6454 (100.0)	6674 (100.0)	8354 (100.0)

Source: CMIE, 2009.

Notes: Figures in parenthesis are percentage to total

Table 5: Production of Crops in Rainfed Areas

States	Rice	Jowar	Bajra	Maize	Ragi	Wheat	Gram	Tur	Gr.nut	R & M	Cotton
A.P.	10086 (11.5)	615 (8.6)	104 (1.1)	2543 (17.4)	81 (3.6)	7 (0.0)	477 (8.5)	246 (10.0)	1331 (17.4)	0 (0.0)	2063 (12.7)
Gujarat	1271 (1.4)	176 (2.5)	1252 (13.5)	601 (4.1)	24 (1.1)	2105 (3.0)	124 (2.2)	258 (10.5)	3251 (42.6)	419 (5.7)	5175 (31.9)
Karnataka	3947 (4.5)	1294 (18.0)	293 (3.2)	2150 (14.7)	1527 (67.9)	164 (0.2)	206 (3.7)	309 (12.5)	616 (8.1)	2 (0.0)	502 (3.1)
M.P.	1525 (1.7)	738 (10.3)	266 (2.9)	1456 (10.0)	0 (0.0)	6833 (9.8)	2528 (45.0)	250 (10.2)	243 (3.2)	701 (9.5)	670 (4.1)
Maharashtra	2565 (2.9)	3472 (48.3)	1018 (11.0)	834 (5.7)	150 (6.7)	1031 (1.5)	556 (9.9)	715 (29.0)	450 (5.9)	3 (0.0)	3060 (18.9)
Raj.	156 (0.2)	321 (4.5)	4140 (44.8)	1478 (10.1)	0 (0.0)	5816 (8.3)	653 (11.6)	14 (0.6)	423 (5.5)	3709 (50.5)	785 (4.8)
T.N.	4502 (5.1)	243 (3.4)	130 (1.4)	262 (1.8)	186 (8.3)	0 (0.0)	4 (0.1)	24 (1.0)	1007 (13.2)	0 (0.0)	177 (1.1)
SAT States	24052 (27.4)	6859 (95.5)	7203 (77.9)	9324 (63.8)	1968 (87.5)	15956 (22.8)	4547 (80.9)	1816 (73.7)	7320 (95.9)	4834 (65.9)	12431 (76.6)
Non-SAT States	63765 (72.6)	326 (4.5)	2039 (22.1)	5298 (36.2)	282 (12.5)	54094 (77.2)	1072 (19.1)	649 (26.3)	311 (4.1)	2505 (34.1)	3788 (23.4)
All India	87817 (100.0)	7185 (100.0)	9242 (100.0)	14622 (100.0)	2251 (100.0)	70050 (100.0)	5619 (100.0)	2465 (100.0)	7631 (100.0)	7339 (100.0)	16219 (100.0)

Source: CMIE, 2009.

Notes: Figures in parenthesis are percentage to total



**Table 6:** Productivity of Crops under Rainfed Sector (kg/ha)

States	Rice	Jowar	Bajra	Maize	Ragi	Wheat	Gram	Tur	Gr.nut	R & M	Cotton
A.P.	3013	1160	994	3571	1146	656	1242	494	766	-	345
Gujarat	1881	1097	1289	1251	1038	2628	838	961	1636	1398	484
Karnataka	3062	795	737	2683	1620	677	465	547	653	335	205
M.P.	915	1094	1421	1638	214	1720	928	778	1148	1036	194
Maharashtra	1686	747	712	1969	1049	1314	618	664	1076	313	184
Raj.	1518	507	807	1405	-	2797	596	734	1554	1173	319
T.N.	2539	666	1157	1423	1577	-	654	594	1654	-	245
SAT States	2318	794	865	2052	1516	2022	798	651	1185	1163	293
Non-SAT States	1971	827	1379	1820	986	2909	876	850	1122	994	560
All India	2056	796	942	1962	1421	2645	812	694	1182	1100	330

Source: CMIE, 2009.

gram, 74% of tur, 96% of groundnut, and about 77% of cotton was produced by SAT states during the period TE 2005-06. However, in case of water intensive crops like wheat and paddy, rainfed areas in SAT accounts only about 23 and 27% of total production in the country respectively.

### Productivity of Crops Under Rainfed Agriculture

It is well-known fact that due to the severe shortage of water, higher evapo-transpiration, less rainfall, and widening gap in two successive rainfall, the rainfed crops suffer in terms of growth due to poor nutrition intake. Most of the farmers from the rainfed area are reluctant to take new high yielding varieties whose performance under rainfed condition which is even more risky. Also due to low level of irrigation, low application of fertilizers and other nutrients, uncertainty of rainfall, adoption of tradition varieties, and non-availability of crop varieties suitable for rainfed farming, the yield levels of rainfed agriculture in semi-arid states are significantly lower than of irrigated agriculture in the same region. The average yield rates of rainfed and irrigated agriculture is presented in Table 6. It can be seen from the table that incase of major cereal crops such as jowar, bajra, ragi (except maize), the yield per hectare is lower in rainfed areas as compared to irrigated area. In case of commercial crop like cotton, the yield per hectare in rainfed sector is almost half of the yield level of irrigated area

### Major Factors Affecting SAT States in India

There has been an increasing concern amongst the policy makers, planners, and development agencies that developmental policies and programs have not adequately

addressed the problems of agriculture in rainfed sector. Despite concerted efforts made in the past to improve the productivity by transferring improved technologies, gains in terms of higher yield and income have not been spectacular due to associated risks like aberrant weather, land degradation, and poor socio-economic base of the farmers. Therefore, it is important to identify the major issues affecting the semi-arid agriculture in India. The major constraints of rainfed farming in SAT states can be categories in five sub-groups as under.

1. Biophysical problems
  - a) Water scarcity and droughts, b) Land degradation and poor quality of soils.
2. Technological Issues
  - a) Low Productivity, b) Low level of adoption of new technologies.
3. Economic problems
  - a) Lack of financial viability, b) Low public investments in agriculture.
4. Institutional/Organizational Problems
  - a) Lack of appropriate Institutions, b) Lack of Community participation.
5. Public-policy related problems
  - a) Food and nutrition insecurity, b) Lack of access to markets and marketing facilities.



---

## Strategies for Development of Rainfed/Semi-Arid Tropical Agriculture

As mentioned earlier, after five decades of agricultural development, 72% of oilseeds, 85% of pulses, and about 55% of foodgrains are still produced by rainfed agriculture. It is projected that after having developed all water resources, 50% of agriculture will still continue to be rainfed. Therefore, in order harness and harmonize tremendous potentials of the rainfed agriculture by converting weaknesses into strengths and threats into opportunities by appropriate policies, programs, professionalism, capacity building, monitoring, and evaluation. The government of India has set up the National Rainfed Area Authority (NRAA) with an objective of overall holistic and integrated development of rainfed regions of the country. The authority will have an executive committee headed by a chief executive officer who will be supported by five technical experts in the fields of water management, agriculture/horticulture, animal husbandry and fisheries, forestry and watershed development. The mandate of NRAA include preparing a perspective plan for holistic and sustainable development of rainfed areas, coordinate and bring convergence within and among agriculture and watershed development programs, promotion of farming systems, micro-enterprising, diversification, safety-nets, common property resource management, forest rehabilitation and internalization of social capital of landless and assetless and monitoring of these activities at the centre and state level. Thus, the major aim is convergence, coordination, networking, harmonization, rationalization, monitoring, and integration of the capacities of all stakeholders and service providers. Transparency, cooperation, contribution, and participation of local communities, bodies, NGOs, professionals and government organizations is being looked upon to galvanize a sustainable growth and development process for the holistic and integrated development of rainfed areas. In order to improve the economic condition of rainfed areas in SAT states of India through increase in production and productivity of crops grown in those areas, following strategies may be adopted.

- Improved access to supplementary irrigation along with complementary inputs;
- Adapting new dryland technologies to local conditions for a wider diffusion;
- Reclamation and productive use of wastelands, fallow lands, and common pool lands;

- Diversification, marketing, and commercial orientation of agriculture;
- Revamping and targeting public distribution system;
- Strengthening support systems, basic infrastructure, and institutional innovations;
- Better-targeted wage employment schemes to address transient poverty;
- Develop cost-effective methods of integrated watersheds development;
- Techno-economic assessment of water saving micro irrigation technologies;
- Breed water-efficient drought tolerant varieties of rainfed crops;
- Explore markets, policy, and alternative options to make the farm family financially viable;
- Mainstream gender in the SAT agricultural development strategies;
- Apply economics of post harvest technologies in the semi-arid tropics;
- Reduce high transaction and marketing costs through institutional innovations;
- Harness modern information and communication technologies.

Sawant et al. (1999) have noted in his report 'Agricultural Development in Maharashtra: Problem and Prospects' that agricultural growth strategy which appeared to have yielded better results in Akola district of Maharashtra involved relatively successful development and extension of dry farming technologies well integrated with the new seed fertilizers technologies and the watershed management approach suited to the agro-ecological conditions in the district. Thus, this strategy can also be helpful for dry land farming.

### ***Dry Farming Strategy: The Akola Experience***

The district of Akola did not enjoy advantages like high level of irrigated area, infrastructure development, adoption of HYV, or intensive use of fertilizers and yet, it had the maximum agricultural income growth rate among the districts of Maharashtra in the 1980s. The success story involved several mutually complementary components:

- Rainfall Water Conservation: Spread of vegetative bunds with grass on the boundaries and rows of subabul within the fields helped conservation of rainfall



---

water, prevention of water runoff and thereby soil erosion. It increased not only supply of organic manures but also efficiency of chemical fertilizers under rainfed conditions.

- **Inter/Mix Cropping:** Inter/mix cropping was adopted with appropriate combinations of early maturing short root crops and late maturing deep root crops helped utilization of moisture in both upper and lower layers of the soil. For example, cotton was cultivated with green gram or soyabean, hybrid jowar with tur, and tur with green or black gram.
- **Flexibility in crop sequence/mix:** The local agricultural university and ICAR's centers for dryland agriculture devised the cropping pattern and crop sequencing to suit different rainfall conditions (e.g., early or late commencement of monsoon, occurrence of long dry spells, and early withdrawal of monsoon).
- **Extension Program:** The widespread diffusion of this technology was possible with the combined efforts by the university centers and government officials who demonstrated their profitability and superiority. The World Bank's Rainfed Farming Project implemented in a few villages supplemented/complemented these efforts.
- The success of Akola is thus due to development and extension of dry farm technology suited to the agro-ecological condition of the region and watershed development programme. These pushed up cropping intensity even in the absence of irrigation.

### Conclusions and Policy Implications

Indian agriculture in general has shown a spectacular growth in terms of both production and productivity during the last five decades of planned development. However, it is well recognized that there are large variations in terms of growth of agricultural production and productivity across the regions/states and amongst the crops. The green revolution technology adopted in mid 1960s was considered the cornerstone of India's agricultural growth by-passed the rainfed areas, remaining confined primarily to the irrigated tracts. As a consequence, much of the growth was confined to a limited number of states which led to high growth in agricultural output in selected regions while the other regions suffered from stagnancy or poor growth in agricultural output. The rainfed agriculture plays an important role in Indian economy and significantly contributes in country's development. It accounts for nearly

half of the total value of agricultural output and hundreds of millions of poor rural people depend on the rainfed agriculture as the primary sources of their livelihood. After five decades of agricultural development, 72% of oilseeds, 85% of pulses, and about 55% of foodgrains are still produced under rainfed agriculture. However, rainfed agriculture is seriously lagging in the development as compared to agriculture in the green revolution areas, and therefore, needs priority attention as the prospects for Indian agriculture depend to a significant extent of the potential of rainfed agriculture which has not been effectively harnessed so far. The major constraint of rainfed farming in SAT states is high dependence on rainfall and shortage of water. With productivity levels of staple crops in the irrigated areas plateauing off and factor productivity declining, it is clear that unless food production in the rainfed areas increases significantly, food security may be adversely affected. As envisaged in the National Agriculture Policy 2002, if the target of over 4% annual growth in agriculture sector during the 11<sup>th</sup> five-year plan period is to be achieved, all areas where rainfed farming is predominant whether in the central plain, hill, semi-arid or coastal lands will need to contribute substantially to incremental output and augment food security by producing marketable surpluses more reliably by improving productivity and promoting the agri-business activities in rainfed areas.

### References

- Bhalla G.S. and Gurmail Singh.** (2001). *Indian Agriculture-Five Decades of Development*. New Delhi: SAGE Publications.
- Bhatia, M.S.** (2005). "Viability of Rainfed Agriculture in Semi-Arid Regions," Occasional Paper No. 40, Department of Economic Analysis and Research, National Bank for Agriculture and Rural Development, Mumbai.
- Chand, Ramesh and Sonia Chauhan.** (1999). *Are Disparities in Indian Agriculture Growing*, Policy Brief No. 8, National Centre for Agricultural Economics and Policy Research, New Delhi, October.
- CMIE.** (2009). *Agriculture*, Centre for Monitoring Indian Economy Pvt. Ltd., Mumbai, January.
- Dantwala, M.L.** (1986). "Strategies of Agricultural Development since Independence," *Indian Agricultural Development since Independence: A Collection of Essays*, Oxford and Publishing Co. Pvt. Ltd.
- Dhan Foundation.** (2006). Themes-Rainfed Farming. Available online at <http://www.dhan.org/rainfed.php.6k>
- GOI.** (2008). *Agricultural Statistics at a Glance 2008*, Department of Economics and Statistics, Department of Agriculture and Cooperation, Ministry of Agriculture, Govt. of India, New Delhi.



---

**Gulati, Ashok and Tim Kelley.** (1999). *Trade Liberalization and Indian Agriculture- Cropping Pattern Changes and Efficiency Gains in Semi-Arid Tropics*, New Delhi: Oxford University Press.

**Jharwal, S.M.** (2008). "Rainfed Agriculture- Need for Rainbow Revolution," *Agricultural Situation in India*, LXV(5): 259–266.

**Kerr, John M.** (1996). *Sustainable Development of Rainfed Agriculture in India*, Discussion Paper No. 20, Environment

and Production Technology Division, International Food Policy Research Institute, Washington, D.C., U.S.A.

**Ramakrishna, R. and D. Tata Rao.** (2008). "Strengthening Indian Agriculture through Dry Land Farming: Need for Reforms," *Indian Journal of Agricultural Economics*, 63(3): 440–476.

**Sawant, S.D., B.N. Kulkarni, C.V. Achuthan, and K.J.S. Satyasai.** (1999). "Agricultural Development in Maharashtra: Problems and Prospects," Occasional Paper No. 7, National Bank for Agriculture and Rural Development, Mumbai.

*That action is best which provides the greatest happiness for the greatest number.*

— Francis Hutcheson



# Productive Specialization and Regional Development at State level in India

Diniz Francisco and Vinod Kumar Upadhyay

---

*The purpose of this article is to analyze the specialization of Indian productive structures in 2006, using specialization indicators, namely localization quotient estimation, to assess both the relative degree of concentration of a given activity in a certain area and the specialization coefficient, that helps characterize a region's economy according to its degree of specialization. Reference variables for specialization analysis purposes are GDP at factor cost at constant price (Base=99-00) and Employment for 2001 and 2006 in an attempt to compare differences observed with productivities. This study was a thorough research into the time-spatial relationship between specialization, productivity, and development.*

*Diniz Francisco is a senior researcher at the Centre for Transdisciplinary Studies for Development (Centro de Estudos Transdisciplinares para o Desenvolvimento) (CETRAD) and a senior lecturer of the Economy, Sociology and Management Department (DESG) of Trás-os-Montes e Alto Douro University (UTAD), Vila Real, Portugal and Vinod Kumar Upadhyay is from the National Institute of Science Technology & Development Studies (CSIR).*

## INTRODUCTION

Productive specialization has always been at the heart of economic and regional development studies and recently produced regional science literature can provide some very good examples of it. Akgüngör and Falcioğlu (2005) addressed the question of the relationship between Turkey's transforming industry regional specialization patterns and European integration; Michaels, G. (2006) elaborated on the consequences of a resources based specialization especially when it lasts for a long period; Ezcurra et al. (2004) and Traistaru and Iara (2002) worked on regional integration and industrial localization in central and eastern Europe countries within a project financed by EU Phare Program examine productive specialization in the regions of the European Union over the period 1977 to 1999 using the information provided by various methodological instruments. The results obtained reveal a process of convergence in regional productive structures during the 23 years considered. Diniz and Sequeira (2009) analyzed how the specialization of Portuguese productive structures has evolved between 1995 and 2004, using specialization indicators, namely localization quotient estimation, to assess both the relative degree of concentration of a given activity in a certain area and the specialization coefficient, that helps characterize a region's economy according to its degree of specialization. Desrochers's (2007) main purpose is to point out some shortcomings of traditional approaches to the study "knowledge spillovers" and to suggest an alternative based on how knowledge is actually created and exchanged by individuals. Evidence is drawn from the history of technology, some Baltimore cases related to research activities conducted at the Johns Hopkins University, and from a survey of Southern Quebec inventors, bearing in mind that regional specialization has long been thought to be both the logical outcome of market competition and the best geographical setting for innovation. Partly as a result of this belief, policies promoting regional



specialization through “industrial clusters” have enjoyed worldwide popularity in the last decade. In recent years, however, a heated debate as to whether local diversity or specialization of economic activity is the best incubator of technological change and economic growth has been raging.

With recourse to specialization indicators, such as the localization quotient, which allows to assess the relative degree of concentration of a given activity in a given region; the specialization coefficient, which enables the characterization of a region’s economy according to its higher or lesser specialization, it was possible to analyze the specialization evolution of Indian regional productive tissue in 2006. The reference variables chosen were Gross Domestic Product at factor cost at constant price (Base=99-00) for 2001 and 2006, and Employment for only 2006, and the differences found were compared with productivities, which in turn were related to GDP per worker within each territorial unit. The main purpose of this study was, thus, to go deeper into the spatial and time relationship between specialization, productivity, and development.

## Methodological Aspects

### Variables analyzed

Productive specialization indicators used in this study focussed on two variables—GDP and Employment in 2006. The territorial unit comprised Indian states and the reference unit was all India, that is, the whole of the national territory.

In the case of employment, the origin of the worker is taken into consideration. That means three different types of analyses will be then possible. Rural and urban employment can be dealt separately as well as together.

Data were collected at “Employment and Unemployment Situation in India 2005-06” National Sample Survey Organisation, Ministry of Statistics and Programme Implementation, Government of India, January 2008 and State Analysis Service.

Concentration/distribution of economic activities was analyzed based on data for GDP and Employment concerning primary, secondary, and tertiary sectors, respectively.

### Productive Specialization Indexes

Specialization indicators are statistic analysis measures which allow us to infer thesis and conclusions about the

productive structure specialization of each territorial unit at two levels. On the one hand they measure each territorial unit specialization compared against a reference model, both in global terms and for each of the activity sectors taken into consideration. In this case we are before relative specialization indicators, of which both the localization quotient and the specialization coefficient are two examples. On the other hand, it is possible to build absolute specialization indicators for each territorial unit, which will deal with characteristics revealed by the variable sectoral distribution in that territorial unit.

### Localization Quotient

This indicator Localization Quotient (LQ) is a localization measure, in the sense that it allows us to assess the relative concentration degree of a given activity (k) in a given region (i). Analytically,  $LQ_{ik} = (x_{ik}/x_j) / (x_k/x)$  where the numerator measures the concentration of the gross value added of region i in sector k and the denominator measures the concentration of the reference region’s gross value added in sector k. The reference basis is the unit. Thus:

- $LQ_{ik} < 1$  – means that sector k in region i is not very significant, and that the region is not particularly specialized in sector k;
- $LQ_{ik} = 1$  – in this case the relative importance of sector k in region i equals its importance in the reference region;
- $LQ_{ik} > 1$  – means that sector k in region i plays an important role, and that the region is relatively specialized in sector k.

Localization quotients are useful tools to characterize regions internally and to compare them both among themselves and to the reference territorial unit. Additionally, the analysis of their evolution in time, namely by descriptive statistical measures, allows us to approach the regions’ internal dynamics as well as their inter-relationships, (Delgado and Godinho, 2005).

### Specialization Coefficient

Determining the region’s specialization coefficient ( $SC_i$ ) requires calculating its employment percentage in each sector,  $x_{ik}/x_i$ , and the same percentage relative to pattern  $x_k/x$ , determined by the following expression:  $SC_i = \sum_{k=1}^n [ | (x_{ik}/x_i) - (x_j/x) | ] / (k-1)$ .

The index allows us to characterize the region’s economy in terms of its higher or lower specialization



regarding its productive structure when compared to the pattern's with a variation in the interval  $[0, 1]$ . If  $SC_i = 0$ , there is no specialization in region  $i$  compared to the pattern. The nearer the  $SC_i$  value is to 1, the higher the specialization of region  $i$  compared to the reference pattern (Delgado and Godinho, 2005).

### **Multiple Linear Regressions**

In order to establish a relationship between development, productivity, and regional specialization, a multiple linear regression is also performed using SPSS statistical software. As explaining variables we selected productivity, measured by the GDP per worker. As regards specialization, of the various indicators considered, LQ concerned with industry produced the best results. Due to an obvious multicollinearity problem and in view of the results obtained, we decided to eliminate Rural Employment Localization Quotient for primary sector, Urban Employment Localization Quotient for tertiary sector, Rural/Urban Employment Localization Quotient for primary sector and GDP Localization Quotient for secondary sector. The data presented refers to 2006.

### **Results and Discussion**

Further considerations are based on the analysis of results obtained by calculating the indexes presented before. The different states of India as the territorial units were to be studied and were taken in relation to the whole of the national territory year 2006.

#### **Localization Quotient (L.Q)**

##### **Employment**

###### *Primary Sector (Rural)*

As rural persons are taken into consideration, this sector plays a more significant role in Andhra Pradesh, Bihar, Chhattisgarh, Gujarat, Himachal Pradesh, Karnataka, Madhya Pradesh, Maharashtra, Orissa, Rajasthan, and Uttaranchal, that is, it is relatively specialized in the primary sector than all in India. The level of specialization is 10% above all India only in Karnataka, Madhya Pradesh, and Maharashtra. All other states but Uttar Pradesh are not that specialized in the primary sector. That state has the same pattern as all India.

###### *Primary Sector (Urban)*

Delhi with a  $LQ=0$  for the primary sector proves to be predominantly a service city where the central government

is based. Most of the states followed the pattern of all India. Above it, one can mention Bihar and the north-eastern states ( $LQ>2$ ). In Assam, one can observe that primary sector is less important than the all India pattern for urban persons.

###### *Primary Sector (Rural/Urban)*

When all persons come into analysis, in only three states, the employment in the primary sector indicates that the specialization is far below the pattern of all India, such as in Delhi where the location quotient is almost zero. A similar situation can be seen in Goa and the Group of UTs, both with an  $LQ<0.4$ .

###### *Secondary Sector (Rural)*

Secondary sector is well above all India ( $LQ>1,5$ ) in Goa, Kerala, Group of UTs, Tamil Nadu, and Jharkand. The same patterns as in all India can be found in Himachal Pradesh, Gujarat, and Uttar Pradesh. All other states are more than 10% below the pattern of all India and the most distant is Chhattisgarh.

###### *Secondary Sector (Urban)*

Two thirds of the states follow the pattern of all India when a combination of both rural and urban populace in the primary sector is analyzed. Uttaranchal and north-eastern states are the ones where secondary sector plays a relatively minor role with an LQ less than 0.5.

###### *Secondary Sector (Rural/Urban)*

In exactly one third of all states, the secondary sector is less significant than the all India pattern. Assam and Chhattisgarh have a localization quotient inferior to 0.5. All other states have either a similar pattern or the secondary sector is more significant when both rural and urban workers are taken into consideration. Goa and Group of UTs have an  $LQ> 1.5$  which can be justified by the relative weight in all India and in the case of Goa, the importance of mining activity that is included in the secondary sector.

###### *Tertiary Sector (Rural)*

Delhi ( $LQ<5$ ) followed by Kerala ( $LQ>2$ ) and Group of UTs ( $LQ>1.5$ ) are the States where Tertiary sector is more important than in all the country. Delhi attracts rural population to work on the services sector. Himachal Pradesh, Orissa, and Jharkhand have almost the same pattern as all India. Chhattisgarh is the most distant State from the pattern.



---

### *Tertiary Sector (Urban)*

In all the States the pattern for all India is present for urban persons employed in the Service sector. Definitely urban areas are places where this sector flourishes.

### *Tertiary Sector (Rural/Urban)*

In about one third of all states of India, tertiary sector is less important than the pattern of the country as a whole. Chhattisgarh has an LQ of 0.51 while all the other six (Bihar, Himachal Pradesh, Jharkhand, Madhya Pradesh, Orissa, and Rajasthan) have an LQ > 0.7.

The rest of the states follow a similar pattern as the whole country. Delhi has a location quotient a little bit above 3 and Goa above 2. This can be explained by the presence of the central government ministries and other governmental departments in Delhi and the importance of tourism sector in Goa.

One can say that India is becoming a services economy, following the pattern of developed countries.

## **GDP**

### *Primary Sector*

For 2006 in most of the primary sector's Gross Domestic Product at factor cost at constant price, the share is above the pattern of all India, but the value of localization quotient does not exceeds 1.6.

Only in seven states (Delhi, Goa, Gujarat, Jharkhand, Kerala, Maharashtra, and Tamil Nadu), the primary sector is less important than in all India. For all of them but Delhi, the localization quotient is above 0.5. Delhi presents a very low LQ, around zero, which means that primary sector's contribution to the formation of Gross Domestic Product is insignificant.

When one calculates LQ in more desegregated sector approach one can clearly see that for the two states (Punjab and Uttar Pradesh), the agriculture sector shows a significant level relevance compare to the all India situation, the highest LQ value for Punjab in 2006 being 1.71. No state has the lowest value for the localization quotient for agriculture.

Forestry and logging is significant in Bihar, Himachal Pradesh, Karnataka, Rajasthan, and Uttarakhand. Localization quotient value is a little bit higher than 2 only in Bihar in 2006. In Delhi, Goa, and Gujarat, forestry is the least important economic activity.

Fishing is the most important economic activity in Andhra Pradesh, Goa, Kerala, and West Bengal. In these states the LQ is higher than 3 for both the years, 2001 and 2006. In Kerala the fishing sector loses importance from 2001 to 2006 where it gave place to construction, expressing a change in specialization pattern of this state. This sector shows the least degree of specialization in Haryana, Himachal Pradesh, Jammu & Kashmir, Jharkhand, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan, Uttarakhand, and Uttar Pradesh.

### *Secondary Sector*

For 2006, in this sector, 11 states follow the pattern of all India with a localization quotient between 0.8 and 1. The other three states (Bihar, Delhi, and West Bengal) have a LQ superior than 0.5 but they do not exceed 0.75.

In the rest of the Indian regions, secondary sector plays a more important role than in all India. The most industrialized ones are Chhattisgarh, Goa, Gujarat, and Jharkhand, with an LQ in the interval of [1.4 – 1.7].

Comparing the situation that occurred in 2001 and 2006 when the localization quotient was calculated for sub-sectors of mining and quarrying, manufacturing, electricity, gas & water supply and construction the situation is as follows: (1) Mining and quarrying is more significant than the all India pattern in Assam, Chhattisgarh, Jharkhand, Madhya Pradesh, and Orissa. In Chhattisgarh, this sector is more than 7 times important than for all country for both years of 2001 and 2006; (2) Manufacturing is well above the all India pattern in Gujarat, Haryana, Tamil Nadu, and north-eastern states both in 2001 and 2006. In this last state, the share of the GDP of this sub- sector is 4 times more than the one of all India; (3) Electricity & gas and water supply is significantly more relevant in Jammu & Kashmir than in all India.

For the secondary sub-sector of mining and quarrying, the least important states are Bihar, Karnataka, Kerala, Punjab, and Tamil Nadu and for manufacturing, this pattern can be found in Andhra Pradesh, West Bengal, north-eastern states, and group of UTs.

Orissa and Chhattisgarh are the states where construction has less relevance. In 2001, Orissa, and in 2006 Assam and Chhattisgarh trade, hotels and restaurants and finance related activities played the least



important role in terms of specialization pattern.

### **Tertiary Sector**

This sector is the one that is more approximated from all India pattern. Localization quotient is less than one in eight states but the value never goes below of 0.7.

One can say that regional pattern of the tertiary sector has a tendency to overcome its importance in relation to the all India one. Indian economy is on the path of the most developed countries.

Delhi confirms its position as a service region with a localization quotient of 1.53. As referred above in the analysis for the employment localization quotient for Goa, due to the relevance of tourism as an economic activity this region follows Delhi but when Gross Domestic Product at factor cost turns to be the variable in question the situation does not remain the same. Goa has an LQ = 0.95. This reinforces the idea that one may have to question the real role of tourism as a strategic economic activity for the regional development process. Not everything that shines is gold.

Delhi and Maharashtra, sure due to Mumbai, are the states where finance, insurance, real estate, and business services are the financial heart of India and finally, community services and personal services is the most important activity in group of UTs.

Trade, hotel and restaurant in Orissa 2001, and finance, insurance, real estate, and business services in Assam and Chhattisgarh are the least important activities regarding specialization comparing to all India situation.

Transport, storage and communication and community services and personal services are activities where no state in particular has a significant degree of specialization.

### **Specialization Coefficient (SC)**

We should bear in mind that  $SC_i \in [0 - 1]$ . In the case of the limit inferior both the territorial unit  $i$  and the reference space have identical specialization profiles; therefore that territorial unit has no relative specialization. The higher the specialization coefficient (closer to 1), the more the territorial unit  $i$  has a specialized productive structure compared to the productive structure of the reference space, since the specialization profile of territorial unit  $i$  is very different from what the reference territorial space shows.

Precisely because we are dealing with a relative

specialization measure, a low specialization coefficient does not necessarily entail a diversification of the regional productive structure but rather a proximity between specialization profiles both of the territorial unit  $i$  and of the reference space.

### **Employment**

Through the results expressed by the calculation of the Specialization Coefficient (SC<sub>i</sub> Employment) it is not clear whether a specialization of the Indian economy is going on. The figures are far from one implying that the level of specialization is not significant at state level. Delhi could be one exception with an SC above 0.5 when both rural and urban workers are in analysis. It may be considered a paradox but the fact is that the rural situation of the workers that contributes more as a differentiation in the specialization pattern. The services, and in a less degree industries, are attracting rural manpower to urban areas creating problems of the incapacity of these areas to solve the problems associated to this rural exodus such as housing, water, and electricity supply as well as hygienic conditions. In an order, one can question whether the ongoing strong growth process that is now occurring in India can be translated into a development process with the inherent better well being status of all population.

### **GDP**

If terms of employment specialization coefficient does not show a clear evidence of a regional specialization which is also the case when Gross Domestic Product at factor cost is taken into consideration. The values of SC<sub>i</sub> are below 0.3 for all states, again Delhi with the highest value of 0.29 and 0.27 in 2001 and 2006, respectively.

### **Regression estimation**

$$Y = \beta_0 + \beta_1 LQ_{II} E-R + \beta_2 LQ_{III} E-R + \beta_3 LQ_{I} E-U + \beta_4 LQ_{II} E-U + \beta_5 LQ_{II} E-R/U + \beta_6 LQ_{III} E-R/U + \beta_7 Sci E-R + \beta_8 Sci E-U + \beta_9 Sci E-R/U + \beta_{10} LQ_{GDP} - I + \beta_{11} LQ_{GDP} - III + \mu_i$$

where  $Y$  is the dependent variable (productivity) and rest of the variables are explanatory variables,  $\mu_i$  the stochastic disturbance term of  $i$ th observations,  $\beta_0$  is the constant term it gives the average effect on  $Y$  of all the variables,  $\beta_1, \dots, \beta_{11}$  is regression coefficients.

As expected, there is a positive relationship between productivity on 15 independent variables. The data set of analysis of multiple regression of four independent variables



**Table 1: Excluded Variables**

Model	Beta In	t	Sig.	Partial Correlation	Collinearity Statistics
					Tolerance
1 LQ I E- R	. <sup>a</sup>				.000
LQ III E- U	. <sup>a</sup>				.000
LQ I E- R/U	25.961 <sup>a</sup>	.353	.731	.106	1.021E-6
LQ GDP- II	-298.320 <sup>a</sup>	-.397	.699	-.119	9.767E-9

Notes: a. Predictors in the Model: (Constant), LQ GDP - III, LQ II E- R, LQ I E- U, LQ II E- U, LQ GDP - I, Sci E- R/U, LQ III E- R, Sci E- U, LQ III E- R/U, Sci E- R, LQ II E- R/U

b. Dependent Variable: Productivity

are highly correlated due to which it represents multicollinearity, that is tolerance is very low in collinearity (see Table 1). After this, four independent variables are excluded namely LQ I E- R, LQ III E- U, LQ I E- R/U & LQ GDP - II. The 11 independent variable analysis based on the R<sup>2</sup> value is 0.94, which means that 94% of the variation

**Table 2: R<sup>2</sup>**

R	R Square	Adjusted R Square	Std. Error of the Estimate
0.969	0.939	0.882	0.456

in productivity is explained by eleven variables (see Table 2).

That means regression model explains the variation in the dependent variables fairly well; the adjusted R<sup>2</sup> is 0.882. The ANOVA tables show the F value which is the proportion of variation explained by variables in the model significantly good, that is, p value = .000 (see Table 3).

**Table 3: ANOVA<sup>b</sup>**

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	37.851	11	3.441	16.652	.000 <sup>a</sup>
Residual	2.480	12	.207		
Total	40.330	23			

Also, if the overall model is significant, then at least 1 or more of the individual variables will most likely have a significant relationship with the dependent variables. In individual significance, only two predictors were positively related to the outcome variable, such as (Localization Quotient Tertiary Sector Employment Rural/Urban) LQ III E- R/U ( $\beta = 1.77$ ,  $p = .05$ ), (Specialization Employment Rural/Urban) Sci E- R/U ( $\beta = 6.387$ ,  $p = .08$ ), and rest of other independent variables non-significant. The intercept value of 1.532, it means that if the value of independent

variables were fixed at zero, the mean productivity would be about 1.532 (see Table 4). It can be concluded that there was a positive significant relationship between LQ III E- R/U & Sci E- R/U. Furthermore, 94% of the variability in

**Table 4: Coefficients**

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.532	1.997		.767	.458
LQ II E- R	-.675	1.357	-.267	-.497	.628
LQ III E- R	-.076	.386	-.054	-.196	.848
LQ I E- U	-.366	.240	-.146	-1.526	.153
LQ II E- U	-.570	1.798	-.095	-.317	.757
LQ II E- R/U	.784	2.344	.221	.335	.744
LQ III E- R/U	1.766	.823	.776	2.146	.053
Sci E- R	-3.700	3.482	-.402	-1.062	.309
Sci E- U	-3.922	4.060	-.203	-.966	.353
Sci E- R/U	6.387	3.438	.651	1.858	.088
LQ GDP - I	-.511	.391	-.139	-1.306	.216
LQ GDP - III	-.853	1.109	-.109	-.769	.457

A. DEPENDENT VARIABLE: PRODUCTIVITY

productivity could be explained by explanatory variables.

### Final Remarks

This article was motivated by a first approach to the time-space relationship between productive specializations on the one hand and productivity and the level of territorial development measured by the productivity per worker on the other hand. India is a vast and heterogenic country. The tradition of heterodoxy has a clear relevance for democracy and secularism in India, and may have helped Indian philosophy as well as other sciences but it also raises questions such as the recognition of inequalities in order to making easy to pursue regional peace. The features of India's unity vary greatly with the context. For instance, the statistical argument that more than four-fifths of Indian citizens are Hindus in terms of standard classification cannot be used as enough ground for an immediate identification of India as pre-eminently Hindu country. Is historical reasoning behind seeing India as mainly a Hindu country not to consider the role of other religions (Muslim and Buddhism) in the construction of the Indian identity?

Two most meaningful Indian ideologists, Tagore and Gandhi, have different views that were expressed by



Jawaharlal Nehru when learning Tagore's death in 1941 in his prison diary "Gandhi and Tagore two types entirely different from each other and yet both of them typical of India, both in the long line of India's great men..." Tagore had a great admiration for Mahatma Gandhi as a person and as a political leader, but he is also highly sceptical of Gandhi's form of nationalism and his conservative instincts regarding the country's past traditions. Tagore diverges from Gandhi. He, for example, remained unconvinced of the merit of Gandhi's forceful advocacy that everyone should spin at home with the "charka," the primitive spinning wheel. For Gandhi, this practice was an important part of India's self-civilization. "The spinning wheel gradually became the centre of rural uplift in the Gandhian scheme of Indian economics" (Nanda, 1958). Tagore found the alleged economic rationale for this scheme quite unrealistic.

Two main conclusions—first, the results do not allow us to say that there is a strong degree of specialization by industry at state level in India when employment and GDP is taken into consideration and secondly, it is employment in the tertiary sector that contributes more for the productivity. Can India be considered today a modernized country? Is India still an ancestral country attached to hold traditional way of organizing its economy? These are the questions that do not have a clear and precise answer with this piece of research. More detailed data of the sectors, either for employment or for GDP state wise and even better for a smaller territorial unit is decisive to refine the analysis

and will provide better results which will provide a confirmation or not of the present achieved ones. It will be also interesting to have an annual evolution of a longer period in order to observe changes in pattern taking into consideration time factor.

## References

- Akgüngör, S; Falcioğlu. (2005). "European Integration and Regional Specialization Patterns in Turkey's Manufacturing Industry," Discussion Papers Series N°05-01, October 2005, Dokuş EYKÜM University, Faculty of Business, Department of Economics.
- Delgado, A.P, I.M. Godinho. 2005. "Medidas de localização das actividades e de especialização regional," in *Compêndio de Economia Regional 2ª Edição* José Costa Coordenador APDR, Coimbra, pp 713–732.
- Desrochers, P. 2007. "Human Creativity and the Case Against Regional Specialization: Theory, Case Studies and Policy Implication," Working paper of Institute for Policy Studies, Johns Hopkins University.
- Diniz, F., T. Sequeira. 2008. "Uma possível hierarquização através de um índice de desenvolvimento económico e social dos concelhos de Portugal continental", *Interações – Revista Internacional de Desenvolvimento Local*, Vol. 9 (1), Janeiro a Junho de 2008, pp. 19–28.
- Ezcurra, R, C. Gil, P. Pascualy. 2004. "Regional Specialization in the European Union," D.T.2004/04, Department of Economics Universidad Pública de Navarra.
- Gujarati, Damodar. 2000. *Econometria Básica*. Terceira Edição. Pearson Education do Brasil. São Paulo.
- Nanda, B.R. 1958. *Mahatma Gandhi*. Delhi: Oxford University Press.

*Trade increases the wealth and glory of a country, but its real strength and stamina are to be looked for among the cultivators of the land.*

— 1<sup>st</sup> Earl of Chatham, William Pitt



**A. Indian States: Localization Quotient (Lqik) - Employment - 2006**

States	LQ I	LQ II	LQ III	LQ I	LQ II	LQ III	LQ I	LQ II	LQ III
Andhra Pradesh	1.03	0.88	0.97	0.85	1.01	1.02	1.04	0.91	0.97
Assam	0.98	0.45	1.66	0.38	0.52	1.37	1.10	0.40	1.22
Bihar	1.06	0.62	1.10	2.18	0.56	1.10	1.22	0.53	0.84
Chhattisgarh	1.26	0.38	0.37	1.30	0.81	1.07	1.38	0.43	0.51
Delhi	0.12	1.30	5.04	0.00	0.76	1.28	0.02	1.33	3.19
Goa	0.46	2.38	2.21	0.99	0.88	1.07	0.29	1.69	2.21
Gujarat	1.05	0.99	0.77	0.71	1.19	0.93	0.96	1.15	0.97
Haryana	0.89	1.19	1.34	0.90	1.06	0.98	0.88	1.16	1.18
Himachal Pradesh	1.01	1.00	0.97	1.86	0.93	0.92	1.16	0.86	0.72
Jammu & Kashmir	0.85	1.40	1.31	1.03	0.97	1.01	0.89	1.22	1.10
Jharkhand	0.89	1.58	0.92	1.11	0.92	1.03	0.97	1.31	0.83
Karnataka	1.10	0.76	0.78	1.20	1.05	0.94	1.07	0.89	0.91
Kerala	0.58	1.72	2.32	1.90	0.92	0.92	0.61	1.43	1.62
Madhya Pradesh	1.21	0.55	0.41	1.14	0.91	1.03	1.24	0.66	0.69
Maharashtra	1.12	0.66	0.74	0.94	0.98	1.02	0.99	0.91	1.10
Orissa	1.02	1.01	0.90	1.24	0.99	0.98	1.12	0.91	0.77
Punjab	0.85	1.17	1.55	0.85	0.99	1.03	0.77	1.18	1.42
Rajasthan	1.02	1.30	0.62	0.88	1.04	0.99	1.07	1.16	0.71
Tamil Nadu	0.86	1.53	1.15	1.21	1.09	0.92	0.76	1.46	1.22
Uttaranchal	1.06	0.88	0.85	0.85	0.35	1.40	1.11	0.69	0.99
Uttar Pradesh	1.00	0.99	1.01	0.96	1.08	0.96	1.04	0.98	0.91
West Bengal	0.79	1.64	1.39	0.58	1.11	0.99	0.77	1.45	1.22
North-eastern States	0.97	0.68	1.46	2.26	0.44	1.15	1.05	0.58	1.21
Group of Uts.	0.55	2.26	1.92	0.81	0.87	1.10	0.40	1.68	1.96
All India	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Source: "Employment and Unemployment Situation in India 2005-06," National Sample Survey Organisation, Ministry of Statistics and Programme Implementation, Government of India, January 2008 and own calculations.

Note: Primary sector excluding "Mining and Quarrying". Mining and Quarrying is included in the estimates of secondary sector. Number of workers includes all the workers with principal and subsidiary activities



B. Indian States: Localization Quotient (Lqik) – State Gross Domestic Product at facto Karnataka r cost at constant price (Base=99-00) – 2001

2001	Agriculture, F & F	Agriculture	Forestry & L	Fishing	Industry	Mining & Q	Manufacturing	Electricity, G & W S	Construction	Services	Trade, Hotel & Rest.	Trans S. & Comm.	Fin., I, RS & BS	Comm. S & P S
Andhra Pradesh	1.23	1.18	0.99	2.31	0.89	1.55	0.79	0.92	0.92	0.95	0.95	0.95	0.89	1.00
Assam	1.38	1.38	1.27	1.45	0.71	2.98	0.44	0.40	0.82	0.96	0.86	0.78	0.49	1.60
Bihar	1.58	1.59	1.59	1.21	0.42	0.13	0.40	0.47	0.54	1.01	1.06	0.91	0.53	1.46
Chhattisgarh	0.81	0.73	2.12	1.23	1.49	7.69	0.97	2.00	0.61	0.85	0.79	0.85	0.70	1.04
Delhi	0.05	0.06	0.00	0.03	0.76	0.01	0.71	0.44	1.25	1.59	1.51	1.48	2.27	1.08
Goa	0.45	0.38	0.16	2.19	1.65	1.92	2.10	0.64	0.96	0.94	0.87	1.45	0.99	0.70
Gujarat	0.61	0.60	0.35	1.03	1.58	1.39	2.00	1.03	0.87	0.89	0.95	0.99	0.91	0.77
Haryana	1.23	1.31	0.71	0.12	1.10	0.18	1.36	0.49	1.04	0.84	1.05	0.90	0.76	0.67
Himachal Pradesh	1.01	0.95	3.18	0.19	1.44	0.19	0.84	1.85	3.07	0.77	0.65	0.48	0.61	1.20
Jammu & Kashmir	1.22	1.20	2.26	0.64	0.92	0.07	0.30	3.32	1.52	0.93	0.52	0.47	0.80	1.70
Jharkhand	0.71	0.70	1.48	0.23	1.60	7.59	1.21	0.77	1.12	0.84	0.67	1.09	0.52	1.17
Karnataka	1.15	1.16	1.49	0.55	0.95	0.34	0.94	0.95	1.15	0.95	0.82	0.82	1.24	0.87
Kerala	0.89	0.81	1.59	1.91	0.83	0.17	0.65	0.79	1.46	1.14	1.47	1.22	0.97	0.94
Madhya Pradesh	0.96	0.96	1.68	0.23	1.01	1.91	0.87	1.03	1.08	1.01	1.17	0.86	0.85	1.09
Maharashtra	0.62	0.63	0.66	0.33	1.08	0.47	1.31	0.97	0.79	1.14	1.02	1.23	1.54	0.85
Orissa	1.17	1.09	2.57	1.41	0.97	2.81	0.67	1.08	1.09	0.93	0.66	0.99	0.73	1.35
Punjab	1.49	1.60	0.31	0.24	0.91	0.00	1.02	1.16	0.80	0.81	0.89	0.67	0.67	0.92
Rajasthan	1.16	1.19	1.54	0.06	1.09	1.24	0.88	1.50	1.36	0.88	0.99	0.74	0.76	0.95
Tamil Nadu	0.68	0.66	0.41	1.25	1.20	0.26	1.37	1.06	1.12	1.06	1.09	1.19	0.98	1.03
Uttarakhand	1.12	1.14	1.91	0.05	0.88	0.36	0.78	0.67	1.39	1.00	1.23	0.97	0.70	1.07
Uttar Pradesh	1.38	1.45	0.86	0.34	0.89	0.55	0.86	1.39	0.85	0.87	0.90	0.97	0.76	0.89
West Bengal	1.18	1.10	0.74	3.33	0.71	0.73	0.70	0.61	0.80	1.06	1.06	1.00	1.08	1.06
North-eastern States	0.94	0.94	1.17	0.73	0.94	4.62	0.12	1.13	1.72	1.06	0.67	0.81	0.99	1.63
Group of UT's	1.13	1.09	1.99	1.13	0.75	0.31	0.26	1.10	1.89	1.07	0.68	0.76	0.63	2.00

Source: State Analysis Service and own calculations.



C. Indian States: Localization Quotient (Lqik) – State Gross Domestic Product at facto Karnataka r cost at constant price (Base=99-00) – 2006

2001	Agriculture, F & F	Agriculture	Forestry & L	Fishing	Industry	Mining & Q	Manufacturing	Electricity, G & W S	Construction	Services	Trade, Hotel & Rest.	Trans S. & Comm.	Fin., I, RS & BS	Comm. S & P S
Andhra Pradesh	1.24	1.20	0.88	2.42	0.90	1.61	0.78	0.93	0.95	0.96	0.90	1.06	0.87	1.04
Assam	1.34	1.33	1.22	1.55	0.80	2.47	0.66	0.76	0.68	0.97	0.97	0.83	0.44	1.70
Bihar	1.39	1.34	2.08	1.75	0.54	0.06	0.35	0.44	1.04	1.09	1.37	0.78	0.54	1.61
Chhattisgarh	1.09	1.06	1.67	1.30	1.41	7.86	1.02	1.42	0.63	0.75	0.76	0.72	0.54	0.98
Delhi	0.04	0.05	0.00	0.00	0.72	0.00	0.61	0.48	1.18	1.53	1.50	1.32	2.11	1.05
Goa	0.50	0.39	0.18	2.88	1.48	2.13	1.99	0.71	0.60	0.95	0.55	1.87	1.11	0.56
Gujarat	0.85	0.87	0.33	0.80	1.47	1.08	1.96	0.97	0.79	0.81	0.96	0.89	0.79	0.60
Haryana	1.06	1.12	0.64	0.13	1.10	0.20	1.29	0.56	1.12	0.92	1.09	1.05	0.90	0.67
Himachal Pradesh	1.14	1.10	3.14	0.16	1.39	0.18	0.81	2.83	2.32	0.73	0.61	0.43	0.60	1.26
Jammu & Kashmir	1.39	1.39	2.40	0.59	0.90	0.09	0.39	2.40	1.59	0.89	0.54	0.65	0.68	1.72
Jharkhand	0.62	0.60	1.50	0.32	1.69	5.86	1.71	0.50	1.06	0.78	0.72	1.03	0.47	1.04
Karnataka	0.91	0.91	1.34	0.46	1.07	0.52	1.11	0.91	1.18	1.00	0.88	0.91	1.31	0.84
Kerala	0.80	0.74	1.46	1.44	0.87	0.25	0.49	0.75	1.77	1.15	1.36	1.29	0.93	1.05
Madhya Pradesh	1.28	1.31	1.85	0.25	0.93	2.01	0.67	1.37	1.03	0.93	0.98	0.84	0.80	1.08
Maharashtra	0.63	0.65	0.49	0.30	0.97	0.41	1.25	1.03	0.55	1.17	1.10	1.02	1.63	0.81
Orissa	1.20	1.14	2.35	1.38	0.97	3.59	0.81	1.27	0.57	0.93	0.81	1.15	0.62	1.28
Punjab	1.59	1.71	0.31	0.37	0.88	0.01	0.97	1.34	0.78	0.83	0.87	0.84	0.63	1.00
Rajasthan	1.33	1.37	1.93	0.07	1.09	1.26	0.80	1.19	1.56	0.82	0.92	0.78	0.68	0.90
Tamil Nadu	0.61	0.59	0.40	1.23	1.12	0.28	1.33	0.64	1.08	1.09	1.18	1.19	1.01	1.02
Uttarakhand	0.96	0.97	1.81	0.04	1.12	0.78	0.83	1.38	1.66	0.95	1.09	0.98	0.56	1.22
Uttar Pradesh	1.40	1.47	1.04	0.42	0.96	0.60	0.85	1.50	1.07	0.86	0.76	1.02	0.71	1.04
West Bengal	1.21	1.10	1.00	3.37	0.72	0.67	0.65	0.77	0.84	1.07	1.01	1.02	1.12	1.11
North-eastern States	1.01	1.02	1.40	0.58	1.00	4.61	0.31	1.29	1.35	1.00	0.69	0.86	0.80	1.66
Group of UT's	1.23	1.20	1.90	1.17	0.87	0.39	0.23	1.36	2.02	0.98	0.56	0.73	0.59	2.07

Source: State Analysis Service and own calculations.



D. Indian States: Specialization Coefficient (SCik) - Employment -2006

	Sci-E- R	Sci-E -U	Sci -E- R/U
Andhra Pradesh	0.02	0.01	0.03
Assam	0.10	0.21	0.11
Bihar	0.06	0.15	0.13
Chhattisgarh	0.18	0.07	0.22
Delhi	0.62	0.16	0.57
Goa	0.38	0.04	0.41
Gujarat	0.04	0.06	0.03
Haryana	0.08	0.02	0.07
Himachal Pradesh	0.00	0.07	0.09
Jammu & Kashmir	0.10	0.01	0.06
Jharkhand	0.09	0.03	0.06
Karnataka	0.07	0.03	0.04
Kerala	0.30	0.07	0.22
Madhya Pradesh	0.15	0.03	0.14
Maharashtra	0.09	0.01	0.02
Orissa	0.02	0.02	0.07
Punjab	0.10	0.02	0.13
Rajasthan	0.06	0.01	0.07
Tamil Nadu	0.10	0.05	0.14
Uttaranchal	0.04	0.23	0.06
Uttar Pradesh	0.00	0.03	0.03
West Bengal	0.15	0.04	0.14
North-eastern States	0.07	0.19	0.08
Group of Uts.	0.32	0.06	0.35
<b>All India</b>	0.00	0.00	0.00

Source: "Employment and Unemployment Situation in India 2005-06," National Sample Survey Organisation, Ministry of Statistics and Programme Implementation, Government of India, January 2008 and own calculations.

Note: Primary sector excluding "Mining and Quarrying". Mining and Quarrying is included in the estimates of secondary sector. Number of workers includes all the workers with principal and subsidiary activities



Annex E.: Indian States - Specialization Coefficient (SCik) - State Gross Domestic Product at factor cost at constant price (Base=99-00) - 2001 and 2006

State	Sci GDP 2001	Sci GDP 2006
Andhra Pradesh	0.06	0.05
Assam	0.09	0.07
Bihar	0.15	0.13
Chhattisgarh	0.12	0.13
Delhi	0.29	0.27
Goa	0.17	0.13
Gujarat	0.10	0.13
Haryana	0.11	0.04
Himachal Pradesh	0.05	0.14
Jammu & Kashmir	0.05	0.08
Jharkhand	0.15	0.19
Karnataka	0.04	0.02
Kerala	0.07	0.07
Madhya Pradesh	0.01	0.06
Maharashtra	0.09	0.09
Orissa	0.04	0.04
Punjab	0.12	0.12
Rajasthan	0.06	0.09
Tamil Nadu	0.08	0.08
Uttarakhand	0.03	0.03
Uttar Pradesh	0.09	0.08
West Bengal	0.07	0.08
North-eastern States	0.03	0.00
Group of UT's	0.06	0.05

Source: State Analysis Service and own calculations.



# Creation of Non-Performing Assets in the Banking Sector (with special reference to State Bank of India)

Tamma Koti Reddy and Siddhartha Arora

---

*Non-Performing Assets (NPAs) have become a critical performance area for banks of all hues. Even private and foreign banks have been showing signs of NPA deterioration gradually. While gross NPAs as a percentage of gross advances for public sector banks have come down from 22.3% in 1993 to 2.23% in 2007–08; the absolute figure is still growing. There are several factors for this rise. The internal factors are diversion of funds, time/cost overruns business failure, inefficient management, product obsolescence. External factors include recession, natural calamities, change in government policies. Perhaps willful default is the biggest culprit of all. Initiatives like better credit appraisal and supervision, exchange of credit information among banks and close monitoring could yield better results. RBI has also brought about a large number of measures for fast recovery of dues. The study is an attempt to analyze factors which could have led to creation of NPAs in the account of a Private Limited Company 'X' maintained at State Bank of India, Kolkata. It indicates that this was a trading account marked by a high degree of uncertainty in revenues. Other factors that emerged are overzealousness of promoters, non-implementation of project, diversion of funds to associate concerns, etc., which led to the accounts becoming non-performing. The article also analyses factors which have contributed significantly to decreasing NPAs of Public Sector Banks in India during 2001–2008 using forward stepwise regression analysis and concludes that decreasing level of NPAs of Small Scale Industries have contributed the fall.*

*Tamma Koti Reddy works in the faculty of Economics, ICFAI Business School, Hyderabad, India and Siddhartha Arora is an M.B.A. 2nd Year from ICFAI Business School, Hyderabad, India.*

## Introduction

A banking sector performs three essential functions in an economy—operation of the payment system, mobilization of savings, and allocation of savings to the investment projects. By allocating capital to the highest value use while limiting the risks and the costs involved, the banking sector can exert a positive influence on the overall economy and thus is of broad macroeconomic consequence (Jaffee and Levonian, 2001; Rajan and Zingales, 1998; Roland, 2006). Commercial banking has been one of the oldest businesses in India and the earliest reference of commercial banking in India can be traced in the writings of Manu. Modern banking in India can be dated as far back as in 1786 with the establishment of General Bank of India (Kalita, 2008). In the early 19<sup>th</sup> three presidency banks were established in Bengal, Bombay, and Madras and in 1921, they were merged to form the Imperial Bank of India. In 1935, the Reserve Bank of India (RBI) was established under the Reserve Bank of India Act as the central bank of India (Chakrabarti, 2005). The Imperial Bank of India was converted into State Bank of India (SBI) under the State Bank of India Act, 1955.

In spite of all these developments, independent India inherited a rather weak banking and financial system marked by a multitude of small and unstable private banks whose failures frequently robbed their middle-class depositors of their life's savings. After independence, in 1949, RBI was nationalized and given wide powers in the area of bank supervision through the Banking Companies Act (later renamed Banking Regulations Act). The nationalization of the Imperial Bank through the formation of SBI and the subsequent acquisition of the state owned banks in eight princely states by SBI in 1959 made the government a dominant player in the banking industry. In keeping with the increasingly socialistic leanings of the Indian government, 14 major private banks, each with deposits exceeding Rs 50 crore, were nationalized in 1969. This raised the proportion of scheduled bank branches in government control from 31% to about 84% (Kalita, 2008)



---

In 1980, six more private banks, each with deposits exceeding Rs 200 crore, were privatized further raising the proportion of government controlled bank branches to about 90% (Chakrabarti, 2005).

While there are those who have emphasized the political importance of public control over banking, most arguments for nationalizing banks are based on the premise that profit maximizing lenders do not necessarily deliver credit where the social returns are the highest. The Indian Government when nationalizing all the larger Indian banks in 1969 argued that banking was "inspired by a larger social purpose" and must "subserve national priorities and objectives such as rapid growth in agriculture, small industry and exports" (Banerjee et al, 2004, Das et al., 2005).

There are essentially two views that justify government's ownership of financial markets. The optimistic or "developmental" view of Alexander Gerschenkron who emphasized on the necessity of financial development for economic growth (Dobson 2006; La Porta et al., 2002). Gerschenkron argued that privately owned commercial banks had been crucial for channelizing savings into industry in the second half of the 19<sup>th</sup> century in industrialized nations such as Germany. However, in some countries, most conspicuously Russia, economic institutions were not sufficiently developed for private banks to play this crucial development role. According to Gerschenkron, "...no bank could have successfully engaged in long term credit policies in an economy where fraudulent banking practices had almost elevated to the rank of a general business practice..." (La Porta et al., 2002).

Gerschenkron view was part of a broader sentiment in development economics which advocated government ownership of banks in strategic economic sectors. In the words of Lenin, "...without big banks, socialism would be impossible. The 'big banks' are the state apparatus which we need to bring about socialism and which we take ready made from capitalism..." (La Porta et al., 2002). These ideas were widely adopted throughout the world including India as governments in 1960s and 1970s nationalized the existing commercial banks and established new ones across Africa, Asia, and Latin America (La Porta et al., 2002).

The alternative "political" view of the government participation in finance shares with the development view; the desire of politicians to control investment by firms, but emphasizes political rather than social objectives (La Porta

et al., 2002). In this view, governments acquire control of enterprises and banks in order to provide employment, subsidies and other benefits to supporters, who return the favor in the form of votes and political contributions. The attraction of such political control of banks is greatest in economies with underdeveloped financial systems and poorly protected property rights, because the government does not have to compete with the private sector. The view of state ownership is buttressed by considerable evidence documenting the inefficiency of government enterprises, the political motives behind the provision of services and the benefits of privatization (La Porta et al, 2002).

Prakash Tandon, a former chairman of the Punjab National Bank (nationalized in 1969) describes the rationale for nationalization as follows:

Many bank failures and crises over two centuries, and the damage they did under 'laissez faire' conditions; the needs of planned growth and equitable distribution of credit, which in privately owned banks was concentrated mainly on the controlling industrial houses and influential borrowers; the needs of growing small scale industry and farming regarding finance, equipment and inputs; from all these there emerged an inexorable demand for banking legislation, some government control and a central banking authority, adding up, in the final analysis, to social control and nationalization. (Banerjee et al, 2004).

Bank nationalization thus served to intensify the social objective of ensuring that financial intermediaries fully met the credit demands for productive purposes. The two significant aspects of nationalization were rapid branch expansion and channeling of credit according to Plan priorities (Mohan, 2002).

As in other areas of economic policy-making, the emphasis on government control began to weaken and even reverse in the mid-80s and liberalization set in firmly in the early 1990s. The poor performance of the public sector banks, which accounted for about 90% of all commercial banking, was rapidly becoming an area of concern. The continuous escalation in Non-Performing Assets (NPAs henceforth) in the portfolio of banks posed a significant threat to the very stability of the financial system. They were the "smoking gun threatening the very stability of the Indian Banks" (Bidani, 2002). The lack of recognition of the importance of transparency, accountability, and prudential norms in the operations of the banking system led also to a rising burden of non-performing assets (Ghosh and Prasad, 2007).



Banking reforms, therefore, became an integral part of the liberalization agenda which provided the necessary platform for the banking sector to operate on the basis of operational flexibility and functional autonomy enhancing productivity, efficiency, and profitability (Kalita, 2008). For good reason, India chose a “gradualistic” approach to the reform over a “big-bang” approach (Bhide et al., 2002). As pointed out by Bhide et.al. (2002), such gradualism was due to the fact that reforms were not introduced in face of a prolonged economic crisis, and most importantly, gradualism was a result of India’s democracy and highly pluralistic polity in which reforms could be undertaken only if based on popular consensus. While expansion of credit was desirable to help the economy grow, equally important was the need to stop the growth of NPAs which were ailing the Indian banking sector.

NPAs or Non Performing Loans (NPLs) have become a critical factor for the performance of a bank. Campbell (2007) has identified NPLs as an important cause of bank insolvency. The problem of NPAs is ravaging even in economies such as China, although the level of NPAs in China is considered to be much higher as compared to that of India (Muniyappan, 2002). An asset is considered as “non-performing” if the interest or installments of principal due remain unpaid for a period of more than 90 days. Any NPA would migrate from the sub-standard to doubtful category after 12 months (standard 12 months is also under international norms). The asset can remain in the doubtful category for three years and further, it will be classified as a loss asset if it is irrecoverable or only marginally collectible (Muniyappan, 2002). Accordingly, the banks have to make full provision for loss assets, 100% of the unsecured portion of the doubtful asset plus 20 to 50% of the secured portion (depending upon the period for which the asset is doubtful), and a general 10% (20% under international norms) of the outstanding balance in case of sub-standard assets (Muniyappan, 2002).

A sound and efficient banking system is a sine qua non for maintaining financial stability. Therefore, considerable emphasis has been placed on strengthening the capital requirements in recent years. According to the RBI report, the capital to risk-weighted assets ratio (CRAR) of Scheduled Commercial Banks (SCBs), a measure of the capacity of the banking system to absorb unexpected losses, improved further to 13% at end-March 2008 from 12.3% at end-March 2007. Asset quality of SCBs also improved consistently in the past few years as reflected in the decline in NPAs as percentage of total advances. During 2007–08, while overall gross NPAs of SCBs declined

to 2.3% of gross advances from 2.5% in the previous year, net NPAs as %age of net advances remained at the previous year’s level of 1%. Thus, in terms of the two crucial soundness indicators, viz., capital and asset quality, the Indian banking sector showed further improvement during 2007–08. The SCBs have been showing a consistent decreasing trend in both Gross NPAs/Gross Advances as well as Net NPAs/ Net Advances since 1999–2000 to 2007–08 as shown in Chart 1. In absolute terms the Gross NPAs of SCBs showed an increase of Rs 6,435 crore to reach a total of Rs 56,435 crore at the end of March 2008. This was the first time since 2001–02 that Gross NPAs increased in absolute terms. However, as pointed out in Trend and Progress of Banking in India Report, 2007–08, there was rapid growth in credit during the past few years and therefore some slippages could be expected.

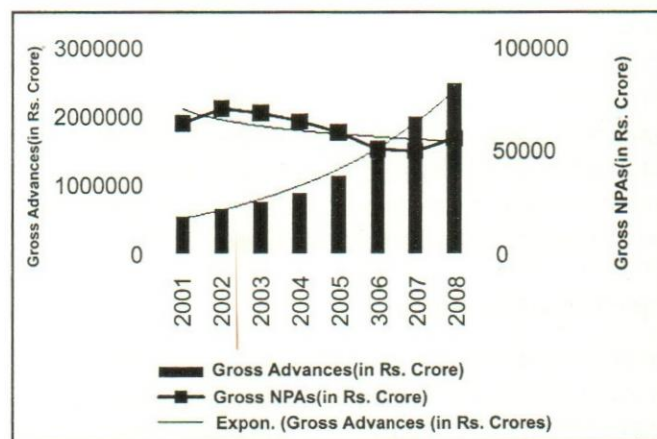


Chart 1.2: Movement of Gross Advances and Gross NPAs of Scheduled Commercial Banks since 2000-2001

If the State Bank Group is taken into consideration which comprises of eight banks it is seen that for the FY 2007–08, the greatest share of Net NPAs as a percentage of Net Advances was for the State Bank of India (1.78%) whereas the least is for the State Bank of Hyderabad (0.16). The Gross NPAs/Gross Advances ratio for State Bank of India for the same year was 3.04 whereas it was 0.87 for the State Bank of Hyderabad which was the least among the State Bank Group.

It may be noted that the increase in gross NPAs was more noticeable in respect of new private sector and foreign banks, which have been more active in the real estate and housing loans segments. Gross NPAs (in absolute terms) of nationalized banks and old private sector banks continued to decline during the year. It is clearly seen in that when we consider all the Scheduled Commercial Banks (SCBs) in India, which include public, private as well as foreign banks, the ratio of Gross NPAs/Gross Advances as well as Net NPAs/Net Advances has



steadily come down since 1999–2000. If the trend of movement of Gross Advances and Gross NPAs (both in Rs crore) over the years is observed, it is seen that whereas Gross Advances have significantly risen, Gross NPAs have steadily come down from their high values in 2001-02 except during the year 2007–08 when the Gross NPAs figure rose. The Gross NPAs figure was Rs 70,861 crore in 2001–02 which came down to Rs 50,299 crore in 2006–07 but again rose to Rs 56,435 crore in 2007–08 thereby showing a decrease of 20.4% since 2001–02.

The paper henceforth is planned as follows. Section II focuses on the primary and secondary objectives of this project along the methodology which shall be employed to achieve the objectives mentioned. Section III presents some background information on the reasons which commonly lead to NPAs as illustrated in the works of past researchers. Section IV focuses on the reasons for development of NPA in the account of Company 'X' at State Bank of India, Mid Corporate Group, Kolkata. A regression analyses is also performed to empirically assess the contribution of some of the factors which have led to decreasing NPAs of Public Sector Banks in recent years. Section V concludes with the bibliography of the literature reviewed.

### Objectives of the Study

The primary objective of this paper is to identify and study the various factors which have possibly led to the creation of Non-Performing Assets (NPAs) in the account of a Private Limited company at State Bank of India, Mid-Corporate Division, Kolkata.

The secondary objectives are

- To understand the concept of NPAs;
- To gauge the current scenario of NPAs in the Indian Banking Sector with respect to Public, Private and Foreign Banks including sector-wise and Bank-wise distribution of NPAs;
- To empirically investigate the factors which relate to NPAs of public sector banks using forward stepwise Regression method and Perception study;
- To understand the various provisions of the RBI to deal specifically with NPAs.

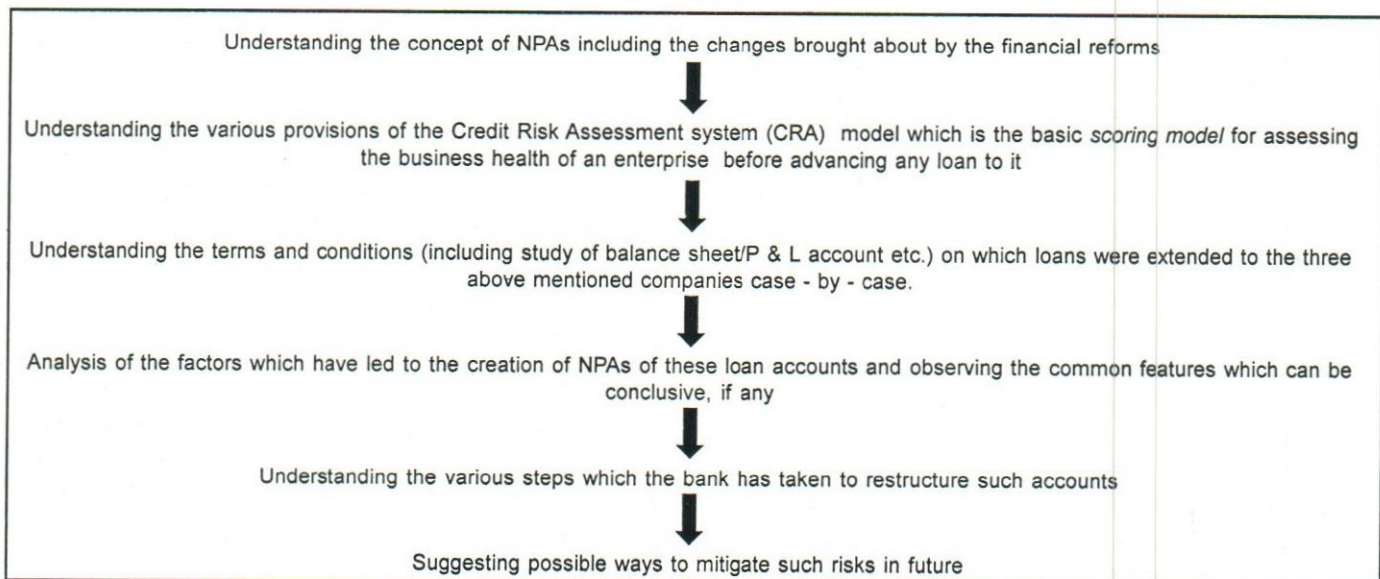
### Methodology

The methodology is essentially the way in which the prospected task at hand shall be completed. Secondary data available from various sources (journals, books, and web resources) including the respective company's case files maintained at State Bank of India, Kolkata are used for accomplishing the objectives. Thus, a case study based approach has been used. An empirical investigation using Forward Stepwise Regression Analysis is used to determine those factors which have most significantly contributed to the decreasing Gross NPA ratios of Public Sector Banks in India. SBI officials have also been interviewed to know their perceptions on the factors which can commonly lead to NPAs.

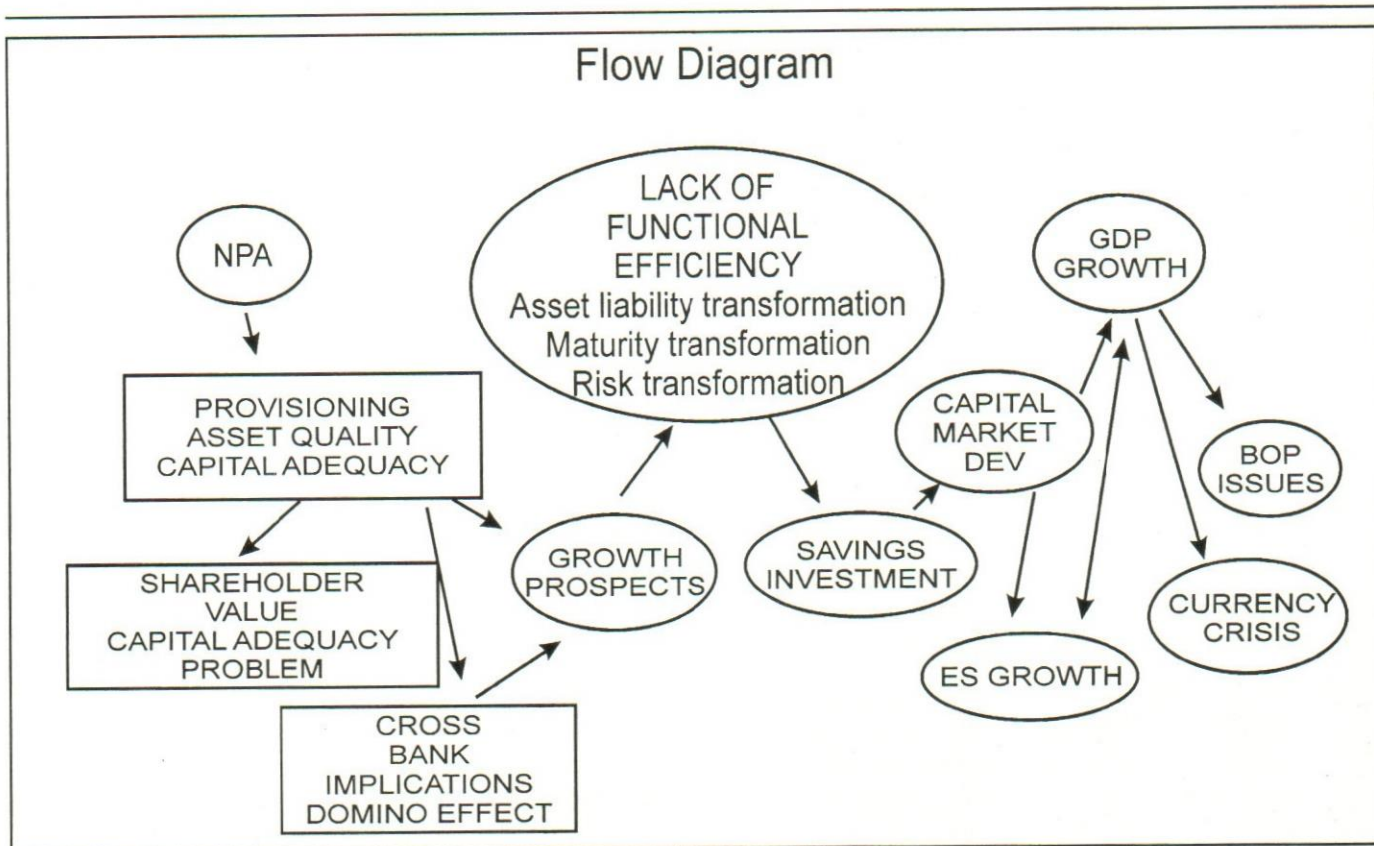
The project methodology essentially should tackle two basic questions namely:

1. How shall the data be collected?
2. How will the data be analyzed?

In this regard, the following steps have been performed:







Source: (Chaudhuri, 2005: 3)

### Hypothesis

The present study is an attempt to analyze factors which have led to decrease in NPAs in Public Sector Banks in India. Several factors are implicated which have led to decrease in NPAs in Public Sector Banks. Preliminary analysis reveals that GDP growth rate, Credit Deposit ratio and decrease in SSI NPAs could have led to decline in NPA levels. It is seen that the largest decline is seen in case of SSI NPAs which leads to the hypothesis that SSI NPAs have paid a critical role in reduction of NPAs in India. This hypothesis is tested via Stepwise forward regression analysis.

### Review of Literature

Although NPAs are a balance sheet issue of individual banks and financial institutions, it has wider macroeconomic implications and the literature, while discussing financial sector reforms, has gone into a discussion on NPAs also. The reasons can be observed from Figure 2. According to Dutta Chaudhuri (2005),

presence of NPAs indicates asset quality of the balance sheet and hence future income generating prospects. This also requires provisioning which has implications with respect to capital adequacy. Declining capital adequacy adversely affects shareholder value and restricts the ability of the bank/institution to access the capital market for additional equity to enhance capital adequacy. If this happens for a large number of financial intermediaries, then, given that there are large interbank transactions, there could be a domino kind of effect. Low capital adequacy will also severely affect the growth prospects of banks and institutions.

The various reasons, either singly or jointly, behind an asset turning NPA can be from the economy side, from the industry side, from the borrower's side, from the banking system side, from the loan structuring side, from the security side, and from the regulatory side. The article argues that the strategy for recovery is dependent on the reason (Chaudhuri, 2005).



---

According to RBI, a company or an institution is said to make a wilful default if it has defaulted in meeting its payment or repayment obligations to the lender even when it has the capacity to honor the obligations. This is clearly shown in the broad based definition of wilful defaulters as given by RBI (CIBIL website).

A wilful default would be deemed to have occurred if any of the following events is noted:

- a) The unit has defaulted in meeting its payment/repayment obligations to the lender even when it has the capacity to honour the said obligations.
- b) The unit has defaulted in meeting its payment/repayment obligations to the lender and has not utilised the finance from the lender for the specific purposes for which finance was availed of but has diverted the funds for other purposes.
- c) The unit has defaulted in meeting its payment/repayment obligations to the lender and has siphoned off the funds so that the funds have not been utilised for the specific purpose for which finance was availed of, nor are the funds available with the unit in the form of other assets.

According to Muniyappan (2002), incidence of NPAs on account of deficiencies on part of banks such as delays in sanction and disbursement of funds whereby the borrowing units are starved of the funds when in need and delay in settlement of payment and subsidies by the Government bodies also contributes albeit on the lower side to the creation of NPAs.

Muniyappan argues that the lack of effective coordination between banks and borrowers in respect of large value projects does contribute to the emergence of NPAs even at the implementation stage of the project. In this respect, the author points out that RBI in February 2000 had elaborated on certain ground rules in consultation with banks/FIs for implementation.

Muniyappan feels that slackness on the part of credit management staff in their follow up to detect and prevent diversion of funds in the post disbursement stage is one of the prominent reasons for creation of NPAs. Borrowers, he feels, should, in the interest of the viability of the banking system on which they are dependent, resist the temptation to divert bank funds for uses other than that they are sanctioned for. Banks at the same time should be vigilant to detect and prevent diversion of funds as any failure in

this front can lead to creation of NPAs.

According to Israte et al. (2007) there can be situational as well as systemic causes for creation of Non Performing Loans (NPLs). As pointed out by Biswas, systemic risk arises on account of the uncertainties which are prevalent in the market itself. This type of risk is also called market risk (Pandey, 2008). On the other hand, unsystematic risk arises from the unique uncertainties of a particular business (Pandey, 2008).

The Professional Banker's Team in the article "NPA: Ground Reality" has identified micro as well as macro level management aspects in the creation of NPAs. The authors state that the "unimaginative attitude" of the bankers goes a long way in creating NPAs. The authors cite an example by stating that a particular cash credit account may run into arrears and in such situations, instead of examining the reasons behind the same at that point of time, the management stops any further debit from such accounts till the account is regularized. The borrower in such cases has no option but to open a current account with another bank to facilitate smooth operations. This gives rise to a paradoxical situation as the lending bank unsuccessfully tries to recover its dues but the second bank enjoys the credit balances. In many instances, the authors argue, managers follow a "ditch-it" attitude whereby if they perceive some early warning signals in an account, they simply let it go for fear of giving explanations to higher authorities and commissions at that point of time.

Some other alternative hypotheses explaining NPAs of the Indian PSBs are (Biswas and Deb (2004), Muniyappan (2002); Rajeev (2008), Das (2002))

1. High incidence of NPAs is a result of slowdown of the economy, particularly industrial recession;
2. Stagnation in specific industries with large share of loans contributed to NPAs;
3. The high share of lending to the priority sector, consisting of primarily agriculture and SSI, contributed to NPAs in a big way.

## **An Empirical investigation into the causes of Non-Performing Assets (NPAs)**

### **Introduction**

Since 1991, the Indian Commercial banks have undergone a reform process aimed at putting the Indian Banking Sector at par with the international standards.



Performance in terms of profitability has become the benchmark for the banking industry like any other enterprise. In particular, due to the social motto of the Government, the problem of NPAs was not considered seriously after the post nationalization period. However, the drive for financial liberalization introduced various prudential norms relating to asset classification, income recognition, provisioning for bad loans and assigning risks to the various assets of the bank. As the quality of credit is also important, RBI since the period of financial liberalization has been taking proactive steps to maintain good quality of assets in the Indian Banking sector and to minimize the loss due to NPAs.

It is important to recognize the factors which lead to the creation of NPAs. This is because proactive steps for future prevention of a loan turning bad can only be taken place if it is known well in advance the reasons why a loan can turn bad. These reasons can be either company specific, industry-specific or economy-specific reasons. Thus, it is prudent to empirically investigate those factors which can lead to an increase or decrease in the Non-Performing loans of banks.

### Methodology

In this empirical study, "Forward Stepwise Regression Technique" has been used to find out those factors which have contributed most to the decreasing trend of Gross NPAs/ Gross Advances ratio of Public Sector Banks. The data for the past eight years has been gathered from various issues of the Report of Trend and Progress of Banking in India published by RBI. The data is tabulated (Table 1).

Gross NPAs/Gross Advances of Public Sector Banks is taken as the dependent variable and Credit-Deposit Ratio, GDP growth rate, Small Scale Industry (SSI) NPA, Agricultural NPA and Non-priority sector NPA are taken as dependent variables. Credit-Deposit ratio as explained earlier is taken as a marker for the credit-friendliness of banks, with a higher ratio signifying that the bank has mobilized much of its deposits for extending as credit. This shows that the bank is willing to extend credit for economic expansion and it is seen that banks with higher C-D ratio are perceived to be borrower friendly. Thus, there is little likelihood of defaults for such banks as the prospective borrower would again approach such banks for credit. The GDP growth rate variable is used to capture the economic growth over the past few years. Two important components of non-priority sector include agriculture and SSI. Public sector banks have huge exposures to these sectors and therefore the NPAs arising from these sectors are taken into consideration. Finally, non-priority sector NPA is also taken as the fifth independent variable.

The main objective of regression analysis is to explain the variation in one variable (called the dependent variable) based on the variation in one or more variable (called the independent variable) (Nargundkar, 2008: 243). A multiple regression model is used when there are several independent variables and one dependent variable. A forward stepwise regression is basically a hit and trial approach where data is collected on a large number of independent variables and then we try to fit the model with a stepwise regression model entering one variable into the regression model at a time (Nargundkar, 2008: 243; Schmidt and Hollensen, 2007). This approach is generally

Table 1: Trend and Progress of Banking in India

Years	Gross NPA/Gross Advance (%)	Credit-Deposit Ratio	GDP growth rate (%)	SSI NPA (Rs Cr.)	Agricultural NPA (Rs Cr.)	Non Priority Sector NPA (Rs Cr.)
2000-01	12.39	48.5	3.9	10339.41	7376.65	17257
2001-02	11.1	50.6	5.6	10583.95	7821.54	18777
2002-03	9.36	51.4	4.3	10161.53	7707.35	18402
2003-04	7.79	51.5	8.2	8837.92	7240	17895
2004-05	5.53	57	6.9	7834.96	7254.05	15626
2005-06	3.7	68.2	9	6917.4	6202.92	12845
2006-07	2.66	72.2	9.4	5843.28	6506.34	9965
2007-08	2.23	73.3	9.3	5804.75	8268.03	7941



**Table 2: Model Summary of Regression Analysis**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.9785	0.9574632	0.95037371	0.868936048
A	Predictors: (Constant), SSI NPA			
B	Dependent Variable: Gross NPA/Gross Advance			

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	101.9727	1	101.9727009	135.0543	2.445E-05
	Residual	4.5302991	6	0.755049855		
	Total	106.503	7			

**Coefficients**

**Variables Entered/Removed**

Model	Variables Entered	Variables Removed	Method
1	SSI NPA		Forward (Criterion: Probability-of-F-to-enter <= .050)

Notes: a Dependent Variable: Gross NPA/Gross Advance

**Table 3: Excluded Variables in Regression analysis**

	Beta In	T	Sig.	Partial Correlation	Collinearity Statistics		
					Tolerance	VIF	Min. Tolerance
Credit Deposit Ratio	-0.03215	-0.10058	0.923792	-0.04494	0.08308	12.03701	0.08308
GDP	-0.11324	-0.5339	0.616284	-0.23224	0.17890	5.58971	0.17890
Agricultural NPA	-0.00479	-0.04901	0.962811	-0.02191	0.88832	1.12572	0.88832
Non Priority Sector NPA	-0.3008	-1.30332	0.249252	-0.50357	0.11921	8.38847	0.11921

Predictors in the Model: (Constant), SSI NPA

Dependent Variable: Gross NPA/Gross Advance

used in exploratory research where the main objective is to fight out one or more most significant variables which can explain most of the variance in the dependent variable.

**Results**

The data was run in SPSS 13 software by using the technique of stepwise forward regression. The output results are shown in Table 2 and Table 3.

**Interpretation**

The forward stepwise regression model uses six independent variables as input but only one variable i.e.

SSI NPA is found to be significant to be considered in the final regression equation. The final regression equation can be written as

$$Y = a + b_x$$

Or,

$$Y = -9.1138 + 0.0019x$$

where

Y= dependent variable, i.e., Gross NPA/Gross Advances

a = constant, i.e., -9.1138

b = coefficient of x, i.e., 0.0019

x= SSI NPA



The product moment correlation or  $r$  (also called beta) is used to measure the strength of the linear relationship between  $X$  and  $Y$ . SSI NPA has a good amount of correlation with Gross NPA/Gross Advances as reflected in the value of  $r = 0.9785$ . The model has a  $R^2$  value of 0.9574 which shows that nearly 96% of the variation in the dependent variable can be explained by the independent variable. The results of Analysis of Variance in Table 3 show that the Regression sum of squares has a very high value as compared to the residual sum of squares. This is significant as the regression sum of squares tells us about the explained portion of the variance and the residual sum of squares tells us about the unexplained portion of the variance. A model with a large regression sum of squares in comparison to the residual sum of squares indicates that the model accounts for most of variation in the dependent variable.

The  $F$  statistic is the ratio of regression sum of square to residual sum of square. As the significance value of the  $F$  statistic is small, it denotes that the  $F$  statistic is significant and the independent variables do a good job explaining the variation in the dependent variable.

The  $t$ -test is used to test the null hypothesis that there is no linear correlation between the two variables. The low significance results denote that the coefficients are significant and the null hypothesis can be rejected.

The table depicts the excluded variables. The excluded variables show a high degree of collinearity as indicated by high values of Variance Inflation Factor (VIF) which is the reciprocal of tolerance.

Thus, the forward stepwise regression model establishes declining trend in SSI NPAs over the past few years as one of the variables which can influence the Gross NPA/Gross Advances. Although the product moment correlation values do not signify causation, yet they indicate to the fact that if Public Sector Banks can manage to keep their SSI NPA levels low, it can have possible significance on Gross NPAs.

### Perception Study

A perception study is designed to measure, compare, and assess the perceptions of the participant toward a particular object. A perception study was conducted with the help of a questionnaire at SBI, Mid Corporate Group, Kolkata. The aim of this survey was to find out the most common factors which, according to the perceptions of the participants, commonly lead to NPAs. The participants

included Credit analysts of the Credit Processing Cell (CPC), officials of the Credit Monitoring Department (CMD) and Relationship Managers. The total number of participants who participated in the study were 30.

The questionnaire listed down 23 factors which lead to NPAs and which were diverse in nature. The factors included company-specific, industry-specific as well as economy-specific factors. The factors were taken from the relevant literature that was reviewed, as mentioned earlier. The questionnaire was designed on a Balanced Likert Scale of -2 to 2 with the extreme negative values signifying *strongly disagree* to the extreme positive value signifying *strongly agree*. A Likert Scale was the scale of choice as it is commonly used in surveys to indicate a respondents' degree of agreement or disagreement with a series of statements about a stimulus object (Schmidt and Hollensen, 2007).

Results: The participants' response to each of the 23 items was calculated as follows. Suppose, out of 30 participants, 17 give a score of 2 to item no.1, 8 give a score of 1 and 5 give a score of 0; so the net score for that particular item is calculated as:

$$17*2+8*1+5*0/30 = 1.23$$

In this manner, the weighted score for each of the 30 items was calculated. The top 5 factors, according to the perception of the officials at SBI, which most commonly lead to creation of NPAs at SBI are as follows:

- Diversion of funds to associate concerns/ expansion/new projects, etc., other than those which are stated objectives for utilization of funds
- Lack of efficient post-sanction monitoring
- Recession in the economy
- Business (either product or marketing) failure
- Inefficient management of the company

The results clearly show that diversion of funds by the borrower remains to be a major problem which the banks need to tackle effectively in the near future. Amount of loan should be consistent with the purpose for which the money is requested. Initially, any excess sanctioning viz-a-viz the required capital for establishing a project is likely to result in diversification of funds while the cash flows from the investment are not sufficient to service the debt obligations. Effective post-sanction monitoring of disbursed funds is also important by way of regular stock



---

audits, manual inspection of company's sales showrooms, examining the monthly cash flows, etc. The global meltdown has had its effect on the Indian economy also and, therefore, banks are increasingly facing requests by borrowers to restructure their loans. The global financial crisis also highlighted the fact that bank failures could lead to huge financial costs because of the need to deal with inherited bad debt (Pat, 2009). Restructuring of loans is believed to give some time for the client to tide over the unfavorable situation and fulfill his debt obligations with a time lag. This slowdown has severely affected several industries such as retail, trading sector, iron and steel, etc. As the Mid-Corporate group had a fairly decent exposure with respect to trading and iron and steel sector, it faced the problem of bad loans in some accounts on account of slowdown in the Indian economy. Finally, the officers perceive management set up as well the product mix of the company to be an important factor which could lead to the success and future growth of an organization. If the management lacks vision and clarity along with proper managerial acumen to handle the day to day affairs of the company, then inevitably the company cannot live up to the expectations. The product which the company is dealing should have a ready market for consumption by prospective consumers. If the products are of seasonal nature or the company has a product mix which is seasonally dependent or if there are too many competitors targeting the same set of consumers (which is often the case with trading concerns that are small players), then the company shall face problems to service its debt obligations at a time when sales are low. The dwindling performance of the company ultimately has its repercussions not only upon the future growth prospects of the company but also results in turning the loan accounts bad. This finally proves to be a burden on the balance sheet of the lending banks.

According to Amit Kr. Mukhopadhyay, Chief Manager and Team Leader of CPC, the Credit Rating Assessment (CRA) system of SBI is one of the best in the banking industry. The method developed takes into account a large number of suitable factors reflecting the credit worthiness of the borrower, the general state of the economy and the industry, etc., for analysis before sanctioning of the loan amount. However, he expresses his concern over the post-sanction monitoring part which he feels, should have a more robust organizational structure. There should be a strong information network to detect the early warning signals so that concrete measures can be taken before the loan turns bad in the books of the Bank. He also

expresses his concern over the fact that Public Sector Banks are often assumed to be lax in their approach to recovery of overdues which is often taken in the form of an undue advantage by unscrupulous borrowers. Amit cites another reason for NPAs—at times explicit government policies in terms of directed lending makes credit officers complacent in their analysis of a credit proposition. This lull in proper credit analysis especially of projects emanating from weaker sections of the society often make lending decisions redundant as banks perceive such loans to be compulsorily sanctioned category. This is seen more in case of non-urban branches. This naturally leads to high proportion of NPAs and corresponding low level of asset quality.

Almost all the officials at SBI perceived the credit appraisal process at SBI to be extremely robust and therefore none perceived that there were any such lacunae in the pre-sanction process.

Ajay Kumar, Credit Analyst, feels that the type of industry and the integrity of the promoters are some of the important factors which decide the future health status of a loan account. He cites the example of iron and steel industry which is dominated by fluctuation in prices from time to time due to changes in government policies and market forces. Such industries, in case of unfavourable economic situations are more likely to turn into NPAs. Moreover, he feels that if the promoters are of dubious nature whose aim is to achieve short term gains on the expense of the banks, then inevitably such cases lead to high defaults. However, he expresses his confidence in the recent measures taken by the RBI to tackle such wilful defaulters which according to him, will act as a deterrent for such individuals.

According to Chirag Jain, Credit Analyst, name or relationship driven lending can also add a potential NPA to the system as it is not uncommon among banks to be overawed by big names behind the loans proposals being considered for sanctioning. This can result in loan sanction approvals typically made without proper financial appraisal. Poor financial analysis obviously lacks the checks and balances that a systemic credit analysis process imposes and is therefore subject to abuse.

Mr Jain elaborates further by stating that sometimes it is seen that banks in an effort to convert every proposed idea into business reality are found to rely too much on collateral securities. Their anxiety to safe lending makes them vulnerable to being lured by collateral securities offered by a client. This over-reliance on collateral to



sanction a loan simply weans away the credit officers' attention from the projected cash flows that are essentially supposed to repay the loan and its critical analysis. It is also possible that the collaterals are being overvalued and during an economic crisis such an overvalued asset may be a fraction of its estimated price. Even if the value of the collateral is appropriate it may not be always possible to enforce the right to dispose off the charged securities and appropriate the sale proceeds towards the outstanding loans. The kind of legal system that is operating today makes the process of enforcing securities so time consuming and expensive that the realized amount may make a "mockery of the time value of money." Over and above all this reliance on a collateral, solely on the purpose of justifying the sanction of a loan which is incidentally not uncommon among the banks, does no good to the bank it would mean that the underlying project is not self liquidating. Thus a potential NPA can be added to the system.

## **Case of Company "X"**

### **Case History**

"X" was banking with SBI since October 16, 2006. As per Basel 2 compliant Credit Risk Assessment (CRA) model, it was given a CRA rating of SB7. The total indebtedness of the company included a Fund Based limit of Rs 25 crore and a Non-fund Based limit of Rs 10 crore. Out of the total Fund Based limit of Rs 25 crore, Company X was given a term loan of Rs 10 crore and Fund Based Working Capital (FBWC) limit of Rs 15 crore. A Non-Fund Based Working Capital (NFBWC) of Rs 10 crore was also granted. Thus, the total indebtedness of the company was Rs 35 crore.

The CEO of the Company X had an experience of more than 6 years in trading gift and fashion items. His wife was actively involved in the finance, administration, and marketing aspects of the unit.

Initially the Company was given CRA rating of SB2 (based on Audited Balance sheet of 2005–06) and the new Basel 2 CRA rating of SB7 was subsequently given (based on ABS of March 31, 2007).

The company was a specialty retailer of lifestyle gift items' fashion accessories, etc.

The company had requested for a sanction of FBWC limit of Rs 15 crore and NFBWC limit (Letter of Credit) of Rs 10 crore for its operations in existing as well as

proposed outlets. The LC limit would be utilized mainly for import of goods from China, Korea, Thailand, and Taiwan for its existing as well as proposed outlets.

The status of the retail outlets of the company were as follows at the time of loan sanction: 5 units in West Bengal and one each in UP (Ghaziabad), Karnataka, Maharashtra, Patna, and Ranchi.

With a view to establish the brand in the retail segment, the promoters of X had decided to expand its existing retail trade business by setting up a number of quality retail outlets in various metro and non-metro business centers. At the time of sanctioning of the proposal the company was planning to set up eight retail outlets (four big and four small outlets). The proposed outlets were to be set up at Vashi, Gurgaon, Bangalore, Chennai, Aurangabad, Delhi, and Durgapur. The total cost of the project was estimated to be Rs 20 crore which was proposed to be financed by way of promoter's contribution of Rs 10 crore and term loan of Rs 10 crore. The Professional Management Consultant, the Bank's empanelled consultant found that the Rs 10 crore limit for the term loan was justified in setting up this expansion project. This was done by computing the costs which had to be incurred for carrying out the expansion work. For the period upto September 30, 2007, Company X had paid security deposits for opening its outlets at Aurangabad (Provogue mall), Baroda (BLB mall), Navratan (Ahmadabad), Ansal (Noida), Ansal (Panipat), Ansal (Meerut) and AMPA housing (Chennai), and Cinemax (Nagpur). At the same time, it had nearly completed the work on its stores in Mumbai (4), and one each at Raipur, Kanpur, and Kolkata. By November 30, 2007, the company had started its plans of expanding into two more stores at Paras Downtown Square Zirkipur (NCR) and DLF Infocity (Chandigarh) taking its number of new malls to 18. A report showed that as on December 2008, the company was simultaneously working on opening of 18 showrooms throughout the country.

### **Loan: Terms and Pricing**

The total term loan requirement for setting up four large retail outlets of 15,000 sq. ft. each and four smaller outlets of 2,100 sq. ft. each had been proposed at a cost of Rs 10 crore against a total project cost of Rs 20 crore. A CRA rating of SB7 was awarded to it as per the new Basel norms. The term loan had to be paid in 16 quarterly installments. The term loan was to be disbursed in phases on production of the agreement/MOU and other related



documents in respect of the proposed outlets and 100% collateral security by maintaining D/E ratio of 1:1. All other standard covenants were rigorously followed by the bank before sanctioning the loan amount.

Although the commercial operations in all eight retail outlets were to commence in October 2007, the commencement of repayment of first installment was fixed prior to completion of all the projects. This was because the company's Debt Service Coverage Ratio (DSCR) was high and some of the retail outlets were expected to commence operation by this year 2006 itself.

The rate of interest charged by the Bank for the loan facilities was as follows:

Facility	CRA rating	Loan Pricing
Cash credit	SB2(old CRA model)	1.50 % above SBAR
Term Loan	SBTL-1	1.25% above SBAR

#### **Problems with the Loan account and Reasons for NPA**

The bank noticed that the company:

- Had frequent devolvement of cash credit account
- Frequent devolvement of LC
- Inability to raise long term funds resulting in diversion of short term funds

The financials of the company fared quite well for 2006–07. However the estimates of 2007–08 and 2008–09 took a hit due to the diversion of funds. The projected current ratio thus reduced drastically which is a reflection of the liquidity crunch that the company was facing.

According to SBI, one of the reasons for sickness was that the company had gone massive expansion of its network by opening shops/malls at various parts of the country from short term sources without arranging for funds from long term funds for expansion (at present 12 outlets were run and 20 more were in the pipeline). Thus the company used short term funds available to it for funding its expansion plans. Despite request from the branch for consolidation of its networking exercise, the company could not contain its spree for expansion. As gathered from the company it expected Rs 60 crore from Standard Bank, Singapore in the form of equity infusion in one of the group companies but finally the fund was not available to the company.

The account often ran into intermittent irregularities which were however resolved albeit with a lag from time to time. Irregularity was observed in March 2008, April 2008, and May 2008 due to devolvement of bills drawn under LC. In view of the non-servicing of periodical interest on the accounts of the company as also non repayment of installments of term loan account, the account was classified as SMA (Special Mention account) on August 31, 2008. Consequent to the irregularities in the Cash Credit account of Company X for more than 90 days due to non payment of periodical interests, the account of Company X was classified as an NPA on September 30, 2008. As per the assurance of the key promoter director, the High Power Task Force on NPA Management at Corporate Centre reviewed the account on November 14, 2008 and allowed time for regularization of the account by December 15, 2008. But despite active follow up and persuasion by the branch the account did not regularize. A legal notice was also issued to the borrower and guarantor on November 8, 2008 allowing 30 days time for repayment of the loan which also expired. Therefore, the bank U/S 13(2) of the SARFAESI Act 2002 served a notice to the borrowers and guarantors on February 17, 2008 allowing 60 days' time to repay all the dues of the bank. Subsequently, an empanelled SARFAESI agent was appointed by the bank on December 29, 2008 to assist the branch for the recovery of the bank's dues from the company. The corporate center at Mumbai finally agreed to shift the account to the Stressed Asset Management Branch in March 2008.

The company was also granted a corporate term loan of Rs 12 crore at an interest rate of 14.75% to be repayable in 36 monthly installments starting from August 2008 to help it tide over the current crisis.

Following the above developments the Director of the Company, approached the Bank for restructuring of the bank's dues with a promise to pay Rs 1 crore to reduce the irregularity in the Cash Credit Account. He subsequently deposited Rs 0.25 crore in the account on February 4, 2009 and February 17, 2009 but thereafter, due to his illness, he was not able to keep his commitment. The account was subsequently reviewed by the High Power Task Force (NPA account of more than 25 crore) and the committee decided that restructuring exercise should be initiated. According to the Director, Company X was doing well till early 2008 and was servicing the dues of the bank. With a view of expanding its presence all over India gradually, Company X continued to expand its geographical presence. From the second quarter of 2008, the global



---

economy worsened and it witnessed unprecedented recession which had an adverse impact on the Indian economy also. All sectors of the economy including the retail sector were badly hit. The resultant outcome was slowdown in demand coupled with the frequent hike in interest rates thereby eroding the profit margins completely. Thus, operations which were profitable last year started suffering operational losses. Besides the company started new stores last year which were yet to scale up desired sales turnover and generate income. The company was already running 13 stores all over India (as on January 2009) and another 15 stores were in the pipeline in which the company had made partial to major investments. The company had also expected an equity infusion of Rs 60 crore from Standard Bank, Singapore but finally the fund could not be availed by the company leading to a severe liquidity crunch.

The Financial Crime Investigation Bureau (an empanelled recovery agent appointed by the Bank) in its report stated that a total of 567 families were dependent on the functioning of this Company X. The expenses on account of electricity and rent varied from Rs 10–15 lakh and Rs 40 lakh, respectively. The bureau concluded that the borrower was incurring huge expenses and with a view to running the unit as well as saving the families of 567, the meager sales were being spent and the liabilities of the bank were being ignored. The bureau suggested the following measures which it believed the company could follow to tide over the adversity that was prevailing:

- The borrower should negotiate with the landlord for substantial reduction of rent or avail of revenue concession through sharing of profit of actual sales.
- The borrower should also curtail expenses on account of electricity and maintenance by using ACs as and when required. The reduction of contract laborers and guards may also increase surplus funds for repayment of the dues of the bank.
- The borrower can also submit a restructuring proposal with the bank and hope that the rejuvenation will usher in a new area to a dying unit.

## INFERENCES

This case clearly showed the overzealousness of the promoters in gaining quick returns which had led to such

massive expansion spree. The success of the store at its flagship Camac Street Branch had probably led to the belief amongst the management that such performance could be replicated elsewhere in the country also. Thus, the company not only opened a large number of stores in metro cities but in non metros as well. In such cases, the company made simultaneous investments in opening showrooms without waiting for the revenue generation from the stores which were already in the process of being developed. Each showroom of company X had elaborate lighting and decoration which led to massive expenses on store decoration. The high rentals paid at the time when property prices were soaring at the time of economic boom could not be justified as the company failed to earn the revenues when the economy took a downturn.

Another possible reason for its dwindling sales could be that the company failed to gauge the taste of the youth whom it was essentially targeting in Tier 2 and Tier 3 cities. Was there a market for such kind of expensive gifts and decoration items in such cities is a question to be explored. Even if such a market did exist at the time when the showrooms were being planned to be opened, it has to be investigated by the company whether such a market still exists or not. Thus, it has to be taken into consideration whether the downfall in sales is only a temporary phenomenon (due to global retail slowdown) or it is of a more permanent nature due to the nature of the goods that are sold by the company. In the latter case, if the company has to tide over this situation it has to change its portfolio of goods or think of more aggressive marketing strategies to market its products.

Thus a combination of both Internal as well as external economic factors led to a downfall of the company due to which it failed to service its debt obligations. Consequently, its account turned into an NPA.

## Significance of the Study

The health of the financial sector is a matter of policy concern, especially in developing countries where failure in financial intermediation can critically disrupt the development process. Financial Sector reforms in India has progressed rapidly on aspects like interest rate deregulation, reduction in reserves requirements, barriers to entry, prudential norms, and risk based supervision. The issue of NPAs has been a matter of concern for all economies and reduction in NPAs has become synonymous to functional efficiency of other financial intermediaries. It is clear that the problem of Non-Performing Loans has a deleterious effect on the balance



---

sheet of the banks and more importantly has wider macroeconomic implications. The RBI, after recognizing the intensity of the problem, took concrete measures to tackle the problem of NPAs and as seen from the financial performance of banks in India, its efforts have borne fruit. Definitely, it is not just the onus of the Central Bank but changes required to tackle the NPA problem would have to span the entire gamut of judiciary, polity, and bureaucracy to be truly effective.

As the report suggests, there has been a considerable improvement in the performance of Public Sector Banks in controlling the NPA menace. In fact, Public Sector Banks are now at par with their private counterparts in the quality of their assets which bodes good sign for the Indian economy.

The report also analyzes the potential causes of NPAs and the various tools which the Government of India along with the RBI has devised to recover the loss generated by them. The reasons for NPAs are broadly classified into two types—external and internal. Whereas the external factors are outside the banks' control, the internal factors are much within the control of the bank. Discussions with bank officials at SBI reveals that diversion of funds, lack of efficient post-sanction monitoring, economic recession along with company specific factors such as an inefficient management and/or inadequate entrepreneurial skills have been the major reasons for accounts turning bad at SBI, Kolkata. By taking these factors into account, the bank might devise a strategy to mitigate its risks in the future. Further the report analyzes the factors which could have led to creation of NPAs in the accounts of the three companies as discussed before. The available literature on this topic helps to build a theoretical framework on the basis of which the above three cases are analyzed. The special emphasis is on the behavior of trading accounts. The report also stresses upon the fact that a decrease in SSI, NPA level might have led to an improvement in the NPA position of Public Sector Banks in India.

### **Recommendations**

It is seen that the account of Company X was a trading account. As such, trading units operate under very low margins so a small fluctuation in sales can actually lead to a loss in the business venture. In this respect, the bank should

- Take into consideration the variations in the past sales record of the company for deciding whether

the venture will be able to sustain itself on a grander scale in the future. It is generally seen that banks take into consideration the average sales for the past few years (generally three) in the CRA rating but it is imperative that equal attention should also be paid to the year-to-year variations in sales figures.

- Chances of Inventory pile-up, stocks not being sold due to recession, changes in taste and preferences of consumers, diversification in respect of goods traded, obsolescence of the products sold, etc., are important considerations while deciding on granting a loan.
- As seen in the case of Company X, the promoters were overzealous to earn quick returns and, therefore, expansion of outlets took place at a rapid pace without waiting for the generation of revenues from the stores already under construction. In fact, the eligible sanction amount was initially taken for expansion of eight outlets but was utilized for constructing far more. In such cases, it is important for the bank to take proactive steps in curbing the vested interests of the promoters. The bank should quickly identify cases where the business plan is deviating from its original track and it should allow the management of the company to deviate only if it is satisfied after conducting a feasibility study on its own. It is also important for the bank to treat each business proposal as its own business venture where its own funds are at stake. Thus, it should look at all the aspects of the business including the market feasibility of the project, operational feasibility, etc., apart from the financial feasibility which is of course is of prime importance. It is often seen that past financial ratios of the company are given utmost importance while deciding the loan amount but the management set-up of the company, the market feasibility of the venture, etc., are given little importance. It is necessary to realize that the healthy financial ratios are dependent variables which rely on the soundness of the business proposal. In some cases, the bank might also go for a market feasibility study on its own with the help of a reputed marketing research agency and only after it is convinced of the project, it should give the eligible loan sanction limit.
- When the bank is faced with an account which is



non-performing, the bank has essentially two options in front of it—either to exit from the account by one-time settlement or go for restructuring. There are a number of factors which decide which approach fits best to a particular case. Clearly, for a company whose competitive position is good and the market prospects are also bright, the lender should stay with the company (Choudhuri, 2005). On the other hand, for a company whose overall market growth prospects are poor and its competitive position is also weak, the lender should do a One-time settlement (OTS) and exit. It is also possible that the borrower may not come forward for a negotiation and at that time, the bank has no option but to file a suit. An OTS is also a desirable situation for a company whose current competitive position is quite good but where the future market prospects are dim. Further, for a company whose current competitive position is quite weak but future prospects look bright, it should go for financial restructuring to provide some temporary respite. Thus, the type of approach typically depends upon the kind of situation which the bank is facing with respect to a particular case. In case of Nik-Nish, it is seen that the future prospects do not look bright unless there is a radical redesigning of the entire marketing strategy or the product profile. There is a need to look into certain grey areas such as whether the stores opened in small towns will be profitable or not and issues such as how the expenses can be curbed. This can be done only after conducting a thorough study on its feasibility. If it is found that it is no more prudent to finance the company the bank should opt for rapid settlement of its dues rather than wait and watch for things to improve on its own.

- Strict post-sanction monitoring of accounts is extremely important to prevent misuse or diversion of funds to associate concerns and/or diversion of short term funds (working capital loan) for long term purposes. The branch should ensure genuine movement of goods. The bank should, from time to time, verify the credibility of the debtors of the company, against whom bills are being discounted. The bank should also emphasize on the importance of regular stock statements and compulsorily conduct physical stock audits. If a project is being proposed, the bank should strictly

verify from time to time that the funds are being utilized as per the original covenants of the loan. It is often seen that lax post-sanction monitoring of the funds can lead to NPAs. By the time, the bank realizes its mistake, it is often too late.

- To protect itself against losses in cases of NPA accounts, the bank should also stress upon certain legal terms such as creating equitable mortgage of property/hypothecation of goods prior to sanction of loan amount which is often not done diligently.

## References

- Banerjee, Abhijit and Esther Duo. 2004. "Do Firms Want to Borrow more? Testing Credit Constraints Using a Directed Lending Program," Mimeo, MIT.
- Bhide, M.G., A. Prasad, and S. Ghosh. 2002. "Banking Sector Reforms: A Critical Overview," *Economic and Political Weekly*, 37(5).
- Bidani, S.N. 2002. *Managing Non Performing Assets in Banks*. New Delhi: Vision Books
- Biswas, P.K., A.T. Deb. 2004. "Determinants of NPAs in the Indian Public Sector Banks: A Critique of Policy Reforms," *ICFAI Journal of Bank Management*, IUP: 11–41
- Campbell, Andrew. 2007. "Bank insolvency and the problem of nonperforming loans," *Journal of Banking Regulation*, 9: 25–45
- Chaudhuri, T.D. 2002. "India's Experience with Recovery from Non-Performing Assets (NPAs)," in Tamal Dutta Chaudhuri (ed.), *Management of NPAs-Country Experiences*, Hyderabad: ICFAI University Press.
- Chaudhuri, T.D. 2002. "Resolution Strategies for Maximising Value of Non-Performing Assets (NPAs)," in Tamal Dutta Chaudhuri (ed.), *Management of NPAs-Country Experiences*, Hyderabad: ICFAI University Press.
- Chakrabarti R. 2005. "Banking in India: Reforms and Reorganization," Working paper series, January 17. Available online at SSRN: <http://ssrn.com/abstract=649855>
- Das, R. 2002. "Managing the Risk of Non Performing Assets in the Small Scale Industries in India." Available online at SSRN: <http://ssrn.com/abstract=1330798>
- Das, A., A. Nag, and S.C. Ray. 2005. "Liberalisation, Ownership and Efficiency in Indian Banking : A Nonparametric Analysis," *Economic and Political Weekly*, 40(12): 1190–1197.
- Dobson, W. 2006. "Financial Reforms in India and China: A comparative analysis," Working paper series 9 presented at International Conference on The Dragon and Elephant: China and India's Economic Reforms, Shanghai, July 1–2, 2006. Available online at <http://www.rotman.utoronto.ca/userfiles/iib/File/IIB09.pdf>



- Ghosh, S. and A. Prasad.** 2007. "Competition in Indian Banking: An Empirical Evaluation," *South Asia Economic Journal*, 8(2): 265–284.
- Israte, E., D. Das Gupta, P. Weissburg.** 2007. "Toward Developing a Structured Approach to the Diagnosis and Resolution of Nonperforming Loans: The Case of China and India," *Review of Policy Research*, 24:4.
- Kalita, B.** 2008. "Post 1991 Banking Sector Reforms in India: Policies and Impacts," Second Singapore International Conference on Finance 2008, January 31, 2008. Available online at SSRN: <http://ssrn.com/abstract=1089020>
- La-Porta, R., F. Lopez-De-Silanes, A. Shleifer.** 2002. "Government Ownership of Banks," *Journal of Finance*, 58: 265–301
- Levonian, M. and D.M. Jaffee.** 2000. "The Structure of Banking Systems in Developed and Transition Economies," EFMA 2000 Athens Meetings. Available at SSRN: <http://ssrn.com/abstract=239350> or DOI: 10.2139/ssrn.239350
- Mohan, R.** 2002. "Deregulation and performance of Public Sector Banks," *Economic and Political Weekly*, 37(5).
- Muniyappan, G.** 2002. "The NPA Overhang: Magnitude, Solutions, Legal Reforms," in Katuri Nageshwar Rao (ed), *Bank Credit: Emerging Trends*, pp. 120–134. Hyderabad: ICFAI University Press.
- Nargundkar, N.** 2008. *Marketing Research: Text and Cases*, pp 242–271. New Delhi: Tata McGraw Publishing Company Ltd.
- Rajan, R.G. and L. Zingales.** 1998. "Financial dependence and growth," *American Economic Review*, 88(3): 559–586.
- Rajeev, M.** 2008. "Assets or Liabilities: NPAs in the Commercial Banks in India," *South Asia Network of Economic Research Institutes*.
- Roland, C.** "Banking Sector Liberalization in India," Indian Institute of Capital Markets 9th Capital Markets Conference Paper. Available online at SSRN: <http://ssrn.com/abstract=877811>
- Schmidt, M.J. and S. Hollensen.** 2007. *Marketing Research: An International Approach*. New Delhi: Pearson Education.
- Trends and Progress of Banking in India* (current and previous editions). Available at [www.rbi.org.in](http://www.rbi.org.in)

*To be successful you have to enjoy doing your best while at the same time contributing to something beyond yourself.*

— Mihaly Csikszentmihalyi



# Structure and Performance of Small Scale Industries in India

Nomita P. Kumar

---

*Small industry has been one of the major strings of India's economic development strategy since the inception of planning. The small scale sector has been imbued with a number of objectives, important among which are the generation of immediate employment opportunities with relatively low investment; the promotion of more equitable national income; effective mobilization of untapped capital and human skills; and dispersal of manufacturing activities all over the country (Dhar, 1979). We are here interested in the size of this sector and its importance in the total manufacturing activity in the country, in terms of employment, output, and exports.*

*Nomita P. Kumar is a Fellow, Giri Institute of Development Studies, Lucknow.*

## Introduction

Worldwide, the small scale enterprises (SSE) are being viewed as an engine of equitable economic growth and poverty alleviation. They generate high rates of employment growth and account for a major share of industrial production and total exports. Thus, SSEs constitute one of the most important segments of the economy in a labor abundant country like India. In the present global environment, survival of an enterprise depends largely on how quickly it can adapt to rapid change in the market conditions. The SSEs score over their larger counterparts in this respect. Further, they generally have lower capital costs for important deliverables because of their flexibility and size.

Today small industry continues to occupy prime position in the fabric of economic structure due to its significant contribution in terms of output, exports and employment generation. Besides this its regional diversification fervor adds flavor to its virtues so far realized (Kumar, 2007). At the end of March 2002, there were 3.4 million small industry units, accounting for more than 40% of gross value of output in the manufacturing sector, about 35% of total exports, and providing employment to over 19.2 million people which is second only to agriculture (Planning Commission, 2002 as quoted in Subrahmanya, 2004). As per the final results of the Third All India Census of SSIs registered and unregistered units, for the year 2001–02, there were 105.21 lakh SSI units in the country, out of which 13.75 lakh were registered working units and 91.46 lakh unregistered units having the production of Rs 282,270 crore and employment potential of 249.09 lakh persons. This article pulls together the empirical material available on the Small Scale Industry (SSI) sector in India. We are first interested in the size of this sector and its importance in the total manufacturing activity in the country, in terms of employment, output, and exports.



## Definition of SSI

In most countries, small- and medium-scale units are clubbed together for policy purposes and called SMEs. Hence, the Planning Commission Study Group on Development of Small Enterprises, which submitted its final report in May 2001, has suggested that tiny, small, and medium establishments could be redefined in terms of investment limits of Rs 25 lakh, Rs 5 crore, and Rs 10 crore, respectively. The government should think of creating a separate category of medium-scale units with investment limits of Rs 10–15 crore and encourage them to raise equity capital, including foreign equity to supplement institutional finance. While the broad policies should be the same for the SMEs, the tiny units could be given a much higher level of institutional support to promote self-employment.

The clubbing together of small and medium enterprises for policy purposes and raising the investment limit would encourage technology upgradation and facilitate seamless growth of small to medium and eventually even to large-scale units. This would also attract more foreign investment in the sector. The present policy discourages the small units to grow into bigger ones because of the low investment limit in plant and machinery and the artificial props such as excise duty exemptions (Naik, 2002).

## Performance of SSI in India

The SSI sector contributes a major share to exports and the total value added in GDP. There has been a structural relationship between the SSI sector's growth and the growth of industry and the overall economy. The performance of the overall industry, manufacturing and SSI sector is given in the Table 1. It is pertinent to correlate the overall growth of the industry sector with that of the SSI sector to understand the growth pattern in the past and workout the impact of reforms on performance of various manufacturing activities. To make the comparison more meaningful the two periods taken are pre and post liberalization period. The period 1980–81 to 1989–90 is taken as the pre-liberalization and the period 1991–92 to recent available data is taken as post-liberalization period. These two periods sharply differ from each other in terms of liberalization policies that were initiated vigorously from 1991 onwards. The overall compound annual growth rates of industry during these two sets of periods were 7.2% and 5.9%, respectively. It is seen that the rate of growth of SSI sector is more than the rate of growth of total industrial sector. It is really striking to find that the rate of growth of SSI over the entire post reform period, i.e., 1991–92 has been more as compared to the rate of growth of the whole industrial sector. Thus we can conclude that SSI sector is contributing positively to the national economy.

Table 1: Growth Rates of SSI Sector and Total Industrial Sector in India

{(Base : 1993-94) (1994-1995 to 2003-2004)}

Year	Real GDP	SSI Sector Growth Rate	Manufacturing Growth Rate	Total Industrial Sector Growth Rate
1994-95	7.3	10.1	9.1	9.1
1995-96	7.3	11.4	14.1	13
1996-97	7.8	11.29	7.3	6.1
1997-98	4.8	9.19	6.7	6.7
1998-99	6.5	7.84	4.4	4.1
1999-00	6.1	7.09	7.1	6.7
2000-01	4.4	8.04	5.3	5
2001-02	5.8	6.06	2.9	2.7
2002-03	4.0	7.68	6.8	5.7
2003-04	8.5	8.59	7.1	6.9
2004-05	6.9	10.88	8.1	8.4
2005-06	8.1	12.32	9.0	8.1

Source: Ministry of Commerce & Industry, Govt. of India.



**Table 2:** Correlations between Growths in SSI, Industrial Sector, and GDP

Year	Real GDP	SSI Sector Growth Rate	Manufacturing Growth Rate	Total Industrial Sector Growth Rate
Real GDP	1000	.593(*)	0.424	0.431
		0.042	0.169	0.162
SSI Sector Growth Rate	.593(*)	1000	.738(**)	.722(**)
	0.042		0.006	0.008
Manufacturing Growth Rate	0.424	.738(**)	1000	.984(**)
	0.169	0.006		0
Total Industrial Sector Growth Rate	0.431	.722(**)	.984(**)	1000
	0.162	0.008	0	

\*Correlation is significant at the 0.05 level (2-tailed).

\*\*Correlation is significant at the 0.01 level (2-tailed).

Table 2 highlights the correlation coefficients tabulated between growth of SSI sector and growth of manufacturing, industrial sector and the real GDP of the national economy. What is worth mentioning is that SSI sector growth is positively correlated with total industrial sector as well as the growth of the manufacturing sector. It is also influencing growth in real GDP of the national economy which is well depicted by positive association of 0.593 (\*) coefficients which is significant to the 0.05 level. Real GDP of the economy is more closely correlated with growth of SSI sector as compared to the growth of industrial sector and the manufacturing sector growth.

Further, it is interesting to note that over the entire census period of SSI, i.e., 1<sup>st</sup>, 2<sup>nd</sup>, and 3<sup>rd</sup> Census of SIDO growth of units registered compound annual growth to the tune of 8.21% and if we dichotomize the period into pre-reform and post-reform then we notice that growth of units have slowed down after the reforms. Similarly, growth of employment has also shown slower pace in the post reform period as compared to the pre-reform period. It is interesting to note that growth in fixed investment has shown negligible change in the two periods under consideration. Though, production in the pre-reform period registered growth of 20.55% which was higher than the post reform period, i.e., 11.74%.

The SSI sector in India produces over 7,500 products ranging from consumer goods to sophisticated

machinery and computer peripherals and covers a wide spectrum of industries. The status of production, number of units, employment and exports from the SSI sector from the year 1980–81 to 2004–05 as per the estimates of office of DC (SSI) is presented in Table 2. SIDO includes those units which fall under its purview and adhere to the investment ceiling in plant and machinery as defined by the government from time to time. The SSI sector has grown steadily since independence. The sector occupies special role in generating employment in a capital scarce economy and accordingly has been given due attention in the form of concessions and product reservations. The growth of the sector can be gauged from the increase in number of units, production, employment, and exports over the period of time in this segment.

#### **Growth of SSI Units**

The progress of SSIs on the basis of number of units has been shown in Table 3. Firstly, there has been continuous increase in the number of SSIs over the period in pre-reform as well as post-reform period. Secondly, this number has more than doubled during the pre-reform period, i.e., from 8.74 lakh in 1980–81 to 18.26 lakh in 1989–90, while it could not respond in the same manner in post-reform period. Thirdly, if we evaluate this performance on the basis of growth rate the situation becomes very confusing. To make the data comparative over the two



**Table 3: Number of Units in SSI**

Pre-Reform			Post-Reform		
Year	Units (No. lakh)	Growth Rate	Year	Units (No. lakh)	Growth Rate
1980-81	8.7	7.41	1991-92	70.6	3.98
1981-82	9.6	10.34	1992-93	73.5	4.11
1982-83	10.6	10.42	1993-94	76.5	4.08
1983-84	11.6	9.43	1994-95	79.6	4.05
1984-85	12.4	6.9	1995-96	82.8	4.02
1985-86	13.5	8.87	1996-97	86.2	4.11
1986-87	14.6	8.15	1997-98	89.7	4.06
1987-88	15.8	8.22	1998-99	93.4	4.12
1988-89	17.1	8.23	1999-00	97.2	4.07
1989-90	18.2	6.43	2000-01	101.1	4.01
			2001-02	105.2	4.06
			2002-03	109.5	4.09
			2003-04	114	4.11
<b>CAGR Pre-Reform</b>		<b>7.66</b>	2004-05	118.6	4.04
<b>CAGR Post-Reform</b>		<b>4.36</b>	2005-06	123.4	4.05
<b>CAGR Overall</b>		<b>11.36</b>	2006-07 (P)	128.4	4.05

Source : Reserve Bank of India.

periods, i.e., pre and post-reform periods we have divided one period from 1980-81 to 1989-90 and the other from 1991-92 to 2003-04 into post reform period and have omitted the year 1990-91 as there is sudden spurt in the data after revision on the basis of Third Census as mentioned in the footnote of the Table 3 above.

The Table 3 show that the growth rate of number of units varied between 6% annually to 11% in the pre reform period and compound annual growth rate for the entire period has been 7.66% which is much higher as compared to the growth rate of 4.07% in the post reform period. The growth rate has been consistent enough by obtaining 11.5% (CAGR) to attain special attention in the entire period.

#### **Employment Generation in SSI**

The employment scenario during pre- and post-reform period is shown in the Table 4. The table shows the

continuous increase in the number of persons employed in small scale industries. Table 4 also reveals that if we leave the year 1990-91, the data becomes comparative and it is surprisingly interesting to find that the compound annual growth in the number of workers for pre-reform period was 5.35% which was higher than the one observed for post-reform period, i.e., 4.19%. This is not a welcome note for a country like ours with so much stress on employment generation to remove major obstacle for economic development.

#### **Value of Output in SSI**

The value of output of SSIs has been shown in Table 5. Here we find the same increasing trend regarding the absolute value of production of small scale industries during pre-post reform period.



**Table 4: Employment Generation in SSI**

Pre-Reform			Post-Reform		
Year	Employment (lakh)	Growth Rate (%)	Year	Employment (lakh)	Growth Rate (%)
1980-81	71	5.97	1991-92	166	4.86
1981-82	75	5.63	1992-93	174.8	5.3
1982-83	79	5.33	1993-94	182.6	4.46
1983-84	84.2	6.58	1994-95	191.4	4.82
1984-85	90	6.89	1995-96	197.9	3.4
1985-86	96	6.67	1996-97	205.9	4.04
1986-87	101.4	5.63	1997-98	213.2	3.55
1987-88	107	5.52	1998-99	220.6	3.47
1988-89	113	5.61	1999-00	229.1	3.85
1989-90	119.6	5.84	2000-01	239.1	4.36
			2001-02	249.1	4.18
<b>CAGR Pre-Reform</b>		<b>5.35</b>	2002-03	260.1	4.42
<b>CAGR Post-Reform</b>		<b>4.62</b>	2003-04	271.4	4.34
<b>CAGR Overall</b>		<b>6.11</b>	2004-05	287.6	4.24
			2005-06	299.9	4.28
			2006-07 (P)	312.5	4.20

Source : Reserve Bank of India.

**Table 5: Value of Output in SSI**

Year	Pre-Reform Value of Output (crore Rs)	Growth Rate	Year	Post-Reform Value of Output (crore Rs)	Growth Rate
1980-81	28100	30.09	1991-92	80615	2.3
1981-82	32600	16.01	1992-93	84413	4.71
1982-83	35000	7.36	1993-94	98796	17.04
1983-84	41600	18.86	1994-95	122154	23.64
1984-85	50500	21.39	1995-96	147712	20.92
1985-86	61200	21.19	1996-97	167805	13.6
1986-87	72300	18.14	1997-98	187217	11.57
1987-88	87300	20.75	1998-99	210454	12.41
1988-89	106400	21.88	1999-00	233760	11.07
1989-90	132300	24.34	2000-01	261297	11.78
			2001-02	282270	8.03
<b>CAGR Pre-Reform</b>		<b>16.76</b>	2002-03	311993	10.53
<b>CAGR Post-Reform</b>		<b>15.21</b>	2003-04	357733	14.66
<b>CAGR Overall</b>		<b>12.91</b>	2004-05	429796	15.3
			2005-06	497842	15.83
			2006-07 (P)	585112	17.53

Source: Reserve Bank of India.



Table 6: Exports Generation in SSI

Pre-Reform			Post-Reform		
Year	Exports (crore Rs)	Growth Rate (%)	Year	Exports (crore Rs)	Growth Rate (%)
1980-81	1600	33.33	1991-92	13883	43.66
1981-82	2100	31.25	1992-93	17784	28.1
1982-83	2000	-4.76	1993-94	25307	42.3
1983-84	2200	10	1994-95	29068	14.86
1984-85	2500	13.64	1995-96	36470	25.46
1985-86	2800	12	1996-97	39248	7.62
1986-87	3600	28.57	1997-98	44442	13.23
1987-88	4400	22.22	1998-99	48979	10.21
1988-89	5500	25	1999-00	54200	10.66
1989-90	7600	38.18	2000-01	69797	28.78
<b>CAGR Pre-Reform</b>		<b>16.86</b>	2001-02	71244	2.07
<b>CAGR Post-Reform</b>		<b>20.1</b>	2002-03	86013	20.73
<b>CAGR Overall</b>		<b>20.83</b>	2003-04	97644	13.52
			2004-05	124417	27.42
			2005-06	150242	20.76
			2006-07 (P)		

Source: Reserve Bank of India.

### Exports in SSI Sector

As far as value of exports is concerned there has been a continuous increase in absolute value of exports during the whole study period as shown in Table 6. If we want to ascertain the growth rate of exports there has not been any clear cut trend. The rate has been fluctuating very much over the entire period. In terms of growth rate of exports, the situation looks a bit grim. This may be due to various measures undertaken to boost the sector by the government.

SIDO estimates put the SSI sector's contribution to the country's export as between 45 to 50%. Direct exports of the SSI sector accounts for about one third of the country's total exports. Besides, SSI units contribute to exports indirectly through merchant exporters, trading houses, and export houses. Indirect exports from the SSI sector may include goods exported by large units utilizing parts and components that are manufactured by SSIs used for finished exportable goods. Product groups where SSI dominates in exports are gems and jewelry, sports goods, readymade garments and knitwear, plastic products, processed food,

and leather products. Growth in SSI exports has largely been contributed by gems and jewelry, garments and leather products (SIDBI, 2001).

### Individual Industry Performance

The major objective of promoting SSIs has been rooted in the idea to develop a wide spread entrepreneurial base across various industries. Industry wise contributions in terms of the number of units and employment creation have been analyzed in Table 7. The number of units can be understood to be a good indicator to represent the entrepreneurial base in a particular industry. The prominent industry groups in this category are repair services, food products, miscellaneous manufacturing, hosiery and garments, metal products, wood products, and machinery parts as these industries together account for above 75% share to the total units in SSI sector.

In case of employment it can be observed that the maximum employment has been generated in repair and services, food products, miscellaneous manufacturing, hosiery and garments, and metal products. These five industry groups account for the maximum employment, i.e., 61% of the total employment generated in the SSI sector.



Table 7: Industrial Category-wise Distribution of Employment in Small Scale Industries in India

NIC	Description of Industry Employ/UniT	Employment			Employment			Employment
		1st Census 1972-73	2nd Census 1987-88	3rd Census 2000-01	Percent Share 1972-73	Percent Share 1987-88	Percent Share 2000-01	Compound Annual Rate of Growth 1972-2001
20/21	Food & Food Products	131220	481682	403113	7.94	13.14	11.69	4.09
22	Beverages, Tobacco & Tobacco Products	4577	73375	35863	0.28	2.00	1.04	7.63
23	Cotton Textiles	-	24725	79312**	-	0.67	-	-
24	Wool, Silk & Synth. Fibre Textiles	12314	-	-	0.74	-	-	-
25	Jute, Hemp & Mesta Textiles	2599	-	-	0.16	-	-	-
26	Hosiery & Garments	75346	198387	374836	4.56	5.41	10.87	5.90
27	Wood Products	94703	229061	290696	5.73	6.25	8.43	4.09
28	Paper Products & Printing	89146	199389	119658	5.39	5.44	3.47	1.06
29	Leather & Leather Products	31775	81667	65174	1.92	2.23	1.89	2.60
30	Rubber & Plastic Products	81690	188784	117934	4.94	5.15	3.42	1.32
31	Chemical & Chemical Products	159013	313986	96209	9.62	8.57	2.79	-1.78
32	Non-Metallic Mineral Products (Glass & Ceramic)	202269	446218	258627	12.24	12.17	7.50	0.88
33	Basic Metal Products	109626	202463	84830	6.63	5.52	2.46	-0.91
34	Metal Products	300060	372711	358629	18.15	10.17	10.40	0.64
35	Machinery & Parts Except Electrical	145333	279292	37242	8.79	7.62	1.08	-4.75
36	Electrical Machinery/ Apparatus	65908	137260	33104	3.99	3.74	0.96	-2.43
37	Transport Equipment & Parts	83492	100360	36208	5.05	2.74	1.05	-2.94
38	Misc. Manufacturing Industries	40025	65322	-	2.42	1.78	-	-
97	Repair Services	38995	192267	161728	2.36	5.24	4.69	5.21
99	Services not e.c.	-	2720	-	-	0.07	-	-
OT	Other Services & Products	-	61228	895193	-	1.67	25.96	-
	<b>Total</b>	<b>1653178</b>	<b>3665810</b>	<b>3448356</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>2.66</b>

Source: India Year Book 2003, Institute of Applied Manpower Research.

Note: Concordance table was applied for converting NIC-98 based of 3rd census in terms of NIC-87, at two digit level of 1st & 11nd small scale industrial census data.



Table 8: Industrial Category-wise Distribution of Working Units in Small Scale Industries in India

NIC	Description of Industry Employ/Unit	Working Units			Working Units			Working Units
		1st Census 1972-73	2nd Census 1987-88	3rd Census 2000-01	Percent Share 1972-73	Percent Share 1987-88	Percent Share 2000-01	Compound Annual Rate of Growth 1972-2001
20/21	Food & Food Products	6577	96123	104489	4.712	16.51	13.93	10.38
22	Beverages, Tobacco & Tobacco Products	469	3669	5851	0.336	0.63	0.78	9.43
23	Cotton Textiles	-	1451	10876**	-	0.25	-	-
24	Wool, Silk & Synth. Fibre Textiles	-	1158	-	-	0.20	-	-
25	Jute, Hemp & Mesta Textiles	-	219	-	-	0.04	-	-
26	Hosiery & Garments	6178	39778	107565	4.426	6.83	14.34	10.74
27	Wood Products	12188	54975	77110	8.732	9.44	10.28	6.81
28	Paper Products & Printing	8332	33320	26104	5.969	5.72	3.48	4.16
29	Leather & Leather Products	5040	24028	17027	3.611	4.13	2.27	4.44
30	Rubber & Plastic Products	7688	25819	18228	5.508	4.43	2.43	3.13
31	Chemical & Chemical Products	11837	25941	11177	8.481	4.45	1.49	-0.20
32	Non-Metallic Mineral Products (Glass & Ceramic)	7794	315891	25128	5.584	54.24	3.35	4.27
33	Basic Metal Products	5073	14937	7876	3.635	2.56	1.05	1.58
34	Metal Products	34011	65868	80636	24.367	11.31	10.75	3.13
35	Machinery & Parts Except Electrical	12701	40802	8776	9.100	7.01	1.17	-1.31
36	Electrical Machinery/ Apparatus	4409	12283	5626	3.159	2.11	0.75	0.87
37	Transport Equipment & Parts	6049	11325	2100	4.334	1.94	0.28	-3.71
38	Misc. Manufacturing Industries	3489	8852	4726	2.500	1.52	0.63	1.09
97	Repair Services	7197	80412	75385	5.156	13.81	10.05	8.75
99	Services not e.c.	-	613	1200	-	0.11	0.16	-
OT	Other Services & Products	-	9206	160222	-	1.58	21.36	-
	Total	139577	582368	750102	100.000	100.00	100.00	6.19

Source: India Year Book 2003, Institute of Applied Manpower Research.

Note: Concordance table was applied for converting NIC-98 based of 3rd census in terms of NIC-87, at two digit level of 1st & 11nd small scale industrial census data.



Table 7 and 8 shows the growth rate of employment and working units, in different industries over the period of three censuses. The compound annual growth of units showed that units in the category of repair services increased at the rate of 6.66% followed by miscellaneous manufacturing, electrical machinery and apparatus, leather products and jute, hemp and mesta textile. Similarly investment increased to the tune of 7.77 in repair services followed by miscellaneous, electrical machinery and apparatus and leather products industry group. On the other hand while analyzing employment trend we find that it increased maximum in repair services followed by miscellaneous manufacturing, food products, hosiery and garments and wool, fiber and synthetic textile category. Overall the number of units increased at the rate of 4.58%, investment at the rate of 4.47%, and employment generated was to the tune of 4.90% during the period 2001–05—after the implementation of the policy reforms by the state government.

#### **Statewise Performance of SSI Sector**

Data on the SSI sector as available from the office of the DC (SSI) broadly gives the estimates at the macro level. To furnish state-wise information in the present study data has been collated from *indiastat.com* for the year 2006–07. On the basis of the information given in the table in the report the status of SSI is presented in Table 9 below. The data depicts the following picture:

- A major concentration of SSI units has been in the state of Uttar Pradesh (16.48%) followed by Andhra Pradesh (8.12%), Tamil Nadu (7.84%), Maharashtra (7.70%), Madhya Pradesh (7.61%), West Bengal (7.17%), Karnataka (6.27%), Gujarat (5.03%), Bihar (4.90%), and Kerala (4.22%).
- Uttar Pradesh accounted for the highest share of employment in the SSI sector (16.24%), followed by Tamil Nadu (9.09%), Maharashtra (8.65%), West Bengal (8.28%), Andhra Pradesh (8.13%), Karnataka (6.58%), Madhya Pradesh (5.38%), Gujarat (5.07%), Kerala (4.40%), and Bihar (4.22%).
- Maharashtra accounted for the largest share of fixed investment in the SSI sector in our country (19.87%) followed by Uttar Pradesh (11.99%), Tamil Nadu (8.32%), Andhra Pradesh (6.98%), Gujarat (6.91%), Punjab (6.36%), and Karnataka (5.41%). The remaining states/UTs had shares in investment less than 5%.

- The average employment per SSI unit is estimated to be 2.43 persons at the all India level. The average employment per unit is the highest in Daman and Diu (17.37%) followed by Nagaland (4.79 persons), Pondicherry (4.44 persons), Goa (4.42 persons), Sikkim (3.74 persons), Delhi (3.50 persons), and Arunachal Pradesh (3.28 persons). The other 11 states having an average employment above the all India average are Lakshadweep (3.12 persons), Meghalaya (3.09 persons), Manipur (2.85 persons), Tamil Nadu (2.82 persons), West Bengal (2.81 persons), Maharashtra (2.73 persons), Karnataka (2.56 persons), Kerala (2.53 persons), Gujarat (2.45 persons), and Andaman & Nicobar islands (2.44 persons). The lowest employment per unit has been in the states of Madhya Pradesh (1.72 persons), Himachal Pradesh (1.80 persons), and Uttaranchal (1.91 persons).
- Investment per unit is the highest for Daman & Diu (Rs 920.73 million) followed by Goa (Rs 98.80 crore), Pondicherry (Rs 68.88 crore), Maharashtra (Rs 41.64 crore), Delhi (37.52 crore), Haryana (34.38 crore), and Nagaland (31.59 crore). Rest of the states and UTs had investment per unit less than 30 crore.

In order to find out the state-wise position of the overall SSI sector in relation to India as a whole, we have selected only those states which have more than one percent share in India's population. Table 9 gives the percentage of employment, number of enterprises, and fixed investment in the SSI sector in all states in relation to the all India value of these variables. In terms of number of enterprises, Uttar Pradesh's position is at the top in the year 2006–07, whereas in terms of employment and fixed investment UP's position is inferior to Tamil Nadu and Maharashtra, respectively.

However following Mathur and Parashar (2004), the absolute value of any state variable does not convey a correct idea about the relative significance of any variable for the state's economy since the absolute magnitude of any variable is dependent upon the relative size of the state concerned. UP's relative size may be judged in terms of its population size also as it occupies position number one. In order to neutralize the effect of size on any of the three variables which we have considered the location quotient is estimated in terms of the three variables, namely, number of enterprises, employment, and fixed investment with regard to population by using the location quotient formula as given below:



Table 9: Statewise Estimates of SSI Units, Employment and Fixed Investment, 2007

States	No of Units('000)	% Share	Employment Share	% Share	Fixed Investment (Rs. Crore)	% Share	Employment per unit	Investment per unit
Andaman and Nicobar Islands	4.032	0.03	9.831	0.03	58	0.03	2.44	14.38
Andhra Pradesh	1043.512	8.12	2539.234	8.13	14480	6.98	2.43	13.88
Arunachal Pradesh	1.578	0.01	5.178	0.02	42	0.02	3.28	26.62
Assam	235.576	1.83	530.497	1.70	1451	0.70	2.25	6.16
Bihar	629.509	4.90	1319.395	4.22	3392	1.64	2.10	5.39
Chandigarh	26.612	0.21	57.743	0.18	604	0.29	2.17	22.70
Chhattisgarh	315.118	2.45	635.522	2.03	2420	1.17	2.02	7.68
Daman and Diu	4.579	0.04	79.558	0.25	4216	2.03	17.37	920.73
Delhi	210.905	1.64	737.325	2.36	7913	3.82	3.50	37.52
Goa	8.654	0.07	38.26	0.12	855	0.41	4.42	98.80
Gujarat	646.379	5.03	1585.675	5.07	14327	6.91	2.45	22.17
Haryana	263.308	2.05	640.564	2.05	9052	4.37	2.43	34.38
Himachal Pradesh	95.572	0.74	172.35	0.55	1104	0.53	1.80	11.55
Jammu and Kashmir	89.726	0.70	192.254	0.62	1738	0.84	2.14	19.37
Jharkhand	163.22	1.27	352.479	1.13	839	0.40	2.16	5.14
Karnataka	804.811	6.27	2056.678	6.58	11206	5.41	2.56	13.92
Kerala	542.61	4.22	1374.692	4.40	8998	4.34	2.53	16.58
Lakshadweep	0.675	0.01	2.106	0.01	13	0.01	3.12	19.26
Madhya Pradesh	976.981	7.61	1680.379	5.38	4723	2.28	1.72	4.83
Maharashtra	989.254	7.70	2704.767	8.65	41197	19.87	2.73	41.64
Manipur	57.171	0.45	162.667	0.52	428	0.21	2.85	7.49
Meghalaya	28.591	0.22	88.418	0.28	202	0.10	3.09	7.07
Mizoram	14.335	0.11	33.383	0.11	167	0.08	2.33	11.65
Nagaland	19.024	0.15	91.032	0.29	601	0.29	4.79	31.59
Orissa	468.468	3.65	1134.891	3.63	2640	1.27	2.42	5.64
Pondicherry	11.12	0.09	49.428	0.16	766	0.37	4.44	68.88
Punjab	441.797	3.44	1042.995	3.34	13186	6.36	2.36	29.85
Rajasthan	538.728	4.19	1097.842	3.51	9254	4.46	2.04	17.18
Sikkim	0.474	0.00	1.774	0.01	14	0.01	3.74	29.54
Tamil Nadu	1006.684	7.84	2840.532	9.09	17252	8.32	2.82	17.14
Tripura	29.141	0.23	68.147	0.22	384	0.19	2.34	13.18
Uttar Pradesh	2116.791	16.48	5076.632	16.24	24852	11.99	2.40	11.74
Uttaranchal	137.618	1.07	262.737	0.84	2294	1.11	1.91	16.67
West Bengal	921.221	7.17	2586.716	8.28	6638	3.20	2.81	7.21
India	12843.8	100.00	31251.68	100.00	207307	100.00	2.43	16.14

Source: Indiatat.com



$$Lq_j^I = \frac{V_j^I / V_j^I}{P_j / P^j} * 100$$

where  $Lq_j^I$  denotes location quotient of state  $j$  in respect of segment  $I$ ;

$V_j^I$  is value of variable  $I$  for state  $j$ ;

$V_j^I$  is value of variable  $I$  for the country, i.e.,  
 $V_j^I = V_j^I = V_j^I = \dots = V_j^I$ ;

$P_j$  is population of the  $j$ th state;

$P^j$  is population of the country, i.e.,  $P^j = P^1 = P^2 + P^3 + \dots + P^n$ ;

$I = L, E, F$ , i.e., labor, employment and fixed investment;

$j = 1, 2, 3, \dots, n$ ;

$n =$  Total number of states in India including the three new and very small states (35).

The ratio in the numerator of  $Lq_j^I$  gives the proportion of variable  $I$  for state  $j$  to the all India magnitude of variable  $I$ . Similarly, the ratio in the denominator gives the proportion

of population of  $j$ th state to population of the country. The ratio  $P_j/P^j$  thus plays the role of neutralizing the ratio in the numerator with regard to population.

The value of location quotients of different states in respect of enterprises, employment and fixed investment are given in Table 10. As may be observed, while in terms of the proportion of absolute value of enterprises, employment, and fixed investment, UP appeared at or near the top, once these ratios are neutralized with regard to the effect of size in terms of population, the location quotient values for UP emerges to be near or below median value of the location quotients. In terms of population share UP ranks first whereas in case of location quotients of enterprise, employment, and fixed investment, UP's value stood at 1<sup>st</sup>, 11<sup>th</sup>, and 12<sup>th</sup> rank. Thus in terms of relative significance of the SSI sector, all the three variables presented a gloomy picture and particularly down the ladder as far as fixed investment is concerned. So we come to the conclusion that absolute data present a very rosy picture of UP's SSI sector whereas when the data is treated in

Table 10: State wise Location Quotients of SSI Enterprises, Employment, and Fixed Investment, 2006–07

States	% Share of Pop	Rank	LQ Unit	Rank	LQ Emp	Rank	LQ Inv	Rank
Andhra Pradesh	7.330	6	1.108	6	1.108	6	0.952	10
Assam	2.600	13	0.705	15	0.653	15	0.269	16
Bihar	10.170	2	0.482	17	0.415	17	0.161	17
Gujarat	4.790	10	1.051	8	1.059	8	1.443	6
Haryana	1.990	15	1.030	9	1.030	10	2.194	3
Karnataka	5.120	9	1.224	5	1.285	5	1.056	9
Kerala	3.100	12	1.361	3	1.417	4	1.398	8
Madhya Pradesh	8.110	4	0.938	10	0.663	14	0.281	15
Maharashtra	8.860	3	0.869	13	0.977	11	2.243	2
Orissa	3.440	11	1.061	7	1.057	9	0.371	14
Punjab	2.300	14	1.495	1	1.450	3	2.764	1
Rajasthan	5.470	8	0.767	14	0.642	16	0.816	11
Tamil Nadu	5.900	7	1.329	4	1.541	2	1.411	7
Uttar Pradesh	17.840	1	0.924	11	0.910	12	0.672	12
West Bengal	7.790	5	0.921	12	1.063	7	0.411	13
Delhi	1.600	16	1.480	2	2.394	1	2.192	4
Jammu & Kashmir	1.010	17	0.607	16	0.827	13	2.114	5

Source: Calculated from Table 9.



---

terms of location quotient it present other side of the coin which narrates the true story.

### Conclusion

Industrial economy of the state is dominated by SSIs, of which about 0.28 percent are already sick. The main cause of their sickness has been lack of professional management and rapid technological obsolescence. This has eroded their competitiveness viz-a-viz large industries. They will be at a further disadvantage in future with progressive dereservation of the items produced by the SSI sector and the continuous influx of technologically strong MNCs, as the liberalization and globalization of the economy progresses. However, there is no need to panic because progressive integration of the domestic economy with the global economy has also opened up new vistas for the SSI sector, as it would now have greater access to the world markets, state-of-the-art technologies,

and abundant finance. The need is to infuse a fresh zeal and structural modernization of SSI units by reinvigorating their technological prowess and professional management, so as to bolster their competitive strength.

### References

- Bala Subrahmanya, M.H.** 2004. "Small industry and Globalisation-Implications, Performance and Prospects," *Economic and Political Weekly*, May 1: 1826-1834.
- Directorate of Industries.** 2001-02. "Final Results- Third Census of Small Scale Industries Uttar Pradesh," Udyog Bhawan, Kanpur.
- Kumar, Nomita P.** 2007. "Small Scale Industry Performance in Uttar Pradesh: Pre and Post Reform Scenario,' *Productivity*, 48(1).
- Naik S.D.** 2002. "Small-scale industries: Preparing for the WTO challenges," *Financial Daily* from The Hindu group of publications, Friday, Jul 12, 2002.
- Reserve Bank of India (RBI).** Report on Currency and Finance, various issues, Mumbai.

*The young do not know enough to be prudent, and therefore they attempt the impossible and achieve it, generation after generation.*

— Pearl S. Buck



# Productive Visual Planning, Scheduling, and Control with Calendar Load Charts: Two Case Implementations

Nesa L'abbe Wu

---

*Many Lean Principles that were developed since the early 1970s have been introduced on a very large scale since the 1990s (Walker, Wu, 2004a, p. 404). Some of these principles have benefited product development, the work place in general and production control on the shop floor. Lean thinking, centered on finding waste and eliminating it, must include lean communication tools and systems. These not only include Value Stream Mapping, but could be simple visual controls. Very effective lean communication tools, such as visual controls, are used to communicate what needs to be done in a timely fashion. This paper presents a brief overview of old and new systems. It also introduces the reader to the use of the "Calendar Load Chart" as a powerful visual tool that can be used in both the service and the manufacturing industry to plan, schedule and control work. The paper also demonstrates the effectiveness of the "calendar load charts" through the presentation and discussion of two case implementations.*

*Nesa L'abbe Wu, PhD, Professor Production and Operations Management and Decision Sciences, Eastern Michigan University.*

## Introduction

Vision is perhaps our greatest strength, it keeps us alive to the power and continuity of thought through the centuries; it makes us peer into the future and lends shape to the unknown" (Li Ka Shing).

This saying perhaps explains the successful implementation of visual controls, like charts and labels that guide management and workers in expert execution of their future tasks.

Lean operation systems use both visual and computer controls to communicate tasks and information for the purpose of managing operations. Visual controls are a system of symbols that conveys the right information to the right person in a timely manner. The objective of visual controls is to achieve management by sight. Often used visual controls are: visual production controls such as Gantt charts and Kanbans; visual maintenance controls such as andons, maintenance load charts, color-coded tools and tool holders, labeled tool storage; visual inventory controls such as labels and taped off space on the shop floor for limiting inventory storage; visual quality controls such as X-Bar charts, R-charts and p-charts; and visual office controls such as pitch boards and labels.

## Visual Production Controls

Visual communication for production and operations dates back to the scientific management era. Henry L. Gantt, an industrial psychologist, placed considerable emphasis on the human element in management's attitude towards labor. He introduced in 1913 the Gantt chart that businesses still use for scheduling and control. Gantt



Fig. 1: Gantt Load Chart for Five Jobs on Two Machines (Wu, 2009a, p. 311)

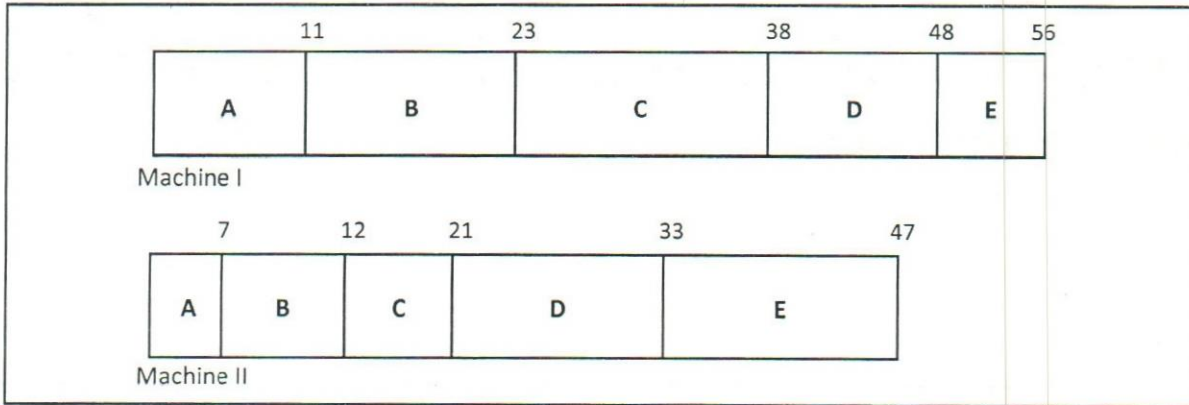


Fig. 2: Gantt Sequencing Chart of Five Jobs in Two Work Centers (Wu, 2009a, p. 316)

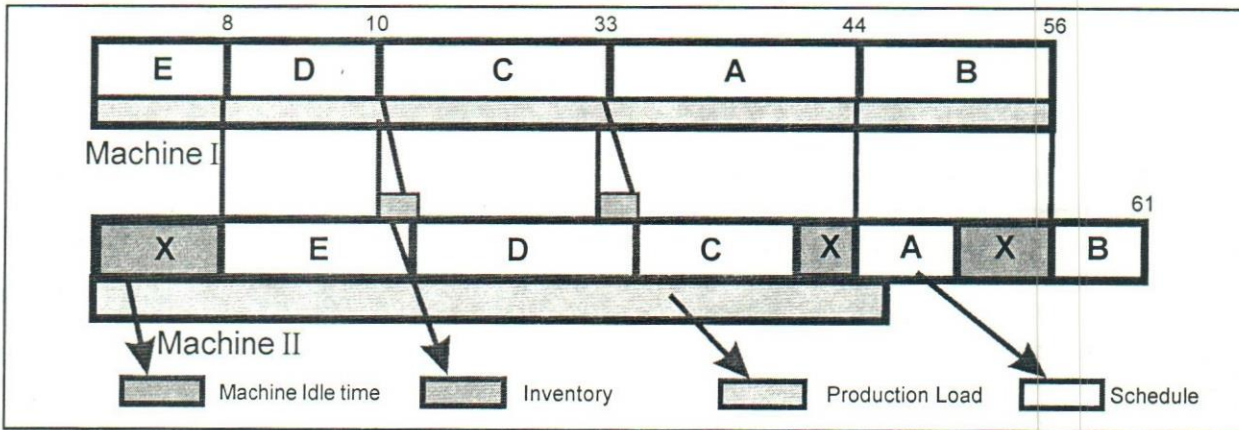
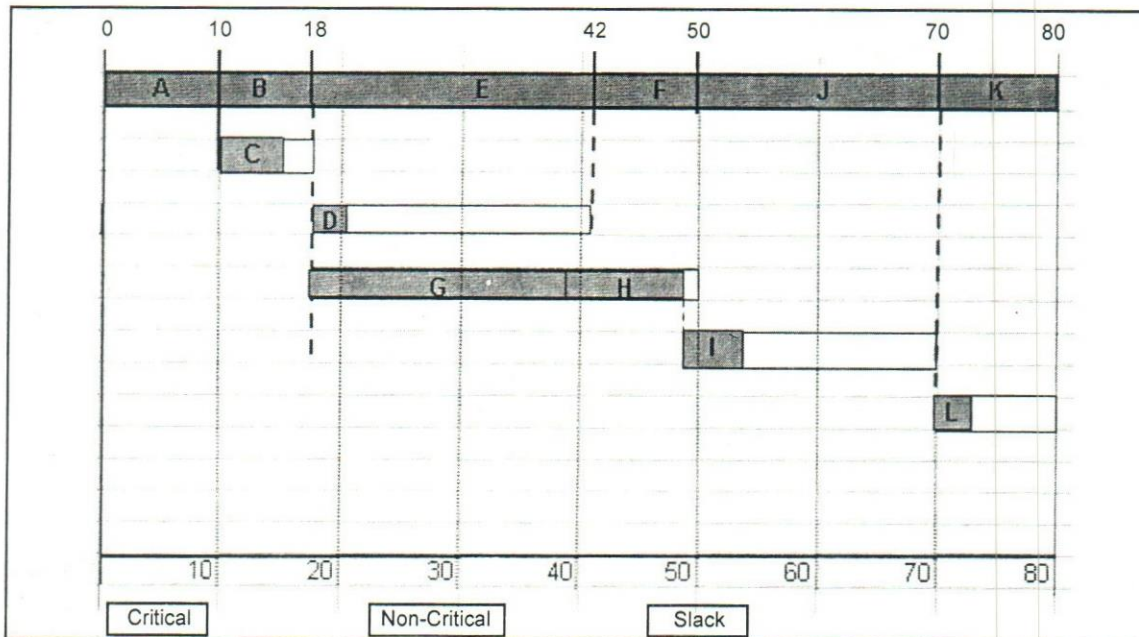


Fig. 3: Project Bar Chart (Wu, 2009, p. 435)



charts are used to capture work load, as shown in the Gantt load chart of Figure 1 and to reflect schedules and sequencing as shown in the Gantt sequencing chart of

Figure 2. Its most popular application has been in project management with the project bar chart as shown in Figure 3. This chart summarizes the analysis of a project



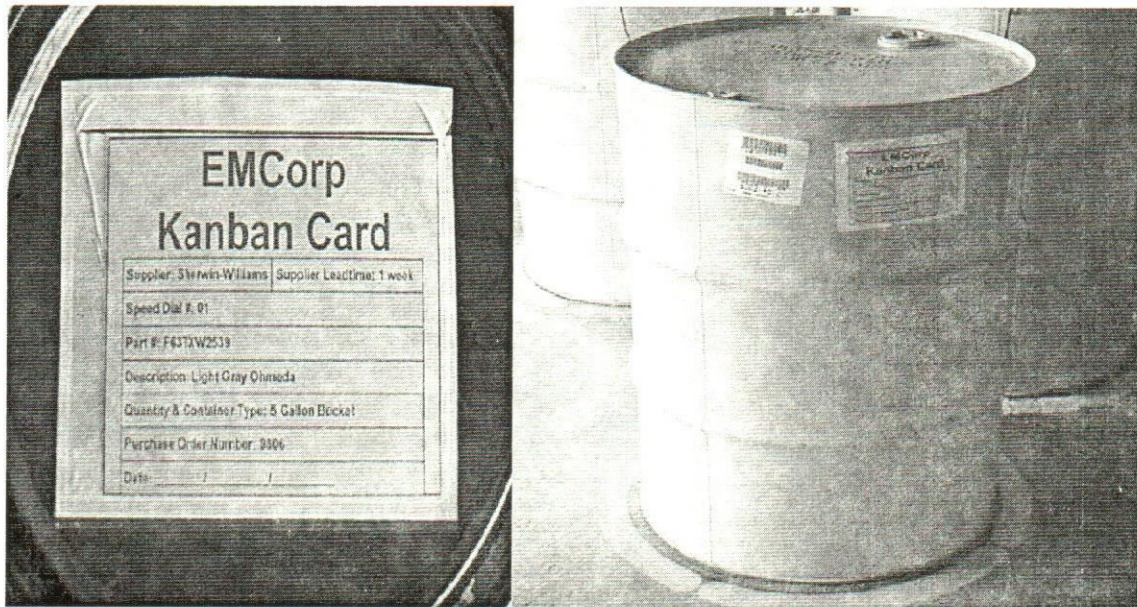


Fig. 4: Kanban Card and Kanban on Container

Source: Available online at [http://www.bec.msos.edu/sig\\_presentations/kanbans\\_2005\\_jan.pdf](http://www.bec.msos.edu/sig_presentations/kanbans_2005_jan.pdf). (downloaded on January 8, 2010)

network. It is used for the day-to-day control of major projects.

The Kanban system, that visually tracks and manages jobs and inventory with Kanban cards, was introduced by Mr Ohno at Toyota. When introduced at Toyota it became the most popular Japanese just-in-time visual production control system. In Toyota's Kanban system, an order release mechanism is triggered by an order card called Kanban (meaning signboard or signal). Kanbans are visual communication devices that communicate from the point of use to the previous operation. In other words it is the communication tool between two stages of production. The Kanban system has two visual control cards—the conveyance Kanban and the production Kanban. The conveyance Kanban allows for parts to be moved from one process to the next process,

while the production Kanban allows for the production or processing of parts at a specific location on the plant floor. The ultimate goal of this visual system is just-in-time production that prevents inventory waste due to over-production. Figure 4 shows a container with a Kanban card. Such a card typically contains following information: next operation, part number, description, supplier or previous operation, work order number, container quantity and number of containers.

### Visual Maintenance Controls

Andons (see figure 5) are visual signals, often color-coded lights, at machines and operations to flag machine stoppage in need for maintenance support. There are manual and automatic andons. Personnel operating

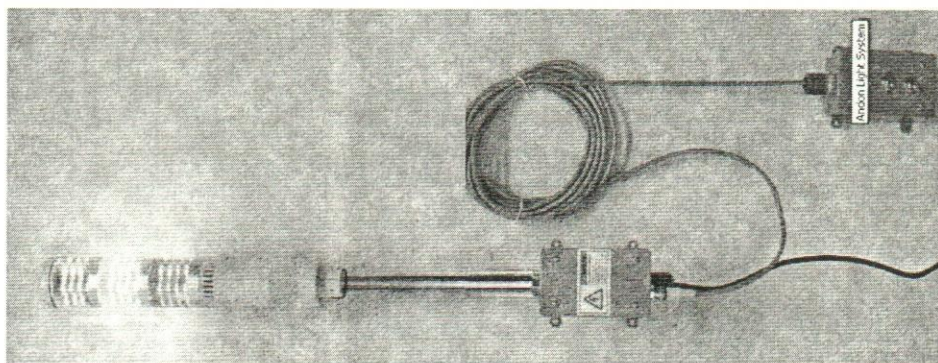


Fig. 5: Andon Light System (15000-3LTSTD)

Source: Available online at [www.leansupermarket.com/servlet/Detail?no=474](http://www.leansupermarket.com/servlet/Detail?no=474) (downloaded on August 3, 2009)



equipment who notice problems can manually trigger andons. Automated equipment can have built in andons that can be triggered when equipment is not performing according to specifications or when the number of output cycles require tool change or routine maintenance.

Other, less known, visual maintenance controls are maintenance calendar load charts, designed and developed by this author. These charts communicate to maintenance supervisors to peer into the future need for inspections, routine maintenance and preventive maintenance activities and guide them towards timely execution of such maintenance. A total productive routine maintenance (RM) and preventive maintenance (PM) system is a system that is both efficient and effective. On one hand, an efficient maintenance system is one that has all the proper tools for timely execution of all maintenance requirements; while on the other hand an effective maintenance system is a system that can be managed with minimum effort of control. Routine and Preventive maintenance systems with visual

communication controls significantly improve the scheduling and control of routine inspections, routine maintenance or preventive maintenance work. Without the presence of visual controls a maintenance supervisor spends an enormous amount of time going through files, data forms, past work done and other documents to ensure the timely execution of all future maintenance work. This wasted time can better be spent supervising and improving the maintenance department.

An example of a maintenance calendar load chart is shown in Figure 6. It was developed for a small Mexican resort of an American Time Share Company. In this example the shaded bars in the chart prompt the timely execution of routine inspections and preventive maintenance that needs to be performed during a calendar year on all hot water heaters at the resort. As the maintenance activity is performed the supervisor will mark it with an X mark (X) in the appropriate month/week of the chart. If maintenance is performed in a timely fashion,

Mar Azul	INSPECCION Y LAVADO/INSPECCION DE CALENTADORES DE AGUA												
Year:	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
CONDO 10													3 meses
CONDO 11													3 meses
CONDO 20													3 meses
CONDO 21													3 meses
CONDO 30													3 meses
CONDO 31													3 meses
CONDO 40													3 meses
CONDO 41													3 meses
CONDO 50													3 meses
CONDO 51													3 meses
CONDO 60													3 meses
CONDO 61													3 meses
CONDO 62/72/82/92													3 meses
CONDO 70													3 meses
CONDO 71													3 meses
CONDO 80													3 meses
CONDO 81													3 meses
CONDO 90													3 meses
CONDO 91													3 meses
PH1													3 meses
PH2													3 meses
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	

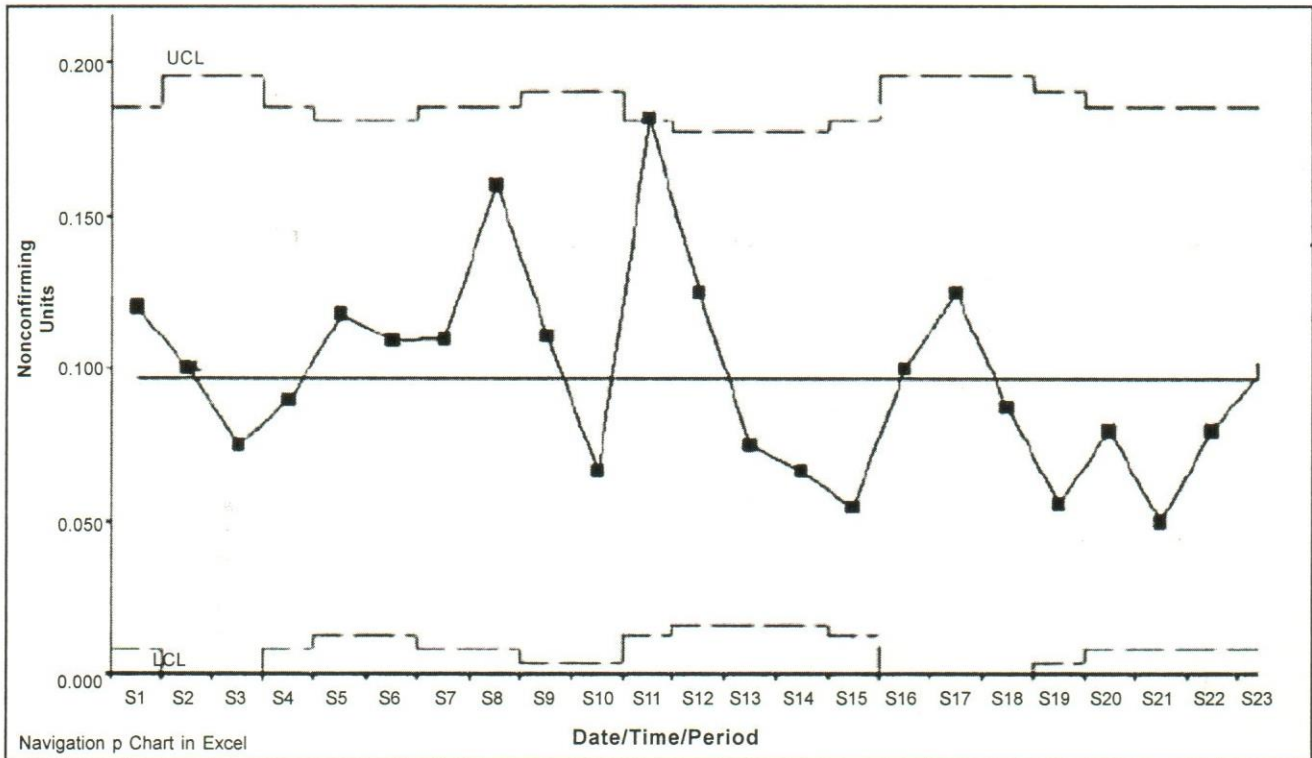
Fig. 6: Maintenance Load Chart

then each colored strip ought to have an X mark. If, due to breakdowns, additional work is performed then a star (\*) is marked on the chart. At the end of the calendar year the charts can be reviewed to evaluate the need for increasing or decreasing the amount of preventive or routine

maintenance work, or the need for replacement of the equipment, etc.

Here the visual control reflects when maintenance needs to be done and when work is done.





Source: Available online at [www.qimacros.com/qowozard/pcharhtml](http://www.qimacros.com/qowozard/pcharhtml) (downloaded on August 3, 2009)

Fig. 7: The P-Chart

### Visual Quality Controls

Visual quality control charts, such as X-Bar charts, R-charts and p-charts (as shown in Figure 7) are developed to observe and control the variation in produced parts and products. They reflect the limits of acceptable variability levels and picture how a product or process conforms to these levels. Many companies post these charts to alert both production supervisors and maintenance people about variation in production. Some causes of such variation could be: improperly maintained equipment; tool wear; machine vibration; poor material quality; poorly calibrated equipment; and sloppy work. When unacceptable variation in product output is identified on the chart, appropriate personnel can promptly analyze its cause and correct the problem.

### Visual Office and Workplace Organization Controls

Visual office control charts must communicate on a daily basis work to be done. It can be reflected in a visual pitch board. A pitch board is a physical device that communicates the work that is required throughout the day. Specific times show the commencement of various activities. A visual pitch board prompts the start of work and gets it off a

worker's desk into a common process. It creates a visual to control whether work is done in a timely fashion, in so called pitch increments, rather than rushed towards the end of the day. If a worker gets behind in his work the pitch board steers him towards immediate problem resolution.

Whether it is an office or a manufacturing floor, a work place needs to be organized and stay organized. A work place is well organized if it is safe, clean and neat. The principles used for the organization of the workplace are defined by the Japanese 5S program, roughly translated as "Sort," "Set in Order," "Shine," "Standardize," and "Sustain." To "Sort" the work place and to remove all unnecessary items red tags are used. Red tagged items are then moved to a red tag holding area. This area is periodically reviewed by the leadership in order to dispose of these items or to place them at designated inventory locations. Remaining items are "Set in Order" at ideal locations for reduced cycle time and ergonomic considerations. These items are labeled or shadowed using colored tape, labels, signs, shadowing material, pegboards, portable hand held labelers, or floor paint. These visual tools enforce workplace organization and maintenance of the 5S lean principles, leading towards



"Shining," "Standardizing," and "Sustaining" an orderly work place.

### Implementation of Calendar Load Charts: Two Cases

Here are two successful implementations of calendar load charts. The first case shows the planning, scheduling and control necessary to manage the operations of a professional student organization, leading towards the National Platinum APICS Award. The second case discusses the successful introduction of calendar load charts for managing maintenance work at several resort locations in Mexico.

#### Case #1: Visual Controls for Managing the EMU/APICS Chapter<sup>1</sup>

The Eastern Michigan University professional APICS Student Chapter uses visual controls such as calendar load charts to manage its chapter throughout the school year. Load charts for a whole year are set up in order to meet the necessary requirements to get the APICS Platinum Award and to fulfill the College of Business requirements of a student chapter. Their Chapter Management Manual includes two very important sections that guide the organization in defining these charts; they

are the APICS Chapter Summary Sheet and the Student Chapter Management Program. The manual requires performance in five areas: Administration, Education, Programs, Membership, and Public Relations.

Visual control is accomplished through pre-planning with calendar load charts and recording of planned, scheduled and accomplished activities as follows.

Pre-planning the year with calendar load charts is done at the end of each school year (in April) when the outgoing president of the EMU/APICS Board loads next year's calendar based on past year's performance. The incoming board members are expected to do at least as good as last year's group. Throughout the upcoming school year adjustments can be made to the plan. The plan is flexible and items can be added and deleted as they move through the new school year. A sample calendar load chart for "Administration Requirements" is shown in Figure 8.

With respect to the "Administration Requirements," the manual refers to 7 different activities that need to be addressed. The patterned bars are the load chart items the organization plans to do in each of the upcoming months. Note that two different patterns are used: lines and crosscheck. Lightly shaded lines means that we need

ADMINISTRATION	April	Spring	Sum.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	Done	Possible	Goal
1. Chapter Organization					▨							20	20(1)
2. Chapter General Meeting Agenda					▨	▨	▨	▨	▨	▨		20	20(6)
3. Chapter Budget				▨								10	10(1)
4. Income Statements	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨		10	10(all)
5. Transition Meeting					▨							20	20(1)
6. Executive Board Meeting	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨		30	30(6)
7. Attendance Parent Board Meeting				▨	▨	▨	▨	▨	▨	▨		20	10(3)
Total Points: (90 gold)													

Requirements

Fig. 8: Calendar Load Chart for APICS Administration



Fig. 9: Planned, Scheduled, and Accomplished as of October

ADMINISTRATION	April	Spring	Sum.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	Done	Possible	Goal
1. Chapter Organization				X							20	20	20(1)
2. Chapter General Meeting Agenda				X								20	20(6)
3. Chapter Budget	X										10	10	10(1)
4. Income Statements	X	X	X	X	X							10	10(all)
5. Transition Meeting				X							20	20	20(1)
6. Executive Board Meeting				X	X							30	30(6)
7. Attendance Parent Board Meeting				X	X							20	10(3)
Total Points: (90 gold)													

**Requirements**

to document the requirement in our manual; while cross checks means that we only need to get a signature on the summary sheet of the manual.

The patterned areas on the calendar shows when the activities can be planned based on previous year's plan, whereas the last column (goal) shows the actual execution of the previous year's plan (note for example that the last column of the chart shows that previously only three parent chapter board meetings were attended).

Specifically this load chart recommends that a transition meeting must be held no later than October (item #5) and at that time the chapter organization chart (item #1) must be prepared. A chapter budget must be prepared and approved no later than September, whereas income statements must be prepared in each period.

Similar calendar load charts are designed for the other four program requirements— "Education Requirements," "Program Requirements," "Membership Requirements," and "Public Relations Requirements."

During the school year, as the organization plans, schedules and accomplishes the tasks they record the accomplishments by placing a mark (X) on the chart. By

October the "Administration Requirements" chart could look as shown in Figure 9. It shows that the organization, as compared to last school year, is ahead of schedule in the following areas: the transition meeting, together with the chapter organization occurred in September (one month ahead of schedule); the chapter budget was approved in April, rather than in September; and they started their chapter general meetings one month earlier than last year. The plan also shows that no executive board meeting was held in April, nor Spring. This is not a problem yet, because there are plenty of months left to schedule a total of six monthly executive board meetings during this school year. On a monthly basis the president of the organization reviews the execution of the plan and makes decisions accordingly.

Using visual controls like these calendar load charts helps the EMU/APICS professional student organization in effectively planning and controlling all its activities. These charts are extremely helpful because the board membership of this organization changes every year and is composed of many foreign students of diverse cultures. Without these charts and their controls the board members are required to consult and read on a regular basis numerous pages in the management handbook. Before



---

using these visuals the EMU/APICS chapter was not always able to achieve its objectives because students just did not seem to take the time to regularly consult and execute the management handbook. Since implementing this planning system this organization has been awarded both Gold and Platinum Awards from its National APICS organization and was invited to make a presentation on the subject of visual controls at its Great Lakes District meeting in October 2008.

### **Case #2: Communicating Preventive/Routine Maintenance for Mexican Resorts**

An International Vacation Club<sup>2</sup>, headquartered in California, operates 10 resorts in the USA, Mexico and Spain. During the 2004 winter this author had an opportunity to research this company's operations and to propose a comprehensive maintenance management system for some of its Mexican Resorts (Cancun, Puerto Vallarta, and Acapulco). All locations were requested to submit copies of all the forms they use: inspection forms, forms to generate work orders, material request forms, scheduling and control forms, maintenance tracking forms, and inventory and parts/tools control forms. A quick review of these forms revealed the following:

- The three resorts in Puerto Vallarta that are under the supervision of one maintenance supervisor were the best organized resorts with respect to maintenance management and inventory control;
- The organization of the maintenance office in Acapulco was chaotic, needed to be cleaned and organized;
- The maintenance areas in the Cancun Resort were fairly well organized, however significant improvement was possible;
- Each location had developed its own maintenance procedures and forms for recording and tracking maintenance;
- Forms are used to record maintenance performed; however none of the forms helped in future timely scheduling and control of routine- (RM) and preventive maintenance (PM);
- Supervisors were all very knowledgeable about PM and RM maintenance activities requirement;
- Each location had developed their own system to track, control and execute RM and PM activities. This timely execution demanded an enormous effort

in the Cancun and the Acapulco resorts and it was not clear that these activities were done in a timely fashion;

- At none of the locations could one easily assess the need and magnitude of PM and RM, nor could one judge the severity and magnitude of breakdown maintenance;
- The headquarters in California had no timely access to maintenance information, schedules and their execution because computers were not used for instantaneous information transfer.

Additionally, at the headquarters in California only one person (a vacation scheduler) and his assistant spoke Spanish.

To improve and correct these problems it was decided to develop a productive visual maintenance control and communication system that with very little effort can be understood by all interested parties: management at the resorts (who are bi-lingual), maintenance people and their supervisors (who only speak Spanish), the general manager for all Mexican resorts (who is bi-lingual), the company president (who speaks English only) and her secretary (who speaks English and knows some Spanish) and all board members of this company (who speak English only).

Armed with a dictionary this author, who does not speak Spanish, spent one week at each of the three locations to generate visual communications to help schedule, control and collect data for routine, preventive and breakdown maintenance activities. The manager at each location was the only person who was bi-lingual and who initially helped in getting the data needed to develop the visuals. The only sentence that the manager had to translate from English into Spanish was a question addressed by this author to the supervisor:

Give me an **organized list** (in Spanish) of all PM and RM activities that need to be done throughout the year; indicate the date that this activity was **done last**; tell me **who performs this activity** (your crew or contracted) and tell me the **frequency of occurrence** (weekly, bi-weekly, monthly, bi-monthly, every three month, and so on).

Such input was provided for maintenance activities on water pumps, filtration pumps, elevators, Jacuzzis, roof, alarms, swimming pool, washers, dryers, air conditioners,



etc. This information was then used to generate the visual maintenance communication system under the form of Yearly Maintenance Load Charts. In total there were 5 charts developed for the Acapulco Resort; seven charts for the Cancun Resort; and seven charts for two Puerto Vallarta Resorts. One such chart that was developed for the Acapulco Resort is shown in Figure 6. Note that it reflects all work that needs to be performed in specific weeks of each month of the year. As explained in a previous section these visual communication sheets can be used to help schedule work in a timely fashion (by being guided by the shaded areas); to record work performed (by placing an X-mark) ; and to record any additional work done because of breakdowns (by placing a (star)\*-mark ).

Due to its ease of use and with strong support from all maintenance supervisors the company immediately implemented the use of these charts. On a regular basis their input is analyzed and electronically transmitted to the headquarters for review by the board of directors of the company. The data generated over the past three years have shaped and defined the proper frequency of routine and preventive maintenance; have helped in rewriting maintenance contracts by either increasing or decreasing the maintenance cycles; have aided in replacing equipment in a timely fashion; and have reduced many aspects of maintenance waste.

#### Endnotes

<sup>1</sup>With contributions from Vanessa Frankowski and Bi Florence Du, students at Eastern Michigan University 2009.

<sup>2</sup>Upon request of the company's president, the name of the company is withheld.

## Conclusions and Recommendations

The sky is the limit for the application of visual communication systems. Any business function can mold its own application and format for communicating schedules, work to be done, location of information, procedures to be followed, etc. When introduced they are welcomed with open arms and people perform their tasks better, faster, and with less errors. This in turn increases productivity, improves morale and ultimately elevates customer satisfaction.

## References

- Wu, Nesa L. (2005). *An Inquiry into Lean. Part I: The main Office*, unpublished manuscript.
- Wu, Nesa L. (2006). *An Inquiry into Lean. Part II: Resort Maintenance*, unpublished manuscript.
- Walker, Curtis and Nesa L. Wu. (2006). "Assessing Lean Operations: Methodology for the Service Industry," *Productivity*, 47 (October–December): 211–222.
- Walker, Curtis and Nesa L. Wu. (2006). "Philosophy, Principles and Productivity of Lean Manufacturing," *Productivity*, 45 (October–December): 404–412.
- Wu, Nesa L. (2009). *Production/Operations Management –Applying Lean Principles- From Design to Shop Floor Control*. McGraw Hill.
- [www.leansupermarket.com/servlet/Detail?no=476](http://www.leansupermarket.com/servlet/Detail?no=476)
- [www.qimacros.com/qiwizard/pchart.html](http://www.qimacros.com/qiwizard/pchart.html)
- [www.bec.msoe.edu/sig\\_presentations/kanbans\\_2005\\_jan.pdf](http://www.bec.msoe.edu/sig_presentations/kanbans_2005_jan.pdf)

*Productivity is never an accident. It is always the result of a commitment to excellence, intelligent planning and focused effort.*

— Paul J Meyer



# Status and Capacity Utilization in Small-Scale Industries: A Case Study of Selected Industrial Units in Udupi District

Sureshramana Mayya, Bharath V., and S Mayya

---

*Over the past year, the global economic crisis has exerted considerable influence on many business organizations of any size. Large industrial establishments have attempted to manage this crisis in their own ways. Amid all this, SME's are increasingly being brought into focus on account of their huge growth potential. The present study aims at examining the status of small industries, industrial policy and capacity utilization of small industries and the reasons for not utilizing it to the fullest extent. Capacity utilization has been examined taking into account the location of the unit, industry group to which it belonged, year of establishment, form of organization, investment in plant and machinery, the entrepreneur's background and various reasons specified by the entrepreneurs. This study is empirical in nature and it is based on the data collected with the help of questionnaire. Efforts are also being made to offer suggestions.*

*Sureshramana Mayya is presently working as Associate Professor, in the Department of Commerce, Mahatma Gandhi Memorial College, Udupi, Karnataka, Bharath V is working as Reader, in Poornaprajna Institute of Management, and S Mayya is working as Associate Professor in the Department of Statistics, Manipal University.*

## Introduction

Small and medium enterprises have an important role to play in the present context due to its capacity for employment generation, technological innovation, raising exports, and developing entrepreneurial skills. They reduce regional imbalances. They have been accorded a strategic position in the successive five year plans towards fulfilment of our socio-economic objectives and helped to achieve our dictum of growth with equity. Since the early 1990s, Indian SMEs have been exposed to intense competition due to the accelerated process of globalization. But at the same time, globalization has brought new opportunities and challenges to Indian SMEs.

India used to support small and medium industrial sector since independence compared to many developing countries. Series of institutions have been set up by the central government, state governments, and provided financial assistance, technical consultancy, information, technical input, training, legal advice, and marketing support and helped in the healthy development and progress of small and medium industries. But a pertinent question that has often emerged here is whether their capacity has been utilized to the fullest extent or not. Through this article an effort is made to study the capacity utilization of small scale and medium industries.

## Meaning and Definition

In the Indian context, we have not so far succeeded in giving a definition to small and medium industries. What is neither small nor large industry is being loosely defined as medium industry. Here, the term enterprise encompasses business, services, and industries. The Micro, Small and Medium Enterprises Bill, 2006 defined the segment on the basis of investments in plant and machinery. Small enterprises are those with an investment of not more than Rs 50 million in plant and machinery, and medium enterprises with an investment of over Rs 50



million but less than Rs 100 million in plant and machinery. This definition has finally put the segment within a legal framework. Under the Act, enterprises have been categorized broadly into those engaged in (i) manufacturing, and (ii) providing/rendering of services.

Both the categories have been further classified into micro, small and medium enterprises, based on gross investment in plant and machinery for manufacturing enterprises, and in equipment in case of enterprises providing or rendering services, as shown in Table 1.

**Table 1:** Classification of Enterprises

Category	Micro Enterprises	Small Enterprises	Medium Enterprises
1. Manufacturing enterprises in terms of gross investment in plant and machinery.	Not Exceeding Rs. 2.5 mn (Rs. 25 lakh)	Above Rs. 2.5 mn and up to Rs. 50 mn (Rs. 25 lakh—5 cr)	Above Rs. 50 mn and up to Rs. 100 mn (Rs. 5—10 cr)
2. Service enterprises in terms of gross investment in equipment.	Not Exceeding Rs. 1.0 mn (Rs. 10 lakh)	Above Rs. 1 mn and up to 20 mn (Rs. 10 lakh-2 cr)	Above Rs. 20 mn and up to Rs. 50 million (Rs. 2—5 cr)

**Table 2:** Position of Sick SSI Units and Sick/Weak Non-SSI Units Financed by Scheduled Commercial Banks in India (1987 to 2008)(Rupees. in Crore)

Year (As at End-March)	Sick SSI		Sick Non-SSI		Weak Non-SSI		Sick/Weak Total	
	Units	Amount Outstanding	Units	Amount Outstanding	Units	Amount Outstanding	Units	Amount Outstanding
1987	158226	1542	1057	2680	655	1515	159938	5738
1988	217436	1980	1172	3026	743	1922	219351	6927
1989	186441	2243	1419	4258	762	2183	188622	8684
1990	218828	2427	1455	4539	814	2387	221097	9353
1991	221472	2792	1461	5106	876	2870	223809	10768
1992	245575	3101	1536	5787	813	2646	247924	11533
1993	238176	3443	1867	7901	657	1790	240700	13134
1994	256452	3680	1909	8152	591	1864	258952	13696
1995	268815	3547	1915	8740	476	1452	271206	13739
1996	262376	3722	1956	8823	418	1203	264750	13748
1997	235032	3609	1948	8614	420	1564	237400	13787
1998	221536	3857	2030	9862	446	1964	224012	15682
1999	306221	4313	2357	13114	435	2037	309013	19464
2000	304235	4608	2742	16748	422	2299	307399	23656
2001	249630	4506	2928	18478	389	2792	252947	25776
2002	177336	4819	2880	17591	381	3655	180597	26065
2003	167980	5706	2999	21518	397	7591	171376	34816
2004	138811	5285	5054	31166	567	4531	144432	40982
2005	138041	5380	4478	29644	774	4783	143293	39807
2006	126824	4981	3408	26013	1132	6976	131364	37970
2007	114132	5267	2982	17984	1010	7082	118124	30333
2008 (P)	85187	13849	-	-	-	-	-	-

Source: Reserve Bank of India.

Notes: Abbr. : P : Provisional.

SSI : Small Scale Industry. Note : 1987 and 1988 data relate to end-June.

1989 data relate to end-September.



SMEs are not uniform across the globe. The way they are defined depends on the stage of economic development and the broad policy purposes for which the definition is used. The most commonly used definitions relate to either size of employment and or quantum of capital investments or fixed assets. As the process of economic development leads to changes in industrial sector shares in GDP and the contribution of sub-sectors within industry, the definition is extended to include not only manufacturing industries but all enterprises which fall within or below the defined cut off point.

Small scale units engage themselves in various kinds of manufacturing such as manufacturing of metal alloys and products, machinery, electrical equipments, chemicals, drugs, electronics, and miscellaneous products. But most of the small scale units have not been able to achieve capacity utilization to the fullest extent. A very few of them have been able to achieve a capacity utilization greater than 80%, as revealed by many surveys. Recent study conducted at Dakshina Kannada and Udupi Districts of Karnataka have indicated that more than 80 of the industrial units in the various industrial estates of the two districts are either closed or sick. The fact that the same scenario prevails throughout the country and the difference, if any, is only in degree and cannot be a consoling factor. We know that this situation is not good for the economy of the country and due to these financial institutions and the banks in the country themselves are becoming sick as it increases the non-performing assets' of industrial units and other enterprises.

The position of Sick SSI and Weak and non-viable units financed by commercial banks are not encouraging. Table 2 throws light on the magnitude of sickness.

Despite several measures for the promotion of this sector, it is very disappointing to observe that its performance has not been satisfactory. The problems are many like finance, production, marketing, labor, which have resulted in under utilization of installed capacity. At the same time, power cut, lack of demand, lack of working capital are all hindering the full utilization of installed capacity.

### **Objectives of the Study**

The present study is intended to examine the capacity utilization of selected small scale units in the Udupi

Districts and to find out the reasons for it. The specific objectives are:

1. To examine and project the existing performance level of industrial units in the study area.
2. To investigate into the reasons for underutilization of capacity in the small scale units of target area.
3. To examine the relation between the investment and capacity utilization.
4. To examine the relationship between the age of the unit and the capacity utilization.
5. To examine the relation between the background of the entrepreneur and capacity utilization.
6. To study the current status of the small and medium scale industries.
7. To study the industrial policy and importance of the small-scale industries.

### **Limitation of Study**

The study is not free from limitations. Some of them are likely:

1. Udupi district itself is not an industrialized area; hence based on this study we cannot make generalizations.
2. The researcher collected data from only 100 respondents, out of which only 85 units responded.
3. Few sample units did not maintain the books for recording their capacity utilization, production, etc. Hence collected data may be biased.

### **Review of Literature**

A number of studies on the efficiency of small and medium industries were undertaken. Dhar and Lydall (1961), Hajra (1965), Sandesara (1966 and 1969) and Mehta (1969) studied the relationship between size and output-capital ratio by using the data from confederation of medium industries. Their report showed positive relationship.

Bhavani (1980) conducted a detailed census of SSI units and concluded that the capital productivity of SSI units is lower than that of large scale units suggesting efficiency differences in line with the findings of Dhar-Lydall-Sandesara.

Tambiinam (2007) found out that the levels of productivity are higher in large enterprises (LEs) and



---

foreign-owned enterprises than in small and medium enterprises (SMEs), partly because they have higher levels of technology capacity. He suggested that increasing the productivity of SMEs might be facilitated through improved knowledge or technology.

Business outlook survey conducted by Confederation of Indian Industries (CII) based on preliminary analysis of responses from 352 small and medium members reveals a dull scenario (June 2003). However, the small and medium industry foresees an improvement in the business situation in the coming years and expects an increase in turnover of production, profit margins, capacity utilization, and exports.

According to the information collected from Small Scale Industrial Centers, government agencies for small scale industries and some of the associations of the small scale industries, no in depth studies have been made till now on the capacity utilization of small scale industries. Under utilization of capacity may be considered as one of the problems, but neither the entrepreneurs nor the concerned authorities have taken up this issue very seriously.

Empirical studies in several countries show that SMEs are characterized by

1. Lower and more variable profitability (Dunlop, 1992; Cosh and Hughes, 1993; Peel and Wilson, 1996);
2. Lower liquidity (Gupta, 1969; Chittenden et al., 1996);
3. Lower use of long-term debt (Audretsch and Elston, 1997; Chittenden et al., 1996; Levratto, 1997);
4. Lower leverage (Rivaud-Danset et al, 1998);
5. Higher short-term debt (Tamari, 1980; Cosh and Hughes, 1993; Rivaud-Danset et al., 1998).

In one of the study conducted by Prof. Jayachandran, Narendra Kumar and Dr Himachalam at selected small scale units of Tirupathi Industrial Estate revealed that 50% of the SMEs were utilizing 25% to 50% capacity and the remaining 50% were utilizing 50 to 75%. None of the studied units was utilizing more than 75% of plant capacity. Further it revealed that age of the unit alone is not accountable for the extent of capacity utilization. They concluded that entrepreneurial talents and problems, which confronted the unit, also influenced the level of capacity utilization in the small

scale units.

From the above review, it is obvious that few research studies have been undertaken on the subject capacity underutilization in SMEs. Hence, there is a research gap necessitating further study, particularly SSI sector and the problems confronted by them. This article throws light on the status of small and medium enterprises and their capacity utilization.

### Research Methodology

The present study aims at examining the status of small industries, industrial policy, and capacity utilization of small industries and the reasons for not utilizing it to the fullest extent. Capacity utilization has been examined taking into account the location of the unit, industry group to which it belonged, year of establishment, form of organization, investment in plant and machinery, the entrepreneur's background and various reasons specified by the entrepreneurs. This study is empirical in nature and it is based on the data collected with the help of questionnaire. Attempts have also been made to extract the correct information through discussion with the entrepreneurs.

Chi-square test is applied to study the association between capacity utilization and variables like location of the plant, investment, age of the unit and background of the industrialists. Besides the primary data, necessary information and data also collected through secondary sources like periodicals, reports, government publications of industrial association, research organization, and company documents. Documents are also collected from District Industrial Centre of Udipi and Industries Association, Manipal.

In the study, convenience sampling of 85 units were selected. Heterogeneous sample units were selected for the study. Importance was given for the amount of investment on the units and the location as well.

### Present Study

There are 15 medium scale industries existing in the District. Among them printing, fishnet, granite, water gel explosives are the major industries. There are 5629 tiny and small scale industrial units registered in the District. Total amount of Rs 218.49 crore has been invested in these units generating employment for 34,123 numbers.

Table 3 reveals the number of SSI registered, the



**Table 3: Tiny and SSI registered in the District (Up to March 31, 2008)**

Sl. No	Type of Industries	Number	Investment	Employment
1.	Food and Beverages	2,080	8,346.68	11,689
2.	Textile and Garments	365	904.52	2,596
3.	Wood and Wood Products	322	1,084.46	1,834
4.	Printing and Stationery	264	3,549.44	1,492
5.	Leather and Leather Products	108	269.92	444
6.	Rubber and Plastics	180	1,839.58	1,118
7.	Chemical and Chemical Products	125	665.49	670
8.	Glass and Ceramics	185	1,424.84	2,413
9.	Basic Metal and Metal Products	207	1,129.95	1,238
10.	General Engineering, Machinery parts, Agro based implements	335	1,149.81	1,946
11.	Electrical and Electronics	112	512.68	1,489
12.	Automobile	39	138.56	664
13.	Job work repairs & servicing	10	35.17	85
14.	Transport & Equipment	05	4.60	22
15.	Ferrous & Non ferrous	544	78.36	2,006
16.	Other services	250	324.34	700
17.	Miscellaneous	498	1,785.86	3,717
	Total	5,629	21,845.48	34,123

**Table 4: List of Existing Medium Scale Industries up to March 31, 2008**

SL No.	Name of industry	Product	Investment in lakhs	Employment
1.	Manipal security printers	Printing	76	149
2.	Canara security press	Lottery tickets	394.4	125
3.	Manipal power press	Printing	509	500
4.	Manipal printers & publishers	News paper	252	136
5.	Lamina Foundries	Auto brake drums	328	220
6.	Indian plywood manufacturing	Plywood	43	259
7.	Manipal Prakashana Pvt Ltd.	Printing	503	72
8.	Baliga Exports Pvt. Udupi	Nylon fishnet	99	50
9.	LUCI & :LUCI Fisheries Pvt. Ltd	Fishing activity	152	22
10.	Western India Chemicals	Urea	137	32
11.	Amitha Jullian Marine Pvt Ltd	Nylon fishnet	550	20
12.	Keltek Energies Pvt Ltd	Waterjell, Explosives	99.99	84
13.	Shubashika Aive Industries Pvt Ltd	Granite	188	40
14.	Bestsellers, Manipal	Readymade Shirts/Pants	440	310
		Total	3770.99	2019



total investment and employment generation by this sector.

Table 4 shows the list of existing medium scale industries up to March 31, 2008.

The district has only one industrial area and it is located at Shivally—Manipal—about 5km from Udupi town. There are three industrial estates one at Shivally, Manipal in Udupi Taluk and the others at Koteswara in Kundapur Taluk and Karkala in Karkala Taluk.

The district has ports at Malpe, Gangolly, and Hangarakatte. But these ports are not used for commercial transportation, for commercial transportation the nearest

port is New Mangalore port at Mangalore. The District has the nearest aerodrome at Mangalore.

### Capacity Utilization in a Sample Survey Conducted at Udupi District.

The study is based on data collected from primary and secondary sources. The primary data were collected from 85 Small Scale Industrial Units situated in and around the Udupi District. Table 5 shows the Capacity Utilization-Industry Group Classification.

Table 6 shows that out of 85-sample units, 4 units (5%) utilized up to 25% while 13 units (15%) utilized

**Table 5: Capacity Utilization - Industry Group Classification**

S. N	Industry group	Capacity utilization in percentage				Total no of Units
		0.25	26 to 50%	51 to 75%	75% & above	
1.	Chemical		-	1	1	02
2.	Textile product	-	-	-	1	01
3.	Rice mills	-	2	1	-	03
4.	Printing & paper products	1	2	4	3	10
5.	Pipes (PVC)	-	1	1	-	02
6.	Cashew industry	-	-	3	2	05
7.	Canning	-	2	2	-	04
8.	Metallic product	1	-	-	2	03
9.	Fisheries	-	-	3	3	06
10.	Engineering	2	2	6	1	11
11.	Food & Beverages	-	3	5	2	08
12.	Wood & Wood Products	-	-	3	4	05
13.	Edible Oil products	-	-	2	5	06
14.	Rubber & plastic products	-	-	5	2	11
15.	Metal	-	1	1	3	03
16.	Electrical products	-	-	2		05
	Total	04	13	39	29	85

**Table 6: Variables Associated with Capacity Utilization**

Capacity Utilization in terms of percentage	Units	A Location				B Establishment				C From of Org.			
		Industrial area	Commercial area	Residential area	Non Residential area	Up to 1990	1993-1997	1997-2002	2002-2007	Proprietorship	Partnership	Pvt. Ltd.	Pub. Ltd.
0 – 25	04	04	-	-	-	01	02	01	-	01	03	-	-
26 – 30	13	08	02	03	-	06	02	02	03	08	04	01	-
51 – 75	39	25	08	04	02	15	10	09	05	15	15	09	-
76 and Above	29	18	05	02	04	15	10	02	02	10	15	04	-
Total no. of Units	85	55	15	09	06	37	24	14	10	34	37	14	—



**Table 7: Reasons for not utilizing the capacity**

Capacity In terms of percentage	Lack of market demand	Lack of working capital	Inadequate raw material	Inadequate workforce	Power failure	Competition from branded products	Other reasons
0 to 25	02	02	-	-	-	-	-
26 to 50	08	03	-	-	02	-	-
51 to 75	15	05	02	01	05	05	06
76 and above	05	05	04	04	06	03	02
Total no of Units	30	15	06	05	13	08	08

between 26 to 50% of their capacities. Thirty nine units (46%) utilized between 51 and 75% of their capacities and the remaining 29 (34%) utilized above 75%. It can be seen that nearly 20% of the sample units were not in a position to exceed 50% of their capacities.

Table 7 depict the capacity utilization of the units based on their location i.e. whether they are located in industrial estates, commercial area, residential area or non-residential area. Out of 55 units which were located in industrial estates 12 units (23%) used their installed capacities upto 50% only. In the case of units located in commercial area, two out of 15 units (13%), residential areas three out of 9 (33%) and non residential areas all the six units utilizes more than 50% of their installed capacities.

An attempt has been made to examine the direct reasons for utilizing the capacity to the fullest extent. The various reasons indicated by the entrepreneurs are presented in Table 7. Inadequate market demand and inadequate working capital were equally predominant reasons. 45 out of 85 entrepreneurs stated the above reasons.

Irregular and inadequate power supply, reported by 13 entrepreneurs. Inadequate work force (12units), 8 units facing problems from brand products, 8 entrepreneurs stated other reasons like excess tax, technological problems etc. and inadequate raw material reported by four entrepreneurs.

Out of four units which were utilizing their capacity upto 25% only two stated inadequate working capital as the reason for not utilizing their capacities while two units indicated inadequate market demand as the reasons. In the case of ancillaries, mother unit not buying as per the stipulated terms was reported by few units.

Thirteen units utilized their capacity between 26 and

50%. Among these inadequate market demand appears to be the major problem compared to inadequate working capital.

In the third category, 39 units utilized their capacities between 51 and 75%. Inadequate market demand posed a big problem compared to the problem of inadequate working capital. The former was reported by 15 units whereas the latter by five units. Inadequate workforce and irregular and inadequate supply of power were mentioned by five units each and six units stated other reasons.

Among 29 units which were utilizing above 51% of their capacities on an average five each were facing the problems of inadequate working capital, inadequate workforce, inadequate market demand, problem of raw material supply, power cut, problems from branded products and other reasons were mentioned by three and two units respectively.

The above analysis shows that the problems vary from unit to unit. The reasons could be the different types of growing needs. The analysis indicates that units at both lowest and highest extremes largely faced the problem of finance, whereas the units at medium level mostly faced the problem of marketing.

In order of assess the impact, capacity utilization was taken as the criterion in this study. The capacity utilization level was divided into four categories: up to 25%, between 26 and 50%, between 51 and 75%, and above 75%. The capacity utilization was examined viz-a-viz other variable which included the industry group to which they belonged, location of the unit, year of establishment, form of organization, investment in plant and machinery, age of the unit, background of the entrepreneur.

The analysis of the study reveals that only 20% of the sample units were not in a position to exceed 50% of their capacities. But 65% of the sample units were unable



---

to reach the 75% of their installed capacity.

The study of small scale units makes it clear that the form of organization, the area of location, investment in plant and machinery, the background of entrepreneur, etc., do not influence capacity utilization. But the various reasons indicated by entrepreneurs say inadequate market demand, inadequate working capital, inadequate raw material, inadequate workforce, power failure and competition from branded products were reasons for the underutilization of installed capacity.

### Suggestions

In order to overcome the bottlenecks faced by the small-scale units following measures are recommended.

Inadequate market demand and inadequate working capital are the major problems confronted by the small-scale units. Marketing problem includes inadequate market demand, fluctuations in demand, competition from large industrial units and etc. To solve the problem of inadequate or fluctuating market demand the government agencies must give small entrepreneurs periodical training and educate them about modern marketing, using flexible pricing, promotion, incentive and other methods to increase demand including the different uses for the same product. Management Institutions can also extend their help to the small-scale units to modernize their marketing techniques.

To solve the working capital problem it is better to take the help of professional financial experts say chartered accountants and cost accountants. As well as Institutes like Chartered Accountants or Cost Accountants and Financial Management Institutes should extend their assistance to the small-scale units.

Proper manpower planning and adequate wages and salaries can overcome inadequate workforce.

Power failure, inadequate supply of power, and load shedding must be avoided. Due to various reasons the Electricity Corporation is not able to prevent their occurrence. The concerned Governments should take interest to improve the power supply. Alternative sources of energy may be made available to the small-scale industries as a part of the National Energy Policy.

Other causes such as excessive sales tax, procedural delays and practices can be removed by streamlining the tax structure and the office methods followed.

### Conclusion

The cost and value of small-scale industries could benefit a large section of our country's population, if the resources and efforts of small-scale industries could be more productively used.

It is common knowledge that on the one hand surpluses generated are far below normal expectations and on the other obsolescence and industrial sickness among small scale industries threaten to become a net drain. Although the awareness of these issues is now more widespread, the problem of social and economic insecurity prevents effective measures from bringing about the change. The subject of fuller utilization of capacity, modernization and productivity thus tend to be obscured. But the punishment for inaction will be very heavy. To avoid it the need to change now becomes imperative and unavoidable.

Lack of real consultants is adding to the problem. The so called consultants who exist in large numbers, tend to indicate every project as viable as otherwise it affects their own viability and existence. They make every project a success on paper and in reality hardly 20% of the projects register success. The practice of starting enterprise based on exemptions and subsidies is adding to the problem.

Thus a deep study of the capacity utilization in small industries is a crying need. The government policy also needs review in the interest of promoting fuller growth of small-scale units and making them viable.

In the present study an attempt has been made to examine the capacity utilization of small-scale industries in Udupi district and the reasons for not utilizing the capacity into the fuller extent. Capacity utilization was examined taking into account the location of the unit, the industry group to which it belonged, year of establishment, form of organization, investment in plant and machinery, the entrepreneur's background and reasons indicated by the entrepreneur.

Now in this era of socio-economic transformation and favorable conditions it is the turn of small-scale industries to rise to the occasion and tell the society that they are capable of producing results.

### References

- Audretsch, D. and Elston, J. (1997). "Financing the German Mittelstand," *Small Business Economics*, 9: 97-110.



- B.V. Mehta.** (1969). "Size and Capital Intensity in Indian Industry," *Oxford Bulletin of Economics and Statistics*, 31(3).
- Chittenden, F., G. Hall and P. Hutchinson.** (1996). "Small firm growth, access to capital markets and financial structure," *Small Business Economics*, 8: 59-67.
- Cosh, A. and A. Hughes.** (1993). "Size, financial structure and profitability: U.K. companies in the 1980's," Working Paper, Small Business Research Center, University of Cambridge.
- D.A. Bhavani.** (1980). "Relative Efficiency of the Modern Small Scale Industry in India," M.Phil dissertation, Delhi: University of Delhi.
- Dunlop, W.** (1992). "Small vs. large firms in Australian manufacturing," *Small Business Economics*, 4: 45-58.
- Dhar P.N. and H.F. Lydall.** (1961). *The Role of Small Scale Enterprises in Indian Economic Development*. Bombay: Asia Publishing House.
- Gupta, M.C.** (1999). "The effects of size, growth and industry on the financial structure of manufacturing companies," *Journal of Finance*, 24: 517-529.
- J.C. Sandesara.** (1966). "Scale and Technology in Indian Industry," *Oxford Bulletin of Economics and Statistics*, 28.
- J.C. Sandesara.** (1969). "Size and Capital Intensity in Indian Industry: Some Comments," *Oxford Bulletin of Economics and Statistics*, 31(1): 24
- Levratto, N.** 1997. "Small Firms Finance in France," *Small Business Economics*, 8: 279-295.
- Peel, M. J. and N. Wilson.** (1996). "Working capital and financial management practices in the small firm sector," *International Small Business Journal*, 14(2): 52-67.
- Rivaud-Danset, R., E. Dubocage and R. Salais.** (1998). "Comparison between the financial structure of SME versus large enterprise using the BACH data base," University Paris-Nord, Faculte de Sciences Economiques, June.
- S. Hajra.** (1965). "Firm Size and Efficiency in Measuring Industries," *Economic and Political Weekly*, August.
- Tamari, M.** (1980). "The financial structure of the small firm—an international comparison of corporate accounts in the U.S.A., France, U. K., Israel and Japan," *American Journal of Small Business*, 4: 20-34.
- Tulus, Tambiinan.** (2007). "Transfer of Technology to and Technology Diffusion among Non-farm Small and Medium Enterprises in Indonesia," *Springer Science and Business Media*, 0:243-258

*They say you can't do it, but remember, that doesn't always work.*

—Casey Stengal



# Annual Index of Productivity Vol. 50 (April 2009 – March 2010)

## Vol. 50, April-June, 2009, No. 1

Prabhat Kumar  
A Conceptual Model of Human Resource Management in  
Public Service for Excellence and Productivity,  
Vol. 50, No. 1, Page No. 1-8

Madhuchhanda Mohanty and Bibhuti Bhusana Pradhan  
Corporate Reputation Management: The Study So Far,  
Vol. 50, No. 1, Page No. 9-19

R. Nagarajan and Sanjeevaneey Mulay  
Provider Satisfaction in Public Hospitals in Maharashtra,  
Vol. 50, No. 1, Page No. 20-33

Seema Sanghi  
Understanding Motivational Complexities in the Use of  
Plastic Bags, Vol. 50, No. 1, Page No. 34-43

Jai Singh Parmar and Dhyani Singh  
Trade Unionism in Himachal Pradesh State Electricity  
Board, Vol. 50, No. 1, Page No. 44-54

R. Ganapathi and M. Balaji Prasad  
Environmental Impacts: A Study on the Effects of Working  
Environment on the Performance of Executives,  
Vol. 50, No. 1, Page No. 55-60

Shyam L. Kaushal  
Call of Business Process Outsourcing Motivators and  
Determinants, Vol. 50, No. 1, Page No. 61-64

Mohita G. Sharma and Kashi N. Singh  
Binomial Option Valuation of Spares,  
Vol. 50, No. 1, Page No. 65-71

D. Suresh Kumar  
An Inquiry into Determinants of Participation in Self-Help  
Group (SHGs) Institutions, Vol. 50, No. 1, Page No. 72-81

Monica Banerjee  
Variables Influencing Role Performance of Women in  
Panchayats, Vol. 50, No. 1, Page No. 82-92

## Vol. 50, July-December, 2009, No. 2

S.K. Purohit, Ashutosh Sarkar, Debadyuti Das, and Sushil  
Kumar Sharma  
Performance Evaluation of Services of Commercial Banks  
based on Customer Perception: A Fuzzy Approach  
Vol. 50, No. 2, Page No. 93-101

Jaynal Ud-din Ahmed  
Growth of Bank Deposits and its Determinants: A  
Pragmatic Study on Commercial Banks, Vol. 50, No. 2,  
Page No. 103-111

S.S. Chahal and Vijay Singh Hooda  
Productivity Performance of State Co-operative Apex  
Banks in India: An Analytical Study of Northern Region,  
Vol. 50, No. 2, Page No. 112-120

Pradip Kumar Biswas and Indranil Biswas  
Sources of Finance and Productivity: A Study of  
Unorganized Manufacturing Sector in India,  
Vol. 50, No. 2, Page No. 121-129

D. Subramaniam and K. Shyamasunder  
Rural Product and Urban Market, Vol. 50, No. 2, Page  
No. 130-133

Karan Sakhuja, Malyaj Srivastav, Samir Sharma, Soumya  
Sharma, and Abid Haleem  
Planning of Engineering College Machineshops: Need,  
Proposals, and Economic Benefits,  
Vol. 50, No. 2, Page No. 134-144

Neelesh P. Sirdeshmukh, Y.M. Puri, I.K. Chopde, and A.D.  
Pundlik  
Productivity Improvement through Application of "MOST"  
in Switchgear Company,  
Vol. 50, No. 2, Page No. 145-151

Pankaj Chandna and Ashwani Dhingra  
GA Framework for Job Shop Scheduling Problem with Due  
Dates, Vol. 50, No. 2, Page No. 152-158

Dipayan Datta Chaudhuri  
Total Factor Productivity Growth in Indian Manufacturing  
Sector in an Era of Economic Liberalization: A Review,  
Vol. 50, No. 2, Page No. 159-165  
S. Venkatanarayana Reddy and K. Satyanarayana Reddy



---

Trends in and Determinants of Agricultural Productivity: A Study on Chittoor District, Andhra Pradesh, Vol. 50, No. 2, Page No. 166-172

**Vol. 50, October-December, 2009, No. 3**

R.K. Khanna  
Integrated Water Resources Management – A Framework for Action, Vol. 50, No. 3, Page No. 173-183

D. Pawan Kumar  
Water Conservation Opportunities in Industry and Power Sector, Vol. 50, No. 3, Page No. 184-192

R.C. Trivedi  
Water Quality Issues, Status and Initiatives in India, Vol. 50, No. 3, Page No. 193-199

Archana Chatterjee  
Building Ecosystems Management into Development - The IRBM Way, Vol. 50, No. 3, Page No. 200-205

Kanika Kalia  
Standards in the Changing Global Water Management Landscape, Vol. 50, No. 3, Page No. 206-217

P.S. Rana  
Pricing of Water for Sustainability, Vol. 50, No. 3, Page No. 218-225

Sabu Thomas and M.K. Shelly  
Engineering Labor Market: Employment Scenario of the Fresh Engineers in the Pre and Post Economic Recession Period - An Analysis on Kerala, Vol. 50, No. 3, Page No. 226-233

V.K. Sharma and Varinder Pal Singh  
Labor and Machinery Use: A Study of Punjab Agriculture, Vol. 50, No. 3, Page No. 234-238

Nitin Arora  
Technical Efficiency and Profitability in the Sugar Industry of Punjab: A Firm Level Non-parametric Analysis, Vol. 50, No. 3, Page No. 239-254

B.N. Pradeep Babu, C. Sukanya, and G.N. Nagaraja  
Economic Assessment of IPM Technology in Groundnut in Karnataka, Vol. 50, No. 3, Page No. 255-258

**Vol. 50, January-March, 2010, No. 4**

Anita Kumari  
Impact of Technology Policy on Productivity Growth: An Econometric Study of Pharmaceutical Industry in India, Vol. 50, No. 4, Page No. 259-267

Tushar N. Desai and Akhil Teja Erubothu  
A Study of the Interrelationship between Total Quality Management and Productivity, Vol. 50, No. 4, Page No. 268-278

M.J. Sheikh and S.V. Bansod  
Research Issues and Consideration to Improve Truck Driver's Productivity, Vol. 50, No. 4, Page No. 279-284

Sanjay Tupe and Manoj Kamat  
An Empirical Study of Trends and Determinants of Indian Agricultural Production for Pre and Post Reforms Period, Vol. 50, No. 4, Page No. 285-292

Nomita P. Kumar  
Uttar Pradesh's Manufacturing Sector: Status, Structure, and Performance, Vol. 50, No. 4, Page No. 293-309

S. K. Patil  
Design of Automation of Specific Gravity Seed Gradation Process, Vol. 50, No. 4, Page No. 310-318

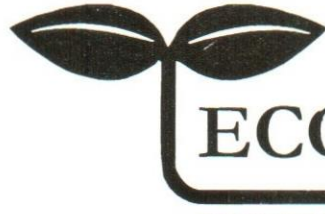
Shyam L. Kaushal  
A Survey on Work Culture and Ethical Behavior : A Case Study of HP Police Force, Vol. 50, No. 4, Page No. 319-325

Suchismita Mondal Sarkar and Soumyendra Kishore Datta  
Status of Entrepreneurship and Associated Environment: A Study from Durgapur, Vol. 50, No. 4, Page No. 326-333

Sangeeta Verma and M. S. Sidhu  
A Study on Certified Seed Production of Wheat and Paddy in Punjab, Vol. 50, No. 4, Page No. 334-343

Mandeep Singh, A.S. Joshi, and A.S. Bhullar  
An Analytical Study of Cost-return Structure and Economic Surplus of Marginal and Small Farmers in Punjab, Vol. 50, No. 4, Page No. 344-353





# ECO PRODUCTS

## INTERNATIONAL FAIR 2010

### ECO-PRODUCTS INTERNATIONAL FAIR 2011

*Green productivity for sustainable energy & environment*

**10 - 12 February, 2011**

Pragati Maidan, New Delhi

#### Organizers:



सत्यमेव जयते  
Government of India



NATIONALPRODUCTIVITYCOUNCIL



Confederation of  
Indian Industry

Department of Industrial Policy and Promotion (DIPP), Ministry of Commerce and Industry, Government of India, Asian Productivity Organisation (APO), National Productivity Council (NPC) & Confederation of Indian Industries (CII) are organizing Eco-Products International Fair (EPIF) during 10<sup>th</sup> to 12<sup>th</sup> February, 2011 at Pragati Maidan, New Delhi with a parallel International Conference on the theme "Green Productivity for Sustainable Energy & Environment".

The objective of organizing this fair is to promote and facilitate exchange of knowledge, experience regarding environmental friendly products being manufactured in India and other developed & developing countries. This would enhance scope for networking, marketing and business opportunities with global Eco-product producers and information & media coverage to the products/services of the exhibitors and potential ideas for innovative green entrepreneurs.

#### For further queries, please contact:

**Mr. M. J. Pervez / Mr. Sunil Kumar**

National Productivity Council

(Under Ministry of Commerce and Industry, Government. of India)

Utpadakta Bhawan, 5-6, Institutional Area, Lodi Road, New Delhi- 110003

Tel: +91 11 24692946/24607320; Fax +91 11 24698139

Email: epif\_2011@npcindia.org, www.npcindia.org







# **Productivity**

**Announces**

**a**

**Special Issue**

**Vol. 51, No. 2,**

**July - Sept., 2010**

**on**

## **Human Resource Development**

*Place your orders with :*



**MD Publications Pvt Ltd**

**"MD House", 11, Darya Ganj  
New Delhi-110 002**

**Telephone : 91-11-45355555**

**E-mail : [contact@mdppl.com](mailto:contact@mdppl.com)**

**website : [www.mdppl.com](http://www.mdppl.com)**