



# Productivity

Vol. 43

April-June 2002

No. 1

Focus : Food Security

Food Availability & Access

Food Security & Structural Adjustment

Trade Liberalisation & Food Security

Food Security through Market Reforms

Organisational Development

Trade Liberalisation & Indian IT Industry

Sugar Industry in Punjab

Rehabilitation of Sick SSI Units

CRM for Competitive Advantage

## 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 Manuscripts

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, Utpadakta Bhawan, Lodi Road, New Delhi-110 003.

### About the References

Only those references which are actually utilised 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, 1988a, 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 organisation, the name of the organisation 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

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

### Editor

N.K. Nair

### Assistant Editor

Arundhati Chattopadhyay

### Editorial Consultant

Himanjali Sankar

### Subscription

<i>Inland</i>	: Annual Rs. 1000 Single Copy Rs. 250
<i>Foreign</i>	: Annual Airmail US \$ 80 Annual Surface Mail US \$ 75 Single Copy Airmail US \$ 20
<i>SAARC Countries</i>	: Annual Airmail US \$ 40 Annual Surface Mail US \$ 30 Single Copy Airmail US \$ 10

**Productivity** will be sent to all subscribers within each quarter. The Journals Division, CBS Publishers & Distributors, may be contacted in the event of non-receipt within one month from the quarter.

All business correspondence to be addressed to:

**The Journals Division,  
CBS Publishers & Distributors,**  
4819/XI, Prahlad Street  
24, Ansari Road, Daryaganj,  
New Delhi 110 002.

*Tel.* : 3289259, 3266861, 3266867  
*Fax* : 91-11-3266838, 3276712  
*E-Mail* : cbspubs@del3.vsnl.net.in

**ISSN 0032-9924**

# Productivity

---

A QUARTERLY JOURNAL OF THE NATIONAL PRODUCTIVITY COUNCIL

Vol. 43 • April–June 2002 • No. 1



**CBS PUBLISHERS & DISTRIBUTORS**

New Delhi, India

# Productivity

COUNCIL OF THE NATIONAL PRODUCTIVITY COUNCIL

Copyright © 2002 National Productivity Council

## CBS PUBLISHERS & DISTRIBUTORS

**NEW DELHI** : 4819/XI, Prahlad Street, 24 Ansari Road  
Daryaganj, New Delhi-110 002

**BANGALORE** : Mr. N. Radhakrishna, No. 21, Ashirwad  
5th Cross Byatarayanapura, Mysore Road  
Bangalore-560 026

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

ISSN 0032-9924

Published on behalf of the National Productivity Council by S.K. Jain for CBS Publishers & Distributors, 4819/XI, Prahlad Street, 24 Ansari Road, Daryaganj, New Delhi 110 002. Typeset by Pagitek Graphics, 7F West Guru Angad Nagar, Laxmi Nagar, Delhi and printed at Daksha Printing Pvt. Ltd., 7/11 Ansari Road, Daryaganj, New Delhi-110 002.

Printed in India.

Production Director: Vinod Jain

# Contents

---

Food Security & Globalisation — <i>G. Denis</i>	...	1
Food Security & Structural Adjustment — <i>S.K. Mohanty</i>	...	5
Trade Liberalisation & Food Security in Asia — <i>Satish C. Jha</i>	...	14
Food Security & Poverty Alleviation in Asia-Pacific Region — <i>Wim Poleman</i>	...	24
Sustainable Development & Agricultural Strategies for Food Security — <i>V. Anbumozhi</i>	...	33
World Food Security & Agricultural Trade — <i>Keiji Ohga</i>	...	41
Rural Women & Food Security — <i>Revathi Balakrishnan</i>	...	49
Enhancing Food Security through Market Reforms — <i>Gopal Naik</i>	...	60
Food Availability & Access in Rural India — <i>Swarna Sadasivam Vepa &amp; R. V. Bhavani</i>	...	67
Biotechnology & Food Security — <i>Akram A. Khan, Farhad Shirani Bidabadi</i>	...	76
Outbound Logistic Planning of a Process Industry — <i>Suman Das, Kampan Mukherjee &amp; B.S. Sahay</i>	...	86

---

---

Organisational Development	...	94
– <i>Biswajeet Pattanayak &amp; Rajnish Kumar Misra</i>		
CRM: A Tool for Competitive Advantage	...	99
– <i>Ajay Pandit &amp; A.K. Saini</i>		
Productivity Improvement in Ophthalmology	...	106
– <i>B. Venkatraman &amp; U.S. Rao</i>		
Research Orientations of National Laboratories – Developmental Needs	...	113
– <i>Pulak Das</i>		
Rehabilitation of Sick Small Scale Industry Units	...	123
– <i>P.R. Kulkarni</i>		
Productivity in Agro Non Food & Non Agro Group	...	133
– <i>B.S. Prakash</i>		
An Analysis of Sugar Industry in Punjab	...	141
– <i>P.S. Rangji and M.S. Sidhu</i>		
Trade Liberalisation & Indian IT Industry	...	149
– <i>Hina Sidhu</i>		
Indian Agriculture: Pre & Post Economic Reforms	...	156
– <i>K. Pochanna</i>		
News & Notes	...	163
Book Reviews	...	166
Annual Index: Productivity Volume 42 (2001-02)	...	170

---

# Food Security & Globalisation

G. Denis

---

*The article discusses India's significant achievements in food security in the last couple of decades. The benefits of further applications of technology and the role that international trade and investment can play to enhance food security are also articulated.*

*G. Denis is Executive Director, International Grains Council (IGC) & Food Aid Committee (FAC). The views expressed in this article are the writer's and do not represent the views of IGC or FAC members.*

The hunger and malnutrition still widespread in many developing countries tends to overshadow significant progress made in the common struggle to enhance world food security. This progress is nowhere more evident than in India. Since the green revolution of the 1970s, the country has made strides in securing sufficient volumes of food grains for feeding a rapidly expanding population. Further expansion of basic food crops, like wheat and rice, is still in sight.

But, India's food security may be entering a new qualitative phase, where productivity improvements and overall economic growth will play a more critical role. Such improvements in efficiency, quality, diversification and competitiveness could be located throughout the food chain, from production to storage, handling, transportation, distribution and marketing systems. In this process, achieving a fuller integration in open world markets and benefiting more fully from them could act both as incentives and rewards.

## Achievements and Constraints

India's experience in substantially expanding the volume of domestic production of agriculture and food products is widely recognised as a significant achievement, particularly in the face of a large population increase and serious resource pressures. In the last 30 years or so, India has more than doubled its cereals production. It has become the second largest world producer of rice and the third for wheat. Nearly all of India's huge food grain requirements for its increasing population are being met domestically.

India's rice production went up from 42 m. tons to 89 m. tons, with yields moving on an average from 1.1 ton/ha to about 2 tons. The country is now a regular exporter of rice: some 2.5 m. tons annually in the last five years. Recent removal of restrictions on exports of non-Basmati rice and wheat suggests that this world market presence may be for the long-term.

India's wheat production went from about 20 m.

tons in 1970 to over 70 m. tons in 2001, an average increase of 1.6 m. tons a year. Wheat yields went up from 1.2 m. tons/ha to nearly 2.8 m. tons, catching up with the world average. India now regularly produces more wheat than the United States, even though a much smaller proportion enters commercial markets. Since 2000, it has been turning to exports for 2-3 m. tons annually to dispose of burdensome wheat surpluses.

India has been a small importer of food grains in recent years, with an average of less than 1 m. tons of wheat, or about 1% of world trade. It has some times imported relatively small amounts of feed grains, although its expanding commercial livestock industry, particularly poultry, may create more feed grain import requirements in the years ahead.

**Table 1:** Yields of Wheat and Rice in India (1969-2001)

Year (average)	Area (m. ha)		Production (m. tons)		Yields (tons/ha)	
	Wheat	Rice	Wheat	Rice	Wheat	Rice
1969-71	16.9	37.7	20.9	41.9	1.23	1.11
1979-81	22.3	40.1	34.5	49.7	1.55	1.24
1981-91	23.9	42.5	53.0	74.2	2.22	1.75
1999-2001	26.6	44.8	71.7	88.3	2.70	1.97

But, food security is too complex to be measured purely by quantitative yardsticks such as ratios of self-sufficiency, or percentages of imports and exports, which do not take account of key factors such as quality and diversity of food products, the characteristics of national diets or the sustainability of domestic food output.

For example, future yield enhancing varieties and technologies should make further production gains possible, but intensive farming with continuous heavy cropping has been depleting soil fertility, while over-irrigation is causing salinity problems and water-logging of soil. Constraints on transportation, handling and distribution facilities are also known to increasingly impact the food sector.

Recent official data put wheat stocks at nearly 30 m. tons, after averaging less than 10 m. tons in the 1990s, and rice stocks at well over 25 m. tons after averaging 13 m. tons in the 1990s. As these stocks have reached levels far exceeding official targets, they are putting a strain on the limited financial resources for economic development.

### Productivity and Technology

It is widely perceived that furthering efficiency improvements and cost reduction through its grain

transportation, handling and other infrastructure facilities would help to minimise waste and damage to the grain, improve the integrity and consistency of products, and strengthen the capacity of the system to respond quickly to changes in market demand. Recent measures to encourage structural reform, private investment and deregulation are in line with developments on world markets, where both grain importing and exporting countries have been stimulating their own productivity by moving toward privatisation and deregulation of handling, distribution and marketing systems. As a result, the international grain market now operates relatively more efficiently, with transactions being more fluid and requiring smaller stocks to meet regular demand.

**The international grain market operates more efficiently, with transactions being fluid to meet regular demand.**

Similarly, moving major grain volumes in bulk between distant producing and consuming areas tends to put considerable pressures on domestic transportation and infrastructure systems. With sea borne transportation being relatively less expensive than overland, there tends to be some unexploited scope in terms of cost savings.

Issues of genetic crop modifications and bio-technology research and technologies, in general, could not be conveniently brushed aside, without potentially making the achievements of food security of developing countries more problematic in the longer-term. This would seem to be particularly important for large portions of the population still living in poverty and in conditions of malnutrition, which are often overlooked by modern research and technology.

The views of the Nobel Prize winning crop scientist, Dr Borlaug, who is widely credited to be a father of the Green Revolution, deserve some attention. After all, the Green Revolution itself would probably not have been possible without the development of hybrid crop varieties together with the supplies of necessary inputs. India's efforts to achieve food security would undoubtedly have remained much more elusive without the contribution of the high-yielding and disease-resistant wheat hybrid developed in Mexico in the 1960s, using a particular Japanese dwarf wheat.

Dr Borlaug recently recalled the importance of agricultural research and techniques to boost productivity, if the world is to be able to feed its expanding population, without having to destroy millions of hec-



tares of forests around the world. But the impact of modern technology is more pervasive, contributing to changing the economics and the organisation of grain industries, from seeds to the consumer plate.

In this regard, it is not difficult to see the considerable scope for applying indigenous Indian information technology, in combination with other research and technology from both private and public sources, in order to improve productivity in its food system. But, realistically, the kind of investment and technology required to achieve longer-term food security also involves using inputs, many of which come from world markets.

In other words, the road to improving the competitiveness of the national economy overall and for enhancing food security may be increasingly more convergent and mutually supportive than in the past.

### **Trade and Food Aid**

This is compatible with the basic judgment at the 1996 World Food Summit by the participants that poverty is the main cause of food insecurity. The role that international trade and investment can play to enhance food security and reduce poverty was articulated in the following terms: "Trade generates effective utilisation of resources and stimulates economic growth which is critical to improving food security. Trade allows food consumption to exceed food production, helps to reduce production and consumption fluctuations and relieves part of the burden of stock holding".

Ensuring a regular and open flow of grain transactions is indeed critical for the food security of many regions in the world and for enhancing the sustainability of global resources. For example, North Africa and Near East Asia, which experience a continuing vulnerability of domestic wheat production to drought and other ecological pressures, together constitutes one-third of the world wheat market and 60 per cent of feed barley trade.

Global markets are now the source of about 17 per cent of all wheat consumption in the world—only 6 per cent for rice. Overall, commercial demand in international food and feed markets has decisively shifted to developing countries. Their aggregate share of world trade is about 80 per cent for wheat, 70 per cent for coarse grains imports, 85 per cent for rice and 45 per cent for meat products.

This expansion in world cereal demand is generally driven by population rises, urbanisation, diet diversification and economic growth. In many developing countries, wheat import demand is also pushed upward through local investment in mills, bakeries, grain

handling and related industries, with some exporting of milling products and by-products made from imported wheat.

**Expansion in world cereal demand is driven by population rises, urbanisation and economic growth.**

UN population data project population increases at an average of 1.2 per cent a year in developing countries, against only 0.2 per cent in industrialised countries. The growth in urban population could average 1.8 per cent a year. Already 40 per cent of developing countries' inhabitants live in towns—where diets are different—and this is where almost all the population increases will occur.

Similarly, with agriculture being usually the main user of water and with one-third of the world's population by 2025 possibly living in countries afflicted by physical water scarcity, open grain trade will remain essential for food security purposes. Some world water experts have estimated that it takes about 1000 tonnes of water to raise one tonne of wheat.

To a considerable extent, the supply of consumers on a regular basis is the commercial life-blood of the international grain and grain processing industry. In a world of greater economic inter-dependence, food security should be a major beneficiary of an increasing globalisation of markets. But, this will require a proper balance between the trade liberalisation and growth agenda on the one hand, and the sustainability of economic development and the promotion of national self-reliance on the other.

In this regard, achieving a more level playing field under the WTO in global food markets would help developing countries in the pursuit of economic and agricultural development objectives. This is because they simply could not expect to afford equivalent levels of support to their agriculture as that provided by major industrialised economies. These are also the countries which may benefit most by as much transparency, stability and reliability as possible in the operation of global food markets.

In the current state of world food security, some 100 countries potentially face emergency food situations or other food needs, which require from time to time food aid from their international development partners. Although the ultimate objective has to remain the elimination of the need for food aid itself, this form of international

solidarity and cooperation is still an essential tool in support of food security, particularly to alleviate poverty and hunger of the most vulnerable groups.

**In the current state of world food security, 100 countries potentially face emergency food situations.**

In concrete terms, an international food 'safety net' is effectively maintained by major food aid donor members of the Food Aid Convention aimed at responding to the needs of developing countries, irrespective of fluctuations in world grain prices and commercial supplies. Over the last ten years, South Asia has received an average of 1.6 m. tons of wheat annually. Attention is also being given to increasing the quality and effectiveness of the food aid provided and to ensuring that food aid complements the food security strategies of recipient countries.

### **Conclusion**

What has been achieved in furthering food security in South Asia within the last 30 years or so, particularly in India, is fortunately quite different from the catastrophic scenarios projected by pessimists and Malthusian watchers. Expansion of production has made a great

contribution to meeting some of the most critical challenges of economic development and global governance.

Looking ahead, India's capacity to successfully respond to its future nutritional requirements is likely to depend increasingly on effective improvements throughout its food chain from production, processing, handling, transportation, distribution and marketing in terms of quality, efficiency, competitiveness, product diversification as well as sustainability of its resource base. Successful structural economic reforms involving significant trade and investment liberalisation, including deregulation and privatisation, should play a significant role.

Globally food aid will remain essential, particularly for the most vulnerable groups in developing countries. A tangible solidarity and cooperation must remain an integral part of the response by the international community to the challenges of economic globalisation and world food security.

If India can make further substantial improvements in efficiency and productivity gains, it will benefit more fully from world markets. This would contribute to making more tangible the potential opportunities created by economic globalisation with Asia and the world becoming more prosperous, food secure and stable.

□

*Prosperity belongs to those who learn new things the fastest.*

**– Paul Zane Pilzer**

# Food Security & Structural Adjustment

S.K. Mohanty

---

*This article discusses food security in developing countries vis-a-vis the global food situation. Four categories of entitlement to food are outlined to find how food security can be maintained in a sustainable manner in the long run.*

*S.K. Mohanty is Faculty Member, Research and Information System for the Non-Aligned and Other Developing Countries, New Delhi. The views expressed are those of the author and not of RIS.*

## Global Food Situation

In recent years, the world economy has witnessed improvement in the overall food situation, and has been partially successful in maintaining food security in the face of rising population (Aziz, 1990). The trend shows that the growth rate of foodgrain production has outstripped the rate of population growth by a narrow margin and the world is moving towards global food self-sufficiency. Developing countries have fared better than industrial countries in the production of foodgrains during the last few decades. There is a marked deceleration in the movements of foodgrain prices in the global market.

Despite the fact that the food situation in LDCs has ameliorated considerably, the absolute number of people under the poverty line has been escalating over the years. More than 80 crore people, mostly in developing countries, currently suffer from malnutrition. One of the important reasons for such a situation is due to general failure of public policies in successfully distributing food among people in a rational manner. In India there is a high concentration of poor and the absolute number of people under this category is increasing consistently despite substantial improvement in the food situation of the country (Dandekar, 1988).

In developing countries, food security continues at the individual level due to lack of purchasing power. The vulnerable sections continue to be unprotected even if the country attains food self-sufficiency at the national level. The lack of employment opportunity both in rural and urban sectors during the slack seasons limits the resources available to the poor. Appropriate policies could generate emergency employment opportunities in the short run. In the early seventies, this was experimented through several ILO missions in countries like Colombia, Sri Lanka, Kenya and Philippines were useful in preventing possible occurrences of entitlement failures in the short run and created durable productive assets for communities in local areas.

Consumption of staple food seems to be growing at a faster rate than production of foodgrains in developing countries. Extending Engel's Law, such a tendency is quite logical and the global economy should organise itself to meet this challenge. A major part of the existing food surplus in the global economy accrues from the excess food production generated by the industrialised countries and can be utilised for bringing stability in the global food order. The short-run and medium-run food crises can be combated effectively by allowing free movement of foodgrains from surplus to deficient regions. In years of rising food prices in the international market due to crop failure in LDCs, the volume of food aid declines significantly. The situation has further deteriorated in the post-Uruguay Round period. In numerous cases, food aid is used as a political weapon rather than humanitarian aid. Difficulties in the transfer of food to developing countries arise due to narrow political considerations. The agricultural strategy of developing countries should concentrate on improving production capacity of agriculture, minimising seasonal fluctuations in land productivity, developing sound agricultural infrastructure, building strong buffer stocks and improving the purchasing power of the deprived sections of society.

The problem of food insecurity can be addressed simultaneously from two fronts—at the household level and the national level. At the individual level minimum wage rate and employment guarantee schemes can provide a basis for generating long term purchasing power of the people. At the national level the policies should be aimed at raising production by employing new inputs, developing appropriate technology in the farm sector, stabilising prices of foodgrains and creating buffer stocks for major foodgrain items. With an effective Public Distribution System (PDS), the minimum household needs could be ensured. There is growing consensus in favour of maintaining food self-sufficiency as a goal of national public policy (Mosca and Ceca Delgado, 1995).

**The problem of food insecurity can be addressed—at the household level and the national level.**

The initiatives, taken by various bilateral and multi-lateral agencies like food aid, emergency food reserve and buffer stock arrangement have been able to provide a cushion to low-income households in food-deficient countries. Other proposals like regional food buffer stock, insurance against food price variability and provision for exclusive food reserve fund, are relevant in

stabilising the food situation in developing countries.

In the Post-Oil Crisis period, two dominant external policies have greatly affected domestic policies of individual countries. Firstly, the Fund-supported structural adjustment policies have brought wide ranging policy changes in programmed developing countries. The implications of such policies have far reaching consequences on the social sector and the food economy. Secondly, under the WTO regime, the national governments are committed under the Agreement to implement wide-ranging policies in their respective economies in a time-bound manner.

Food security is adversely affected by major changes in economic policy regimes. Whether the transition is from inward to outward strategy, or from conservative to liberal economic strategy, or from a socialist pattern to a market-oriented economy—the social sector particularly the food sector is adversely affected in the short-run. Decline in agricultural production would be a temporary phenomenon and it might last till it is able to adjust to the new system.

**Food security is adversely affected by major changes in economic policy regimes.**

During the last two decades, several developing countries resorted to structural adjustment at a great social cost. During the period of structural adjustment, deterioration of social welfare has been a logical fall-out of the new economic policy. A programmed country, therefore, needs to review its strategies pertaining to food security to keep a balance between the level of liberalisation in the agricultural sector and maintaining a food stock in the economy without constraining the balance of payments position.

The new global trade regime under the aegis of the World Trade Organisation (WTO) has created a situation in which food insecurity is more likely in developing countries than it was in the pre-Uruguay Round situation. Under the Agreement on Agriculture (AoA), dual policies have been adopted for developed and developing countries, regarding the question of conferring protection to the agricultural sector. In a normal distortion-free situation, the AoA had pushed the developing countries towards a disadvantageous situation. The wide range of commitments on the part of developing countries has compelled national governments to undertake radical domestic policy adjustments to meet the requirements of the AoA.

These commitments have a direct bearing on the food security situation at the national and at the individual level. The production-based entitlements are affected due to withdrawal of subsidy on agricultural products and inputs, limited government intervention in setting crop procurement price, reduced participation of the state in agricultural R&D activities and extension services to farmers, etc. The trade-based entitlements are affected due to continuation of strong protectionist policies in industrialised countries such as blue box, green box, *decoupled* support; complex tariff barriers including peak tariffs, specific tariffs, tariff escalation; export subsidy, Special Safeguard Measures (SSG), etc. The new trade regime has constrained governments in generating resources due to series of commitments on fiscal liberalisation such as downsizing of average customs tariff, removal of quantitative restrictions, commitments on tariff bindings. The reduction of financial resources has led to poor allocation of resources for employment generating programmes, which eventually affects labour-based entitlements. Various provisions in the AoA have constrained national governments in fulfilling their obligations to people in the form of transfer-based entitlements. During the period of switching of policy regime, not only chronically poor but also those people at the margin face entitlement failure. In the AoA, there is very little provision for the betterment of these 'new poor' (Lipton, 1988). Though transfer of food under the PDS can be possible to the chronically poor under the new regime, there is no explicit provisions to service the 'new poor'. In many such cases there are possibilities of failure of transfer-based entitlements.

## Food Security

Food is the most important product for the sustenance of human life and health. Each individual must have access to food in a sustainable manner, and the domestic government is directly responsible for ensuring sufficient supply of food for the people. The regional and international communities are also indirectly responsible for the regular flow of food supply to avoid incidents of entitlement failure in developing countries where there is no provision of a social safety net.

The issue of food security is sensitive because of the special function of food products. Unlike industrial products, the demand and supply of food items are highly inelastic in nature. The quantum of food demand by an individual is more or less the same irrespective of the price situations in the market. However, access to food is very much contingent upon affordability. The supply of agricultural products is insensitive to price signals in the short run, depending upon the supply conditions in the market. During the period of increasing food

prices, the real income of fixed income, wage earners, chronically poor and new poor is adversely affected and this may result in food insecurity at the individual level. Prices of such basic products are volatile in the short-run. The supply-demand equilibrium is restored only in the long run, either through domestic production or other policy intervention such as imports, buffer stock management, food aid. Food supply is dependent on exogenous factors such as natural calamities, external aggression. The domestic and external policies also contribute to the volatility of the food supply in the domestic market.

**Unlike industrial products, the demand and supply of food items are highly inelastic in nature.**

In economies where the agricultural sector is predominated by subsistence agriculture, the livelihood of the poor farmers are closely linked with the price situations in the domestic grain market. The level of food security of the low-income people, is contingent upon the volatility of food prices, availability of food products and capabilities to access food. A country achieves food security when all the citizens of the country have access to food in a sustainable manner.

**Food security of the low-income people, is contingent upon the availability of food products and capabilities to access.**

There are four elements in food security. They are (a) availability of food, (b) accessibility of food, (c) stability of food supply and prices and (d) food safety/quality and preference of the consumer.

The first element of food security refers to ensuring sufficient supply of food in a sustainable manner, considering the consumption requirement of the population in a country. This should also take into account the changing dietary habits of the people. Secondly, food security is linked to physical and economic access to food. The physical accessibility to food is affected by exogenous factors like war, trade embargo/restrictions. Economic accessibility to food is affected due to lack of purchasing power of a segment of population. While physical accessibility to food could be a problem to people in both developed

and developing countries, the economic accessibility to food might be a problem only in developing countries. Thirdly, it should be ensured that the foodstuffs should be available at reasonable prices in a sustainable manner. Lastly, availability of food for consumption should be safe, with quality control.

The issue of food security has to be addressed at the individual, national and multilateral level. According to FAO (1996), 'Food security exists when all people, at all time, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life'. The World Bank (1986) refers to food security as: 'Secure access by all people at all time to enough food for a healthy and active life'. At the individual level food security should aim at supplying enough of food for an active healthy life, creating conditions for accessing food by all, and giving guarantee of having access to food at any point of time (Christiaensen, 1995).

During the 1970s and 80s, there was a debate on the issue of formulating a policy to have food security at the national level. The discussion was on food self-sufficiency vs. food security. Various policy alternatives have been evolved to resolve the issue at the policy level. In case there is a gap between availability and the total requirement of the food at the domestic economy level, it can be effectively addressed by producing and exporting high valued crops or manufacturer goods, and the net domestic foodgrain deficit can be imported using foreign exchange earned through cash crop exports. The periodic deficiency in staple food requirements can be relied on in the world market either in the form of imports or food aid. However, achieving food self-sufficiency at the national level does not ensure food security at the individual level. This situation may arise because of unequal distribution of food within the country and discrepancy in access to resources by individuals. For example, countries like India, Myanmar, are self-sufficient in food but some section of people are food insecure. Whereas countries like Japan, Norway and Singapore are not self-sufficient in staple food, but have maintained food security due to timely imports.

**Periodic deficiency in staple food requirements can be relied on imports or food aid.**

At the multilateral level, there is a great deal of concern for the maintenance of food security at the national level. In the last Uruguay Round of trade negotiations, there was a long debate on the negative impact of the

Marrakesh Agreement on food security of least developed countries and net food-importing developing countries. In the agreement on agriculture, some provisions have highlighted on the modalities of addressing the issue of food security, but those provisions are too narrow to address food insecurity in different situations.

### Sources of Food Security

The earlier theories on food security emphasise shortage in food availability as the main reason for food insecurity. The seminal work of Sen (1981) explains that food insecurity is due to lack of household access to food, or "entitlements". In explaining famine in Bengal, Sen advocated that occurrence of such a phenomenon is not due to shortage of staple food, but on account of lack of access to food by the people. In a later study, he further argued that entitlements to food can be categorised in four ways.

- the product-based entitlement ensures that individuals are entitled to what they produce
- trade-based entitlement ensures that people are entitled to what they can obtain by selling or exchanging physical assets
- labour-based entitlement ensures that people are entitled to what they can obtain through the sale of their labour power and
- transfer-based entitlement ensures that the individual is entitled to what is given to him through legal transfers, both in the form of formal and informal means of transfer of staple food.

These are four different legal means of securing food. Improvement in any one of these four forms of entitlements may result in strengthening the food security situation since they complement each other in a mutually supportive manner.

#### *Production-based Entitlements*

In low-income developing countries, a large segment of the agrarian economy is dominated by subsistence agriculture, and has a high concentration of very poor people. Production-based entitlement is the most important factor for maintaining their livelihood and also ensuring their food security. The production-based entitlements include access to productive assets such as land, trees, fisheries and livestock in the form of either ownership or other rights including tenancy rights. In the short run, these rights are more or less unchanged, but in the long run, may be affected due to land reforms

and household investment decisions. Investment decisions are also contingent upon numerous factors such as price levels, bundle of commodities demanded in the market, economic and trade policies of the Government. Agricultural price and access to credit are also important in influencing investment decisions in the farm sector. Any change in the policy regime, brings noticeable changes in the farm sector policies, thus, affecting the individual investment decisions in the agricultural sector.

**Investment decisions are contingent upon price levels, economic and trade policies of the Government.**

In the 1980s and 1990s, developing countries have resorted to structural adjustment policies. The changed policy regime has constrained the national government in expending credit support and financial assistance to the farm sector. This pressurised the Government to downsize the level of subsidies in the rural credit sector and affected household access to agricultural inputs such as fertiliser, seeds, electricity, diesel etc. Such policies have also affected marketing of the agricultural products in the form of reducing Government support on procurement of staple crops and controlling the sliding of post-harvest prices. Withdrawal of Government supports in the agricultural sector affects access to income; and therefore, food security. There is also reduced participation of the State in agricultural R&D activities and extension services to farmers etc.

Health services and climatic environment factors also indirectly affect the production entitlement. The level of agricultural production is dependent on labour productivity, which is, in turn, linked to availability of health services. Climate and environmental factors influence the level of production in the absence of sound farm-related infrastructure.

**Health services and climatic environment factors indirectly affect the production entitlement.**

### **Trade-based Entitlement**

For households, access to food through market is an important source of food security. The important issue in this form of entitlement is the extent of fluctua-

tions in the food prices at different points of time and the capabilities of individuals to access food from the market in varying price situations.

Food security at the household level is largely contingent upon signals from the market, and food prices are influenced by several factors. The Government plays an important role in controlling food prices using subsidies and other mechanisms. But, this affects the producer's trade-based entitlements. Food prices are to a large extent determined by the supply factors at the national, sub-national and local level. The supply conditions are determined by domestic production, stockholding, size and the timeliness of imports in supplementing the existing stock of food. The degree of market integration contributes significantly in translating the stock position of the country into price changes in different areas. The level of infrastructure and marketing determines the possibility of price fluctuations in the short run.

Household trade-based entitlement can be maintained with the existing level of income, if the short run price variations can be controlled by an efficient system of supply management. It is suggested that inefficient government parastatals may be replaced by the private sector. However, private sector participation is minimal in loss-making markets, particularly in high-cost areas with poor infrastructure. From the welfare point of view, people in disadvantaged areas should not be discriminated against, and, therefore, the privatisation of the supply of food has to be reviewed with caution.

**Private sector participation is minimal in loss-making markets.**

### **Labour-based Entitlement**

Location of employment opportunities directly influences labour-based entitlement to a large extent. Such entitlements are also swayed by domestic macro-economic policies and trade strategies of other countries. Variations in the expansion of the economy and other economic parameters set the limit for the creation of employment opportunities in the economy. In an open economy, the policy planning in the domestic economy is contingent upon external factors like trade barriers in major trading countries, commodity prices in the global market, exchange rate, etc., which would, in turn, indicate the likely requirement of labour absorption in the economy and, thus, labour-based en-

itlements. In this regard domestic legislation on minimum wages has a direct and positive impact on labour-based entitlements.

Generation of employment in the rural areas would contribute to improvement in the labour-based entitlements. Moreover, the presence of industrial agriculture (basically engaged in the export of agro-products) would allow border prices to prevail in the domestic market, so far as marketing of the domestic produce is concerned. This would improve incomes of large exporting farms, generating employment opportunities for labourers. Therefore, export possibilities of agro-products in the farm sector would improve labour-based entitlements.

### Transfer-Based Entitlements

Transfer-based entitlement is different. The latter form of entitlement is neither produced nor earned by any individual. They are basically donated by others such as the state, foreign donors, NGOs, etc. The transfer-based entitlement could be either formal or informal. The formal transfer depends upon the policies of the government in the form of direct transfer of cash or food to the household; and such initiatives are supported by domestic or external agencies. The informal transfer comes from friends and relatives; and the intensity of such support depends upon the strength of social networks, including kinship networks.

With changes in the policy regime, there is every possibility of entitlement failures at an individual level, particularly among poor people. Living Standard Measurement Series of the World Bank have found the occurrences of entitlement failures during the period of structural adjustment. It has been debated to understand the built-in inadequacies in the policy package of the BWI-supported reforms, and their implications on the social sector in general and food security in particular.

### Adjustment and Food Security

During the last two decades, the developing countries are facing chronic difficulties in their balance of payments, which has led to structural adjustment programmes. Experiences of adjusting countries show that during the period of reform, there is a general ten-

**Developing countries are facing chronic difficulties in their balance of payments, which has led to structural adjustment programmes.**

dency of entitlement failure among the low-income households due to changes in the production pattern in the agricultural sector, which has adversely affected foodgrain production to promote agricultural exports.

### Policy Environment in the BWI<sup>1</sup> – Supported Reforms

The causes of instant crises in the LDCs had its origins both in the external turmoil (Panchamukhi and Mohanty, 1992) and failure of the orthodox domestic policies with respect to the changing global situation. To explain the genesis of economic crisis, it has been argued that interventionist domestic policies of the governments in the past were aimed at rapid industrialisation where domestic firms were kept away from foreign competition and terms of trade deliberately kept unfavourable to agriculture, so as to keep the prices of wage goods low. Continuation of inward-oriented policies have necessitated food self-sufficiency as the main goal of prospective development policies. To provide a cushion to the low-income household and politically-sensitive urban middle class, a provision for huge subsidies is made in the budgetary allocation, which results in fiscal imbalances (Mohanty, 1992). In the 1980s, the consistent efforts to achieve food self-sufficiency has been the major factor for economic crisis in these countries (Peterson, 1991). During the post-colonial period, the pattern of policies prevailing in developing countries, has caused a proliferation of distortions in the economy, leading to recurrence of frequent crises. To overcome the crises, the LDCs have systematically introduced policies that have favoured urban consumers, right from the exchange rate management to the foodgrain price system. Other supportive policies include direct subsidies of food and other necessities, taxing exports to finance increasing budgetary deficits, etc. Overvaluation of the exchange rate has favoured urban dwellers by obtaining food and other consumer durables at cheaper rates but at the cost of exports. The political dimension of such policies is in favour of preventing erosion of urban incomes by scaling down the prices of essentials at the cost of rural food producers. By imposing export taxes on agricultural products, the prices received by the producers have gone down drastically (Timmer, 1986) and on the other hand, high prices of intermediate industrial inputs of the farm sector, like fertiliser and other non-traditional inputs, has escalated the cost of production, leaving a very small margin for the growers.

The consequences of such policies on the economic system of these countries is being felt. The rising international debt, deterioration in the balance of

1. Bretton Wood Institutions.



payment position and other structural maladies in the domestic systems have paved the way for these economies to move towards an inevitable economic disaster (Panchamukhi, Tadas and Mohanty, 1995).

To overcome such a chaotic situation and to become resistant to external shock in the long run, the neo-liberal approach argues for certain corrective measures, which are implemented through BWIs (Franklin and Khan, 1992). When a country decides to implement changes in the domestic policy in accordance with the framework of the neoliberalists, the BWIs make available resources to address fundamental problems (Dethier, 1987) and such promises are strictly implemented through various conditionalities. The broad spectrum of the reform policies are to concentrate on "expenditure-reducing", "expenditure-switching", other institutional and price reforms policies, with a view to improve efficiency and productivity in the adjusting countries (Smith, 1987). The expenditure-reducing policies stress on slashing domestic absorption, cutting down the budgetary deficit, whereas the expenditure-switching policies include depreciation of domestic currency and lowering the level of protection to make the economic system efficient (Mohanty, 1993). Expenditure-reducing policies mainly concentrate on reducing subsidies including on food and fertilisers, and trimming the public sector wage bill, which are considered to be at the root of all economic distortions. The new policy regime allows orderly growth of the economic system in the absence of state-imposed distortions but quick changes in the policies also bring economic recovery without a 'human face' (Cornea, Jolly and Stewart, 1987).

## SAP<sup>2</sup> and Food Security

The overall impact of structural adjustment on the social sector has been adverse in developing countries (Zuckerman, 1989 and Stewart, 1991). These policies are neither neutral with respect to distribution of income nor devoid of any political hazards (Dethier, 1987). These policies have affected food security at the aggregate national level by restructuring the pattern of agricultural production, disturbing the cost of production by raising the prices of intermediate inputs (in the absence of subsidies), etc., and also affecting individual food security by creating conditions for entitlement failure. It is argued that the Fund policies would induce farmers to move towards the production of tradeables (Weissaman, 1990), leaving the country deficient in the production of foodgrains, and the major brunt of the adjustment cost would fall upon the poor (Shaw and Singer, 1988).

2. Structural Adjustment Policy.

**The overall impact of structural adjustment on the social sector has been adverse in developing countries.**

The low-income households would be the major victims of adjustment policies due to failure of entitlement, leading to individual food insecurity. During the period of adjustment, well-nourished individuals may become malnourished (Sen, 1984) and a class of new poor may emerge in the urban areas due to exit policy in the public sector (Lipton, 1988). The in-built system of structural adjustment policies have a tendency to manifest income inequality in the economy (Pinstруп-Andersen, 1988), which is ultimately reflected in the decline in purchasing power of low-income households. The deterioration in the condition of the poor is due to rise in the overall food prices (World Bank, 1987), decline in the wage rate, proliferation of unemployment and failure of the governments to provide the basic amenities of life (Stewart, 1991). The food situation of the adjusting countries deteriorated due to a fall in the rate of agricultural production (Mohanty and Tadas, 1992) and withdrawal of area under food crops (Weissaman, 1990).

**The low-income households would be the major victims of adjustment policies due to failure of entitlement.**

The economic reform policies, from the point of view of food security, are criticised on various counts. The main objective of devaluation has been to make the exports of a country competitive in the international market and enable the country's programme to have better access to other markets, specifically to the markets of high income countries. But such assumptions do not hold good in some cases, leading to failure of the programme objectives and also the trade-based entitlement.

The effectiveness of devaluation is primarily guided by the perception of the consumers and producers regarding the movement of the import prices in relation to the export prices. The devaluation policy fails to retain domestic competitiveness if the inflation rate does not come under the permissive limit and the imports are meant for the upper strata of society (Mukhoti, 1987). In such a situation, the balance of payments position would continue to remain grim and there would be little room for food imports from the expected growth of export earning.

The structural adjustment policies are sometimes criticised for their unrealistic assumption that a new policy regime may lead to improvement in the production level of the country through agricultural pricing policies. In low-income countries, where the agricultural sector is operating at a subsistence level, the market price mechanism may not work efficiently in gearing up production through short term policy changes. It has been noted that supply responsiveness to price changes is very less in stimulating agricultural output. Several studies have observed that price policies in Africa invoked little response in generating food surplus. The pricing effect of agriculture has affected income distribution more than the level of food production (Smith, 1987). In the process of policy restructuring, the country faces greater challenges in income distribution than in resolving the balance of payment crisis and food insecurity. Moreover, the basic objectives of the reforms to overcome the problems through agricultural pricing policies have been frustrated due to restrictive policies of developed countries in the agricultural sector.

**In the process of policy restructuring, the country faces greater challenges in income distribution than in food insecurity.**

Even though the neo-liberal approach is emphatic on improving the agricultural terms of trade, the adjustment policies are too restrictive in the short run to yield desirable results. The impact of these policies on vulnerable target groups, has definitely been adverse. There is therefore a need for consistent support to various programmes pertaining to childcare (Cornea, Jolly, Stewart, 1987), employment, training and other measures to prevent failure of labour-based entitlement among the vulnerable sections of society (World Bank, 1987). The perfect implementation of these activities requires effective designing and monitoring of programmes. A number of multilateral agencies show their inability to support social sectors in the fast-reforming economies in a vigorous way, due to constraint of resources. If resource constraint is a retarding factor in some of the 'people centric' programmes, then collaborative efforts may be undertaken with other multilateral organisations.

## Conclusion

Food security continues to be one of the important policy goals of developing countries. Over the years, the developing countries have realised that food

security can be ensured at the individual level by maintaining food self-sufficiency at the national level. Several other policies such as buffer stock management, food subsidy for targeted groups, efficient distribution of staple food through PDS, timely food imports, etc. can supplement the food self-sufficiency policy to ensure food security at the individual level.

There is a need for predicting the possibility of entitlement failure, and suitable policies are to be made to restrain such occurrences. Sen's theory of entitlement is appropriate for dealing with the problem of entitlement failure.

In the post-war period, two important policy developments have adversely affected food security situations in developing countries. Firstly, in the Post-Uruguay Round period, the member countries have undertaken sweeping policy reforms in their domestic economies. Secondly, many countries have resorted to unilateral reforms as a part of the BWI-supported SAP programmes. The experiences of programme countries indicate that such policies have adversely affected food security in those countries. There is a need for giving a 'human face' to SAP policies in order to maintain food security in programme countries in a sustainable manner.

## Acknowledgement

The author is thankful to Mr. Saikat Sinha Roy for helpful suggestions in the preparation of this paper.

## References

- Aziz Sartaz (1990), 'Agricultural Policies for the 1990s', Development Centre of the Organisation for Economic Co-operation and Development, Paris.
- Christiaensen L. (1995), 'Food Security: from concept to Action', Catholic University of Leuven, Leuven.
- Cornea G.A., R. Jolly and F. Stewart ed. (1987), 'Adjustment with a Human Face: Protecting the Vulnerable and Promoting Growth', Vol.1, Clarendon Press, 1987, Oxford.
- Dandekar V.M. (1988), 'Agriculture, Employment and Poverty', in R.E.B. Lucas, G.F. Papanek (eds.), *The Indian Economy: Recent Development and Future Prospects*, Boulder Co., Westview Press.
- FAO (1996), *World Food Summit—Plan of Action for International Cooperation*.
- Fraklin and Khan Moshin S. (1992), 'Adjustment Policies of the International Monetary Fund and the Long Run Economic Development', *Bangladesh Development Studies*, Vol.20(2-3).
- Lipton Michael (1988), 'The Poor and the Poorest: What Have We Learned', Overseas Development Council, Transaction Books, New Jersey.
- Mohanty S.K. and G.A. Tadas (1992), 'Structural Adjustment and Development', *RIS Digest*, September, Vol.9(3).

- Mohanty S.K.** (1992), 'Structural Adjustment in ASEAN countries: Lessons for India', Paper submitted at Asian Econometric Conference on South-East Asia, Indira Gandhi Institute for Development Research, Bombay.
- Mohanty S.K.** (1993), 'Successful Adjustment with a Human Face: Economic Liberalisation in South-East Asia', unpublished paper.
- Mosca and Ceca Delgado** (1995), 'Ajuste estructural y seguridad alimentaria: El Caso de Mozambique', *Economies et Societies*, Vol.29(3-4), March-April.
- Mukhoti Bela** (1987), 'The International Monetary Fund and Low-Income Countries', United States Department of Agriculture, Economic Research Service, Foreign Agriculture Economic Report No.244, Washington D.C.
- Panchamukhi V.R. and S.K. Mohanty** (1992), 'Effects of Structural Adjustment on Macroeconomic Performance and Basic Needs', RIS Discussion Paper, New Delhi.
- Panchamukhi V.R., G.A. Tadas and S.K. Mohanty** (1995), 'Basic Needs Issues in Development: An Appraisal', RIS Monograph, New Delhi.
- Pinstrup-Andersen P.** (1988), 'Macroeconomic Adjustment and Human Nutrition', *Food Policy*, February.
- Sen A.** (1981), 'Poverty and Famines', New York: Oxford University Press.
- Sen A.** (1986), 'The Causes of Famine: A Reply', *Food Policy*, 11.
- Sen A.K.** (1984), 'Resources, Values and Development', Cambridge, Mass, Harvard University Press.
- Shaw John and Hans Singer** (1988), 'Introduction: food Policy, Food Aid and Economic Adjustment', *Food Policy*, February 1988.
- Smith L.D.** (1987), 'Structural Adjustment, Price Reforms and Agricultural Performance in Sub-Saharan Africa', *Journal of Agricultural Economics*, Vol.40(1), January.
- Stewart Frances** (1991), 'The Many Faces of Adjustment', *World Development*, Vol.19(12).
- Timmer C.P.** (1986), 'Getting Prices Right' New York, Cornell University Press.
- Weissaman Stephen R.** (1990), 'Structural Adjustment in Africa: Insights from the Experience of Ghana and Senegal', *World Development*, 8(12).
- World Bank (1986), *Poverty and Hunger: Issues and Options for Food Security in Developing Countries*, The World Bank, Washington D.C.
- World Bank, (1987), *The Alleviation of Poverty under Structural Adjustment*, World Bank, Washington D.C.
- Zuckerman Elaine** (1989), 'Adjustment Programmes and Social Welfare', World Bank Discussion Paper, No.44, Washington D.C.

□

*If you do things well, do them better. Be daring, be first, be different, be just.*

— Anita Roddick

# Trade Liberalisation & Food Security in Asia

Satish C. Jha

---

*The various factors responsible for the adverse food security situation in South Asian countries is explored in this article. The solutions to the problems posed by the liberal trade regime are discussed.*

*Satish C. Jha is Former Director and Chief Economist, Asian Development Bank. Excerpted from the paper presented at the APO Seminar on International Trade and Food Security held in Tokyo, 12th Jan.-4th Feb. 1999.*

In Asia, people who enjoyed an ample food supply because of their income levels have seen their incomes greatly diminished as a result of declines in food production. Such declines have had a ripple effect throughout the economy, resulting in reduced demand for luxury agricultural commodities such as livestock products, fruit and vegetables, as well as non-agricultural products such as textiles, footwear, etc. The reduction in demand for labour-intensive goods and services has, in turn, sharply reduced the employment and purchasing power of large numbers of poor people.

Food security basically has three frontiers: availability, stability and accessibility. Food security has to foster a situation where everyone has access to food at all times. At the household level, it implies having physical and economic access to food that is adequate in terms of quantity, quality and safety. Access to food is determined by food entitlements, that is, the sum of assets (human, physical or financial) that an individual or household can use to acquire food and the rate at which those assets can be converted into food, either through exchange or production (Sen, 1981). In other words, food security concerns the physical and financial aspects of food entitlements in terms of security at the individual and household levels. However, national or regional food security does not necessarily lead to household or individual food security. Available food may not be equally distributed among different States or among households, and/or individuals may not have equitable access to it.

Poverty has been stressed as the root cause of malnutrition. Two possible routes for achieving food security are: to produce food domestically and to ensure access to food through food trade. Food security can also be attained by improving the generation of income and employment potential for the rural and poor people. This means either creating food production capability or offering an opportunity for better income and employment generation so that the poor can have access to food. International trade will have far-reaching implications for these aspects.

## Historical Perspective

In Asia, the approach to, and strategic direction for, food security are varied. For East Asia, the post-Second World War focus was on rehabilitation and economic growth process. This process was envisaged as bringing a trickle-down effect to agriculture and food security. Japan, the Republic of Korea and the Republic of China shared similarities in this process. With a higher rate of sustained economic growth over a longer span of time, the flow of income and employment reached the grassroots level in both rural and urban areas. As a result, the food security in those three countries was ensured not only in terms of calorie intake but also in terms of nutrition (and dietary energy). The process is ongoing and is expected to continue in the foreseeable future. The recent financial crisis has had no bearing so far on this process.

The countries of Southeast Asia, more or less, have made an attempt to follow the experience of East Asia, with a focus being placed on economic growth and the trickle-down effect. Agriculture and food production were considered to be the mainspring of the economic growth process. With a sound macro-economic thrust, massive investment in agricultural infrastructure development, supported by research and extension, credit and supplies of technical inputs, Southeast Asian agriculture embarked upon a sustainable growth path. Several of the countries in the subregion have doubled their food production since the "Green Revolution" of the early 1960s. As a result, not only has the goal of food security been attained, but some surplus stocks have been available for inter and intra regional export. For Thailand, Indonesia, and Vietnam, food grain exports turned out to be the source of foreign exchange earnings that were deployed for other national development priorities.

**Countries in the subregion have doubled their food production since the "Green Revolution".**

However, those countries still import various other food commodities from each other, as well as from developed countries, to fill in certain gaps (Booth, et al, 1986). Food shortage countries, in varying time frames, would have different trade perspectives than those emerging as food surplus countries. As a result of the pragmatic policies and sound development strategies followed by the Southeast Asian countries, not only has food security been sustained but the "dietary energy" available for consumption has exceeded the required

national average. However, there is no doubt that rice remains the major source of calories throughout the subregion, supplying from 60 per cent to 80 per cent of the total available energy.

A question, however, can be raised with regard to Indonesia's financial crisis viz. food insecurity and food rights. The explanation could primarily be attributed to inadequacies in food distribution. A considerable amount of sudden hoarding took place in the light of the currency crisis and, as a result, a sudden breakdown occurred in the food distribution system. A metropolis like Jakarta could not receive adequate supplies of food grains. In addition, some setbacks occurred at the level of production as a result of prolonged drought in the major rice-producing regions of the country. National planners will now have to reexamine the issue of crop diversification and declining investment in agriculture.

South Asia's experience in food security has been mixed. The countries in that subregion were late starters on the path of the "Green Revolution". The governments of that subregion, conscious of the issues related to food scarcity, took the bold decision to adopt focused macro and micro economic policies supported by massive investments in irrigation, research and extension, and fast availability of technical inputs and farm credit supplies. Despite abysmal poverty, the starvation resulting from widespread drought and famine, has been virtually halted, and chronic malnourishment has begun to decline. The estimated 50 per cent of the population that lived below the poverty line in the 1960s has now declined to 30 per cent or less. It can, however, be safely claimed that, so far, the governments have barely touched the fringes of food security in terms of calorie intake. They have a long way to go in terms of attaining the minimum nutritional level and the average "dietary energy".

The overall macro-economic policies and their management in the subregion, however, have been lopsided. There has been no clear-cut strategic thrust to attain a higher level of economic growth. During the past three or four decades the South Asian subregion has not exceeded the average growth level of 3-4 per cent against the average population growth rate of 2.5 per cent. Thus, the trickle-down effect of growth is almost absent. Massive poverty and unemployment persists. A large proportion of the population do not have

**Long way to go in terms of attaining the minimum nutritional level.**

access to food in spite of its availability in the market. Those with access receive a minimum level and are nutritionally very deficient, leading to health hazards.

Again, subregional differences are striking. For example, India, Pakistan and Sri Lanka have performed better than Bangladesh, Myanmar and Nepal, although Bangladesh's performance has improved substantially in recent years. A study on agricultural growth rates (I.J. Singh, 1987) has revealed that only a limited number of districts in India have attained higher rates of growth (over 4.5 per cent annually). Nearly 50 per cent of Indian districts recorded agricultural growth well below population growth rates. Moreover, even where production has done well, the effects of new food grain technology on employment and income have been weaker than expected in South Asia (Mellor & Lele, 1973) and lower than in other subregions such as Southeast Asia (Bautista, 1988).

**Nearly 50 per cent of Indian districts recorded agricultural growth well below population growth rates.**

Apart from deficient macro-economic policies, the lag in the performance of South Asian countries could be attributed to several other factors. First, the rate of population growth, in general, remained high. Second, the countries continued to follow deficient land reform measures. Third, the sheer incidence of landless people in many parts of the subregion, together with limited irrigation development, diminished the cropping intensity and also retarded crop yields. Fourth, governments failed to invest adequately in rural infrastructure, communication, transport, and power-sectors that have a direct bearing on employment generation as well as the indirect strengthening of agricultural growth linkages. Fifth, improvements can still be made in providing small and marginal producers with access to production impacting services. Sixth, more direct efforts to increase the level of food consumption by the poor will be essential; providing employment for the landless is one way of increasing their access to food.

Apart from the food grain production strategy, government policies to improve the access of poor people to income and food have taken varying forms in countries of South Asia. For example, India gave utmost priority to the accessibility of the poor to food. Measures adopted included integrated rural development, non-farm employment schemes, an employment guarantee scheme, high-yielding, labour-intensive agricultural technology, employment-oriented programmes, the adop-

tion of an equitable price policy, establishment of a foodgrain buffer stock and a public distribution system throughout the country. Each of these measures have a varying impact, but they did contribute towards eliminating hunger and reducing the incidence of poverty.

The question of food security in Bangladesh is concerned as much with the adequacy and growth of the overall food supply, underlined by the high income elasticity of demand and weight of food in overall consumption expenditure, as it is with the limited, wavering and shaky ability of millions of poor households (the landless, small and marginal farmers, artisans, etc., who constitute almost 45 per cent of the total households and the majority of urban poor) to access food (Mujeri, 1996). To meet the aforementioned goals, the focus of long-term policy has been to assure a low-cost supply of food increasingly by accelerated national food grain production. Gaps have been met by regular imports and food aid and by enhancing the purchasing power of the poor by means of rural development programmes and a variety of food-for-work programmes.

Short-term measures have included a national security stock, a targeted relief programme, a public distribution system and price stabilisation schemes. No doubt, these programmes have impinged upon the government's already burdened exchequer. However, the entire food security regime since the late 1980s is being reexamined in the light of structural adjustments in the national economy (World Bank, 1995).

It is ironic that Nepal, a landlocked and least developed country (with a per capita income level of US\$ 170), has been transformed from a food surplus to a food deficit country during recent decades. The rural poor, who account for 95 per cent of the total poor households, participate only marginally in the economy and are therefore insulated, in the short to medium term, from the impact of structural adjustment. To the extent structural adjustment programmes generate economic growth and improve the delivery effectiveness of government programmes, the poor tend to benefit. So far, this has not happened in Nepal. Even if acute hunger has not occurred in the country, about 36 per cent of Nepal's population is reported to consume less than the minimum dietary energy requirement (Thapa & Koirala, 1992).

**Nepal has been transformed from a food surplus to a food deficit country during recent decades.**

One major development thrust has been in rural development and a variety of hill development programmes. However, poor project management has led to the limited success of these programmes. The short-term focus has been on subsidised food distribution by means of the public distribution system. This programme, owing to various loopholes, has proven largely ineffective. The operation of an international food programme, i.e. the food-for-work programme, on the other hand, is minuscule in size, and no noticeable gain seems to have been achieved in closing the food grain gap of an estimated 300,000 mt in terms of requirement and availability. With productivity showing a declining trend and the population growth rate, the food deficit gap is expected to widen. The answer lies in sustained productivity growth. Within the framework of liberalised trade, the proper answer has yet to be found.

Historically, Sri Lanka has remained a net food importing country owing to the main focus being placed on plantation crops while the food crop sector has been completely neglected. Rubber for rice was the main barter arrangement. It is only in recent years that Sri Lanka has adopted the Strategy for Food Grain Self-sufficiency, with various investment projects being launched and a thrust being made in irrigation development. Available estimates reveal that locally produced rice has contributed only 65 per cent of the total Sri Lankan cereal requirement in the past decade (Aberatne, 1994).

**Sri Lanka has remained a net food importing country owing to the main focus being placed on plantation crops.**

Sri Lanka has adopted a two-pronged approach. For a considerable period, access to food was facilitated by consumer price subsidies, first through rice rations and more recently through food stamps. Equitable food distribution has been pursued through "fair price" shops. This has imposed a heavy burden on the national exchequer, accounting for a large part of the government's annual budget. During the recent economic adjustment process, the issue of subsidies was seriously debated but no clear-cut solution has been proposed.

The longer-term strategy for food security focuses on the rural development programme, the stability of production through irrigation development, and other land and infrastructure development programmes, in order to expand the production base. The agricultural pricing policy has been another key element in the

stimulation of local production. Since the late 1970s within the framework of liberalisation, the rice market has been free of controls and the product can be transported freely between regions. As a result, rice yields have increased significantly, while state procurement of rice has declined. Thus, the liberal rice trade has contributed to a higher level of per capita availability. How far this trend can continue needs to be further examined.

Pakistan's long-term development strategy has been investment in irrigation and Barari area development in order to realise the goal of food security. Had there been an effective attack on population growth, Pakistan would have attained full food security, both in terms of calorie intake and the provision of minimum dietary energy. The country attempted to achieve its short-term goal for food security by means of a system of output and input subsidies. This enabled the country to keep domestic prices of food grains and farm inputs comparatively low, thus providing incentives to farmers and food access to the poor strata of the population (Kamal, 1992). The rationing system also helped to ensure distribution of food at affordable prices to the poor. It was estimated that the rationing system contributed an income gain of more than 10 per cent for the medium range of household income and helped to add 114 additional calories to the daily dietary energy consumption per person among urban households (Rogers, 1988). But the rationing system and heavy input and output subsidies created a heavy drain on government resources. Thus, within the structural adjustment process launched in the 1980s, a decision was taken to phase out the past arrangements and to place reliance on market forces. However, recent political uncertainty and economic turmoil has constrained the process of market reforms.

Together with the attainment of high GDP growth (8-10 per cent) over the past decade, China's food security arrangements can be considered praiseworthy. Starting from a low level of calorie intake (1,500 calories per capita) at the beginning of the 1960s, China has increased the average level of food availability to over 2,700 calories per capita since early 1990s. The major focus, through investment and prudent policies, was on increased domestic production. The Chinese experience, since the post-1978 reforms, demonstrates the importance of incentives and a conducive institutional framework in maximising the effects of agricultural infrastructure, as well as successful research on, and dissemination of, new technologies. Over the years, China has successfully met the challenge of universal food security in the face of its increasing population. The proper food and population balance was also struck owing to a remarkable success in controlling

population growth. China's fertility rate has become one of the lowest in Asia. This has allowed a lower level of food imports whenever the situation has so warranted.

**China has successfully met the challenge of universal food security.**

### **Future Trends in Asian Food Security**

In the past 30 years, the major strategic thrust in agriculture was to push up the level of agricultural growth. Poverty eradication was the centrepiece of development strategy. The "Green Revolution" encouraged the Asian governments to adopt sound investment and macro-economic policies to accelerate the process of growth. The progress made proved unprecedented in the economic history of Asia. Food availability was made possible for a large poor segment of rural and urban poor, famine and hunger was mitigated, and general living standards improved in a significant proportion of households. All this happened within a framework of controlled market and government intervention.

The 21st century could be an era of globalisation, market and trade liberalisation, and structural adjustments in the national economies of Asia. The focus could be on competitiveness (both domestic and international), efficiencies in resource allocation, comparative advantages and cost-effectiveness. In such a situation, what would be the emerging scenario for food security and opportunities for the poor? First, ecological balance and environmental protection would be the cornerstone of development strategy, which would create constraints to farm production. Second, technological innovations have reached saturation point and no new high-yielding varieties are in sight, either in national or international research centres. Third, the land base is being squeezed and not much expansion is feasible in new cultivable areas. Fourth, farmers have tasted the benefits of crop diversification, which will have an impact on food grain production. Finally, market-oriented decision-making would bring far-reaching implications for the pattern of crop production, particularly cereal production.

**Technological innovations have reached saturation point.**

As per available projections, if Asia continues to

outperform other regions of the world in terms of economic growth process (an annual GDP rate of 7-8 per cent), the food basket for the average Asian will tend to change: comparatively less cereal and more livestock products, fruit and vegetables. This will have implications for food security arrangements and sustainability. The level of dietary energy supply (DES) in the region as a whole improved from 2,160 kcal/head/day in 1970-72 to 2,444 kcal/head/day in the early 1990s. The lowest level of DES still remains in South Asia, owing primarily to the high incidence of poverty, low rate of economic growth, and high population growth rate. With between 1.5 billion and 1.8 billion additional people that Asia will gain in the next 20 years, and taking into account the recent declines in crop yields, Asia's future food security will be in danger. Hence, appropriate policies and planning have to be put in place soon in order to avoid that danger.

### **Basic Thrust of Trade**

The completion of the Uruguay Round of Multilateral Trade Negotiations, and the advent of WTO set in motion the process for international trade liberalisation. Among the set of negotiations, the cornerstone came from the adoption of new rules governing agricultural trade policy. Agricultural trade concerns that have surfaced since the Uruguay Round have included the use of genetically engineered products in agricultural trade, state trading in farm commodities, and a variety of price adjustment and tariff measures. The exact impact on the various provisions of the agreements on the developing countries is difficult to access, partly because of the complexities of the provisions and instrumentalities in the agreements that could subject them to a variety of interpretations.

However, some general inference can be drawn at this stage from the global perspective. The overall impact on agricultural trade can turn out positive in moving towards several key goals, including reducing agricultural export subsidies, establishing new rules for agricultural import policy, and agreeing on disciplines for sanitary and phytosanitary measures. The provisions might also contribute towards a shift in domestic support prices for agriculture from those practices with the largest potential to affect production and, therefore, trade flows. However, a significant reduction in most agricultural tariffs will have to await a future round of negotiations. So far, agricultural tariffs remain very high for some products in some countries, limiting the trade benefits to be derived from the new rules. To ensure that historical trade levels were maintained, and to create some new trade opportunities where trade had been largely precluded



by policies, countries instituted tariff-rate quotas. A tariff-rate quota applies a lower tariff to imports below a certain quantitative limit (quota), and permits a higher tariff on imported goods after the quota has been reached.

**A significant reduction in most agricultural tariffs will have to await a future round of negotiations.**

The Agreement on Agriculture required countries to reduce outlays on domestic policies that provided direct economic incentives for producers to increase resource use or production. All WTO member countries are meeting their commitments to reduce these outlays, and most countries have reduced this type of support by more than the required amount. Twenty-five countries that employed export subsidies agreed to reduce the volume and value of their subsidised exports over a specified implementation period. To date, most of those countries have met their commitments, although some have found ways to circumvent them.

#### **Implications for Asian Countries**

How far Asian countries would ultimately benefit from liberal trade remains unanswered at this stage as a great deal depends on the developed countries subjecting themselves to the implicit discipline of various agreements. Some researchers, no doubt, have taken an optimistic view on a priori grounds (Anderson & Iyres, 1990). The general assumption is that liberalised trade would help generate income in a number of ways. First, it would enable developing countries to reap the benefits of comparative advantages, as most developing countries are low-cost producers. Second, an increase in export demand would enable farm production to be expanded, with a direct impact on food security. Third, trade would be associated with the transfer of capital and technologies through foreign investment. Fourth, developing countries would derive management benefits in production, processing and marketing. However, the impact may be more positive on larger commercially-oriented farms. Such benefits to subsistence and smallholder farms could remain questionable. Asia has a large proportion of subsistence and smallholder farms and this would provide a major constraint to any trade benefits.

Another argument in favor of liberalised trade emanates from the point of view of efficiency and competition. Exposure to foreign competition would help in

**General assumption is that liberalised trade would help generate income in a number of ways.**

removing inefficiencies that have built up in closed economies and would discourage unproductive activities such as lobbying and rent-seeking. Access to foreign markets would mean that countries would gain exposure to new ideas, knowledge and advanced technologies.

It is also the general perception that rapid economic growth resulting from a liberal trade regime would lead to higher rates of growth of employment and improved income distribution. However, such a relationship is complex. It will be influenced by the effect: (a) of the choice of trade strategy on the overall rate of growth; (b) on the demand for labour via the influence of the trade strategy on the composition of output; and (c) of the trade strategy on factor prices (Krueger, 1978).

Apprehension has been voiced that when export production increases, then food consumption and the nutritional status of the poorest segment of households will tend to decline. Therefore, the mechanism through which export production can influence food consumption and nutritional status includes its effects on local and national food availability, household access to food and intra-household distribution of food. For example, if increased production for export reduces local food availability, local food prices will rise. The nutrition of the poor, who purchase food in the same markets, may suffer.

**Export production increases, food consumption and the nutritional status of the poorest segment will decline.**

It is also perceived that in situations where export production is less labour-intensive than staple food production, reduced employment will have adverse effects on the food security of landless farm labourers. More broadly, increases in foreign exchange earnings through agricultural exports would not automatically guarantee the conversion of those earnings into the types of imports that are required by the poor. Another dimension of trade relates to agricultural modernisation. Trade is envisaged as providing new opportunities for specialisation and exchange, and would be associated with structural changes in agriculture.

Small-scale producers may often lack the resources necessary to grow export-oriented crops and, hence, they remain unable to benefit from trade-oriented growth. They may also find that commercial expansion has an inflationary effect on production costs and on land rent that can even make their traditional production less feasible. Small-scale farmers may abandon their land or sell it to large commercial farmers. Therefore, trade-related growth in Asia has to be examined differently. Here, it is important not just to consider the impact of trade from the perspective of producers, but also to take into account the induced effects on employment, consumers and the overall food security of the country. The major challenge remains within the national policy arena and the institutional arrangements, and is not necessarily with the trade regime *per se*.

Asia moved fast on agricultural production, particularly food production, but it led to serious environmental degradation. Prices for farm inputs such as irrigation water, chemical fertilisers, pesticides, etc. were heavily subsidised and kept artificially low with market distortions. This situation contributed towards crop intensification as well as expansion at the cost of soil and water degradation. A standard was not set for minimum environmental rules and regulations. As a result of mismanagement of farm resources, the quality of cultivable land in several pockets/areas of Asia has deteriorated.

**Prices for farm inputs were heavily subsidised and kept artificially low.**

The rising population in Asia will demand more food. How this food will be produced without further encroachment on marginal land and damage to the environment will pose a challenge to the planners and policy-makers of Asia in the 21st century. Trade and environment can be compatible with future agricultural growth provided certain policies are in place. This issue is currently being examined by a WTO Committee on Trade and Environment, the terms of reference of which include examination of the effect of environmental measures on market access, especially in relation to developing countries, as well as environmental benefits of removing trade restrictions and distortions.

Asia's food security concern, over the past 2-3 decades, has placed heavy pressure on the cultivation of marginal land and the encroachment on forest land without the realisation of the long-term consequences of deforestation. This is undoubtedly a consequence of poverty rather than a deliberate desire to exploit the environment. There is apprehension that liberalisation of

the trade of timber will have a more direct impact on deforestation trends. The rise in producer log prices following liberalisation may lead to increased declines in the remaining commercial timber resources in producer countries. This could have far-reaching implications for Asian food security, owing to the enhanced degree and frequency of flooding and siltation of river beds. Therefore, in the process of trade liberalisation, these issues have to be squarely tackled by planners in Asia.

Another general expectation from trade has been that this would tend to enhance incentives for agricultural production, considering international market prospects. However, time has been too short to judge the impact of liberalisation. Second, governments have not been fully committed to the reform process, so the necessary private sector response has been hesitant and limited. Third, trade liberalisation has to go hand-in-hand with other reforms and adjustments, which has not been the case so far. In some countries, with the launching of structural adjustments of which trade liberalisation is a part, experience suggests that the position of smallholders who produce staple food crops has worsened compared with that of larger cash crop producers. Therefore, these concerns have to be fully highlighted in further negotiations on trade liberalisation and steps have to be taken to minimise their adverse impacts.

### Long-term Asian Perspective

Asia's food security cannot be sustained over the long term if the attack on population growth and poverty fails. The provisions of the Uruguay Round tend to bring in distributional shifts, both between and within countries, with significant implications for household incomes and consequently household food security. On balance, the United Nations Conference on Trade and Development (UNCTAD) estimated that the Uruguay Round would lead to a small reduction in absolute poverty (1.4 percent), although there would be more gains and losses across regions as well as within countries. Should Asia turn out to be the loser and the magnitude of poverty increase, Asia's food security would be in danger.

One of Asia's major commodities in the food security basket is rice. The Uruguay Round is expected to have a significant influence on the rice market because of the reduction in subsidised rice exports by developed countries and the opening of previously closed markets for rice. The volume of the global rice trade is expected to increase by 1.2 million mt and the international rice price to increase by 4-7 per cent above the level they would have reached without the trade agreement. Thus, Asia can be a winner in that regard.

However, any Asian benefit, overall, from liberalised international trade would be derived from efficiency in resource allocation and massive investment in agriculture to arrest land degradation and worsening water scarcity, as well as enable sustained agricultural and food production growth.

**Uruguay Round is expected to have a significant influence on the rice market.**

It is ironic that in the recent past, investment in Asian agriculture, particularly for food production, has been declining. Much public expenditure on agriculture has been in the form of various subsidies, leaving little public funding for the creation of new assets, the maintenance of existing systems or other growth-producing expenditures. The result is that many public sector-supported agricultural services barely function, rural infrastructure is in poor condition, farm machinery is inoperable and irrigation schemes have fallen into disrepair, while soil erosion, deforestation and salinisation continue to worsen at ever-increasing rates. Within the framework of liberalisation, much was expected to be undertaken by the private sector. A marked decline has occurred in Official Development Assistance (ODA) for agriculture and food production. Foreign private capital assistance has generally bypassed agriculture, which remains a relatively unprofitable sector for private investment.

**Foreign private capital assistance has generally bypassed agriculture.**

The gains in growth over the past three decades might flounder if agricultural investments continue to decline. Exclusive dependence on market forces cannot be considered an appropriate policy for handling food shortages. First, market mechanisms do not operate smoothly in all countries and situations; second, permitting scarcity to provide adequate price incentives to producers may be intolerable to consumers with low purchasing power, and must be supplemented by proactive measures to relieve their suffering.

Another constraining factor to long-term food security in Asia arises from inadequate agricultural research. This is turning out to be a major bottleneck as yield growth in different parts of Asia is slowing and research stations have little unused technology to tackle

either the many second generation problems of degeneration in high-potential areas or the new, farmer-friendly systems needed to intensify agriculture on poorer land. Therefore, investment in technology generation and diffusion needs to be urgently accelerated in order to address the issues such as micronutrient deficiencies, reduced water availability for continuously irrigated rice, etc. Irrigation rehabilitation, coupled with more efficient and decentralised water management and the creation of water markets, needs to be given high priority by Asian policy-makers.

**Investment in technology generation and diffusion needs to be urgently accelerated.**

An FAO study revealed that there would be a continuing decline in the degree of self-sufficiency and rising import requirements in developing countries in aggregate, particularly in cereals, from the base period of 1987-89 to the year 2010. Despite the prospects for expanding export earnings as a result of trade liberalisation, there is a strong fear of a sudden sharp decline in the import purchasing power of countries relying on trade for food security. Holding high foreign exchange reserves can be the best guarantee that the food consumption level can be maintained under such circumstances. But in several Asian countries, particularly in South Asia, the level of reserves is inadequate for such purposes and the external debt burden is alarming. In addition, with decreased subsidies on exports by developed countries, the tendency would be to reduce their exportable surpluses in food grains. Thus, it would be unrealistic to assume that enlarged import demand by developing countries could be met unhindered by the developed countries.

Agricultural trade liberalisation has also been burdened with another concern that ongoing structural adjustments in Asian countries may lead to: (a) reduced food security among the very poor and least developed countries, leaving them unable to take advantage of new opportunities; (b) more expensive food imports; and (c) further intensification of agricultural production in low-subsidising countries, which could contribute to further environmental degradation in those countries. That would therefore imply that trade can have an adverse impact on future food security.

Constraints on access to markets for Asian countries would arise as a result of various regional trading arrangements, i.e. the North American Free

Trade Agreement (NAFTA), European Economic Area (EEA), European Union (EU), etc. The question would concern the exact role of these arrangements in free global trade, either enhancing or undoing some of the instruments imposed on country policies by the Uruguay Round agreement. The positive aspect could be to establish and maintain open trading arrangements with other countries or blocs (open regionalism). The negative aspect could surface through the formulation of rules and regulations that would serve the narrower interests of countries belonging to a bloc at the expense of outsiders. All would depend upon the capability of WTO to enforce agreed rules and regulations. Mean-time, Asia's two subregional groups for economic cooperation, the Association of South East Asian Nations (ASEAN), and the South Asian Association for Regional Cooperation (SAARC), need to strengthen their bases for international trade arrangements, particularly in areas where their comparative advantages as well as competitiveness can be enhanced. So far as an agricultural trade regime is concerned, Asia offers tremendous prospects and opportunities. The crux will be innovative economic policies, the level of investments in agriculture, and the generation of new technologies for accelerated agricultural growth.

**Constraints on access to markets would arise as a result of various regional trading arrangements.**

## Conclusions

The region has made considerable progress in improving aggregate per capita food supplies in the past three decades. At the same time, imports and rising carry-over stocks have also helped. The majority of countries have been able to reduce their food import dependency as well as strengthen their import capacity. Growth in real prices of food have been contained. Improvements in food availability have led to a decline in chronic malnutrition. However, the absolute number of chronically undernourished in the poor strata of the population still remains large, at roughly about half a billion. There are, of course, regional variations, East and Southeast Asia, having focussed on economic growth and the trickle-down effect, have performed much better than South Asia. Population and poverty remain the main dangers for food security in South Asia. In addition, lopsided macro-economic management has been the root cause of the low rate of economic growth in the South Asian subregion, with a marginal trickle-down effect on the poor.

**Lopsided macro-economic management has been the root cause of the low rate of economic growth.**

While the structural adjustment programme had already established the grounds for trade reform, the Uruguay Round agreement and the establishment of WTO in the early 1990s added further momentum to the liberalisation process in the agriculture sector. However, the exact impact of the various provisions of the agreement for the Asian region has yet to be assessed, owing to complexities involved in the instruments. The general assumption, however, is that Asian countries will reap benefits of comparative advantages from being low-cost producers. An increase in export demand would enable farm production to be expanded, with a direct impact on food security. Exposure to competition would remove inefficiencies and discourage unproductive activities. A liberalised trade regime would lead to higher rates of growth of employment and improved income distribution, with positive implications for food security. The critics, on the other hand, are of the view that liberalised trade may encourage export growth but at the cost of food consumption and the nutritional status of the poor segment of the population.

The benefits enjoyed by Asia from liberalised international trade and securing sustainable food security will also depend on the trade initiatives of the regional blocs in the developed countries. If their trade perspectives turn out to be narrow and inward-looking, international trade will undergo a setback and Asia will fail to realise the optimum benefits. At the same time, Asian countries will have to strengthen the institutional base of ASEAN and SAARC, with the main focus being placed on economic growth, of which trade will be central.

## References

- Aberatne F.** (1994), "Rice Self-sufficiency and Food Security", *Economic Review*, Vol. 20, No. 1, Colombo, Sri Lanka.
- Alamgir M. and P. Agara**, "Providing Food Security for All", *Studies in Rural Poverty*, No. 1, International Fund for Agricultural Development (IFAD), Rome.
- Anderson I.C. and Roy Tyres** (1990), "How Developing Countries Could Gain from Agricultural Trade in the Uruguay Round" in *la Goldin and Odin Knudssen* (eds.), *Agricultural Trade Liberalisation Implications for the Developing Countries*, OECD, Paris and World Bank, Washington, D.C.
- Bautista R.M.** (1988), "Agricultural Growth and Food Imports in Developing Countries: A Reexamination", paper presented in honor of Prof. Shinichi Ichimura, Kyoto University, June.

- 
- Booth A. et.al.** (1986), "Food Trade and Food Security in ASEAN and Australia", ASEAN-Australia Joint Research Project, Australian National University, Canberra.
- Kamal A.R.** (1992), "National Perspectives Towards the Year 2000", National Approach Paper in S.P. Gupta (eds.), Asia Pacific Economics: A Challenge to South Asia, Macmillan Ltd.
- Kruger A.** (1978), "Foreign Trade Regime and Economic Development: Liberalisation Attempts and Consequences", Ballinger Publishing Company, Cambridge, Massachusetts.
- Mellor J.W. and Uma Lele** (1973), "Growth Linkages of the New Foodgrain Technologies", Indian Journal of Agricultural Economics, Vol. 28.
- Mujeri M.K., M. Alladin and Tisdell** (1996), "Consumption, Saving and Investment by Social Class in Bangladesh: Does the Rural Sector Support the Urban Sector", Journal of Development Studies, Vol. 30, No. 1, Dhaka.
- Pinstrup-Anderson Per and R. Pandya-Lorich**, "The Supply Side of Global Food Security", Occasional Paper, International Food Policy Research Institute (IFPRI), Washington, D.C.
- Rogers B.L.** (1988), "Pakistan's Ration System: Distribution of Costs and Benefits", in Per Pinstrup-Anderson (eds.), Food Subsidies in Developing Countries: Costs, Benefits and Policy Option, John Hopkins Press.
- Sen A.C.** (1981), "Poverty and Famine: An Essay on Entitlements and Deprivation", Calrendox Press, Oxford.
- Singh I.J.** (1987), "Small Farmers and Landless in South Asia", Development Research Department, World Bank, Washington, D.C..
- Thapa G.B. and G. Koirala** (1992), "A Study of Food Situation and Outlook for Nepal", Agricultural Projects Services Center, Kathmandu, Nepal.
- UNCTAD (1995), "Analysis of the Effects on the Livelihood of the Poor of Elimination of Trade Barriers, Increased Competitiveness, Trade Flows, External Shocks, Diversification of Exports, Particularly of Labor Tensive Goods, and Market Access of Such Goods", Standing Committee on Poverty Alleviation, Geneva.
- World Bank (1995), Bangladesh from Stabilisation to Growth, Washington, D.C.
- 

*Every organization—not just businesses—needs one core competence: innovation. And every organization needs a way to record and appraise its innovative performance.*

— Peter Drucker

# Food Security & Poverty Alleviation in Asia-Pacific Region

Wim Poleman

---

*This article focuses on core issues and areas of policymaking which are necessary for fruitful discussions on the new role of government institutions and their linkages with private sector partner institutions, to promote agriculture and rural development. Emphasis is placed on food security for the rural poor, particularly women.*

*Wim Poleman is Head of Rural Development, Faculty of Economics and Rural Development, Hanoi Agricultural University, Vietnam. Excerpted from the Resource Paper presented at the APO Seminar on "Role of Government Institutions for Promotion of Agriculture and Rural Development, Bali (Indonesia) 6-12 August 2001.*

## Rural Poverty & Food Insecurity

Developing countries within the Asia-Pacific region represent more than half of the world population today (a total of 3.7 billion out of 6.3 billion people in 2000). The share of young people will decline from 29.1 per cent in 2000 to 21.6 per cent in 2025, while the share of working people will increase from 61.6 per cent to 62.9 per cent and of the aged from 9.3 per cent to 15.5 per cent. The population in urban areas will increase from 37 per cent to 51 per cent during the same period.

Government policies towards poverty alleviation have been most successful in some populated countries like China and some smaller countries like Thailand. At the regional level, overall poverty level has declined from 60 per cent to less than 30 per cent since the 1970s. Still, the majority of the world's poor live in this region, about 829 million out of a world total of 1.2 billion, living on an average of just one dollar a day. Out of a world total of 792 million under-nourished people (measured over the period 1996-98 and staying at virtually the same level as in 1995), a large majority live in this region, a total of 524 million are chronically under-nourished. A disturbing feature of hunger in the region is that, despite the impressive relative decline in the share of the rural poor and the hungry, the absolute number of the poor and the hungry remains stubbornly at a Himalayan mountain high level.

Thus, formulating and implementing successful poverty alleviation policies to effectively reduce poverty in the region remains a major challenge and a core issue relevant to our discussion on the role of government institutions to promote agriculture and rural development. Within this region about 80 per cent of the poor and the hungry are living in rural areas and about 70 per cent of the workforce depend for their livelihoods on income and employment opportunities in the agriculture, fisheries, forestry and livestock sectors. As an outcome of the Green Revolution, agriculture has in the last

35 years been the engine of broad based economic growth and overall development. The sector is expected to continue to play a central role in achieving sustainable food security and poverty alleviation through increasing food production, improving productivity and quality, expanding non-farm employment and enhancing trade and overall capital formation.

**As an outcome of the Green Revolution, agriculture has been the engine of economic growth.**

Yet the impact of the Green Revolution is waning. Agricultural intensification through inappropriate farming systems has led, in many agricultural areas, to environmental degradation, erosion of top soils, depletion of soil fertility, declining water availability and pollution. The trend towards globalisation leading to opening of the national agricultural markets will force small scale farmers in Asia to meet current ecological and new technological challenges by adapting their farming systems. Appropriate agricultural policies and decentralised institution building will facilitate improvement in the delivery of production services to small scale farmers, such as small farm-base research and technology development, gender sensitive extension and education and support to farmers' organisations and enterprise development. The outcome of poverty alleviation strategies to promote off-farm employment generation will largely depend upon increasing public investment for development of appropriate rural-urban transport, infrastructure and technologies, which are environmentally sustainable and for human resource development through education, job training and entrepreneurship development.

Poverty is a holistic concept, which has both income and non-income components and includes entitlements within the household, community and beyond. For practical purposes it still makes sense for the concerned government agencies to focus on the number and proportion of the people falling under the absolute poverty line, which is an indicator of the extent of material deprivation, instead of on definitions based on inequality.

Throughout the region, poverty correlates in general with hunger and food insecurity. The distribution of undernourished people by sub region (1996-98) out of a total of 792 million is: South Asia 288 million, China and other Asia and Pacific countries 87 and 140 million, respectively. According to IFAD rural poverty report 2000 for East and South Asia, poverty is particularly high in rural areas in the Philippines (rural 51.2 per cent

and urban 22.5 per cent in 1997), Vietnam (57.2 per cent and 25.9 per cent in 1993), Bangladesh (39.8 per cent and 14.3 per cent in 1996), Cambodia (43.1 per cent and 24.8 per cent in 1997), and Papua New Guinea (39.4 and 13.5 per cent in 1996). In India (34.2 and 27.9 per cent in 1997) poverty levels are high but almost equally shared between rural and urban areas. In China poverty levels are much lower in both rural and urban areas (4.6 per cent and 2 per cent). These poverty figures do not reflect the impact of the recent Asian economic crisis, which reversed the trend towards lower poverty levels in many Southeast Asian countries.

Asian rural women, as small farmers and or as rural labourers, represent the most vulnerable rural poor. This is mainly due to the lack of access to assets, unequal control over revenue sharing at the household level and lack of access to appropriate technologies, education and health.

To meet the food needs of the increasing world population of a total of 8 billion in 2025, an additional 3 billion tons of cereals are needed, including rice, wheat and maize. World cereal production per ha has to increase from about 2.98 tons in 1997 to about 4.2 tons per ha in 2025 (based on the estimated 700 million ha for world cereal production). During 1990-97 the average increase in rice and wheat production per ha in Asia has been 1.2 per cent and 3 per cent per annum respectively. Almost all countries in the region are rice growing and consuming as well—some 2600 million rice consumers. Yet the availability of cereals per capita, despite the enormous increase (24 per cent) due to the Green Revolution between 1970 and 1995, is only 225 kg per capita in South Asia and 316 kg per capita in Southeast and East Asia, against the world average of 350 kg per capita in 1995.

While in recent decades there has been less famine in most Asian countries, malnutrition and under nourishment are still serious problems. According to the FAO definition, under nourishment is a situation where food intake is insufficient to meet the basic energy requirements on a continuing basis. No fewer than eleven of the seventeen rice producing countries in the region are classified by FAO as the most severe cases of "prevalence-plus" category of hunger. In these countries the average calorie intake is only 60-65 per cent of the official 2300 kcal/per person per day.

#### **FAO has defined four dimensions of food insecurity:**

- Food availability (sufficient quantities of food supplied through domestic production, food aid or imports).

- Food access (availability of food to individuals in terms of resources, income, common traditions or social policy entitlements).
- Food utilisation (quality of food basket for consumption determined by cultural, socioeconomic conditions of food diet, sanitation, clean water, etc)
- Stability of access (exposure to high risks of losing access to food, like in the case of seasonal agricultural labourers, people in semi desert areas affected by natural disasters, erratic rainfall and general insecurity due to armed violence, etc).

The two main dimensions of food insecurity at the household level are:

- Transitory, mainly due to income and savings shortfall, entitlement failure and acute bad health conditions.
- Chronic, mainly due to inadequate access to assets for food production or income generation, including access to basic education and health services and intra household resource sharing.

### Women & Children

Food insecurity is often associated with vulnerable population groups in rural areas including women and children, the disabled, victims of HIV-AIDS and other diseases. South Asia accounts for about 40 per cent of the world's stunted children, while this sub-region and also East and Southeast Asia account for 40 per cent of under weight children (Children who are too short for their age are stunted due to long term deprivation and children with low weight relative to their age are underweight relative to their height, mainly due to severe short term deprivation). Children in the three sub-regions are the most severely deprived. About five million infants die every year, due to poor sanitation and water pollution.

### Ethnic Minority Groups & the Aged

Many ethnic minority population groups in Asian Countries are absolutely poor and are dependent for their living on natural resources (forests, water and arable land) often in remote, mountainous areas. Food security of ethnic minority groups and communities is strongly affected by deforestation, water pollution, community land invasion by private enterprises or government agencies and the lack of appropriate skills for alternative sustainable farming systems, lack of access to non-farm employment and other sustainable livelihood opportunities. Due to the rural-urban migra-

tion and the impact of HIV-AIDS, children and the aged in rural areas are also increasingly becoming vulnerable to malnutrition.

**Food security of ethnic minority groups is affected by the lack of appropriate skills for alternative sustainable farming systems.**

### Resource Development & Management

In the Asia-Pacific region, most of the 250 million farm households are small holders or near landless. The cultivated land to agricultural population is 0.24 ha/ person compared to the rest of the world average of 1.51 ha/person. Although the region has 68 per cent of the world's irrigated land, the availability is merely 0.09 ha/person against a world average of 0.16 ha/person.

In many cases the governments implement national development strategies, including fiscal and trade policies, which are biased against agriculture and the rural sector in general. These policies are seriously affecting the livelihoods and entrepreneurial development of small agricultural producers, the landless and other producers in rural areas. In most countries, public investment in the agriculture sector (including forestry/fisheries) has been, on an average, less than 9 per cent of total public expenditure per annum, while about 70 per cent of the total workforce depends on the agriculture sector for their livelihoods.

As a consequence of the biased policies and budget allocations, government institutions in most countries concerned have been unable to effectively promote agriculture and rural development through the provision of timely and adequate social and production services in rural areas. The services needed in rural areas by the small farmers, among others, are: access to primary health care, education, safe drinking water and electricity and a wide range of agricultural services in support of market oriented, sustainable farming systems. Services needed by the growing off-farm working population are: access to credit, technology, organisation and entrepreneurship training to facilitate off-farm enterprise development based on local resources and processing of agricultural products.

Governments in most Asian countries have been unable to implement effective natural resources development and conservation policies. Policies and programmes have been decided upon without proper consultation with the rural poor and often, as a result,



these programmes affect negatively the livelihoods of the poor in rural areas.

Fisheries with 52 per cent of total world capture and aquaculture with 91 per cent of the world production contribute significantly to food security in the region. Fish makes up over 50 per cent of the animal production in most countries in the region and provides high protein food and additional nutritional benefits, which are highly beneficial to the physical and mental development of all people, especially children. Yet the major constraint on improved income and nutrition of the rural poor and coastal fisherfolk communities is the lack of regulatory frameworks at national levels. Sustainable fisheries management depends on participation by all the stakeholders. Yet, often, government policies demonstrate a policy bias which has been favourable towards large-scale industrial enterprises in the fisheries and aquaculture sector. In the latter, the policies favour the highly profitable shrimp farming. A land resource management crisis can occur if due to unsustainable shrimp farm practices, the soils of adjacent rice farmers are affected. Silting of soils will diminish rice crop yields and therefore worsen the livelihood conditions of the poorer small scale rice farmer.<sup>1</sup>

A similar policy situation applies to forest tree production on a large scale by professionals and private or state companies. Such forestry policies frequently exclude forest communities from playing an effective role in planning and implementation of sustainable forest development and conservation activities. Yet the rural poor have always been dependent upon forest and tree products as essential in their daily diet and as additional income opportunities. While much has been said in policy documents and programmes about people's participation in community, social forestry, agro-forestry development, these are often not effectively applied in government programmes aimed at sustainable forest development management and conservation. Policy makers and programme designers will benefit from the participation of rural communities, in particular women and ethnic minority groups, who possess extensive local knowledge about sustainable use of forest and tree products for nutritional, medical and wood energy purposes.

Access to water resources in Asian countries has always been (in China and India in irrigated farming, particularly in semi arid areas) and will be a major constraint on promotion of agriculture and rural develop-

1. The shrimp farmer, on the other hand, will have no access to intensify and or diversify his production and agro-enterprise development.

**Rural poor have been dependent upon forest and tree products.**

ment. Deforestation, land erosion, pollution, uncontrolled and inefficient extraction of groundwater and the use of freshwater resources, mainly due to unsustainable forest, farm management systems, industrial development and urbanisation, transform arable land to silt plateaus and or deserts.

The rural poor, in particular, small farmers and ethnic minority groups, is often the most vulnerable. Current development approaches towards promotion of natural resources management by user groups and local communities often have mixed results due to lack of real management powers at these levels as line ministries and the more powerful private sector representatives keep control over the decision-making process, resource allocation and benefits sharing. There is a basic need for local institutional capacity building for participatory resources development and management. There is a tendency to trust too much on the market mechanisms as the only solution towards more sustainable resource management. Conflicts between the ethnic minority groups, small scale farmers and the private enterprises, which turn hill slopes into fruit orchards, coffee and rubber plantations are on the increase.

**There is a tendency to trust too much on the market mechanisms.**

Water shortage, either seasonal or permanent, due to gross mismanagement (e.g. monoculture) and or climate change will be a major challenge in agriculture and rural development. Urbanisation and development of intensive water using peri-urban agriculture are also new challenges to be met by the concerned government agencies in partnership with the private sector and rural communities. At the regional level, inter-country collaboration in water basin and conflict management will become a key policy area for the promotion of sustainable agriculture and rural development.

There is an overall financial constraint at the level of the government institutions, which often have development budgets marginally above their salaries. Donor agencies have sometimes compensated for the finances in selected areas of agriculture and rural development but, by and large, have failed to meet the real needs of the rural sector.

## Off-farm Employment Related Research

The important role of technology to promote sustainable agriculture and rural development cannot be underestimated. There is a need for the generation of sustainable labour intensive agricultural production and large scale off-farm employment for a large number of landless and other rural poor. In view of the limits reached in the expansion of agricultural land, any productivity increase has to come from intensification and or diversification of agricultural production to meet the need for both increased yields in food products per unit of land and also the requirement for increased rural employment opportunities.

Agricultural research and development budgets are very low in most developing countries within the region except in China and India (with R & D expenditures of US\$ 330 million in 1997 and US\$ 500 million in 1994, respectively). Yet there is high return on public investment in agricultural research which contributed to an estimated 20 per cent of China's agricultural output growth from 1993 to 1996. According to a recent international study published in 1999, the marginal internal rate of return of public agricultural research is estimated at over 50 per cent. Agricultural research benefits the rural poor directly through increase in their own farm production. It provides the small farmers and the landless (women) labourers greater employment opportunities and higher wages. Other rural poor will benefit from increased income and employment opportunities due to increased demand for non-farm products, tools and consumer goods in rural areas. Yet, small holder agriculture is often bypassed in the development and dissemination of new technologies. While agricultural productivity enhancement starts at the local farm level, most small farmers still lack adequate access to credit, extension, improved high-yielding and drought resistant varieties, chemical fertilisers, appropriate farm tools and equipment. This is especially so in the case of women, who represent the majority of the agricultural producers in the region.

**Small holder agriculture is bypassed in the development and dissemination of new technologies.**

The daunting tasks of the developing countries in the field of research and extension in agriculture cannot be fulfilled by the public sector alone. Certainly not by the traditional departments concerned with agriculture, fisheries and their education and research institutions. Yet the private sector is not keen on

agricultural research related to low level technologies in response to local farming practices and constraints faced by the small farmers, small scale fishermen, local water users and women. At the high end of agricultural research, such as in biotechnology and plant genetic engineering (GMOs), the new technology development by the private sector is dominated by the international companies often acting as monopolies world-wide and unconcerned with small farmer related food and export crops produced in the region.

Natural resources management technologies are rapidly increasing for promotion and development of sustainable agriculture, forest, water and fisheries. Following the trend towards liberalisation of trade in agricultural products within the framework of the Uruguay Round/WTO, there is an increasing need in the region to promote agricultural exports which are consumer friendly in European, Japanese and US markets. Thus, new technology development will need to meet export requirements of food safety and quality of agricultural products. On a broader scale, not only the products but the entire physical environment needs to be consumer friendly in terms of the standards set for environmental conservation, biodiversity and bio-safety, involving all stages, including handling of agricultural products from farm to agro-industries and to the market.

Government institutions need to promote the use of local knowledge for improved productivity in local food crop production, water conservation, soil improvement, and develop demand driven new farm technologies in partnership with the local communities and small farmers. Government facilitation of small farmers' participation in decision-making on priorities and budget allocation for agricultural research and extension activities are of equal importance as collaboration with private enterprises in high-end biotechnology research.

**Government institutions need to promote the use of local knowledge for improved productivity.**

Of equal importance is research on sustainable and labour intensive agricultural production systems and on rural off-farm production and enterprise development. On this topic, APO organised in Iran a successful regional seminar in 1998. The outcome of this seminar was indeed recognition that government policies should give more priority to investment in public research on technologies to promote agro-industries based on local resources and to the establishment of institutional

linkages between them and small farmers and rural workers, through their own self-reliant, representative and self-managed organisations, including the agricultural cooperatives.

An emerging area of research and technology development for enhancement of agricultural productivity, value added production, processing and marketing within the small holder agricultural sector is the development of rural telecom systems and related information technology and dissemination in rural areas. Rural universities, market information centres, schools, community centres, NGOs and farmers' groups become directly and independently interlinked in the exchange of information, education, extension and marketing activities. Such interactions enhance local opportunities for market oriented production as well as access to new technologies which better guarantee sustainable small farming systems development, natural resources management and off-farm enterprise development. Information technology will also enhance transparency and efficiency in government decision-making on promotion of agricultural and rural development programmes and delivery of related public services. Yet, while some villages or village clusters could become virtual rural service centres, in most cases the development of telecom based virtual market roads between the small farms and the urban markets cannot replace the need for real development of rural infrastructure, in particular, farm to market roads and improved urban-rural people and goods transport linkages.

Research and technology development requires a well defined policy framework to incorporate new paradigms which respond to the ecological challenges in this sector. The paradigm should shift from "green revolution" to "evergreen revolution" and incorporate effectively the concept of pro-poor and gender sensitive small scale farmer participation and extension. The broader trade and ecological dimension of agriculture and rural development will demand a strong effort in human resources development. Agriculture and other relevant ministries need to be restructured to facilitate effective participation of small farmer-led private sector and rural organisations in the planning, implementation, monitoring and evaluation of the programmes and activity mechanisms at decentralised levels between government agencies, private sector agro-enterprises and institutions. Representative small farmers, producer and marketing organisations, agricultural cooperatives and community level NGOs should be included in the decision-making. A policy framework for increased regional networking and collaboration among Asia-Pacific countries is needed to collectively meet international development demands. International research and development efforts need to be focussed on

promotion of national capacity building for agricultural research on productivity improvements in local food and agricultural crops and livestock produced in humid and semi arid areas within the region.

**Ministries need to be restructured to facilitate effective participation of small farmer-led private sector organisations.**

### **Collaboration between the Institutions**

Asian countries are the major trading nations in food and agricultural products. Countries like Thailand and Vietnam are major rice exporters, Malaysia and Indonesia are rubber exporters and so on. About 26 per cent of the total agricultural output in East and Southeast Asia are exported mainly to USA, Europe and Japan, of which about 65 per cent originates from Thailand and Malaysia alone. While Asian countries are active international trade partners, a whole range of policy issues are to be addressed within the framework of the Uruguay Round and WTO agreements. Asian countries are reluctant to further liberalise trade as the concept of national food security/food self-reliance is still considered valid to protect the local small scale rice producers. Also, expected mutual efforts towards liberalisation of imports of food and agricultural products by the developed countries like in the European Union and USA have not taken place convincingly. In most countries, the customs departments and port authorities are among the most corrupt agencies, leading to loss of income for the state and lack of adequate control on quality, disease, etc. Agreed quotas in imports and exports of agricultural products can not be monitored also with interstate borders, which totally lack control, transparency or even telecommunication equipment. Yet the greatest challenge for the Asia and Pacific countries lies in the development of highly modern technologies for food safety and quality control either upon demand from importing developed countries or following the emerging importance of imported GMOs, particularly the corn and soya products consumed by the Asian consumers. According to the World Bank, about 50 per cent of the annual development investment funds have to be reserved for meeting the sanitary and phyto-

**The challenge lies in the development of highly modern technologies for food safety and quality control.**

sanitary requirements (SPS) and conditions for protection of property rights (IPS).

Governments will need to build institutional capacities at the national and international levels (country representations, regional collaborative frameworks in collaboration with international agencies including UNCTAD, FAO, ILO and WTO) for research on various trade-offs in the new trade agreements and provisions in the existing agreements, which should provide necessary safety nets in trade, environmental protection and biodiversity conservation. Many developed and developing Asian governments, though they often do not subscribe to, remain rather passive towards a wide range of international conventions and codes of conduct, concerning sustainable management of agriculture, fisheries and forestry or related to quality of food and nutrition, environment, food security, etc. Governmental level meetings in this region, facilitated by FAO for its 26th South and Southeast Asian and 12 Pacific Island member countries, provide a regional platform for a dialogue and joint decision-making on these matters.

Cereal trade liberalisation will have a profound impact on small-scale rural food producers in both cereal production and processing. The World Bank recognises that there will be large scale changes in the agricultural sector affecting small scale producers who need to diversify their crop and agricultural production and specialise in local food products for urban consumer markets. To meet WTO related requirements in the light of the prevailing low quality of both the social (education and health) and agricultural support services in rural areas, government institutions need to be restructured and decentralised to establish effective partnerships with private institutions, especially with the representative small agricultural producers' organisations and agricultural cooperatives.

Agricultural cooperatives, used to mainly distribute agricultural inputs, are often not able to respond to the needs of local entrepreneurship development, either as agricultural or as off-farm producers. This policy area will become important within the context of the WTO as the private sector is unable to fill the gap in the provision of services. Secondary level agricultural cooperatives in agro-processing and marketing will have to be developed and, where necessary, rehabilitated. The government needs to develop a policy dialogue with respect to the export of food and agricultural products through effective agricultural cooperative networks in the Asian Countries. Government institutions need to consult and collaborate in the design and implementation, monitoring and evaluation activities at the local, regional and national levels with the agricultural

cooperatives and small farmers-based commodity organisations. A major effort in education, training and provision of credit for small and medium enterprise development will be needed.

Public investment for rural infrastructure to improve rural-urban transport and market linkages, telecommunication networks and a consistent rural energy development policy are needed. Rural electricity production, if based upon fuel wood and biomass, by small farmers and the rural poor, will stimulate income generation and rural employment and thus contribute to rural poverty alleviation.

**Rural electricity production based upon fuel wood and biomass will stimulate income generation and rural employment.**

It is evident that governments alone cannot mobilise all the necessary resources for the needed investments. Large-scale donor support from the developed countries, World Bank and ADB and a change in attitude among the political leaders and senior level government officials in favour of agriculture and the rural sector and the needs of the rural poor are needed. That the road will be long and arduous may be clear from a comment by Mr. Thomas Fuller at the meeting of G8, the world's most powerful economic countries in Geneva (Herald Tribune of 18 July). "For Italy, globalisation had bad aspects during their Long March to modernity: inequality of incomes, concentration of wealth, poor working conditions and exposure to environmental degradation, political corruption and bribery, organised crime – all the social phenomena that crowd around any environment in the middle of radical change. Then comes the final shot: I am sure many Italians wish to be as boringly normal as countries like Switzerland and Sweden. Here is the news they will get their wish WITHIN A CENTURY".

### **Strengthening NGOs & Private Institutions**

At the 25th FAO Regional Conference for Asia and the Pacific in Yokohama (Japan) in September 2000, member governments adopted policy recommendations relevant to the above mentioned core issues. One recommendation to the governments is that donor organisations increase funding for agricultural research and for supporting institutions relevant for small-scale farmers. The second recommendation is that they implement policy reforms that encourage private and public sector participation in economic

activities in accordance with their comparative advantages. A third recommendation is to encourage governments to focus on addressing market failures, ensuring competitiveness and quality of support services, protecting the environment and common property resources and promoting balanced regional development. Member countries also adopted a recommendation that urges FAO to assist member countries to develop micro credit programmes, extension services, education and marketing support for small scale farmers, especially women.

**Recommendation is to encourage governments to focus on competitiveness and quality of support services.**

A regional consultation with the Asian NGOs, farmers' organisations and representatives from the agricultural cooperatives and rural workers organisations was also held parallel and as an input to the discussions by member governments at the 25th Regional FAO Conference. In September 2001 another regional FAO consultation with NGOs took place in Bangkok. The focus of this meeting was on the actual outcome of the World Food Summit held in 1996 in Rome and the follow up of the meeting within Asian and Pacific countries.

The FAO Regional Office actively collaborates with the Asian Coalition for Agrarian Reform and Rural Development (ANGOC), representing over 13 Asian NGO country networks and the Network for Promotion of Agricultural Cooperatives in the Asian and Pacific Region, which represents government agencies and cooperative movements jointly from about 13 Asian and Pacific countries. In partnership with these two networks and many other NGOs and farmers' and rural workers' organisations in the region, FAO-RAP supported a broad range of activities to promote sustainable agriculture and rural development at regional and country levels.

The Project formulation for Peoples Participation in Rural Development Activities initiated at the FAO Head Quarters in Rome by the Human Resources Division, was implemented with ANGOC in 1990. The process of dialogue among four government agencies and four NGO representatives led to effective (re)formulation of funding and operations of 19 projects covering community health services, urban poor, cooperatives and self-help groups, small scale fisheries, community forestry and environment and agrarian reform develop-

ment. What is most relevant is laying the foundation of such a collaboration based upon mutually agreed principles and a detailed framework and mechanism for participatory project formulation for people's participation in rural development activities.

FAO-RAP has provided member countries' government agencies and people's movements active support to promote cooperative development policies and institutional capacity building, enabling small-scale farmers to develop viable membership-based agricultural cooperatives. The NEDAC regional network is composed of paid membership and autonomous entities in the region representing thousands of primary, secondary and tertiary level agricultural cooperatives. FAO Rural Development Section in RAP and NEDAC jointly organised regular study seminars and regional level country exchange programmes for cooperative leaders, managers and policy decision makers. Member countries include, among others, China, India, Bangladesh, Nepal, Sri Lanka, Thailand and Mongolia, and provide a unique platform for policy dialogue and advocacy of favourable agricultural cooperative policies and institutional capacity building for small farmers as viable entrepreneurs in the rural sector. The core issue in the promotion of effective partnership between government agencies and agricultural cooperatives is the recognition by law and effective administrative, technical and financial support to promote membership based and managed agricultural cooperative enterprises. Member governments from Vietnam, Thailand and Nepal have requested FAO-RAP technical support. The FAO Regional Rural Development Unit has organised country level Round Table meetings and Training of Trainers seminars based on a training toolkit on agricultural cooperative development in Thailand, Indonesia, Nepal and Mongolia.

There are also many pitfalls, particularly in terms of regulatory framework for decentralised budget allocation, which generates local institutional resources and capacities and guarantees transparency for all stakeholders. Leadership and professional skills formation are major challenges in building local government capacities, able to timely and effectively respond to genuine local demands from the rural poor.

**Leadership and professional skills formation are major challenges in building local government capacities.**

The FAO Regional Rural Development Unit has on

---

behalf of the Rural Development Division based in Rome given priority attention to capacity building of member functions in the field of decentralised participatory planning for sustainable agricultural and natural resources management and poverty alleviation. Recently a training toolkit has been developed in collaboration with the Centre for Integrated Rural Development and the National Institute of Rural Development in India. The first draft of the document, being field tested and thoroughly discussed among experts, is practical and very enriching on normative background developed by FAO and on facts and modalities for participative decentralisation for

poverty alleviation applied in the State of Maharashtra in India. Upon request of the member countries, the FAO Rural Development Unit will assist in further development of such training toolkits in the Asia-Pacific countries for strengthening capacities of government institutions to establish mechanisms for coordination between public and private institutions to promote sustainable agricultural and rural development. Requests for assistance from the Unit have been received from the UNDP in Vietnam and Nepal and assistance has been provided in policy advice on this important topic. □

*The activist is not the man who says the river is dirty. The activist is the man who cleans up the river.*

**– H. Ross Perot**

# Sustainable Development & Agricultural Strategies for Food Security

V. Anbumozhi

*There is widespread consensus about the importance of sustainability and its desirability as a goal for food security. However, its potential as criteria for guiding agricultural development has yet to be realised. It was argued that, in order for sustainability to be used as a criterion in food production planning its characterisation should be system oriented, quantitative and predictive. Agricultural development strategies are discussed and recommended for enhancing food security.*

*V. Anbumozhi is Assistant Professor, University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-0033*

Numerous attempts have been made in recent years to grapple with the question of whether global food production can keep up with population growth in the next few decades. By the end of 2015, the world's population is expected to increase by 8.29 billion (IFPRI, 2000), A 239 per cent increase from 1950. It is anticipated that 90 per cent growth will be in the developing countries. While the rate of population growth is expected to decline, the anticipated fall from 1.85 per cent year to 1.7 per cent (FAO, 1999) is marginal. Although food production is expected to rise by 90 per cent from the present 1.8 billion tons, most of the increase in per capita consumption is predicted to occur in developed countries and remain static. Based on specific assumptions, several simulations have projected global cereal balance for the next decade (Table 1).

**Table 1:** World supply and demand projection of cereals (in million tons)

Projection	World		Developing countries	
	Production	Consumption	Production	Consumption
1989-2000 Average	1,727	1,730	863	953
Projected 2010				
FAO	2,334	2,334	1,318	1,480
IFPRI	2,405	2,406	1,232	1,392
World Bank	2,311	2,308	1,253	1,459

Source: World Bank, 2000

Most projections arrived at a similar conclusion that the world food supply would meet global demand, at least until 2010, even though the picture is a little different for developing countries. Since these projections assume normal conditions in agricultural productivity and investment, this would not necessarily reflect the effects of any major changes in crop production or declining investment in agriculture or other abnormal climate events. Moreover, the scope for raising the ex-

tent of arable land under cultivation is small, 4 per cent increase is projected by 2000. So most of the increase in food production will have to be met by more intensive cultivation of land already cropped. This may require greater use of non-renewable and potentially polluting inputs such as fertilisers, pesticides and fuel. Whether they are positive (Maxwell, 1996) or negative (Dyson, 1994) in outlook, most studies agree that the key issues include the potential for increasing the irrigated cropland area, for increasing the yield and food production. Other scholars emphasise the importance of resource conservation and alternative production models that are less environmentally damaging than the conventional high-input approach to secure sustainable food production.

In developed countries the food production system and agriculture is advanced, modern and intensive, characterised by the use of expensive inputs and managed by a small number of highly knowledgeable, well-equipped farmers. This sophisticated and advanced agriculture is often supported and subsidised by the government as a result of food surpluses, stockpiles and saturated markets without enough buyers. In developing countries, food production systems are at a subsistence level, with high percentage of farmers in the population. Most of them lack economic means and face difficulties in purchasing inputs. Their level of know-how and technology is limited so their food production, quality and prices are low. This type of food production exploits agricultural lands intensively and consumes great quantities of resources. The issues and approaches dealt with in this paper aims to answer the types of sustainability crises mentioned above. An assessment of the opportunities and constraints that will arise when attempting to expand food production is done. The paper concludes with suggestions to improve the empirical foundation for agricultural development on the basis of long-term food security.

**In developed countries the food production system is advanced, modern and intensive.**

### **Sustainable Agricultural Development**

In rural areas, economic, social and environmental change is inherent to agricultural development and food security. Whilst increased food production aims to bring about positive changes in the farm economy, it can lead to conflicts between the environment and social structure. In the past, the promotion of economic growth for increased well-being of the vil-

lage community was the main development thrust with little sensitivity to social or environmental impacts. The need to avoid adverse impacts and ensure long-term benefits led to the concept of sustainability. Increasingly sustainability is being adopted as a desirable goal by researchers and policy makers at national, regional and international levels. Rational pursuit of sustainable development, is possible only if we know what sustainability is or more exactly, what we want to sustain and in what aspect. For example, sustainability of agricultural production systems in terms of food resilience (IFAD, 1988), environment friendly and socially relevant technological development for food production that also conserve land and water resources (FAO, 1991), improving the access to food and poverty alleviation as part of inter-generational economic welfare (UNDP, 1997) 3), ecological integrity and preservation of biodiversity (MAFF, 1991), public participation and collective management of non-renewable resources (ADB, 1991) and social equity and distributive justice in food access (World Bank, 1995). They are not exactly the same goals even though the means to achieve them may well run parallel up to a point.

**In rural areas, economic, social and environmental change is inherent to agricultural development and food security.**

However, what the term 'sustainability' implies is not clearly perceived, nor which elements are encompassed. Some vague notion about it was first derived by the popularly known Brundtland Report (WCED, 1987), "... Humanity has the ability to make development sustainable—to ensure it meets the need of the present without compromising the ability of the future generations to meet their needs..." This report combined several lines of thought on various aspects related to the environmental impact of agricultural development and food security, such as pollution of land and water by fertilisers and pesticides, soil erosion and land degradation, nature conservation and concerns for biodiversity, depletion of agro-environmental resources at prevailing economic growth rates. Despite several publications on sustainable development, in which many attempts have been made to capture the concept of sustainability, few definitions suit conceptual and operational purposes of agricultural development and food production, because many of them are based on partial criteria which lack possibilities for making them operational. Although the concept of sustainability has been useful for consolidating concerns and motivating



change, concrete examples of its use as an operational criterion for guiding efforts to improve agricultural systems are difficult to identify.

### Interpretations of Agricultural Sustainability

The distinction between sustainability as a system describing and as a goal-prescribing concept identifies two current schools of thought that differ in their underlying goals. The goal-prescribing concept interprets sustainability as an ideological or management approach to agricultural development and food security. This concept was developed in response to concerns about negative impacts of agriculture, with the underlying goal of motivating the adoption of alternative approaches. The system-describing concept interprets sustainability either as an ability to fulfil a diverse set of goals or as an ability to continue. This concept can be related to concerns about impacts of global environmental changes and economic challenges on the viability of agriculture and rural life. This also implies the goal of using sustainability as a criterion for guiding agriculture as it responds to rapid changes in its physical, social and economic environments.

### Sustainability as an Approach to Food Security

Sustainable agriculture has been described as an umbrella term encompassing several ideological approaches to food production including organic farming, biological agriculture, alternative agriculture, ecological agriculture, low-input agriculture, biodynamic agriculture, regenerative agriculture, permaculture and agroecology. It is because present environmental problems became associated with 'conventional agriculture' that it was perceived as unsustainable (Dahlberg, 1991). 'Alternative agriculture' is often equated with sustainable agriculture (O'Connell, 1992; Madden, 1987, Harwood, 1990; Dahlberg, 1991; Bidwell, 1986) and promoting alternatives to conventional agriculture. MacRae et al (1990) and Neher (1992) defined sustainable agriculture as a philosophy. Ikerd (1991) described low input, sustainable agriculture (LISA) as more a philosophy than a practice. Examining the concept of conventional agriculture is important, since sustainable agriculture is often described by its contrast with conventional agriculture (Lockeretz, 1998; MacRae et al, 1989; Hauptli et al, 1990; Dobbs et al, 1991; O'Connell, 1992; Hill and MacRae, 1988, Lal 1995). Conventional agriculture is capital-intensive, large-scale, highly mechanised agriculture with monoculture of crops and extensive use of artificial fertilisers, herbicides and pesticides, with intensive animal husbandry. Beus et al (1990) listed decentralisation, independence, community, harmony with nature, diversity and restraint as key values of alter-

native agriculture. Social values such as equity, the value of traditional agricultural systems, self-sufficiency, preservation of agrarian culture and preference for small, owner-operated farms have been incorporated into definitions of sustainability (Okigobo, 1987, Lockeretz, 1988). Francis et al (1990) described sustainable agriculture as a philosophy that guides the creation of food production systems. Specific management strategies are often suggested by ideological interpretations of sustainability. The practices promoted as sustainable (Table 2) are based on the types of problems emphasised and on views of what would constitute an improvement. The strategy most frequently linked to sustainability is reduction or elimination of the use of processed chemicals, particularly fertilisers and pesticides (Stinner et al, 1987; Carter, 1989; Hauptli et al, 1990; Madden, 1990; Dobbs et al, 1991; Swaminathan, 1996; ICID, 2000).

**Table 2:** Sustainability of Food Production System

Practice	Field Method
Reduced use of inorganic fertilisers and promoting organic farming	Agronomy
Promotion of Integrated pest management and elimination of pesticides	Crop management
Improved crop rotation for diversification, water harvesting, soil fertility and pest control	Water management
Crop diversity and integrated farming	Farm system
Maintenance of crop residue and other soil conservation measures such as contour ploughing, strip cropping	Soil conservation
Decreased or disbursed livestock rates	Livestock management
Preferred use of on farm resources to purchased ones	Farm economics

Approaches developed in response to problems in Japan, America and Europe may be inappropriate in other regions like Asia and Africa where circumstances and problems are different. The alternative agriculture movement has its roots primarily in regions characterised by high levels of food surpluses, resource consumption, high levels of chemical inputs, relatively deep, fertile soils and relatively small populations. In contrast, frequent or chronic food shortages, lower levels of resource consumption, lesser levels of chemical inputs, relatively fragile soils and rapidly growing populations characterise many less developed tropical regions. Farzin et al (1999) argued that interpretations of sustainability in the USA have been shaped by food surpluses. However, much of the concern about sustainability in less developed countries is related to the need to increase productivity to meet future needs of growing populations. The potential for the desperation imposed by

poverty to shorten people's planning horizons (IFAD, 1988) raises questions about the ecological consequences of failing to produce more food. The alternative agriculture movement has not adequately addressed the need to feed rapidly growing populations in order to prevent both human and ecological disasters. Because of the temporal nature of sustainability, errors of either ignoring approaches that enhance sustainability or promoting approaches that threaten it, may not be obvious when the approaches are implemented.

**Sustainability in less developed countries is related to the need to increase productivity.**

### **Sustainability as a System Property of Integrated Food Production**

The concept of sustainability as an approach to agriculture and food production evolved parallel with the concept of sustainability as a system property. While Dahlberg (1991) argued that 'sustainability' was first used by an emerging alternative agriculture movement to prescribe a particular set of values, Kidd (1992) countered that the system describing concept developed earlier, but did not use the word 'sustainability' until later. As a property of agriculture, sustainability is interpreted as either the ability to satisfy a diverse set of goals to attain food security or an ability to continue through time. Sustainable goals generally include some provision of basic food needs, maintenance or enhancement of the natural environment, economic viability of food production and social welfare. Lynam and Herdt (1989) argued that an interpretation of sustainability based on several qualitative goals fails to provide a criterion useful for guiding agricultural research. If a system is defined as sustainable when it provides adequate food, protects the natural environment, and maintains producer profitability, then there is no logical way to rank determinants of sustainability. It is not helpful to use sustainability loosely as a general purpose code encompassing all of the aspects of food policy that the authors consider desirable. Hildebrand (1990) suggested that sustainability might be interpreted as the length of time that a system can be maintained. Interpreting sustainability as an ability to continue is consistent with the literal English usage of 'sustain' and its derivatives. Its potential usefulness comes from suggesting criteria for characterising sustainability, providing a basis for identifying constraints and evaluating proposed approaches to its improvement.

**Sustainability is interpreted as the ability to satisfy a diverse set of goals to attain food security.**

### **Characterisation of Sustainability**

For sustainability to be a useful criterion for enhanced food production, several elements should be incorporated into its characterisation. Firstly, characterisation should be based on a literal interpretation of sustainability, i.e. the idea of continuation through time must be included. Secondly, it should be system-oriented and holistic. Sustainability is a relevant criterion for evaluating technology only when the system is clearly specified, including its boundaries, components and context. That is sustainability has meaning only in the context of specific temporal and spatial scales. The objectivity that results from such a system-oriented approach for food production is essential for guiding changes in agricultural development and conservation practices but may also work against motivating change. Thirdly, an approach to characterising sustainability should be quantitative. Sustainability is often treated as a discrete property (Kobayashi, 2001). An agricultural practice is either sustainable or unsustainable, as a system with 'half' sustainability can not be created. However, comparisons among agricultural practices are possible (Reddy et al, 2000). Fourthly, since sustainable development deals with the future, its characterisation should not only be descriptive of the past and present but must be predictive of the future. The fifth element of characterisation is a diagnostic approach, in which sustainable development takes into account variabilities and approximately expresses predictions in terms of probabilities (Farzin et al, 1999) by testing hypotheses about constraints using a measure of sustainability that is both comprehensive and integrated (Reddy et al, 2000). Unsustainability may be easy to recognise when a constraint is dominant say, for impact of nitrogen loading in stream water (Tabuchi, 1989). In the absence of dominant constraints, inferences about sustainability are difficult and must be based on a comprehensive diagnostic measure that accounts for the range of possible determinants. An integrated approach is necessary for comparing, for instance, the relative impact of pesticides or herbicides in food cycle and market fluctuations of commodities on sustainability. The strength or weakness of reviewed approaches for characterising sustainability can be related to success or failure to incorporate the proposed elements, namely literal, system oriented, quantitative, predictive, stochastic and diagnostic. Tools such as modelling and holistic system

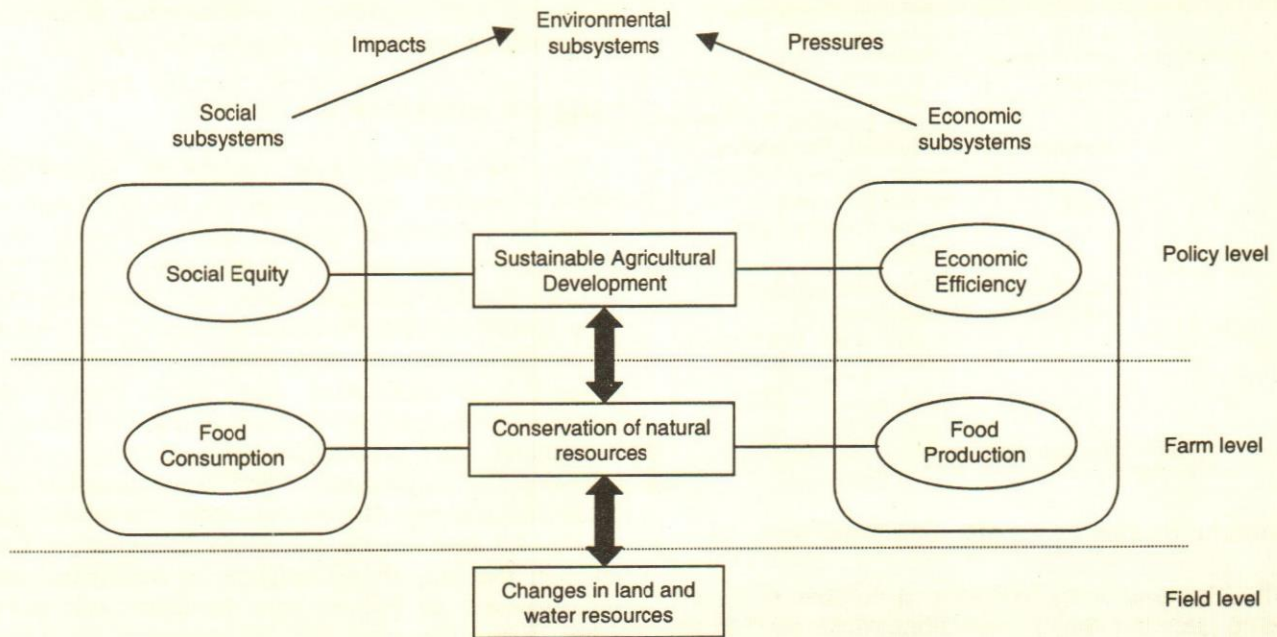


Fig. 1. A Sustainability model for food production at different levels

analysis must be a part of approaches that incorporate all of these elements.

**Sustainability is a relevant criterion for evaluating technology**

#### Agricultural Land Use Planning for Sustainability

A prerequisite for realisation of various definitions or goals of sustainable food production is development of a model that can be used by agro-environmental and socio-economic disciplines with equal ease. Sustainability in this model is associated with agricultural land use because in food production at the farm level, it forms a unifying concept as all variables coincide at this level. As shown in Fig. 1, this model is designed in such a way that it accommodates agro-environmental and socio-economic realms, encompassing three levels of integration; field, farm and policy level. At policy level, the realisation of sustainability in food security must reflect social objectives that can be defined as the desired outcome of the trade-off between agro-environmental quality, social equity and economic efficiency. Agro-environmental quality is expressed in terms of changes in the land and water resources, social equity refers to fair distribution of food products and economic efficiency refers to optimal allocation of resources. This can be done by modifying or improving the institutional and administrative environment to maximise aggregate food security, which needs development of appropriate

development indices. Conceptually, this model can be applied at different spatial levels, (village, watershed, nation, region or the world). At the farm level, sustainability in food production is closely linked to economic viability of the farm household to produce and consume (Farzin et al, 1999). Decisions at the farm household level take into account trade-offs among production, consumption and conservation of agricultural resources. The resources in the farmhouse hold resource base are linked to the field, to the plot and at a national level to the agro-environmental component. Conservation of agro-environmental resources. The resources in the farmhouse hold resource base are linked to the field, to the plot and at a national level to the agro-environmental component. Conservation of agro-environmental resources depends on the relationship between the use of soil and water with the agricultural inputs and labour resources (Anbumozhi et al, 2000). At the plot level, trade-off among human objectives no longer exist. It is imperative at this level that the concept of sustainability should be quantitative to include the indicators shown in Table 3.

The relevant unit of analysis is the land (soil characteristics), water (quantity and quality), air (climate) characteristics under a given land use system (crops, forestry activity, livestock) with technology (energy use, level of mechanisation). A system may be sustainable at one level, but not at another. For instance, water pollution caused by fertilisers and pesticides may be significant problems at the field level but not at the regional policy level. Consequently, the concept of sustainability in food production should be defined or measured by different variables at different spatial scales.

**Table 3:** Field level indicators of sustainable food production

Agro-environmental resource	Environmental impact	Indicator
Land	Soil Characteristics	Soil pH, Electrical conductivity, Permeability, Texture, Soil loss, Fertility status, Heavy metals. Organic matter content, Microbes
Water	Water Quality and Quantity	pH, Electrical conductivity, Oxygen level, Ion concentrations, Sediments, Coliform
Air	Micro climate and Air Characteristics	Precipitation, Temperature, Radiation, Dioxin level, CO <sub>2</sub> and NH <sub>3</sub> content

### **Agricultural Strategies for attaining Food Security**

The above analysis highlights a number of issues including gaps in policy prescriptions which need to be overcome if food security is to be ensured on a sustainable development basis. These call for a wide range of strategies as described below.

#### **Promoting sustainability in food production**

Since a rapid move towards global food security implies market interference, governments in developing countries will be in need of balancing their food production and import needs. Measures have to be taken to reverse environmental degradation. Agricultural policies that vary from region to region are needed to reflect different local needs. Agro-environmental resource inventory and land use potential should be developed as quickly as possible. Classifying land according to best use will determine variations in infrastructure provision and support services, fiscal subsidies and other incentives. In addition, farmers should be encouraged to adopt farming practices that are ecologically sound. Indigenous farming systems often contain a wealth of environmental knowledge which needs to be assessed and adapted with the needs of a growing population.

In the poorest of the developing countries in Asia and Africa effective population policies together with significant investment in the rural social sector is also strongly recommended. Access to food is constrained by poverty. Integrated development will promote the access by the poor to other productive resources such as land and irrigation water.

Renewed focus should be placed on mobilising the under utilised potential of smallholder farmers, the landless, rural women and other deprived groups. This will require the maximum participation and involvement in

the design, implementation, management and follow up of agricultural and rural development projects.

#### **Increasing agricultural productivity**

Considering the rapid population growth and limited non-farm opportunities in many developing countries, agricultural growth and increased grain production will be the most viable alternative for food security. Since the irrigated crop land area expansion is no longer a highly feasible option in many parts of the world, particularly Asia, future increase in local-regional food production must come mainly from higher land productivity. So, sustainable technological innovations for productivity enhancement should receive prime consideration. The development of best water management techniques and biotechnologies suitable for land scarce conditions is important. Crop varieties that are more resistant to droughts, pests and diseases as well as new varieties and hybrids better suited for various agro-ecological conditions will be greatly in demand. Appropriate technology must help increase not only resource productivity but also labour productivity, mainly in developed countries to attain food security. This implies drastic changes in the priorities, location, content and coverage of current agricultural research.

**Sustainable technological innovations for productivity enhancement should receive prime consideration.**

#### **Enhancing market accessibility**

Sustainable agricultural development is not only the key to grow more food but also a medium to create employment opportunities in the rural non-farm sector. The raising of farm income generates demand for local goods and services. Moreover, any agricultural development strategy requires massive investment in building and maintenance of rural infrastructure. This will provide small farmers increased access to markets for their outputs and various inputs such as irrigation facilities, technical assistance, fertilisers, pesticides etc. to meet long term food production goals.

#### **Stability through international cooperation**

Floods and droughts induced fluctuations in food production are not new phenomena. Major donor countries can play a vital role to bring stabilisation in adverse situations. Appropriate policies are needed to

build institutional capacity to protect the poor from this type of transitory food insecurity. Many countries have adopted carry over buffer stocks in their attempt to stabilise food supply. Bilateral and multilateral food aid and emergency relief are some immediate responses to transitory food insecurity. Although they are temporary coping strategies, by careful targeting these can be beneficially used in agricultural development projects. How big a role food aids play in filling the food gap in adverse situations will depend not only on how much aid donor agencies deliver, but also on whether food aid is accompanied by sound policies of sustainable agricultural development.

## Conclusions

There is widespread consensus about the importance of sustainability and its desirability as a goal for enhanced food production. Sustainability in the agricultural development context, shall be characterised as establishing a production system that maintains an acceptable level and satisfies prevailing needs and is continuously adapted to meet the future needs for increasing the carrying capacity of the resource base and other worthwhile human food needs. Sustainability can only be realised when the resources and technology are within the capabilities of the farmer to hire and manage with increasing efficiency to achieve desirable levels of productivity with no or minimum adverse effects on environmental quality and human life. The world has the technology—either available or well advanced in the research pipe line—to feed on a sustainable basis the projected population growth. The more pertinent questions are whether the food producers—farmers—will have access to the continuing stream of new technologies needed to meet agricultural development and the food security challenges that lie ahead. On the world scale, international cooperation is the key to ensure that the benefits of global food production and distribution are shared equitably. Nevertheless, national food security policies and agricultural research programmes must be tailored to each country, its circumstances and levels of food security. To be successful in attaining sustainable food security, action by governments must be based on a comprehensive understanding of the interaction between technology, policy and institutions.

## References

ADB (1991), "Environmental evaluation of agricultural projects: Methods and approaches", Environment Paper No. 8, Asian Development Bank, Manila.

Anbumozhi V. and E. Yamaji (2000), "Intrinsic effects of land and water development on the environment", Proceedings of the Annual Conference, Japanese Society of Irrigation and Drainage Engineering, Tottori.

Beus C.E. and R.E. Dunlap (1990), "Conventional versus alternative

agriculture: the paradigmatic roots of the debate", *Rural Sociology*, 55(4).

- Bidwell O.W. (1986), "Agro ecosystem Analysis", *Agric. Administration*, 20, 31-55.
- Carter H.O. (1989), "Agricultural Sustainability: an overview and research assessment", *Calif. Agric.*, 43(3): 16-37.
- Dahlberg K.A. (1991), "Sustainable agriculture—fad or harbinger?" *Bioscience*, 41(5), 337-340.
- Dyson, T (1994), "World Population growth and Food Supplies", *International Social Science Journal*, 141: 361-385.
- Dobbs T.L., Becker D.L. and D.C. Taylor (1991), "Sustainable agriculture policy analysis: South Dakota on farm case studies", *J. Farming Systems Res.* 2(2).
- FAO (1991), "Issues and Perspectives in sustainable agriculture and rural development: Main document No. 1", United Nations Food and Agriculture Organisation, Rome.
- FAO (1999), "Food Outlook: Global Information and Early Warning System on Food and Agriculture", Number 2, Commodities and Trade Division, United Nations Food and Agricultural Organisation, Rome.
- Farzin Y.H. (1999), "Optimal saving policy for exhaustible resource economies", *Journal of development economics*, 58(1).
- Farzin Y.H. and J.D. Kaplan (1999), "Non-point source pollution control under incomplete and costly information", Fondazione Eni Enrico Mattei working paper, Dept. of Agr. and resource econ, University of California, Davis.
- Farzin Y.H., Huisman K.J.M. and P.M. Kort (1999), "Optimal timing of technology adoption", *Journal of economic dynamics and control*, 22(5).
- Francis C.A. and G. Youngberg (1990), "Cropping systems based on farm-derived renewable resources", *Agric. Systems*: 27.
- Harwood R.R. (1990), "A history of sustainable agriculture", in *Sustainable Agricultural Systems, Soil and Water Conservation Society, Ankeny, Iowa*.
- Hauptli H., Katz D., Thomas B.R. and R.M. Goodman (1990), "Biotechnology and crop breeding for sustainable agriculture", in *Sustainable Agricultural Systems, Soil and Water Conservation Society, Ankeny, Iowa*.
- Hildebrand P.E. (1990), "Agronomy's role in Sustainable agriculture: integrated farming systems", *J. Prod. Agric.*, 3,
- Hill S.B. and MacRae R.J. (1988), "Developing Sustainable Agricultural education in Canada", *Agric. Hum. values*, 5(5).
- ICID (2000), "Asian Regional Workshop on Sustainable Development of Irrigation and Drainage for Rice Paddy Fields", July 24-28, Tokyo.
- IFAD (1988), "Annual report", International Fund for Agriculture Development, Rome.
- IFPRI (2000), "Annual report", International Food Policy Research Institute, Washington D.C.
- Ikerd, J.E. (1991), "Applying LISA Concepts on Southern Farms", *Southern J. Agric. Econ.*, 23(1).
- Kidd C.V. (1992), "The evolution of sustainability", *J. Agric. Environ. Ethics*, 5.
- Kobayashi H. (2001), "Role of material flow analysis in Sustainable development", *Technology and Development*, 14: 21-31.
- Lai R. (1995), "Conservation tillage in sustainable agriculture", in

- Sustainable Agricultural Systems, Soil and Water Conservation Society, Ankeny, Iowa.
- Lockeretz W.** (1998), "Open questions in sustainable agriculture", *Am. J. Alternative Agriculture*, 3.
- Lynam J.K. and Herdt R.W.** (1989), "Sense and sustainability, sustainability as an objective in international agricultural research", *Agric. Econ.*, 3.
- MacRae R.J., Hill S.B., Henning J. and Mehuys G.R.** (1990), "Farm-scale agronomic and economic conversion from conventional to sustainable agriculture", *Adv. Agron.*, 43.
- Madden P.** (1987), "The economics of sustainable low-input farming systems in Sustainable Agriculture in temperate zones", John Wiley & Sons, Inc., New York.
- MAFF (1991), "Agricultural and rural development in Japan", Agriculture Structure Improvement Bureau, Ministry of Agriculture Forestry and Fisheries.
- Maxwell D.G.** (1996), "Measuring Food Insecurity: The Frequency and Severity of Coping Strategies", *Food Policy*, 21(3).
- Neher D.** (1992), "Ecological sustainability in agricultural systems: definitions and measurement", in *Integrating Sustainable Agriculture, Ecology and Environmental Policy*, Food products Press, New York.
- O' Connell** (1992), "Sustainable agriculture—A valid alternative", *Outlook Agriculture*, 21(1).
- Okigobo** (1987), "Shifting cultivation", *FAO soils Bull.* 57, Rome.
- Reddy K.C., Z. Nykatawa, Reddy K.R.** (2000), "Predicting cotton growth and yield parameters under management systems using the gossym model", *Proceedings of International Agricultural Engineering Conference, Bangkok.*
- Reddy V.R., Boone M., Pachepsky Y. and Whistler F.D.** (2000), "Validation of database for crop simulators: Design, assembling, delivery and use", *Proceedings of International Agricultural Engineering Conference, Bangkok.*
- Stinner B.R. and House G.J.** (1987), "Role of ecology in low input, sustainable agriculture: an introduction", *Am.J. Alternative Agric.*, 2.
- Swaminathan** (1996), 'Sustainable Agriculture: Towards Food Security', Konark Publishers, Delhi.
- Tabuchi** (1989), "Water quality management in agricultural area", *Irrigation Engineering and Rural Planning*, 16: 87-94.
- UNDP (1997), "Land quality indicators and their use in sustainable agriculture and rural development," *Proceedings of the Workshop, Rome.*
- WCED (1987), "Our Common Future", World Commission on Environment & Development, Stockholm.
- World Bank (1995), "Environmental Assessment Source Book: Vol. III Sectoral Guidelines", Washington D.C.
- World Bank (2000), "Commodity Markets and the Developing Countries", *A World Bank Quarterly*, Washington D.C. □

*If you don't have have time do it right, when will you find time to do it over.*

— Seth Godin

# World Food Security & Agricultural Trade

Keiji Ohga

---

*The article deals with key questions regarding the relationship between food security and agricultural trade that have been raised in the Organisation of Economic Cooperation and Development (OECD) meetings and at other international forums. The effects of trade liberalisation on international food security and the concerns of policy makers, both in developed and developing countries, is discussed. Finally, measures for achieving food security in developing countries are outlined.*

*Keiji Ohga is Professor, Department of Agricultural and Resource Economics, The University of Tokyo, Tokyo, Japan. Excerpted from paper presented at the APO Seminar on International Trade & Food Security held in Tokyo, 27th Jan.-4th Feb. 1999.*

Food security is defined as a situation in which all households have both physical and economic access to adequate food for all members, and where households are not at risk of losing such access. There are three dimensions implicit in this definition: availability, stability and access. If food needs are met through exploitation of non-renewable natural resources or degradation of the environment, there is no guarantee of food security in the long term.

## National Food Security

When a good is a strategic and pervasive good, it can be very costly for consuming nations to secure a stable supply of that good. It would be dangerous to lose access to the good through an embargo resulting from a disastrous crop failure in a major exporting country, either as a result of oligopolistic pressures or for other reasons. Food oligopoly confers political as well as economic power on the producer countries. The producer nations can use an embargo of food as a lever to coerce reluctant countries into foreign policy concessions. Access to food might be lost when a wartime blockade or natural disasters cut the transportation lines. When the good is of strategic importance, the potential for sudden loss of access to food casts a pall over a normally clear and convincing case for free trade of agricultural products among nations.

From an economic point of view, vulnerable strategic imports have an added cost that is not reflected in the market place. National security is a classic public good. It is not possible for any individual importer to correctly represent collective national security interests in making a decision on how much to import. Thus, leaving the determination of the appropriate balance between imports and domestic production to the market results in an excessive dependence on imports.

The domestic supply curve assumes enough time has been allowed for developing resources. If a nation is hit by a sudden loss of access there will not be enough

time to develop additional resources (time lags of several years would be common). Therefore, in the short term, the supply curve becomes completely inelastic. As prices will rise sharply to equate supply and demand, the loss in consumer surplus during a sudden loss of access can be very large. The estimation of how large the welfare loss will be is almost impossible to calculate because food price data are unavailable at the time of a serious food shortage.

**In the short term, the supply curve becomes completely inelastic.**

How can importing nations react to this inefficiency? Is full self-sufficiency the answer? The vulnerability premium is lower than the cost of becoming fully self-sufficient for two primary reasons: (a) sudden losses of access are not certain events—they may never occur; and (b) domestic steps can be taken to reduce the vulnerability of the remaining imports.

The expected damage caused by one or more instances of sudden loss of access depends on the likelihood of occurrence as well as the intensity and duration. This means that the vulnerability premium will be smaller for imports having a lower likelihood of loss of access. Imports from countries more friendly to the affected nation are more secure and the vulnerability premium on those imports is smaller.

For vulnerable imports, certain contingency programmes can be adopted to reduce the damage that a sudden loss of access would cause. The most obvious measure is to develop a domestic stockpile of food to be consumed during a sudden loss of access. That reserve would serve as an alternative source of supply, which could be rapidly distributed on short notice. It is, in short, a form of insurance protection. The less expensive such protection is, the smaller the vulnerability premium is and the more attractive imports are.

The government can reduce vulnerability to imports, which tends to keep the risk premium as low as possible. Certainly for food, however, even after a stockpile has been established, the risk premium will not be zero. Consequently, a government must concern itself with achieving both an efficient level of consumption and an efficient share of that consumption to be born by imports. Policy choices include the use of tariffs or quotas, the subsidisation of domestic production and food conservation through dietary orientation towards more direct consumption of plant energy.

There are two broad options for achieving food security at the national level: the pursuit of food self-sufficiency or the pursuit of food self-reliance. Food self-sufficiency means satisfying food needs as far as possible through domestic supplies with minimised dependence on trade. A number of large countries have adopted such a policy because year-to-year changes in their import requirements might otherwise have been big enough to affect world prices. This is particularly true with respect to rice, for which the world market is relatively small.

Other countries have pursued a policy to encourage the production of enough food to provide a minimum level of food intake per person, to protect against the contingency that it might be unable to import food in times of sudden loss of access. The concept of food self-reliance takes into account the possibilities of international trade. It implies maintaining a level of domestic production plus a capacity to import in order to meet the food needs of the population. The benefits and risks of relying on international trade to ensure food security are at the heart of the debate between these alternative strategies.

**Food self-reliance takes into account the possibilities of international trade.**

### **Effect of Trade Liberalisation on Food Security**

Trade contributes to food security by: (a) making up the difference between production and consumption needs; (b) reducing supply variability; (c) fostering economic growth; (d) making more efficient use of world resources; and (e) permitting global production to take place in those regions more economically suited to it. But reliance on trade may also bring some risks. These include: (a) uncertainty of supplies; (b) world market price instability; (c) increasing environmental stress; and (d) deteriorating terms of exchange on world markets (falling prices for agricultural exports, higher prices for food imports) if appropriate policies are not in place (FAO, 1996a).

Most countries could meet more of their domestic food needs from domestic production if food prices were allowed to increase to a high enough level or if sufficient alternative incentives were provided to domestic producers. However, the cost of pursuing food self-sufficiency policies can be economically high, as shown by the differences between domestic and world cereal prices in some countries. The differences must be borne by consumers or the government. Trade plays the role



of allowing domestic food consumption to be cheaper through less costly imported supplies. Trade also increases consumer choice by providing access to a greater diversity of food. This is particularly important in high-income countries where food trade includes the exchange of broadly similar but differentiated products. Of the one-third of world food trade that takes place within OECD countries, a major portion is of this type.

While food imports can make a vital contribution to food security, countries relying on food imports have two key concerns: their capacity to maintain food imports at desired levels and reliability of access to those imports.

Food import capacity depends on the prices and other terms on which food can be imported, as well as on the foreign exchange situation. Those countries that have become increasingly dependent on food imports are now more vulnerable to shock changes arising in food or other markets. Another fear associated with opening up a country's food markets to trade is that it will lead to increased competition for food supplies between rich consumers in high-income countries and low-income consumers in developing countries.

**Food import capacity depends on the prices and other terms on which food can be imported, as well as on the foreign exchange situation.**

Since developed countries usually subsidise their agriculture sectors while developing countries often tax them, the net effect of policy reforms on world markets is ambiguous. The effects of the Uruguay Round can be different for agricultural importers and exporters, but all countries have an interest in greater global price stability. The Uruguay Round will influence price stability in at least three ways.

Production will shift from high-subsidy regions to low-subsidy regions, with a differing likelihood of production variability. If the shift results in a concentration of some products in a specific area vulnerable to climatic change, the effect of production fluctuation in that area will bring about disruption of global price stability.

The Uruguay Round will also influence world price stability through the tariffication process. Since tariffs effect prices in all countries by making them more responsive to changes in world market conditions, the magnitude of world market price changes needed to

absorb supply or demand shocks is likely to be reduced. While most agricultural tariffs are now bound, countries may apply lower tariffs at any time. Where non-tariff measures have been replaced by tariffs, use of that clause would also make imports responsive to changes in world prices. Furthermore, as improved information systems are put in place to monitor harvests on a global basis, market surprises (for example, the effect of cereal purchases in 1972 by the former USSR) are less likely to occur.

On the other hand, most producers will respond to a world price change in the same direction. The responses will be more elastic when producers are more deeply involved in the global market economy, even though the synchronisation of responses may be mitigated by the offsetting effect of erratic production fluctuations in various countries.

On balance, the total effect of trade liberalisation is ambiguous, but it may make the price fluctuations worse or at least prolong them when the change in production elasticity is bigger than that of demand elasticity.

**Trade liberalisation may make the price fluctuations worse.**

Another way in which the Uruguay Round can influence the extent of world price instability is through changed incentives for stockholding. The reduction in market intervention, particularly by big exporters, makes it less likely that government stocks will accumulate in the future in the same way as has been the case in the past; thus, the size of global stocks may fall. With reduced global stocks, the world is less able to buffer adjustments of consumption to changes in production. Even though substitution of private stocks for public stocks could make some contribution to stability, on balance, price stability for cereals and for some live-stock products may deteriorate because of the reduced stockholding effect.

#### **Rule-based and Stable Trade System**

For countries dependent on agricultural trade, either as exporters or importers, the prospects for global trade growth provide the greater link between trade and income growth. If greater trade volumes or particular trade regimes lead to higher incomes or faster growth, then agricultural exporters will benefit from more buoyant demand, while agricultural im-

porters will more easily be able to finance food import bills. A more stable general trade regime should also increase the food security of agricultural importers by diminishing fears that arbitrary trade policies might lead to the disruption of foreign exchange earnings and a fall in purchasing power with respect to food imports.

Trade provides new opportunities for specialisation and exchange and is usually associated with structural change. Because small-scale producers, especially those in disadvantaged areas, often lack the resources necessary to grow export-oriented crops, they may not be able to participate in such growth. Small-scale producers and producers in disadvantaged areas may abandon their land or be bought out by larger commercial interests (OECD, 1988). Export production is sometimes associated with the expansion of large-scale commercial enterprises that displace small-scale farmers from their land and worsen the position of the poor majority.

The new WTO rules and commitments on import protection, together with the binding of virtually all agricultural tariffs, represent an unprecedented and important step in the direction of systematically liberalising trade in agriculture, in terms both of improved conditions of competition and trading opportunities. Under the new rules, border protection may only be provided through tariffs. Border measures such as quantitative restrictions and variable levies are now formally prohibited, except for a couple of time-bound product-specific exceptions (mainly rice) in the case of four countries.

**Border measures such as quantitative restrictions and variable levies are now formally prohibited.**

Global food security depends on maintaining and conserving the natural resource base. Many people have come to recognise that the possibility of expanding cultivated land further is now limited and that the development of new farmland should be controlled to conserve the natural environment. How will reduced investment in research by international agricultural research organisations such as the International Rice Research Institute (IRRI) affect the increase in yield by breeding and other efforts? How will reduction in irrigation investment be related to long-term agricultural production? What effects will global warming have on food security? Studies on these long-term problems have just begun, and we do not yet have the answers.

## Concerns about Export Taxes and Embargoes

Policy-makers, both in developed and developing countries, remain concerned about risks associated with reliance on international trade as part of a food security strategy, and in particular whether imports will be available when needed and the possible impact of political trade embargoes. General trends in cereal markets suggest these risks may become lower than previously (Donaldson, 1984). An importer can be more confident that additional import requirements can be supplied without a knock-on effect on market prices.

Occasionally, food surplus nations place restrictions or embargoes on their exports when domestic or political conditions provide the necessary justification. The United States embargoed soybeans in 1973 and 1975 because world demand was threatening domestic availability and driving prices to record highs. More recently, in 1995-96, some exporters in Europe restricted their exports of some cereals via quantity controls or taxes in order to protect domestic consumers.

**Food surplus nations place restrictions when domestic or political conditions provide the necessary justification.**

Food may also be used as a political and strategic weapon. However, political embargoes are difficult to enforce, and the possibility of purchases through transshipment facilities in other countries makes it relatively easy to circumvent exporters' attempts to exert political pressure. Internationally-agreed embargoes may be more effective in this respect but are even less likely to include food. Nonetheless, any trend towards the greater use of trade sanctions to enforce, for example, human rights concerns or international environmental agreements, will increase uncertainty about import supplies.

Food importers' concerns related to food security are reflected in the provisions of the Uruguay Round Agreement on quantitative export prohibitions and restrictions. The new disciplines specifically require that those WTO member instituting export prohibitions or restrictions, aimed at preventing or relieving critical shortages of foodstuffs, give due consideration to the effects of such measures on the food security of importing countries. Specifically, countries instituting such measures are required to give detailed notice in advance to the WTO Committee on Agriculture and to

consult, on request, with any other member having a substantial interest as an importer.

Stabilisation of producer and consumer prices is an **important objective**. Production fluctuations can only be absorbed by consumption adjustments, changes in stocks or trade. For most importing countries, consumption fluctuations are unacceptable because of the vital importance of food for the day-to-day life of the population, and because reliance on stocks tends to be rather costly. Therefore, many countries rely to a significant extent on trade to even out the bulk of their production fluctuations. That approach, however, requires a flexible import management capability and does not eliminate price fluctuations as, in addition to variations in exchange rates, underlying world food prices exhibit a significant degree of variability. Price variability is a function of global production variability, the degree to which markets absorb some of that variability, and the size and behaviour of global stocks.

**Production fluctuations can only be absorbed by consumption adjustments, changes in stocks or trade.**

Food security is most sensitive to cereal market instability the volatility of cereal consumption decreased between 1960 and 1977, and again between 1978 and 1989. Since 1993, the global supply/demand situation has become tighter and there has been a significant fall in the size of aggregate stocks held in the main exporting areas, particularly the United States and the European Union (EU). As a result, wheat and maize prices increased sharply in 1995/96 over 1994/95 (FAO, 1996b). Reviewing the experience of the past 25 years, the irregular appearance of price "spikes" rather than instability per se appears to characterise world cereal markets. For all countries that rely on food grain imports, an important aspect of the evaluation of trading regime changes for food security is the likely impact on world market instability. As global stocks are likely to remain relatively low in the 1990s and 2000s compared with the previous decade and despite the higher share of the more responsive private stocks, future price spikes will probably be greater.

### **Food Supply for Major Importing Countries**

*World Agriculture Towards 2010: An FAO Study* indicated a declining trend in self-sufficiency and rising import requirements in most food importing countries from the base period 1987-89 to the year 2010. The

rising imports would be offset by an increased self-sufficiency ratio in the exporting countries (FAO, 1995). The study concluded that "there appears to be no insurmountable resource and technology constraints at the global level that would stand in the way of increasing world food supplies by as much as required by the growth of effective demand". However, it is becoming apparent that a variety of constraints exist to increasing food production, such as those on the expansion of agricultural land and those resulting from global environmental problems, in addition to factors of instability such as production fluctuations caused by unusual weather.

Other commentators predict the necessity for much larger trade flows, particularly in cereals. They argue that the FAO projections underestimate emerging constraints on growth in food output. Those constraints include: (a) the shrinking backlog of unused yield-increasing technologies; (b) the diminishing yield response of cereals to the use of additional fertilizer, (c) the need to reduce excessive irrigation; (d) the effects on agriculture of social disintegration and political instability; and (e) the effect, on production, of various forms of environmental degradation. If these constraints are indeed more binding than assumed in the FAO analysis, food importing countries will face much higher import requirements and much higher import prices. These constraints should be borne in mind when interpreting the consequences of the policy change in the international trade regime currently underway.

**Commentators predict the necessity for much larger trade flows, particularly in cereals.**

For both of the major food exporters, the United States and the EU, agricultural policy has been under pressure because of budgetary cost. In the United States, under the new bill, spending on farm programmes will be cut further and farmers will be given even greater flexibility in choosing crops to plant. Moreover, it is expected that the additional area currently set aside under the Conservation Reserve Programme will again be brought under cultivation. These changes reduce the government's ability to control the supply of programme commodities as a result of lower programme participation, resulting in prices being more strongly influenced by market forces. In the EU, agricultural expenditure was constrained until 1999 by a financial guideline agreed between the European Council and the European Parliament.

For many food importing countries, pursuing efficient and reasonable food self-sufficiency is the basis of food security. As noted above, the concept of efficient food self-sufficiency should include the vulnerability premium. In the light of the uncertain food situation in the long term, it will be essential for major food importing countries to set and achieve both an efficient level of consumption and an efficient self-sufficiency ratio in order to secure a stable food supply for their people. The question of how much of food should be imported is not only the economic concern but also the security concern of the population. The principle of free food trade must be modified to enable food importing countries to achieve self-reliance in food in the long term.

**Concept of efficient food self-sufficiency should include the vulnerability premium.**

### **Policy Direction Towards World Food Security**

In developing countries, about 800 million people are still suffering from chronic hunger and malnutrition. This serious problem needs to be urgently tackled not only from a humanitarian point of view but also with the objective of stabilising world food supply and demand.

### **Basic Approaches**

In devising their strategies, countries should bear in mind that although the use of a stockpile is effective in meeting the demands of an emergency situation, it is by nature a temporary measure because of quality and cost constraints. It is also important to take into account the fact that although food imports are necessary in supplementing the deficit of domestic food supply, the uncertainty of external supply during food shortages (especially the possibility of large purchases by importing countries with purchasing power) may result in adverse effects on the world food market. In addition, if we take into consideration a large population increase in the future, it would be most important to maintain and increase domestic food production within the framework of international rules, making effective and sustainable use of existing production resources in an economically, socially and environmentally sound manner.

Trade is an important element for achieving food security, as its stable development lead to building a smooth and effective supply system. But it should be noted that sustainable food production in any country is the most reliable basis for securing stable food supplies

to meet growing demands. We still live in an unstable and uncertain world where sovereign countries give first priority to securing a stable and safe life for their own people. It is not appropriate to refer to trade liberalisation as being the sole guideline for the achievement of food security. Trade and domestic production should be carried out in an appropriately balanced manner.

**Sustainable food production is the most reliable basis for securing stable food supplies.**

In view of the important role of trade in securing stable food supplies for importing countries, food exporting countries need to strive for stable production and exports responding appropriately to trends in demand. Those countries also need to ensure continued and stable food exports even during periods of food shortages.

### **Hunger and Malnutrition**

In order to provide a fundamental solution to the hunger and malnutrition problem, the strengthening of sustainable food production capacity in each of those countries and the provision of technical and policy assistance are important. Efforts, mainly by the developing countries themselves, to improve infrastructure and strengthen investment in agriculture will also be vital.

In addition, population problems need to be tackled, and the steady implementation of the Program of Action that was adopted by the International Conference on Population and Development is necessary.

### **Achieving Food Security**

Given the present state of national diets, it is difficult for most importing countries to domestically produce all the necessary food when production resources, including climatic conditions are constrained. It is essential to ensure an appropriate combination of imports and stockpiling in addition to domestic production for a stable food supply to be achieved.

**It is difficult for importing countries to domestically produce all the necessary food.**

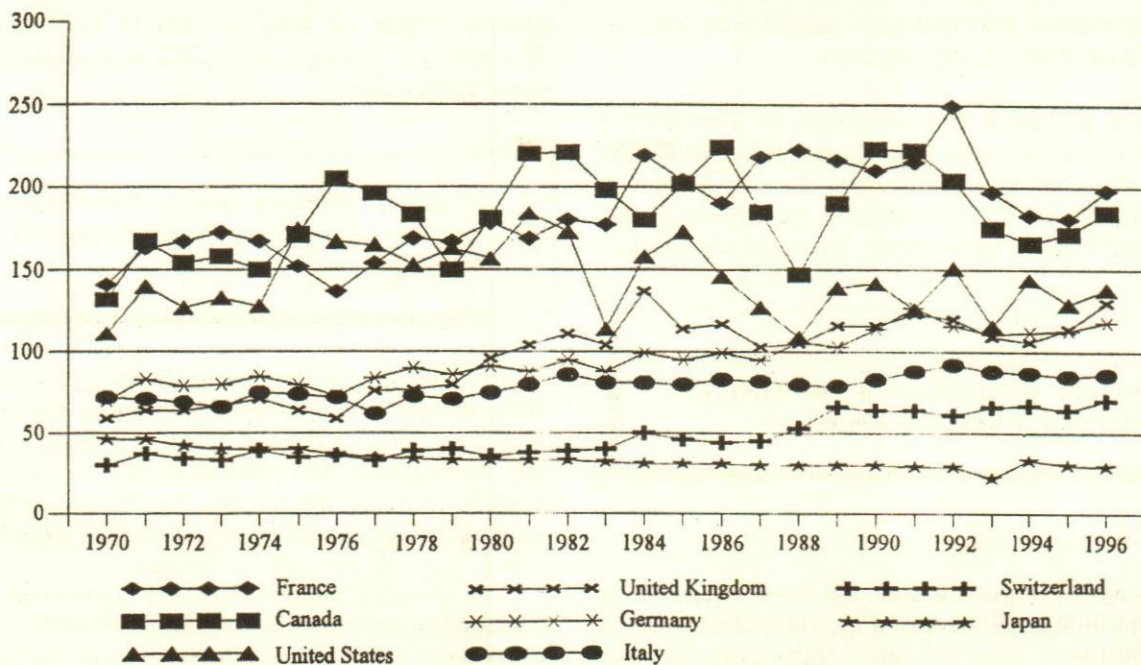


Fig. 1. Cereals Self-sufficiency Ratio of Major Developed Countries

Source: Calculated from AGROSTAT, FAO, Rome.

Table 1: Cereals Self-sufficiency Ratio of Major Developed Countries

Year	France	Canada	U.S.A	United Kingdom	Germany	Italy	Switzerland	Japan
1970	141	132	111	59	70	72	30	46
1971	163	167	140	64	83	71	37	46
1972	167	154	127	64	79	69	34	42
1973	172	158	133	67	80	66	33	40
1974	167	150	128	71	85	75	39	40
1975	152	171	174	64	80	74	35	40
1976	137	205	167	59	73	72	36	37
1977	154	196	165	76	84	62	33	35
1978	169	183	153	77	90	73	39	34
1979	167	150	163	80	86	71	40	33
1980	178	181	157	96	91	75	36	33
1981	169	220	184	104	88	80	38	33
1982	180	221	173	111	95	86	39	33
1983	177	198	114	104	88	81	40	32
1984	219	180	158	137	99	81	50	31
1985	204	202	173	114	95	80	46	31
1986	190	224	146	117	99	83	44	31
1987	218	185	127	103	95	82	45	30
1988	222	147	109	105	106	80	53	30
1989	216	190	139	116	103	79	66	30
1990	210	223	142	116	114	84	64	30
1991	215	222	126	123	127	88	64	29
1992	249	204	151	120	116	92	61	29
1993	197	175	116	109	111	88	66	22
1994	183	166	144	106	112	87	67	33
1995	181	172	129	114	113	85	64	30
1996	198	185	138	130	118	86	70	29

Source: Calculated from AGROSTAT, FAO, Rome.

Japan is a typical food importing country that takes food security seriously. The Japanese food self-sufficiency ratio is only 42 per cent (on a calorie basis for 1995), while the cereal self-sufficiency ratio is 30 per cent, which is an exceptionally low figure compared with other developed countries (Fig. 1 and Table 1). Reflecting this fact, 80 per cent of the Japanese feel concerned over the future food situation and 70 per cent of them are willing to pay additional costs for domestically produced food to secure their food in the long term, according to the result of a recent public opinion poll.

Following those findings, the Japanese food and agricultural policy principally aims at putting the brakes on the declining trend in the food self-sufficiency ratio. In concrete terms, based on the "Long-Term Supply and Demand Outlook for Agricultural Products" (published in 1995), the Japanese Government has expressed the will to make every effort to maintain and increase domestic food production through sustainable utilisation of national land resources. Thus, it is effectively responding to consumer needs for high quality, safe and fresh products at reasonable prices, through production and marketing efforts that take advantage of the merits of domestic products.

Once destroyed, food production resources such as agricultural land are extremely difficult to restore. Therefore it is important to secure the necessary level of domestic food supply capacity to cope with unexpected situations by maintaining and securing good agricultural

1 April-June, 2002

land, improving and enhancing soil productivity, and ensuring the availability of farming skills.

The role of NGOs in contributing to international cooperation in agriculture, forestry and fisheries is also important. Cooperation carried out by NGOs at the grassroots level, taking advantage of their ability to pay close attention to the local needs, has been successful.

**The role of NGOs in contributing to international cooperation in agriculture, forestry and fisheries is important.**

### Conclusion

The purpose of the international trade regime is to facilitate the mutual exchange of goods and services in order to maximize each country's trade opportunities. An efficient trade regime in that sense is likely, as a by-product, to enhance both global and national food security. By encouraging income growth, as well as broadening the range and variety of food domestically available, diffusing the risks arising from domestic production fluctuations and enabling global production to be achieved as efficiently as possible, trade will contribute to food security in the dimensions of access, availability and stability.

Agricultural trade liberalisation has accompanied concerns that structural changes may lead to reduced food security among the food importing countries and poor households. Food imports may become more expensive. Global food price instability may increase in the short term if global stock levels are run down and agricultural production is concentrated in several climatically homogeneous areas. The intensification of agricultural production in low-subsidy regions could contribute to further environmental degradation in those countries. That is, trade liberalisation can also have an

adverse impact on food security in each of its three dimensions of access, availability and stability, as well as on sustainability.

**Structural changes may lead to reduced food security among the food importing countries.**

In negotiating further trade liberalisation, these concerns should be understood and steps taken to minimize their adverse impact. There is a need for policies both at the global and national levels to ensure that the gains from trade are widely distributed and that the potential for greater food security is fully exploited.

The Uruguay Round made very substantial progress in integrating agricultural trade into the GATT disciplines. It has been agreed that negotiations on continuing the reform process should take place one year before the end of the implementation period for developed countries. The negotiations should seriously take into account the food security concerns of food importing countries when implementing the commitment.

### References

- Donaldson G. (1984), "Food Security and the Grain Trade", *American Journal of Agricultural Economics*, Vol. 66, No. 2.
- FAO (1995), *World Agriculture: Toward 2010*, Rome.
- (1996a), *World Food Summit Technical Background Document 14, "Food and International Trade"*, Rome.
- (1996b), *Food Outlook*, Rome.
- OECD (1988), "Food Security Objectives in the Context of Agricultural Trade", AGR(88)14, Paris.
- (1998), *Note by Secretariat, COM/AGR/CATD/TC(98)5/REVI*, Paris.
- Shane and H. von Witzke (eds.), *The Environment, Government Policies and International Trade*, Staff Report No. AFES9314, U.S. Department of Agriculture, Washington, D.C. □



# Rural Women & Food Security

Revathi Balakrishnan

---

*The crucial role of rural women in food security is outlined in this article. Micro studies are documented to emphasise the contribution of rural women in the Asia-Pacific region to agricultural production.*

*Revathi Balakrishnan is Rural Sociologist and Women in Development Officer, FAO Regional Office for Asia and the Pacific, Bangkok. Excerpted from the paper presented at the APO Study Meeting on Food Security held in Tokyo, 13-21 May, 1998.*

In the past two decades, the world food situation has gone through shifting scenarios of fears centred on food crisis to optimism of abundance. Falcon (1996) sums up the dilemma in the food situation as "Can the world produce enough food at reasonable prices, provide access to food by the poor, and not destroy the environment in the process?" In addition, population dynamics—growth and migration—also factor into the food situation predictions. In Asia, most recent downward shifts in economic fortunes raise new queries on the food security situation of the poorer sections and the return of the urban poor to rural roots with implications for agriculture sector. As we move toward a new century, ensuring household food security and generating livelihood opportunities to achieve stable household food security persist as primary development concerns.

## FAO and Food Security

Rome Declaration on World Food Security and World Food Summit Plan of Action (WFS POA) lay the foundation for diverse paths to a common objective—food security at individual, household, national, regional and global levels. Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs. Three dimensions of FAO food security programme are availability, access and stability. In all three dimensions, at the micro-level food security concerns are associated with the capacities of individuals and households to produce, buy and use food of right quantity and quality at various phases of life cycle and seasons. Within the groups of individuals and households it is crucial to differentiate the relative status and roles of women and men in achieving desired food security. FAO WFS POA states that poverty eradication is essential to improve access to food and acknowledges that 70 per cent of all poor are women, which should be taken into consideration when preparing poverty eradication actions. In addition the actions identified under various commitments and objectives, do declare that households individually as well as com-



munities collectively will be sought as active partners in various production sectors and nutritional interventions. These households and communities organise production and resource management around gender division of labour and responsibilities.

### Rural Women and Household Food Security

Rural women in developing countries are responsible for more than 55 per cent of the food grown and comprise 67 per cent of the agricultural labour force. In Asia and the Pacific region, viewed from a micro household economy perspective, among the rural households and communities women, hold the key to food security attributable to their multiple roles as food producers and processors, food vendors and marketers, and food purchasers and meal makers for the family. In addition rural women contribute to the family income pool by engaging in off-farm enterprises such as seasonal agricultural labour, as casual workers in local public work projects and development projects, food processing and local small-scale industries and institutions, in construction, and by making handicrafts. Thus rural women contribute to both availability and access to household food security. One may consider the production of food as availability, yet various household activities also contribute to household food security. These fall under the category of domestic activities and can be listed, for example, as collection of water and fuel for the preparation of food and processing grains for family meals. An IFPRI document identifies nutrition security as an important aspect of food security that is managed by women. Women almost universally are responsible for providing adequate nutritional status in terms of protein, energy, micro-nutrients, and minerals for all household members. It further states that "adequate availability of food at the household level is necessary to achieve nutrition security, but it is not sufficient. Other key contributors to good nutrition are adequate health and child care and access to clean water and good sanitation. Ensuring the nutrition security of the household, through the combination of both food and other resources, is almost exclusively the domain of women (Quisinbing et al, 1995).

**Women almost universally are responsible for providing adequate nutritional status for all household members.**

In Asia and the Pacific a daily resource search for water, fuel, and for inputs either for agriculture or household production is the way of life for regional rural

women. In the region women's roles and constraints to contribute to household food security have to be viewed in the context of changes in the ecological resource base, food trade interaction, liberalisation of trade and transformation to open market economies, employment opportunities, technology access and technical know-how and input supply. Within such a complex agro-resource environment and amidst the debate on food trade or food self-sufficiency for food security, the Asian regional scenario of gender roles in food sector is also characterised by diversity. The status of women in Asia could be summed up as "duality" and it is a "duality" characterised by "coexistence of gender equity gain and gender equity gap amidst economic prosperity and abject poverty". In People's Rep. Of China (PRC) and India disparities within the countries should also be recognised. Though information on women in agriculture is somewhat more formally organised and easily available in Asia, still the information on variations within the country divided by agro-ecological determined production systems is poorly organised and thus pose barriers to site-specific food security-related interventions.

A central challenge confronting Asian development efforts is, achieving the gender equity gain for women in agriculture and rural communities parallel to urban gender gains and creating opportunities for rural women.

Pacific women are no exception to the global realities of rural communities where women play a crucial role in developing household food resources. Pacific rural women's role in food production through home gardening, subsistence fishing, fish and taro processing and informal food vending are all resource developing tasks that contribute to the household food basket. The foremost impediment to addressing rural women's role in food security in the Pacific Island countries is the lack of available data. Based on informal assessment of existing statistics, Lewis raises a concern that the essential needs of Pacific Island women are not being addressed by existing statistics (1995). The paucity of an organised data-base hinders extensive and meaningful macro comparisons of women's role in agriculture in the Pacific Island countries at various time periods. The dearth of data is compounded by uneven measures applied to data collection across these countries for the available data. Yet within the apparent inadequacy of information a clear pattern of Pacific rural women's contribution to food and agriculture sectors and thus to household food security emerges. They are food producers and fisher women in their own rights and ensure an adequate food basket for household food security through food production, marketing and ex-

**Table 1:** Selected indicators of Human Development and Women's Participation in Agriculture and Economic Activities: Asia Region

Countries in Asia	HDI <sup>1</sup> Rank	GDI <sup>2</sup> Rank	Per cent Distribution of Labour Force of Women in Agriculture	Employed Own Account Workers (Per cent)	Unpaid Family Workers (Per cent)
	1996	1996	1994	1990	1990
Bangladesh	143	116	65	5	6
Bhutan	159	na	95	na	na
Cambodia	156	na	75	na	na
China, People's Rep. of.	108	79	74	na	na
India	135	103	78	na	na
Indonesia	102	76	44	27	66
Islamic Rep. of Iran	66	75	69	4	43
Japan	3	12	na	na	na
Korea, DPR	83	na	41	27	69
Korea, Rep. of	29	31	31	27	87
Lao, PDR	138	106	76	NA	NA
Malaysia	53	43	31	24	64
Maldives	107	80	25	22	29
Mongolia	113	83	28	na	na
Myanmar	133	102	35	na	na
Nepal	151	124	97	na	na
Pakistan	134	107	15	NA	NA
Philippines	95	70	34	30	53
Sri Lanka	89	62	50	18	59
Thailand	52	33	64	27	64
Vietnam	121	91	57	NA	NA

Sources: Columns 1 and 2 = Human Development Report 1996, published for the United Nations Development Programme (UNDP), New York, Oxford University Press; and Columns 4,5 and 6 = The World's Women 1995: Trends and Statistics, Social Statistics and Indicators, United Nations, New York, 1995.

Notes: 1 Human development index (HDI) is based on three indicators: longevity as measured by life expectancy at birth; educational attainment as measured by combination of adult literacy (two-thirds weight) and combined primary, secondary and tertiary enrollment ratios (one-third weight); and standard of living as measured by real GDP per capita; and

2 Gender-related development index (GDI) uses the same variables as HDI. The difference is that GDI adjusts the average achievement of each country's life expectancy, educational attainment and income in accordance with the disparity in achievement between women and men. n.a. = Data not available or not separately reported.

change. Their contribution in the commercial sector in crop production and postharvest processing in crop and fisheries make them key participants in these island economies. Yet, the current inadequacy of information on the role women play and their inability to access productive resources do not do justice to their contribution to household food security.

Hence, the challenge in the Pacific is that while development efforts have begun to focus attention on rural women's role, there is still a long way to go in obtaining country situation specific information on women's contribution to food security and to plan for effective interventions to achieve stable food security.

#### Asian and Pacific Rural Women in Agriculture

For the Asia and the Pacific Region inter-country variances are illustrated in the national indicators of women's labour force participation in agriculture sector and gender development as reviewed in Tables 1 and 2, respectively.

**The essential needs of Pacific Island women are not being addressed by existing statistics.**

**Table 2:** Selected indicators of Human Development and Women's Participation in Agriculture and Economic Activities: Pacific

Countries in the Pacific	HDI <sup>1</sup> Rank	GDI <sup>2</sup> Rank	Per cent Distribution of Labour Force of Women in Agriculture			Employed Own Account Workers (Per cent)	Unpaid Family Workers (Per cent)
			1970s/80	1986	1994		
	1996	1996				1990	1990
Cook Islands	n.a.	n.a.	15	9	n.a.	32	26
Fiji	47	50	24	24	38	10	20
Papua New Guinea	126	95	94	91	79	n.a.	n.a.
Solomon Islands	118	n.a.	53	92	13	n.a.	n.a.
Tonga					n.a.	7	4
Vanuatu	119	n.a.			5	n.a.	n.a.
Western Samoa	88	n.a.	16	25	6	9	8
Australia	11	9			6	32	59
New Zealand	14	10			9	26	66

*Sources:* Columns 1 and 2 = Human Development Report 1996, published for the (UNDP), New York, Oxford University Press; Columns 3 and 4 = H. Booth data compiled of UNSTAT 1993, Pacific Women Towards Year 2000, Pacific Platform for Action: Rethinking Sustainable Development for Pacific Women Towards the Year 2000, South Pacific Commission, 1995; and Columns 5 and 6 = The World's Women 1995: Trends and Statistics, Social Statistics and Indicators, United Nations, New York, 1995.

- Notes:** 1 Human development index (HDI) is based on three indicators: longevity as measured by life expectancy at birth; educational attainment as measured by combination of adult literacy (two-thirds weight) and combined primary, secondary and tertiary enrollment ratios (one-third weight); and standard of living as measured by real GDP per capita; and
- 2 Gender-related development index (GDI) uses the same variables as HDI. The difference is that GDI adjusts the average achievement of each country's life expectancy, educational attainment and income in accordance with the disparity in achievement between women and men. n.a. = Data not available or not separately reported.

### Asian Human and Women in Agriculture

In Asia a general comparison among the indicators of Human Development Index (HDI), Gender-related Development Index (GDI) and the percentage distribution of labour force of women in agriculture shows an interesting pattern. In general those countries that fall under the categories of low and medium HDI, also seem to have relatively lower achievement in GDI. The relatively high achievers in HDI and GDI also record relatively lower percentage of women's participation in agricultural labour force with a few exceptions. This is an indicator of urban-rural disparity in gender equity in the key measurement variables of HDI and GDI. Such a disparity is of significance, since it is an indicator of relatively low status of rural women in life expectancy, educational attainment, and income. So rural women should be the target of planned interventions to hasten human resource development to achieve sustained economic progress in all sectors including food.

Within the region, in most of the developing countries, women make up a substantial portion of the agricultural labour force. The South Asian situation is explained as:

In most South Asian countries, employment oppor-

tunities in the formal sector had virtually stagnated during the period under review (1985-93) and a large increase in the labour force have added to the stock of workers employed in the vulnerable informal sector. It has been shown conclusively that women bear the brunt of poverty disproportionately. One facet of the manifestation of women's survival strategies under poverty conditions is to extend their working hours inordinately at home and outside to earn enough cash to feed and maintain the family. The neglect of the agriculture sector in many countries makes it a career of last choice, hence "feminisation of farming" (UN/ESCAP, 1995).

**Women bear the brunt of poverty disproportionately.**

The "feminisation of farming" can be a growing phenomenon as countries adopt rural employment schemes in small-scale industries, self-help group micro-enterprises, town and village enterprises and liberalisation ushered urban job alternatives, that lure away capable young women and men from agriculture (Bangladesh, PRC and India). Additionally, such pull factors of internal migration can also turn into "graying of

farming", a growing phenomenon where elderly, particularly older women, may become the principal farmers, as being witnessed in PRC.

A common shortcoming of the macro statistics is the undercounting of women's extensive participation in both agriculture and income generating labour within the informal sector. An illustrative case is Pakistan, which registers only 15 per cent in the Labour Force Survey. Yet, its 1980 Census of Agriculture estimated 73 per cent of women in agricultural households were economically active. The Labour Force Survey in 1990/91 showed women's economic activity rates of 7 per cent when using the conventional questionnaire and 31 per cent when questions on specific activities such as transplanting rice, picking cotton, grinding, drying seeds and tending livestock were also included. Similar misperceptions of rural women's work and undercounting work in India and Bangladesh were also reported (The World's Women 1995, UN).

Women's economic contributions may be reported under the categories of employed own account workers and unpaid family worker. Similar undercounting of women's work can be a common phenomenon across Asia, irrespective of the remarkable improvements in census methods, statistical services and training. Although since 1975, much disparate effort has gone into this gender data activity, a paucity of sex segregated data persists. The persisting data deficiency is a major barrier to develop policy and programme formulation that recognise women's contribution and support their increased productivity in the agriculture and allied sectors to achieve household food security.

**Undercounting of women's work can be a common phenomenon across Asia.**

### **Human Development Indicator and Women in Agriculture**

Among these small island countries in the Pacific, Fiji is placed high in the achievement of human development as well as in gender-related development (Table 2). Such a human development performance places Fiji in the same grouping with Australia and New Zealand. Western Samoa, the Solomon Islands and Vanuatu are all rated as medium achievers in the human development category, however, no gender-related development data is available for any of these countries. Available information provides evidence that there exists a wide variation across these countries with respect to the participation of women in agriculture (Table 2).

Women's participation in agriculture is high in Papua New Guinea and Fiji.

Among developing island countries that report low participation of women in agriculture, labour-intensive, cash crop processing economies dominate. As such, the data may not present an accurate picture of women's work in the agriculture sector. Another reason for the under representation of women in agriculture could be that the data does not account for many of women's productive activities such as home gardening and taro processing. Additionally, women in these countries may perform agricultural and fishery tasks in the subsistence sector which may be counted under 'unpaid family workers' or as 'own account workers'.

Rural women's work in these categories also contributes to adding value to food through processing and storage. Their food processing skill which add to the shelf-life of seasonal products contributes to evening out the supply of food during lean seasons. The role of women as unpaid family workers in food sector contributing to food security has to be recognised.

### **Rural Women's Social Network and Access to Food**

Women also contribute to household food security in their social roles as members of the kinship communities in the Pacific Island countries. The Pacific Island communities are organised around strong kinship and traditional communal network ties. Social organisations that influence sharing of resources influence the household food security. Nearly all households in Papua New Guinea receive some form of transfer (an inter-household gift expected from or given to a neighbour or family member) which has implications for economic access to food. In rural areas this is particularly true for the aged and the chronically ill (Motsuys, 1985). In areas of high out-migration, transfers from family members in town to rural family members account for a major part of the income. In a study of one community in the Gulf Province, Morauta found that 42 per cent of non-subsistence income across all households came from transfers from outside the village. However, detailed studies show that transfers are a small proportion of income and account for only a small fraction of the resources available to the average households. Women play an important part in the system of transfers. Ties of kinship through women and between women neighbours are common transfer points. The importance of ties in Papua New Guinea is underscored because people often expect to receive as much if not more through sisters and daughters as from brothers and sons. Regular cooperative work is more common among women than men and gives

rise to transfer of produce, betel nut, snacks, etc. For the most part, inter-household transfers in rural areas are small and in kin; garden produce, fresh fish, cooked food and shared meals, all items usually under the sole domain of women. The transfers provide a means through which women are quite influential in determining the income of poorer households, by giving to households other than their own. Additionally, transfers broaden women's resource base particularly of women heads-of-households who engage in production activities. These transfers also provide insurance in times of strife and is a way in which women participate in the social life of their community (Morauta, 1985). Additionally family members who have migrated overseas continue to uphold family obligations and transfer funds which determines the economic access to food. Though in recent times, with a new generation growing up in distant lands, such traditional social obligations may weaken. Hence, the household food security determinants transcend the boundaries of farming system mediated by social roles of men and women, particularly of women.

**Ties of kinship through women and between women neighbours are common transfer points.**

### **Rural Women's Contribution to Food Security**

Asia and Pacific rural women's contribution to food security becomes more obvious from the micro-studies documented. Throughout the region rural women's intensive involvement in crop production, both subsistence and cash crop; livestock raising, fisheries as in artisan and processing, and horticulture, is well documented as site-specific studies. In Asian farm households both men and women contribute to production, but the gender roles vary by such variables as region, agro-ecological systems, types of farming systems, crops grown, inter-links with livestock and fish production and opportunities for off-farm occupation for family members. There is much evidence from these studies that women contribute substantially to the family food needs as active labour in production, postharvest processing and sellers in informal market (CRIAFC and IRRI, 1990, Illo and Veneracion, 1988, University of Philippines, Los Banos, IRRI and Philippine Institute of Development Studies, 1988, and Poats, Schmink and Lspring, 1988, Chen et.al., 1986). As documented in rural Vietnam, Laos, Cambodia, Indonesia and the Philippines, where agriculture is the mainstay of economic activity,

women are always seen toiling in the rice fields, cultivating the field, planting, transplanting, fertilising, weeding, irrigating, harvesting and engaging in postharvest activities (UNICEF). In Bhutan, with the exception of bunding and ploughing, women are involved in the entire agricultural process and the rural women earn income through sale as well as through wage labour (Ehsan, 1993).

In the Pacific, women's role in production and household food security is documented in micro-studies with relation to subsistence farming and fisheries as well as in cash crops. Traditional sexual division of labour seems to be followed in rural areas in Vanuatu. Clearing gardens is considered a joint activity with the heavy work usually being done by men. Planting of root crops is a joint activity, although yams, in many places are the strict preserve of men. After planting, however, the maintenance and eventual harvesting are primarily the responsibility of women. Women tend to pigs and other small livestock while men tend to the cattle. Gathering of foods and reef crop fishing are usually done by women while hunting and fishing are generally done by men (UNICEF/Vanuata Government, 1991). Local land household economies in rural areas in Papua New Guinea continue to rely heavily on the productive work of women. In rural areas women have few opportunities for wage employment outside of some coffee plantations. The division of labour has also created a situation in which rural women are increasingly relegated to subsistence food production so that men can be employed in cash-oriented sectors in the local economy or as migrant workers in distant destinations (Helter and Khoo, 1987). While subsistence food production is a primary activity for women, women and men generally share decisions about which food to produce and purchase (Morauta, 1985). There are female sugarcane farmers in Fiji, though they face greater difficulties than men in the production for the market (Volavola, 1991). Fiji women are also vanilla growers, since it is considered a suitable crop for women and has been promoted as a family-oriented crop since it was introduced in 1986. In training related to vanilla, women outnumber men. In the lives of women in Fiji, two traditional crops masi (mulberry tree) and voivo (cultured pandanus) play a significant role as income-generating crops, but also as cultural and traditional symbols (Cavailati, 1991).

**Women's role in production and household food security is documented in micro-studies.**

## Rural Women in Allied Sectors

In both Asia and the Pacific, women make a sizable contribution to food production in various allied food sectors like fisheries, livestock, forest products, and processing. Fish and fish products are an integral part of the diet among many cultures. In both artisan fisheries and commercial fishery sectors, Asian

women's activities range from shallow water fishing in artisan fisheries to being active labourers in the commercial fishery sector. Women are important contributors to both national and household food security while their labour adds to the foreign exchange earnings of the countries. In parts of India, women net prawns from back waters; in Laos, women fish in canals, and in the Philippines, women fish from canoes in coastal lagoons (FAO, 1987). Women in the Pacific Islands are active in the artisan fishery sector as fisher women, and in postharvest processing in commercial sector (Vunisea, 1996). Livestock is the most important sideline activity of the Asian rural women, particularly homestead poultry and small animals. The income from the poultry maintained by women, providing a separate income stream to women has implications for household food security. In almost all the countries in the region women are the main workers in the postharvest processing for grain, livestock, horticulture products and fisheries. This is true most often in small farm production and medium-scale processing industries. But as the scale of production grows larger and is supported by complex technologies, women tend to lose out, a situation most often attributable to their relatively poor educational status and associated gap of expertise in modern technologies.

**Livestock is the most important sideline activity of the Asian rural women.**

### Seasonal Non-farm Employment for Rural Women

The seasonal dimension of agricultural production, results in certain household food security dynamics. During the off-season their income is interrupted leaving them with no resources to provide for the household food needs. In the case of the marginal farmers the produce from small plots do not last beyond a few months. Often, the male member will leave for semi-urban and urban areas seeking non-farm employment, leaving the women to tend to the marginal land and provide for the household food security. Such a pattern of seasonal food insecurity and related resource management strategies repeats itself all over South Asia. Women in the rural households adopt various

strategies in the interface of farm and non-farm enterprises to mobilise resources to ensure household food security. Non-farm income is a source of supplementary income and employment during slack seasons in agriculture and provides a higher proportion of income and employment for the rural poor, including women in household-based activities (Islam, 1997). Women can mobilise their time, indigenous knowledge and traditional skills. As the economies

transform, these basic resources alone will not be adequate to open up opportunities for women in the non-farm sector. Hitherto, interventions to enhance women's income through non-farm sector had not been visualised in an integrated and forward-thinking mode. We limit women's non-farm opportunities to postharvest processing and handicrafts.

**Non-farm income is a source of supplementary income and employment during slack seasons.**

### Rural Women and Stable Food Security: Prospects

The role of women in the food sector is diversified and relentless. The global prospect of household food security should be improved through effective means to optimise their potential contribution to the food sector. A systematic approach would be to segment out their technology, know-how and input needs on the lines of sector-wise contribution by women to the food sector and household food security. The interventions should be planned to strengthen these specific integrated domains of technology, know-how and input needs. The proposed approach is one of "Production Segment Tasks - Production Support Cluster" to enhance the prospects of household food security (Fig. 1).

Women's contribution should be segmented as follows:

#### Food Sector Production Segment

- Crop production: food crops, cash crops and fodder crops;
- Horticulture/home garden production: fruits and vegetables and floriculture;
- Livestock production: dairy animals/small animals/poultry;
- Fisheries/aquaculture production; and
- Commercial/artisan.

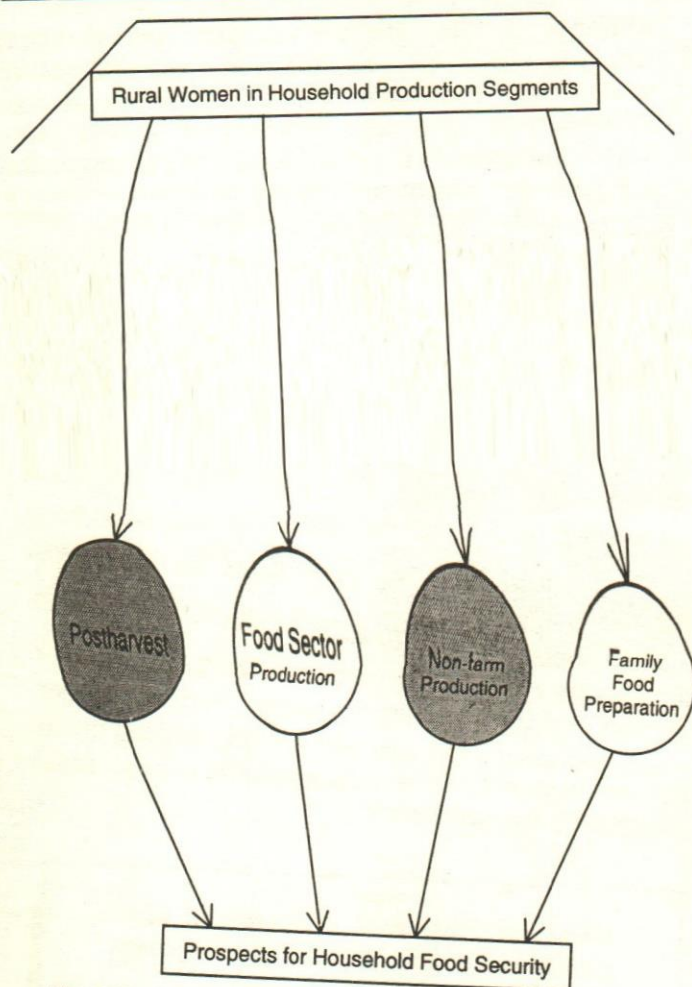


Fig. 1. Production Segment Tasks—Production Support Cluster

**Postharvest Segment**

- Grain/Crop produce, horticulture and floriculture produce, livestock produce and fisheries products.

**Non-farm Production Segment**

- Ranging from handicrafts to small-scale rural/urban demand-oriented market linked industries and food vending and marketing of various produce and products.

**Household Food Production Segment**

- Fuel, water and sanitation and food related consumer goods and services.

**Production Support Cluster for Rural Women**

It is well documented that women do not have the support needed to improve their productivity in various enterprises. "Although rural women are often at the beginning of the food production chain, they are at the end of the distribution chain for the productive resources and social services that are essential to their critical role in the alleviation of poverty through the production of food for consumption by rural households and, by extension, surpluses to be consumed by the nation (Gierycz, 1997). In the Asia-Pacific region women are involved in productive tasks but with differences among the countries and variances within the countries. Hence, the production support to rural women to enhance the

household food security prospects should be tailored to match the local realities of women's contribution to particular segments in the food sector. The production support cluster should match the production segment and the specific enterprise as identified above in Fig. 1 and the related discussion. Two examples of production

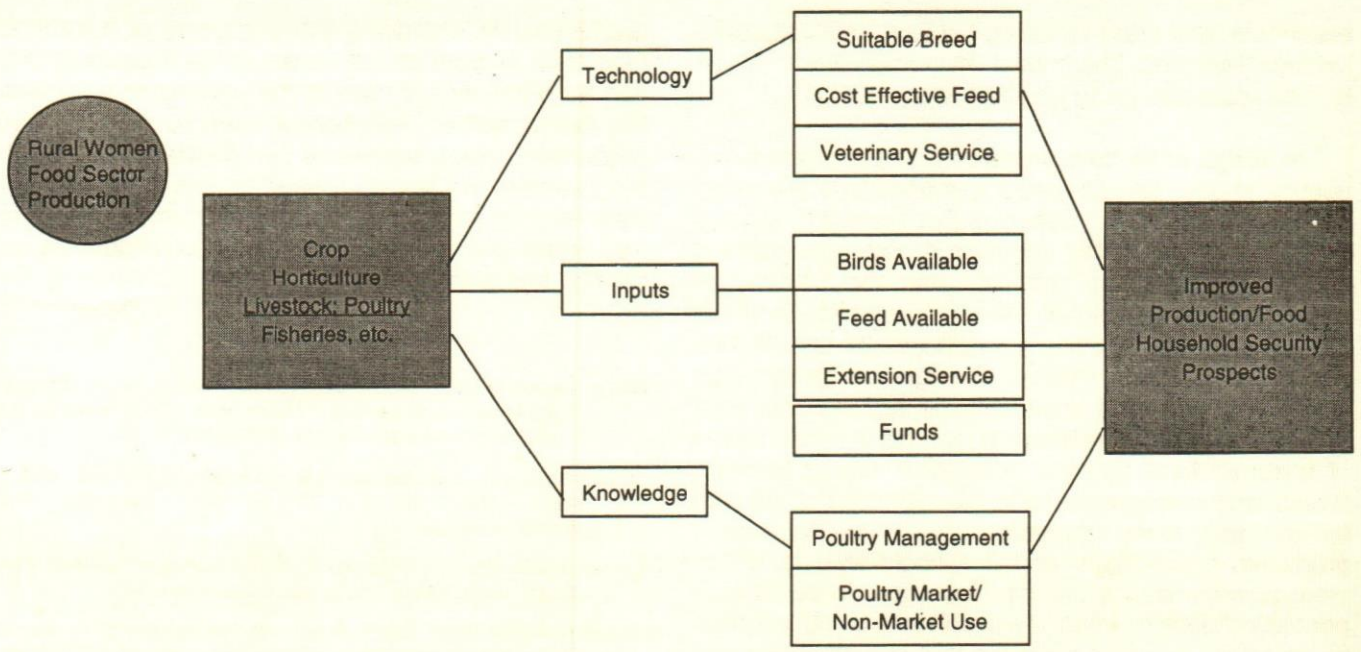
support cluster for specific enterprise are presented in Figs. 2 and 3. As illustrated in the documents, increasing the prospects of food security by optimising the productive capacity of women through the production support cluster is more complex than commonly acknowledged. Providing support to women is most often viewed simplistically as assistance to women, but in reality they are interventions to improve the prospect for household food security.

**Women do not have the support needed to improve their productivity in various enterprises.**

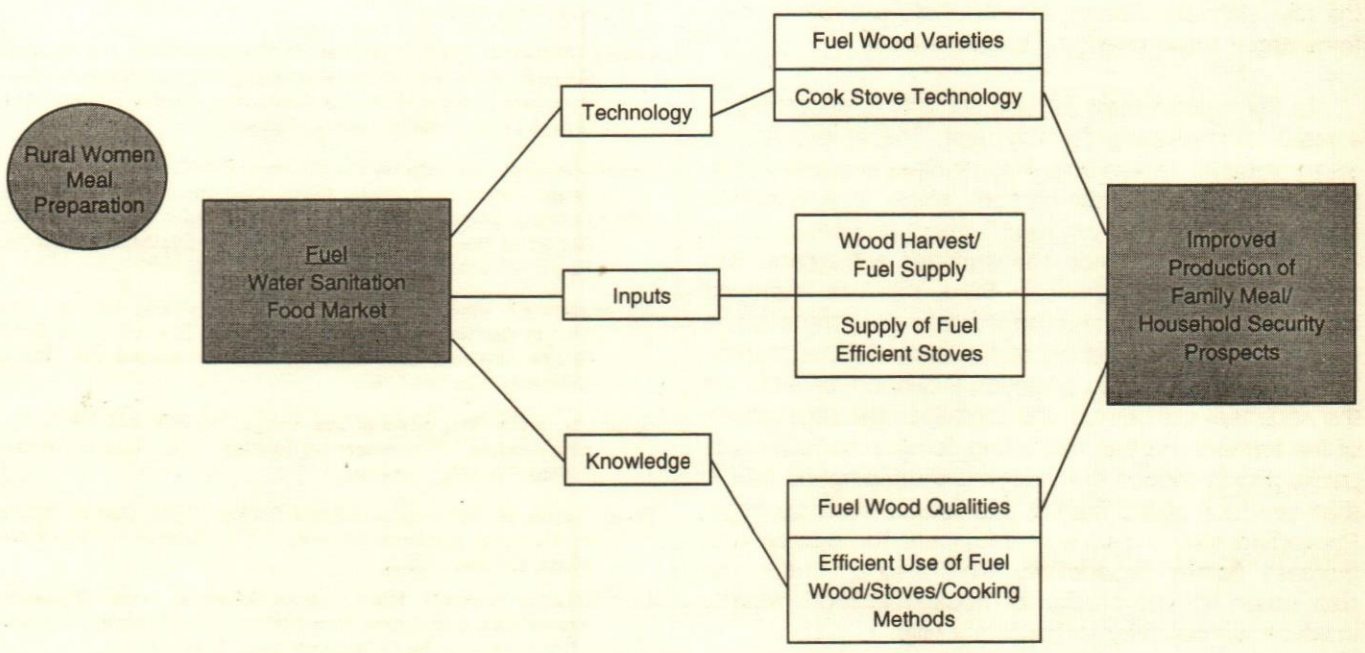
**Macro-changes impacting on Rural Women's Production**

In the region some countries are facing negative economic trends, economic adjustment and transitional problems along with political uncertainty. Yet the agenda for trade liberalisation, and privatisation continue to create concern in some other countries. The countries like India and PRC are confronting a growing population, increasing urbanisation and internal migration. Almost all the countries take note of food production in the context of depletion of ecological resources and loss of bio-diversity. These macro changes impact on Asian and Pacific rural women and their role in the food sector, but the dimensions and intensity vary by country.

As part of the progressive efforts toward economic transition in 1978, the Chinese government introduced the household contract system, which improved rural economy and expanded diversified agricultural economy. The household contract system has changed women's work patterns. It has allowed them to allocate their time between agricultural and household work. Over 50 per cent of workers engaged in specialised activities are women, and they generate 55-65 per cent of the total commodity output value. At the same time a shift is seen from farming to manufacturing and craft industries in the rural areas. Younger women are moving to township enterprises which are either owned by the state or the collective (Guan Minqin, 1987). Croll's (1995) synthesis of village migration studies in PRC, draw attention to the women left behind who are frequently expected to single-handedly take responsibility



**Fig. 2.** Production support cluster for rural women to improve household food security prospects: An example in Food Production Segment



**Fig. 3.** Production support cluster for rural women to improve household food security prospects: An example in Family Food Production Segment

for agriculture, and housework. These often make excessive demands on their labour leaving them tired and exhausted. Where older women are left to undertake agriculture, the village studies suggest that they are rarely able to maintain previous levels of cultivation whether measured in terms of land area or types of crops or allocate sufficient labour and accrue the technical knowledge and inputs necessary to expand into new cropping and agricultural activities. The village

studies also suggest that the declining importance of agriculture and comparatively low status of women have meant that the feminisation of agriculture has led to a mutual and further downgrading of both the status of women and the status of agriculture.

In the countries of South East and North East Asia the changes in the economic situation may drive the marginal urban population to seek minimum food



security in rural areas by falling back on traditional skills for their livelihood. The impact on women due to return to rural roots has yet to be adequately studied.

In Tonga while land shortage is not a problem nationally, relative land pressure is evident in some areas with higher population densities. But access to alternative land and soil fertility depletion is common requiring alternative production methods and the planting of crops lower in nutritional value. Households in these regions are also reporting a larger area of subsistence gardens devoted to manioc. The greater demand on input factors in food production in regions with land pressure may be a significant factor in the consumption of imported food by those who have access to cash. Where land pressure exists in Vanuatu, loss of soil and fertility and lower productivity will be increasing problems in the future and this could lead to an increased dependence on imported food. In some high population density areas, the problem is being lessened by migration, however, since the bulk of that migration is to urban areas this is not contributing to household food security. Yet, there is no systematic documentation of the role shifts for women in household production systems under these changing circumstances.

In Fiji improvement in food security is occurring as a result of marketing development. The emergence of urban squatter settlements, has resulted in some squatters developing "middle-person" roles, in which they buy basic foodstuffs from rural farmers and sell on stalls in squatter areas. Since the squatter settlements are found in various locations in Suva, this has improved food distribution and relieved the farmer of the need to go and spend time selling at the central Suva market. This development also provides livelihood security for the squatters concerned and increases the productivity of the farmers. Further marketing developments include packaging to reduce the time that women spend selling their produce at the market and reduce food spoilage. Packaging also provides employment for women and increase farmer productivity. This also illustrates the rural-urban linkage crucial for household food security in which women play an important role.

**Marketing developments include packaging to reduce the time that women spend selling their produce and reduce food spoilage.**

## Conclusion

It is argued that in the rural region women plan a

pivotal role in improving the prospects of household food security both as individuals at the household level and as producers of food in the farming communities. But the resources available for them to enhance their production in food sector and contribution to household food security do not do justice to them. Hence, their wide ranging roles in the food sector should be given due credit and the production support should be expanded and diversified.

## References

- Water Falcon** (1996), "Commentary: Food Policy Really Matters", 20th Anniversary Lecture, Washington, D.C., International Food Policy Research Institute (IFPRI), 1-4.
- Quisumbing A.R., L.R. Brown, H.S. Feldstein, L. Haddad, and C. Pena** (1995), *Women: Key to Food Security*, IFPRI, Washington, D.C.
- Laurie Lewis** (1995), "View Point: Great Delusion", extract from *South Pacific News*, Vol. 3, No. 4, December 1995.
- United Nations/ESCAP (1995), *Improving The Access of Women to Formal Credit And Financial Institutions: Windows Of Opportunity*, New York, United Nations.
- The World's Women 1995: Trends and Statistics*, United Nations, New York, 1995.
- Louise, Morauta** (1985), "Women in Households in Papua New Guinea", in *Women in Development in the South Pacific: Barriers and Opportunities*, Development Studies Centre, the Australian National University, Canberra.
- Central Research Institute for Food Crops (CRIFC) and the International Research Institute (IRRI), "Gender Analysis in Rice Farming Systems Research: Does It Make A Difference?", Report of the Women in Rice Farming Systems Workshop, Bogor, Indonesia, 1990.
- Illo Jeanne F.I. and Cynthia C. Veneracion** (1988), *Women and Men in Rainfed Farming Systems: Case Studies in the Bicol Region*, Institute of Philippine Culture, Ateneo de Manila University, Quezon City.
- University of the Philippines at Los Banos, the IRRI and the Philippine Institute for Development Studies, 1988, *Filipino Women in Rice Farming Systems*.
- Poats Susan, M. Schmink and Anita Spring** (1988), *Gender Issues in Farming Systems Research and Extension*, Westview Press, Boulder, U.S.A.
- Chen Marty, Manoshi Mitra, Geeta Athreya, Anial Dholakia, Preeta Law and Aruna Rao** (1986), *Indian Women: A Study of Their Role in the Dairy Movement*, Shakti Books.
- Ehsan, Nuzhat** (1993), *Women and Rural Development in Bhutan: A Pilot Time Allocation Survey Report*, UNDP and Ministry of Agriculture, Royal Government of Bhutan.
- UNICEF/Vanuatu Government Joint Publication, *A Situation Analysis of Children and Women in Vanuatu*, Save the Children Fund Australia, June, 1991.
- Helter Carol B. and Siew-Ean Khoo** (1987), "Women's Participation in the South Pacific Economies", ESCAP, Islands/Australia, Working Paper No. 87/4.
- Volavola, Unaisi** (1991), "Fiji: Voices of Women Farmers-Gender in Agriculture", papers and proceedings of the Regional Conference on Gender Issues in Agriculture, Asian Development

---

Bank and United Nations Development Fund for Women, Manila.

**Cavuilati, Ratu S.T.** (1991), "Fiji Women in Agriculture: Gender in Agriculture", papers and proceedings of the Regional Conference on gender Issues in Agriculture, p. 208-209, Asian Development Bank and United Nations Development Fund for Women, Manila.

Women in Fisheries, FAO, Rome, 1987.

**Vunisea, Aliti** (1996), "Women in Fisheries: Up Against Several Barriers", Samudra, July 1996.

**Islam, Nurul** (1997), "The Non-Farm Sector and Rural Development: Review of Issues and Evidence", 2020 Vision, IRRI, Washington, D.C., April.

**Gierycz, Dorota** (1997), "Improvement of the Situation of Women in Rural Areas", Report of the General Secretary, UN General Assembly, September.

**Minqin, Guan** (1987), "Women, Agricultural Systems and Technological Change: China and the Philippines", Agricultural Change, Rural Women and Organisations: A Policy Dialogue, Workshop organised by Asian and Pacific Development Centre and All China Women's Federation, proceedings published by Asian and Pacific Development Centre, Kuala Lumpur.

**Croll, Elizabeth**, "Rural Migration in Rural Development in the Evolving Market Economy", December 1995 (to be published by UNDP). □

*Society is always taken by surprise at any new example of common sense.*

— Ralph Waldo Emerson

# Enhancing Food Security through Market Reforms

Gopal Naik

---

*This article describes how effective distribution mechanisms, through schemes and policies involving both the public and private sectors, can be put in place to ensure food security for the country. It has also been stressed that in the light of the fact that India has been producing surplus foodgrains in the last few years, existing policies also need to be reformed.*

*Gopal Naik is with Center for Management in Agriculture, Indian Institute of Management, Ahmedabad.*

It is evident from the reported starvation cases that despite large stock of foodgrains held by the government, people do not seem to have food security. Thus keeping large amount of public food stock is not adequate as providing food security. Security of adequate, nutritious and safe food on time is critical to the 300 million poor in the country and has both demand and supply dimensions. An effective demand is created through the interplay of purchasing power and market prices. Food security requires an effective distribution mechanism to cater to this demand. The strategy required to meet these supply and demand dimensions differ in situations of deficit and surplus. In a deficit situation the government should play a predominant role in ensuring these requirements. However, in a surplus situation the private sector should play a major role through appropriate market mechanisms. Therefore, the recent change in India's situation from long run deficit to a surplus requires suitable changes in the policy to bring in marketing reforms to enable the private sector to play a major role in the food security.

Government of India has formulated and implemented a number of policies to provide food security in the country. These include price support operations and procurement, buffer stocks, Public Food Distributions System (PDS), and extensive control on the private trade. Central to these policies has been the price policy, which aims at ensuring remunerative prices to the farmers to encourage foodgrains production and to provide foodgrains to consumers at reasonable prices. The key components of the price policy have been the announcement of Minimum Support Prices (MSPs) backed by an institutional structure for market intervention through organisations such as the Food Corporation of India (FCI). The price policy implemented so far has achieved a considerable degree of success especially in the case of major cereals, rice and wheat. The cereals production in the country has increased from 72 million tons in the year 1966 to 208 million tons at the turn of the century, transforming a chronic shortage

situation into one of self sufficiency and surpluses. The policy protected farmers from distress sale of their produce at uneconomical prices. The price policy ensured remunerative prices to the farmers and enabled the government to offer the foodgrains at fair and reasonable prices to the consumers, especially the weaker and vulnerable sections of the society.

In the changed agricultural scenario of surplus foodgrains production and globalisation, the role of markets become important in providing food security. Therefore, the current price policy needs a critical re-examination. Despite a slow growth of foodgrains in the 1990s as compared to the 1980s, the FCI had an accumulated stock of about 60 million tons of foodgrains by June 2001 as against the requirement of 15.80 million tons under the buffer stock policy. The emerging situation is already manifesting major problems associated with this policy. They are:

**The off-take under PDS has been declining.**

- FCI is unable to cope with sustained surpluses because of fiscal and infrastructure constraints.
- The quantity of wheat procured has increased from approximately 8 million tons in 1996-97 to over 20 million tons in 2001-2002.
- The off-take under PDS has been declining (Table 1), amongst others, on account of high central issue prices of wheat and rice. Increased production and procurement, and reduced off-take has resulted in huge stocks which are several times in excess of the buffer stock norms.
- The operation of Food Corporation of India is becoming costlier over time because of its inefficiencies. There are complaints that at many places farmers are not paid Minimum Support Price (MSP) prices.
- A large quantity of procurement and stocks are adversely affecting the growth of the private trade. Not only are traders unable to purchase large quantities, but also the uncertainty about the prices as the Government can off-load a large amount of stocks in an ad hoc manner at arbitrarily determined prices, discourages them from entering markets.
- A large amount of government funds (more than Rs 50,000 crore) is locked in grain stocks.

- Apart from the cost of locked in funds there are storage costs and wastage. The quality of stored foodgrains also deteriorates very fast. The value of the current huge stock, which has accumulated over the years, continues to erode with delay in disposal of the stocks.
- The loss in value of the produce, wastage, inefficiency and storage costs add to the subsidy provided to the food and agriculture sector. The post-harvest foodgrain losses are estimated to be in the range of 11-15 per cent (Chauhan, 1997) compared to only one per cent in Australia and Canada (Vercammen et al., 1998).
- The studies (Ahluwalia, 1993; Radhakrishna et al, 1997; Dev and Ranade, 1999; Kriesel and Zaidi, 1999) have reported that PDS is hampered by poor targeting, rampant corruption and leakage of grains to the open market.

**Table 1:** Allotment and Offtake of Rice and Wheat (In lakh tons)

Year	Rice		Wheat	
	Allotment	Offtake	Allotment	Offtake
1998-99	127.57	106.21	99.20	78.23
1999-2000	140.71	111.89	102.25	56.17
2000-2001	160.92	76.35	113.67	38.44

A detailed study by Umali-Deininger and Deininger (2001) suggests the need for improving further on the targeting and delivery of Targeted Public Distribution System (TPDS), creating an enabling environment for increased private sector efficiency and investments and improving the efficiency and effectiveness of FCI.

### Current Situation

The key concern expressed by the High Level Committee on Long Term Grain Policy, that the current surplus is mainly a short-term misalignment phenomenon, needs re-examination. At the end of the current crop year the total stock of foodgrains could be more than 70 million tons. Such a huge stock will need about 7 to 8 years to clear at the current off-take levels without any further procurement. Even with extensive Food for Work Programmes it would need at the least 5 years to clear the current stock. However, the quality of the grain is unlikely to be fit for human consumption after such a long storage by FCI. Considering the quality degradation, the current stock level could easily meet the off-take, Food for Work Programme and any shortfall for the next three years without further procurement after the current crop year.

The average annual production of foodgrains has

increased by about 17-18 million tons from the Eighth Five Year Plan to the Ninth Five Year Plan. The average foodgrains production during the Eighth Five Year Plan was 187 million tons. The average production during the last four years of the Ninth Five Year Plan up to the year 2000-01 was 203 million tons. The production in the year 2001-02 is expected to be around 210 tons. This implies that the average production of foodgrains during the Ninth Five Year Plan is likely to be around 205 million tons. In the past four years surplus of agricultural commodities have been reported in many States and this trend is likely to continue. Even chronically deficit States like Assam, Bihar and eastern Uttar Pradesh, have been demanding procurement of surplus grains in recent years.

Even after major monsoon/post monsoon failures in the year 2000-01, the procurement was 40 million tons. The off-take being 11.5 million tons and no large-scale imports and exports, the consumption is estimated to be around 168 million tons. If it is assumed that with a lower issue price the off-take could have increased by another 10 million tons, the total consumption would be 178 million tons. Therefore the total requirement of foodgrain can be pegged at around 180 million tons. If about 20 million tons could come from the FCI stocks in the next three years the production required is around 160 million tons which is at the least about 40 million tons less than the current production. This means that nearly 15 million hectares can be diverted from rice and wheat to other crops such as oilseeds, pulses and coarse cereals. Even if we take the demand for foodgrains projected by the Planning Commission in their Working Group Report on Demand & Supply Projections for the Ninth Five Year Plan, the surplus acreage is to the tune of 10 million hectares.

**15 million hectares can be diverted from rice and wheat to other crops such as oilseeds, pulses and coarse cereals.**

Continuation of the existing policy can come only at a very high cost to the economy. This cost includes the cost of funds in maintaining huge stocks, storage costs, erosion in the value of the stocks due to deterioration of quality, inefficiency in procurement and management of stock. There are also indirect welfare losses resulting from lower consumption by economically weaker sections, lower off-take for PDS and loss of export opportunities due to high domestic prices. Poor management of the stock also makes it unsuitable for export purpose even if the international prices of these grains increase substantially. Such export demand even if it exists, will

be limited to the extent of 4-5 million tons per year. Therefore, the total loss to the food sector and society is likely to be enormous and the government would find it difficult to sustain such high losses on an on-going basis. Therefore, substantial changes in the policy are needed to avert the emerging crisis situation.

**Continuation of the existing policy come at a very high cost to the economy.**

### **Key Policies Required**

The Food for Work Programme initiated recently is consistent with the recommendations of the Committee on Agricultural Costs and Prices and the High Level Committee on grains. This would be an important step in resolving the current high stock situation. The other policies needed urgently are:

- Delinking MSP and procurement, and providing income protection
- Diversification policy for areas where sustainability of current food production is under pressure.

### **De-linking MSP and Procurement and Providing Income Protection**

The present arrangement of MSP scheme implementation requires mandatory procurement of surplus stocks by the nodal agencies at the MSP level. Linking support price and procurement has led to several problems as discussed earlier and is not sustainable in the long term. One of the main objectives of the MSP Scheme has been to ensure remunerative prices to the farmers so as to protect their incomes. Therefore any alternative policy should also ensure the benefit of income protection to farmers. Alternative policies, as exists in countries like the USA, are Direct Payments and Income Insurance to the farmers.

### **Direct Payment Scheme (DPS)**

Under the direct payment scheme, the MSP for different crops is announced before each cropping season. But, no mandatory programme of procurement by State or parastatal bodies at that price is undertaken. Actual market prices are determined by the inter play of the market forces. Procurement for buffer stocks and PDS by nodal agencies, like FCI and other central or

state agencies, are also undertaken at market prices. Farmer's income is protected by reimbursing positive difference, if any, between the MSP and the market price. For instance, if the MSP for wheat is fixed at Rs.610/- per quintal and the market price is only Rs.510/- per quintal, farmers would suffer a loss of about Rs.100/- as a result of their selling wheat in the market. This loss in income to farmers is compensated by the Government by making direct payment to the farmers.

To implement such a scheme, institutional arrangement for identifying the beneficiaries, benchmarking the yield levels, assessing current yield levels and prices, tracking of individual market transactions and financial operations in terms of payment of cash by government agencies will have to be created. Such a scheme is also prone to misuse as the farmers and the private traders might join hands and report manipulated figures of quantity sold and prices received possibly with the connivance of the officials in order to get greater reimbursement. The efficiency of the government machinery in providing cash compensation in genuine cases could also be very low. The High Level Committee on Long Term Grain Policy has also, therefore, not favoured this Scheme.

**The efficiency of the government machinery in providing cash compensation in genuine cases could be low.**

However, an effective alternative mechanism to implement this scheme would be to tie it up with the existing National Agricultural Insurance Scheme (NAIS). NAIS provides yield risk insurance and collects past and present yield levels for making an assessment. With the same data direct payment can also be made. The additional piece of information needed would be the market price at which the farmers have sold the produce. As of now, in many states NAIS is compulsory for loanee farmers. This can be extended to availing direct payment as well. This combination of yield and price risk support comprehensively covers farmers' income risk and would create an opportunity for higher income earning with payment of premium only towards yield risk.

The total payment to farmers, if any, would have two components: one yield risk component (if the yield has gone down below the assured yield) and the second MSP component. While calculating MSP component an amount equivalent to  $0.2 \times (\text{number of consuming units in the family})$  could be deducted from the actual total yield (in tons) in order to reflect marketable surplus.

## Income Insurance Scheme (IIS)

The other method of compensating the farmer is through an appropriate income insurance programme. Implementation of such a programme requires among others, determination of income of farmers, indemnity levels and premiums. For estimating income, information on market prices and yield rates are required. Information on market prices is available from regulated markets for most of the commodities. Information about yield rates at the village level is not available. It can be calculated at the block level through crop cutting experiments as in the case of NAIS. The advantage of this policy is that it effectively provides threshold income support which MSP alone will not be able to provide. In the current arrangement only a combination of MSP and the yield insurance offered under the National Agricultural Insurance Scheme (NAIS) could provide such a protection.

Both these schemes are completely, in line with the National Agriculture Policy (NAP)-2000 which try to provide a package insurance policy for the farmers, right from sowing of the crops to post-harvest operations, including market fluctuations in the prices of agricultural produce. Only in the USA similar schemes of Crop Revenue Coverage, Income Protection and Revenue Assurance are being implemented which provide protection to the total income of the farmers. IIS is expected to be sustainable in the long run.

## Coordination in Policy Formulation

A critical success factor in any agricultural policy is the coordinated effort to evolve a policy that is consistent with other policies. For example, setting tariff levels for commodities which permits imports at lower than the MSP levels could only lead to huge stocks with the nodal agencies. Therefore care has to be taken while setting interrelated measures such as MSP, tariffs and CIP, that they do not lead to large amount of subsidy expenses for the government, and, at the same time, farmers' and consumers' interests are protected. Other policies such as production related technology, research and extension, processing technology, should be consistent with the broad framework of the policy. For example, if diversification from food crops to oilseeds is required in Punjab, the research and extension has to focus on it and provide an attractive solution for oilseed production at competitive costs. Therefore, it is essential that a broad framework is developed for the agricultural sector in coordination with other related ministries such as Commerce, Food, Food Processing, Rural Development, Consumer Affairs, etc to prepare specific action plans for the short, medium and long term.

**Setting tariff levels for commodities which permits imports at lower than the MSP levels could lead to huge stocks.**

### Determination of MSP Levels

The MSP is finalised based on the recommendation of the CACP and by taking other factors such as food security into consideration. The price recommended by the CACP for a particular commodity covers all paid out cost, imputed value of family labour, rental value of owned land and interest on owned fixed capital (C 2) for efficient areas and ensures that paid out cost and imputed value of family labour is covered even for inefficient areas. After receiving CACP recommendations, the Government enhances the recommended price with respect to certain commodities. Consequently, the MSPs of crops like rice, wheat, have increased substantially, not only in absolute terms as compared to the cost of cultivation but also relative to costs of other agricultural commodities, covered under MSP. For instance, the C2 cost of rice in Punjab is slightly below Rs.430/- per quintal against the last year's MSP of Rs.510/- per quintal. Significant increase in the MSP of wheat was made during the 90s (Fig. 1). However, for pulses and coarse cereals, the MSPs have tended to remain low, discouraging their production.

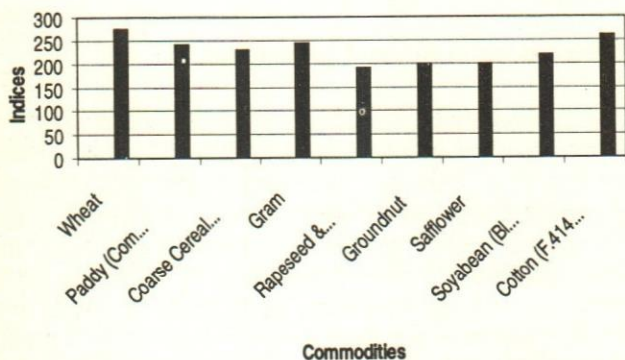


Fig. 1. Extent of Increase in MSP by 1999-2000 with 1990-91 as 100

Such an approach was justified when shortages necessitated production of cereals like wheat and rice on account of their higher productivity levels. But in the

**While the country has a surplus of rice and wheat, there is a continued shortage of pulses and edible oils requiring large imports.**

changing situation this needs to be reviewed. While the country has a surplus of rice and wheat, there is a continued shortage of pulses and edible oils requiring large imports. There is a need to correct this imbalance in the MSPs of these commodities. Such a shift in the approach, in turn, will facilitate change in the cropping pattern and encourage diversification.

Therefore, MSP could have two components: cost and market requirement. As far as cost component is concerned there is a standard methodology used by the CACP. The market requirement component should be determined based on the estimated supply and demand conditions for the next year and therefore should be done by experts. However, no discretionary changes should be made in this component by the government. In some years the market requirement component could be zero and when shortage is expected an appropriate level could be determined based on the estimate of the shortage.

### Reforms in Commodity Markets

Following steps need to be taken to strengthen the agricultural marketing system in order to enable farmers to get prices reflecting demand-supply situations and also to help implement the government policies effectively.

Market intelligence and information system need to be strengthened and streamlined to provide accurate and real time data. Effective built-in mechanisms and controls are to be activated to monitor and eliminate activities of vested interests in engineering price manipulations.

Legislation needs to be amended to streamline the role of the Agricultural Produce Market Committee's (APMC's) and commission agents. Transparency in transactions in APMC's is possible with limited role of the commission agents. Private companies and processors should be able to procure directly from the farmers without transacting through the APMC by passing a nominal market fee. The APMCs should also allow for forward contracting arrangements between farmers and the companies, with the consent of the Forward Market Commission. APMCs should develop infrastructure facilities at the market yards to reduce the marketing costs on transactions. The role of the Mandi among other things should include daily reporting of prices and arrivals. It is essential to have an efficient Market Information System so that the market prices for agricultural commodities are available online to all market players including farmers.

Any restriction on the intra and interstate movement and on the storage limits of the foodgrains by private trade need to be removed. The Essential Commodities Act needs to be reviewed to present freer trade in agricultural commodities.

**The Essential Commodities Act needs to be reviewed to present freer trade in agricultural commodities**

Quantities of grain required for the Public Distribution System could be prescribed through greater involvement of States. The requirement of the deficient States could also be met through private trade. The operation of private trade needs to be encouraged and while formulating policies on food management their impact on private trade must be kept in view. The losses on account of decentralised PDS could be reimbursed by the Central Government.

#### **Private Sector Participation**

Several agribusiness models are being developed in the country by the private sector. One such very interesting model is that developed by Mahindra Shubh Labh Services Ltd. The company offers extension services to farmers for a fee but ensures a certain level of yield. If farmers get lower than the assured level of yield they need not pay the fee. During the last kharif season this service was offered to about 100 acres of land in Madurai assuring an yield of 3 tons of paddy per acre. The fee was Rs 500 per acre. The assured yield was achieved in 75 per cent of the registered farms. In the second season in 750 acres, 2.3 tons of paddy per acre was assured. The success rate was 80 per cent in spite of the area having been hit by drought. The company has also developed a Share Cropping Model and Contract Farming Model for foodgrains. Such models of the private sector ensure that yield risks are low and will also essentially keep proper records at the farm level. Therefore insurance schemes could be implemented wherever such models are extensively implemented. When a very high yield level is assured by the company the premium levels for the average yield levels insurance could be either reduced drastically or the indemnity level could be increased substantially, or both. The income protection Schemes and the models complement each other and would attract more farmers when offered in combination. Such models will also be able to increase productivity and therefore competitiveness of crops. The government should facilitate such models with required

legislation as their success will reduce the burden on the government, increase farm income, improve productivity and quality of the products. They are also in line with the government's recent initiative of providing financial support to agricultural and agri-business graduates to set up consultancy services. In fact, the insurance company can pass on a significant part of the premium if these consultancy services can assure higher yield levels to the farmers.

The government should also encourage private insurance companies to come forward to offer insurance schemes. Government/insurance companies should be able to appoint crop surveyors to assist in offering insurance at the individual farmer level, based on his/her yield levels.

**The government should encourage private insurance companies.**

#### **Conclusion**

While the MSP-procurement regime has served the national objective of increasing food production and food security in the country during the last three decades, its suitability in the changed scenario of surplus production and globalisation needs re-examination. In recent years the MSP-procurement linkage has led to accumulation of a huge stock of wheat and rice, around 60 million tons as of June 2001 and expected to be around 80 million tons by the end of the current kharif procurement season. Such a huge stock can not be disposed of either in the domestic or in the international market without substantial additional cost to the government. It would also have implications for India's commitments in the WTO Agreement on Agriculture. Even with additional subsidy it may be difficult to sell large quantities in the international market due to quality problems as the recent experience in wheat exports to Iraq has shown. Both international and domestic markets will not be able to absorb this stock without considerable reduction in the price. Disposing this huge stock in the domestic market alone will also destroy the confidence of private trade.

The suggestions of government bodies such as the CACP and the High Level Committee on Long Term Grain Policy of implementing Food for Work Programme has already been initiated. They have also recommended diversification of crops in favour of coarse cereals, pulses and oilseeds. The High Level Committee felt that the current surplus situation is transitory. How-



ever, continuation of the current policy is likely to lead to even greater surpluses in future. In order to manage the current crisis situation three major measures have to be taken up immediately. First, about 10 million hectare should be diversified from rice and wheat to other commodities such as oilseeds, pulses and coarse cereals in the short run. The diversification policy involves extending the schemes to major rice and wheat surplus areas such as Punjab and Haryana. These two states are also experiencing environmental problems associated with producing rice and wheat. Second, extensive Food for Work Programmes can operate along with the PDS. Third, in order to exhaust the current stock before it deteriorates in quality, it is also necessary to stop further procurement until the stock reaches the bufferstock requirement of 16 million tons.

However, de-linking MSP with procurement will take away incentives for farmers to produce marketable surplus of rice and wheat. Therefore, for income protection two schemes have been examined: first, Direct Payment Scheme and second, Income Insurance Scheme.

In the Income Insurance Scheme average income is calculated as the product of average yield and MSP. The premium rate will be actuarial and part of it could be subsidised by the government. The Income Insurance Scheme initially is suggested for rice and wheat as the Scheme is likely to be sustainable in the long run. The total expenses estimated in a worst case scenario, under IIS are comparable with the current expenditure on MSP-procurement system.

There are several positive implications of the IIS. First, private trade will play a major role and therefore the pricing mechanism would reflect the actual demand supply situation. Excess production or supply will cause the prices to decline. The decline in prices will help in increased demand, particularly from the poorer sections or BPL segment of population. Besides, if prices fall below international levels, the commodity can also be exported. There would thus be a possibility of sustained exports of foodgrains from the country. On the other hand, in case of decline in production, the prices will increase, either obviating the need for income support payments to farmers and reducing liability under the Insurance programme. The requirements of the weaker sections of the society would continue to be met from buffer stocks maintained by public sector organisations like FCI and SFCs through PDS.

Second, the existing system of MSP-procurement is

essentially functional in the States of Punjab, Haryana, Uttar Pradesh and Andhra Pradesh. Thus the benefit of the present policy, which is being implemented at such a huge cost is available only to a very small number of farmers in a few States. The alternative schemes will have a much wider reach and potentially a larger number of farmers in all the States will be benefited.

Third, the Scheme offers comprehensive coverage of income instead of either yield or price risk. Farmers will be benefited from comprehensive risk coverage consistent with the objective of the National Agricultural Policy - 2000.

Fourth, the alternative Scheme provides incentive to the farmers for improving quality. In the MSP regime, quality is confined to FAQ, which is also subject to flexibility. The farmers' real income in the market will be rewarded for quality grade while his income protection is covered by the Insurance. This will also help the country to compete in the world market.

And last, it would reduce wastage of foodgrains through proper marketing, storage and handling. The efficiency of FCI would also improve if the level of stock is around the bufferstock requirement.

#### Reference:

- Ahluwalia D. (1993), 'Public distribution of food in India, coverage, targeting and leakage', *Food Policy* 18(2).
- Chauhan K.K.S. (1997) 'A study of post-harvest losses in India', Report prepared for the Canadian International Development Agency, New Delhi.
- Dev. S. M. and Ranade A. (1999), 'Persisting poverty and social insecurity, a selective assessment' in: Parikh, K. S. (ed.), *India Development Report 199-2000*. Oxford University Press, New Delhi.
- Kriesel S. and Zaidi S. (1999), *The Targeted Public Distribution System in Uttar Pradesh—An Evaluation*, mimeo.
- Radhakrishna R., Subbarao K., Indrakant S. and Ravi C. (1997), 'India's Public Distribution System: a national and international perspective', *World Bank Discussion Paper No. 380*, World Bank, Washington DC.
- Umali-Deininger D.L. and Deininger K.W. (2001), 'Towards greater food security for India's poor: balancing government intervention and private competition', *Agricultural Economics*, 25.
- Vercammen J., Barichello R. and Bronsko A. (1998), 'A preliminary investigation of grain losses in China', Paper presented during the Western Coordinating Committee Symposium on Food Markets in China, New Look, Deeper Understanding, East West Center, University of Hawaii.

□

# Food Availability & Access in Rural India

Swarna Sadasivam Vepa & R. V. Bhavani

---

*An analysis of the food production levels of various vegetable and animal products across States reveals that we are just about producing enough cereals and are even deficit in the production of some commodities. This clearly indicates that the huge stock of foodgrains is piled up due to lack of purchasing power and problems of distribution.*

*Swarna Sadasivam Vepa is Project Leader, B.V. Rao Centre for Sustainable Food Security and R.V. Bhavani is with M. S. Swaminathan Research Foundation, Chennai.*

Food and Agricultural Organisation on the occasion of the World Food Summit in 1996 defined the term 'food security' in a report titled "Food for All". Food security is being able to provide physical and economic access to sufficient, safe and nutritious food to all people at all times. There is no food security unless the lower sections of the population get enough to eat all the time.

India is one of the largest producers of foodgrains and milk in the world. Foodgrain production has increased four-fold since the fifties and has almost doubled since the seventies (Ministry of Agriculture). Thanks to the Green Revolution, Operation Flood, and the governmental support given to crop and milch animal production, we are not dependent upon other countries for food. The country has accumulated close to 70 million tons of food stocks that gives the impression of excess production over demand.

The stocks can be treated as surplus stocks if they are there, after everybody has eaten enough. They are stocks of distress, if they have accumulated as a result of people not being able to afford enough food to eat. On one side, there are studies showing deceleration in foodgrain production. There are also claims of reduced capacity of our soil and water to produce enough in the future to take care of food and fodder requirements (Bhalla, Hazell et al, 2000). There are studies to show declining cereal and calorie consumption as a result of diversification of food basket. Diversification of food basket is associated with higher incomes and better quality foods and lifestyles that require less manual work (Suryanarayana, 2000, and Rao, 2000).

For the country as a whole, on an average, the consumption level appears to be adequate. But as per the National Sample Survey (NSS) 55<sup>th</sup> Round data in 1999-2000, while the average calorie consumption in rural India is about 2,668 kilocalories per consumer unit per day, consumption level of the lowest three consumer expenditure classes was only

1,983 kilocalories per consumer unit per day. The lowest 10 per cent of the population in rural areas of India consumed as little as 1,883 kilocalories per capita per consumer unit. Some economists feel that the lower income groups actually eat more, but NSS figures show lower levels of consumption. However, the reports about starvation and seasonal problems of food confirm the possibility of low levels of consumption. In addition, a large percentage of India's population is affected by silent hunger - deficiencies of micronutrients. Iron deficiency appears to be most common (International Institute of Population Sciences, 2000). Many people do not eat protective foods such as pulses, milk, eggs, meats, fruits and vegetables in sufficient quantities. This is obvious not only from National Sample Survey data but also from the surveys of the National Nutrition Monitoring Bureau as well as district profile surveys conducted by the Department of Women and Child Development.

**India's population is affected by silent hunger - deficiencies of micronutrients**

Are we producing enough for our population? Does accumulation of stocks mean large surplus over the requirement? What is the consumption pattern of the lower income groups? Are they eating enough? Do they eat balanced diets? Can the consumption level of the lower income groups be related to production in the State? The questions on the production adequacy can be answered more easily than the questions on the consumption side. On the consumption side it is difficult to judge whether one has enough to eat since it depends upon the individual body metabolism, build, activity status and so on. However, at the average level we can use the calorie consumption per consumer unit as a measure.

The present paper attempts to compare the average production and average consumption per capita of various food items at the State level. The average levels of consumption do not tell us anything about the consumption of the lower income classes. However, if the consumption levels at the average level are not satisfactory, we can conclude that the lower-income groups are not eating enough. We have information regarding the consumption of cereals and consumption of calories by the lower income groups, which further clarifies the gap that exists in consumption. Based on the analysis we have tried to assess the relationship between the local production and the consumption levels of the lower income groups.

## The Data and its Limitations

The main source of data on consumption is the National Sample Survey (NSS) reports published from time to time. The Quinquennial surveys with larger sample size are said to be more reliable. However, it has been alleged that the 55<sup>th</sup> Round NSS data has overestimated expenditure as well as food consumption compared to the earlier rounds. It was claimed that there was an overestimation for all the expenditure groups with the likelihood of higher levels of overestimation for the lower income groups, compared to the previous rounds of NSS. Thus the data pertaining to 1993-94 from the 50<sup>th</sup> round is not comparable with the 1999-2000 data from the 55<sup>th</sup> round. The discrepancy arises out of the recall period, which has created complications in the 55<sup>th</sup> Round data (Sen, 2002). For our study, we have mostly used the NSS 50<sup>th</sup> Round data pertaining to 1993-94. Some part of the analysis has also been carried out with the help of the NSS 55<sup>th</sup> Round data, but no comparisons are made over the period.

## Net Production of Food at the State Level

The availability of food is defined as the sum of net production (net of seed, feed and wastage), net imports and changes in stocks. Thus, State-level availability depends not only upon local production but also on net inflows of food from outside the region and outside the country. There are outflows of food from States because of government procurement operations and private trade. There are inflows of food into the States due to the existence of the Public Distribution System and operations of private trade.

Unfortunately, State-level assessment of availability is hampered by the lack of data on private trade in foodgrains, which make quantification of the net inflows into a State impossible. All the same, net food production is the main determinant of availability in the State and more so in the rural areas. Therefore, we examine the relative position of the States in the net production of food.

**State-level assessment of availability is hampered by the lack of data on private trade in foodgrains**

By food, we mean not only cereals, but all items of food, which are essential for healthy living. Data on all items of food are not available. We have included cereals, pulses, tubers, sugar, edible oils, fruits,

**Table 1: Per capita net production of vegetative foods (grams/day)**

States	Cereals	Tubers	Pulses	Sugar	Edible oilseeds	Fruits	Vegetables	Total
ICMR norms	420	75	40	30	22	50	125	
Andhra Pradesh	363.35	6.87	22.68	30.67	27.78	106.33	66.41	624.08
Assam	322.29	58.01	5.84	0.67	4.84	49.83	196.33	637.80
Bihar	318.40	42.48	15.90	10.67	0.98	45.17	199.52	633.11
Gujarat	221.90	30.46	28.96	54.67	44.01	58.83	109.04	547.88
Haryana	1291.46	22.84	45.98	60.00	37.10	11.50	162.98	1631.86
Himachal Pradesh	487.03	50.88	4.17	0.00	1.03	70.17	211.70	824.98
Karnataka	371.11	20.91	29.49	59.00	26.26	141.00	230.26	878.03
Kerala	65.92	197.09	1.42	0.67	0.32	78.67	209.09	553.17
Madhya Pradesh	454.43	22.21	100.22	3.33	46.62	20.17	85.55	732.54
Maharashtra	274.13	3.95	43.00	140.67	18.45	97.67	100.63	678.50
Orissa	389.27	28.20	21.20	5.33	4.55	55.33	354.33	858.22
Punjab	2132.58	85.37	7.67	61.67	10.38	48.00	166.75	2512.42
Rajasthan	458.77	1.02	89.27	1.33	48.19	7.00	15.95	621.52
Tamil Nadu	270.31	123.47	9.26	68.00	24.11	84.83	158.05	738.03
Uttar Pradesh	545.68	116.76	33.62	65.67	7.16	38.17	160.95	968.00
West Bengal	413.24	210.85	4.73	0.33	4.32	21.17	438.77	1093.42
All India	430.33	65.73	31.94	41.00	18.10	58.33	179.22	824.66

Net Production = Production - Seed, Feed and Wastage @ 13% for cereals, tubers, pulses, vegetables; 70% for edible oilseeds; 50% for fruits and no wastage for sugar.

Source: Ministry of Agriculture.

vegetables, milk, eggs, and fish, for which we could get State-wise data. States producing more food per capita cannot be food insecure from the point of view of food availability.

In all, ten items are considered for production. Certain foods such as meat and poultry could not be included due to paucity of data. Seven major items of crop and horticultural production viz., cereals, tubers, pulses, sugar, edible oils, vegetables and fruits are included under crop production. Cereals consist of wheat, rice and coarse cereals. Tubers consist of potato, sweet potato and tapioca. Pulses include Bengal gram, red gram, green gram, black gram, lentils and others. Sugar produced in the sugar mills is considered, instead of sugarcane. Reliable data on gur from sugarcane is not available. We have included State-wise production data on total vegetables and fruits. Triennium average production is a better measure than a single year's production, as the latter does not reflect the true position of the State. Transient factors influence production. Hence, all the production figures taken are the three-year averages of 1995-96, 1996-97 and 1997-98. In some cases where data is not available, we have used two-year averages. Average production is converted into per capita daily quantities in grams. To obtain the net

production, we have deducted 13 per cent for seed feed and wastage for cereals, pulses, tubers and vegetables. For cereals and pulses 12 per cent is considered in many studies. In view of the increasing feed requirements, we have taken a higher percentage. To represent the edible portion of the total crop, we have deducted 70 per cent in respect of oilseeds and 50 per cent in the case of fruits. The production of sugar is taken as it is without any deduction for wastage. Our estimates of production per capita are for the year 1997-98. The production is kept at the triennium average level ending in 1997-98 and rural population projection is that of the year 2000. This allows for a declining trend in the per capita availability of essential food items, as the diversification of agriculture into commercial crops is likely to reduce the per capita food production.

Net production per capita shows whether a State is producing less or more in relation to its population. States have shown wide variation in production per capita of various foods. Production of fruits and vegetables is more evenly spread across the States, commensurate with population. All other items of production are concentrated in some States.

Cereal production per capita is high in Punjab and

Haryana followed by Uttar Pradesh, Himachal Pradesh and Rajasthan. On an average Punjab produces more than 2 kilograms per capita per day. Haryana produces more than 1.2 kilograms per capita per day. Uttar Pradesh produces just a little over half a kilogram per capita per day and Rajasthan produces close to half a kilogram per capita per day. There are some States such as Kerala, which produce as little as 65 grams of cereals per capita per day. The per capita cereal production of Gujarat is the next lowest at 221 grams per capita per day. Tamil Nadu and Maharashtra produce around 270 grams per capita per day. These are the four States with the lowest per capita availability. Tuber production per capita is highest in West Bengal, followed by Kerala, Tamil Nadu and Uttar Pradesh (Table 1).

Per capita availability of pulses is high in Madhya Pradesh and Rajasthan. Similarly per capita per day sugar production is high in Maharashtra at 140 grams. Punjab and Haryana produce around 60 grams per capita per day. Rajasthan, Madhya Pradesh and Gujarat produce more oilseeds per capita than other States. Thus the production per capita of almost all foods except fruits and vegetables shows a high coefficient of variation, exceeding 90 to 100 per cent. It can be seen that the crop production across the States is characterised by specialisation in a few crops rather than the production of some of each crop. This is probably an indication of the commercialisation of agriculture in many States. The gaps between the highest producing State and the least producing State are very large. However, an encouraging message is that even a small effort by some of the States to close the production gaps existing at present in a more sustainable fashion, would increase the food production in the country.

**Crop production across the States is characterised by specialisation in a few crops.**

The three food items from animal sources for which we have data are milk, eggs and fish. Production per capita per day for all these three items varied between a low of just 48 grams of milk in Orissa, to a high of 777 grams in Punjab. Haryana produces 570 grams and Rajasthan produces 270.6 grams. Orissa, Bihar and Assam produce less than 100 grams of milk per capita per day. The highest per capita production of eggs is seen in Punjab, followed by Andhra Pradesh and Kerala. Tamil Nadu, West Bengal, Karnataka and Haryana also produce more eggs per capita compared to other States (Table 2).

**Table 2:** Per capita net production of animal foods

States	Milk	Eggs	Fish	Total
ICMR norms	150	45	25	
Andhra Pradesh	158.05	26.74	13.01	197.80
Assam	81.05	6.85	16.35	104.25
Bihar	92.34	4.87	6.35	103.56
Gujarat	265.22	3.63	40.32	309.17
Haryana	570.60	10.72	3.83	585.15
Himachal Pradesh	281.32	3.62	2.41	287.35
Karnataka	171.47	10.35	15.52	197.34
Kerala	139.00	21.46	51.94	212.40
Madhya Pradesh	178.47	5.21	3.27	186.95
Maharashtra	151.72	9.90	15.26	176.88
Orissa	48.00	5.78	20.47	74.25
Punjab	776.91	37.48	3.23	817.62
Rajasthan	270.61	2.90	0.70	274.21
Tamil Nadu	170.17	17.54	20.18	207.89
Uttar Pradesh	193.69	1.36	2.37	197.42
West Bengal	116.39	11.28	31.06	158.73
<b>All India</b>	<b>184.33</b>	<b>9.38</b>	<b>14.01</b>	<b>207.72</b>

Source: Ministry of Agriculture.

Kerala, West Bengal and Gujarat produce larger quantities of fish. Per capita daily availability of fish is about 52 grams in Kerala, 40 grams in Gujarat, 31 grams in West Bengal and around 20 grams in Orissa and Tamil Nadu. Even though Andhra Pradesh has a long coastline, the production of fish per capita is not high. Karnataka, Maharashtra and Assam produce fish at around 15 grams per capita per day.

The relative position of the States in terms of animal food availability indicates that Orissa is the lowest producer of animal foods. Assam, Bihar, West Bengal, Madhya Pradesh and Maharashtra produce less than 200 grams per capita per day of animal foods. Punjab and Haryana, Gujarat, Rajasthan and Himachal Pradesh produce the largest quantity of animal foods per capita. Kerala, Tamil Nadu, Uttar Pradesh and Karnataka produce around 200 grams per capita per day of animal foods.

Variation in per capita production of animal foods is also very high. Punjab, Haryana and Gujarat produce far larger quantities of milk than other States. Similarly, Kerala, Gujarat and West Bengal produce more fish than any other State. What we need to keep in mind is that per capita production helps us to judge the State in terms of adequacy of production of each item.

The per capita figures do not show the contribution

**Table 3:** Per capita net production index of food with ICMR base

States	Cereals	Tubers	Pulses	Sugar	E.oilseeds	Fruits	Vegetables	Eggs	Fish	Milk
Andhra	0.87	0.09	0.57	1.02	1.26	2.13	0.53	0.59	0.52	1.05
Assam	0.77	0.77	0.15	0.02	0.22	1.00	1.57	0.15	0.65	0.54
Bihar	0.76	0.57	0.40	0.36	0.04	0.90	1.60	0.11	0.25	0.62
Gujarat	0.53	0.41	0.72	1.82	2.00	1.18	0.87	0.08	1.61	1.77
Haryana	3.07	0.30	1.15	2.00	1.69	0.23	1.30	0.24	0.15	3.80
Himachal Pradesh	1.16	0.68	0.10	0.00	0.05	1.40	1.69	0.08	0.10	1.88
Karnataka	0.88	0.28	0.74	1.97	1.19	2.82	1.84	0.23	0.62	1.14
Kerala	0.16	2.63	0.04	0.02	0.01	1.57	1.67	0.48	2.08	0.93
Madhya Pradesh	1.08	0.30	2.51	0.11	2.12	0.40	0.68	0.12	0.13	1.19
Maharashtra	0.65	0.05	1.08	4.69	0.84	1.95	0.81	0.22	0.61	1.01
Orissa	0.93	0.38	0.53	0.18	0.21	1.11	4.96	0.13	0.82	0.32
Punjab	5.08	1.14	0.19	2.06	0.47	0.96	1.33	0.83	0.13	5.18
Rajasthan	1.09	0.01	2.23	0.04	2.19	0.14	0.13	0.06	0.03	1.80
Tamil Nadu	0.64	1.65	0.23	2.27	1.10	1.70	1.26	0.39	0.81	1.13
Uttar Pradesh	1.30	1.56	0.84	2.19	0.33	0.76	1.29	0.03	0.09	1.29
West Bengal	0.98	2.81	0.12	0.01	0.20	0.42	3.51	0.25	1.24	0.78
All India	1.02	0.88	0.80	1.37	0.82	1.17	1.43	0.21	0.56	1.23

Source: Ministry of Agriculture.

of the State to the whole country. Uttar Pradesh, having a larger area under crops, contributes about 20 per cent of the entire food crop production of the country. Madhya Pradesh and Maharashtra contribute about eight per cent of the total food crop production. Punjab also contributes about eight per cent of the total production. Bihar contributes about seven per cent, the same as Andhra Pradesh. Ultimately, levels of food production of various States are to be judged in the light of the capacity of the State to provide better livelihoods and higher levels of consumption. Per cent levels of food production should also be judged against the hidden dangers of fertility depletion, land degradation and overall environmental damage. The future capacity of the State to produce more is determined by these factors.

Specialisation in a few items with intensive production rather than extensive production of large varieties of foods appears to be the norm. The gaps between the highest producing States and the least producing States are very large in the case of cereals. Such gaps would lead to deficits in production and consumption.

#### Deficit of Production over Requirement

To study the adequacy of food production, we had to necessarily stipulate arbitrary norms based on some average requirements. It is worthwhile linking food availability to required consumption and the required

consumption to actual consumption, to measure adequacy. The use of adequacy norms stipulated by the Indian Council of Medical Research only shows that at the average level we require these quantities of Kcal per day. On an average, if a State is producing enough food, we call the State and the nation self-sufficient. Self-sufficiency in food is important at the national level. While self-sufficiency at the regional level may be of little relevance, adequacy of production at the State level may have a bearing on the consumption of the lower income groups.

**It is worthwhile linking required consumption to actual consumption, to measure adequacy.**

Using Indian Council of Medical Research (ICMR) recommended levels of per capita consumption of various food items as the base (ICMR, 1989) the per capita net production index was computed for all the States and for all India. It indicates whether a State is a surplus State or a deficit State for a particular food item from the point of view of requirement.

If we compare per capita net production with the recommended daily allowance given by ICMR, we find

that the country does not produce all foods in adequate quantities. We seem to be producing just enough of cereals, sugar, fruits and milk, but are deficient in the production of all other food items such as pulses, oil-seeds, tubers, eggs and fish (Table 3).

The surplus of production over requirement for a few commodities noted above is so low that any fluctuation in the production of any of these food items would lead to a deficit situation. For example, cereal availability is estimated to be 430 grams per capita per day by us, compared to the ICMR norm of 420 grams per capita per day for the country as a whole. The country is therefore producing just about enough to meet the requirements. By inference it is clear that the seventy odd million tons of foodgrains that are piled up are there due to non-affordability and problems of distribution. These stocks are not excess over requirement.

When compared with the dietary requirements per capita per day given by ICMR, many States are deficient in the production of even cereals. Only the States of Punjab and Haryana produce much above their requirements. Punjab produces five times more than its requirement, while Haryana produces three times its requirement. All the other States are either deficient in production or produce small surpluses. Uttar Pradesh, Rajasthan, Madhya Pradesh, and Himachal Pradesh produce cereals above their requirements.

None of the States are self sufficient in the production of all the food items. Some States producing a surplus in some food items may be noted. Madhya Pradesh and Rajasthan produce twice their requirement of pulses and Kerala and West Bengal produce twice their requirement of tubers. Maharashtra produces more than four and a half times its requirement of sugar. Punjab, Haryana, Tamil Nadu and Uttar Pradesh produce more than twice their requirement of sugar. Karnataka and Gujarat are close behind. Rajasthan, Madhya Pradesh and Gujarat produce twice their requirement of edible oils. Andhra Pradesh and Karnataka produce twice their requirements of fruits. Orissa seems to produce almost five times its requirement of vegetables. West Bengal also produces more than three times its requirement of vegetables.

**None of the States is self sufficient in the production of all the food items.**

As far as animal products are concerned, only Punjab produces more than five times its requirement of milk. Haryana produces more than three times its re-

quirement. Rajasthan and Himachal Pradesh produce close to double their requirement. All the States as well as the country as a whole is deficient in the production of eggs. Kerala produces double the requirement of fish, while West Bengal and Gujarat produce small surpluses. Surprisingly, Bihar is a surplus producer of vegetables by a small margin, while it is deficient by big margins in the production of all other foods. Orissa produces an excess of fruits and vegetables, while the availability of other products is below the requirement level. Orissa produces about 93 percent of its requirement of cereals.

Those States producing more than three times their requirement are definitely specialising in those products. It need not necessarily mean that the concentration of production is a consequence of soil suitability or sustainability. It definitely means favourable price, markets and infrastructure and commercial success. It is important to look into the sustainability of these production patterns, before encouraging further production in these areas. It is also important to see where attention is needed in order to increase production.

#### **Deficit in Production Over Consumption of Cereals**

Self-sufficiency in food production cannot be the goal for a State, since there are possibilities of specialising in one product and getting supplies of other items from other States. If the people of the State can afford it, items that are not produced locally will come into the State without any special effort. Good infrastructure and a well-established private trade infrastructure normally ensures this, as in the case of Punjab. Alternately, a well-established Public Distribution System as in Kerala helps many more people, who cannot otherwise afford food items that are not locally produced. Whatever the arrangement, production and consumption gaps reveal the availability as well as the affordability situation of the State.

Here we shall consider the production and consumption of cereals alone to depict the deprivation and insecurity caused by low levels of production. The rural poor in India derive more than 80 per cent of their daily energy and protein requirement from cereals (NSSO, 1997). Non-availability of cereals represent extreme deprivation and hence justifies additional attention. The

**Non-availability of cereals represent extreme deprivation and justifies additional attention.**

ratio of consumption to production per capita (C/P) reflects the levels of consumption and production, indicating whether the State is a surplus or deficit State. The extent of deficit indicates the extent of inadequacy of food production.

The ratio of per capita rural consumption to per capita production can also be interpreted as the share of rural consumption in the total production. The gap between per capita consumption and per capita production reflects both availability as well as affordability. Affordability of food leads to higher levels of consumption on an average.

We have seen the deficit of production over required consumption in the previous section. In food deficit areas, particularly when the staple food is not produced locally, the local prices may increase and the low income deciles may face food insecurity. For the purpose of comparison, we have taken the three-year average cereal production of 1991-92, 1992-93 and 1993-94 and divided it by the 1994 projected population to get the per capita cereal production that represents availability in 1994. Information on the per capita consumption of cereals per month was obtained from the National Sample Survey 50<sup>th</sup> round data on 1993-94. The deficit of production is represented by the ratio of consumption to production. Where the ratio is greater than one, it means that there is a surplus in production. If the ratio is less than one, there is a deficit in production.

The deficit is largest in Kerala and Bihar, where the consumption is almost four times the production. In Gujarat also, the deficit is about 75 percent. Maharashtra, Rajasthan and Assam showed a deficit ranging from 25 to 30 percent in 1994. A marginal deficit of 10 to 18 percent was seen in Tamil Nadu, West Bengal, Andhra Pradesh, Orissa and Karnataka. It is interesting to find that only four out of sixteen States produce surpluses (Table 4). The others get food from other States. There is reason to believe that the shift of agricultural areas from food crops to non-food crops may have resulted in reduced production and a widening gap between production and consumption. Reduction in production and availability of coarse cereals is said to be one of the reasons for declining cereal consumption (Meenakshi, 2000). Further, the consumption pattern might have shifted towards cheaper wheat compared to rice. In a bumper crop year such as 1994, many States might have consumed more due to lower prices, leading to a larger number of States with deficits. The spread of the Public Distribution System in the southern States might have particularly contributed to the spread of wheat consumption.

The extent of deficit by itself does not show how much the population is consuming, but it would definitely point to the vulnerability of low-income groups to inflow of cereals from other places. In a bad agricultural year, the surplus available in some States will be less, leading to higher prices in the deficit States. Then the lower income groups in rural areas will be adversely affected. This is more so if the inflow is through private trade and not through the government and the Public Distribution System. Thus, there is always an element of built-in food insecurity in the States that experience large deficits.

### Consumption of the Lowest Ten Per Cent of Population

As per the National Sample Survey 55<sup>th</sup> round, for the year 1999-2000, which is alleged to be an over es-

Table 4: Deficit of cereal production over consumption

State	Total Cereals Tri. Avg 1991-92 to 1993-94 ('000 tons)	Projected Population in 1994 ('000)	Per capita Consumption of cereals gms/day	Per capita Net Production of cereals gms/day	C\P Ratio
Andhra Pradesh	11136.53	70471.74	442.33	381.90	1.16
Assam	3399.97	24067.19	439.00	341.40	1.29
Bihar	10072.67	91407.08	477.00	266.31	1.79
Gujarat	3667.27	43514.83	355.33	203.67	1.74
Haryana	9509.67	17548.97	430.67	1309.58	0.33
Himachal Pradesh	1312.47	5442.52	445.67	582.78	0.76
Karnataka	7742.03	47370.90	438.33	394.97	1.11
Kerala	1055.87	30205.72	337.00	84.48	3.99
Madhya Pradesh	14189.90	70471.37	473.33	486.61	0.97
Maharashtra	10342.07	83882.93	379.67	297.95	1.27
Orissa	6492.37	33273.23	531.00	471.55	1.13
Punjab	20327.73	21348.04	359.3	2301.17	0.16
Rajasthan	7689.80	46994.43	495.00	395.44	1.25
Tamil Nadu	7970.03	58124.15	390.67	331.38	1.18
Uttar Pradesh	33797.53	147760.64	463.67	552.77	0.84
West Bengal	12500.43	72207.97	498.67	421.71	1.18

Source: Col. 2: Ministry of Agriculture

Col. 3: Projections are based on the growth rate of the previous decade and

Col. 5: NSSO, 50th Round 1993-94.



timation of the consumption by the lower income groups, cereal consumption at the average level has always been higher than the consumption of the lowest ten per cent of the population per consumer unit per day (Table 5).

**Table 5:** Cereal consumption of the lowest ten per cent of the rural population

State	Cereal Consumption of the lowest 10 per cent (Gm/day)	Average Cereal Consumption for all classes (Gm/day)
Andhra Pradesh	322.47	421.67
Assam	316.15	421.00
Bihar	348.62	458.33
Gujarat	291.11	339.67
Haryana	310.52	379.00
Himachal Pradesh	375.91	428.67
Karnataka	288.53	384.33
Kerala	252.85	329.67
Madhya Pradesh	340.33	431.33
Maharashtra	309.59	377.33
Orissa	397.33	503.00
Punjab	288.23	352.67
Rajasthan	400.35	473.00
Tamil Nadu	268.63	355.33
Uttar Pradesh	373.98	454.00
West Bengal	335.31	453.00
All India	347.92	424.00

Source: NSSO, 2001

Total calorie consumption of the lowest deciles in all the States is also lower than the average level in each State. In some States the gap is higher than the others. The calorie intake of the lowest deciles in Kerala and Tamil Nadu are the lowest. Maharashtra and Gujarat also show a fairly low level of calorie consumption of their lower expenditure groups. Percentage of population consuming less than 1,890 kilocalories is also high in Tamil Nadu, Kerala, Gujarat and Maharashtra as per the NSS 50<sup>th</sup> round data (Table 6). There is a significant negative rank correlation of  $-0.496$  across the States, between the per capita cereal production and the percentage of the population consuming less than 1,890 Kcal in 1993-94. The deficits in production over consumption may create hardships for some while fluctuations in production would accentuate the food insecurity of the region and the people. At least for the rural poor there still seems to be a connection between production and consumption, though the link may be weakening at the average level.

It is important at this point to make a reference to relevant arguments about Kerala and Tamil Nadu. These States have higher literacy levels and better public dis-

tribution system and other basic amenities provided by the government to the poorer sections of the people. The average levels of calorie consumption are quite good. The lowest expenditure groups in these States however report very low calorie consumption.

**Table 6:** Calorie Consumption Patterns across States

State	Average intake per consumer unit per day Kcal	Calorie intake of the lowest decile (Kcal) per cu/day	Percentage of Household Consuming less than 1890 Kcal
Andhra Pradesh	2559.00	1858.39	14.10
Assam	2406.00	1842.48	13.30
Bihar	2637.00	1790.88	14.10
Gujarat	2470.00	1788.34	20.40
Haryana	3109.00	2022.33	8.70
Himachal Pradesh	2916.00	2170.65	5.30
Karnataka	2575.00	1803.85	17.40
Kerala	2451.00	1556.33	23.70
Madhya Pradesh	2697.00	1894.03	12.20
Maharashtra	2427.00	1747.75	21.90
Orissa	2740.00	1918.96	10.40
Punjab	3007.00	2116.48	6.30
Rajasthan	3090.00	2249.85	4.20
Tamil Nadu	2347.00	1551.38	28.20
Uttar Pradesh	2899.00	2103.15	8.00
West Bengal	2733.00	2012.57	7.40
All India	2683.00	1954.03	13.40

Source: NSSO, 1997.

What the figures clearly establish is that a majority of people being better off does not preclude the most disadvantaged in a State from facing hardships. Particularly in these two States, there are problems of livelihood access. Though the wages are high in Kerala, the unemployment rates are also very high. Casual labour constitutes a large percentage of population both in Tamil Nadu and Kerala (NSSO, 2000). Satisfactory levels of consumption on an average therefore by no means ensure food security of the vulnerable sections of the population in a State.

## References

- Area and Production of Principal Crops in India, 1995-96, Ministry of Agriculture, Government of India, New Delhi.
- Bhalla G.S., Hazell, Peter and Kerr (2000), 'Prospects for India's Cereal Supply and Demand to 2020', in National Seminar on 'Food Security in India: The emerging Challenges in the context of Economic Liberalisation, March 25-27, mimeograph, Hyderabad.
- Bulletin of Food Statistics, 1999-2000, Ministry of Agriculture.

---

Indian Council for Medical Research (ICMR), (1989), Recommended Daily Allowance for India, ICMR

International Institute for Population Sciences (IIPS) and ORC Macro, (2000), 'National Family Health Survey (NFHS - 2), (1998-99): India', IIPS,

**Meenakshi J.V.** (2000), 'Food Consumption Trends in India: A Regional Analysis', in Public Support for Food Security: The Public Distribution System in India, edited by Krishnaji, N. and Krishnan, T.N., Sage Publications, New Delhi.

National Sample Survey Organisation (NSSO) 50th Round, Levels and Pattern of consumer expenditure, 1993-94. Government of India, New Delhi.

National Sample Survey Organisation (NSSO) Sarvekshna (1997), Vol XXI, No. 2, 73<sup>rd</sup> issue, Government of India, New Delhi.

National Sample Survey Organisation (NSSO), (2001) 55<sup>th</sup> Round

Report No. 458: 'Employment and Unemployment Situation in India, Part I & II', Government of India, New Delhi.

**Rao, Hanumantha C.H.** (2000), 'Declining demand for foodgrains in rural India, causes and implications', Economic and Political Weekly, January, Vol 35, No.4

**Sen, Abhijit** (2002) 'Agriculture, Employment and Poverty, Recent Trends in Rural India', in Agrarian Studies, Essays on Agrarian Relations in Less Developed Countries, edited by Ramachandran, V.K. and Swaminathan, Madhura, Tulika Books.

**Suryanarayana M.H.** (2000), 'Food Security and Calorie Adequacy across States: Implications for Reform', in Public Support for Food Security: The Public Distribution System in India, edited by Krishnaji, N. and Krishnan, T.N., Sage Publications, New Delhi. □

*The idea flow from the human spirit is absolutely unlimited.  
All you have to do is tap into that well.*

— Jack Welch

# Biotechnology & Food Security

Akram A. Khan, Farhad Shirani Bidabadi

---

*This article discusses the importance of agricultural biotechnology in relation to food security and production. India's policies towards genetically modified crops is outlined at length, along with discussions on various positions on biotechnology in other countries.*

*Akram A. Khan and Farhad Shirani Bidabadi are with Faculty of Agricultural Science, Aligarh Muslim University, Aligarh.*

India's greatest achievement in the past century has been its capability to expand its food production and thus keeping Malthusian fears at bay. Nevertheless, India still faces daunting challenge of hunger and malnutrition. At present 207.6 million people (around 21 per cent of India's population) are living in a state of food insecurity (FAO, 2000), leading life of permanent or intermittent hunger, and are chronically malnourished. The rapid growth from the green revolution is waning, public investment in agriculture has failed to pick up, and intense input use has degraded the environment. Population growth, which has become more complex because of urbanisation and industrialisation will put a limit on the availability of land and water for agriculture, and in the decades to come per capita availability of agricultural land will get reduce. Therefore, if these concerns of future food security are left unaddressed it will lead to widespread hunger and civil unrest. "There is no option but to produce more food and other agriculture commodities from less arable land and irrigation water. In other words, the need for more food has to be met through higher yields per unit of land, water, and time" (Swaminathan, 1999).

Advances in biotechnology provide India with a new window of opportunity to deal with issues related to food production and food security. Presently, agrobiotechnology cites ethical, safety and intellectual property right issues. How the potential of human imagination and creative spirit should be nurtured, guided, interpreted, and ultimately directed and controlled with respect to biotechnology deserves to be discussed, contemplated and digested at all levels of society (McCouch, 2001). The questions for India are: why should plant biotechnology be used in agriculture when traditionally bred crop varieties have provided food for the human population for thousands of years? Who will benefit from plant biotechnology? What are the risks and who will take responsibility for the problems, which are sure to emerge?

Keeping an eye on issues related to biotechnology, besides assessing some of the challenges before India's

food system, an endeavour has been made in this paper to analyse problems and opportunities related to application of biotechnology techniques in agriculture. Finally, there will be a discussion on what can be done to make the role of biotechnology more effective in India's context.

### Food and Agricultural Challenges

Several research organisations and individuals have projected demand for and supply of foodgrains in general and cereals in particular under different assumptions and scenarios (Bhalla 1999, Kumar 1998, Rosegrant et al 1995, and Bansil 1998).

Foodgrain demand has been constructed variously by accounting for the additional needs generated by one or more than one of the following elements: population growth, changing food habits (dietary patterns), seed and feed needs, buffer stock building, export/import, and wastage. Most of the projections are based on calculation of demand elasticities and assumptions about per Capita income growth rate. But, the uncertainties in the economic scenario in most of the developing countries, specially India, and irregular behaviour of demand elasticities for food over long periods of time makes it impossible to project accurate food demand for a long time period.

To overcome these shortcomings in demand projections, which are based on the definition of food security, a well-fed India scenario is developed to project the actual food needs required to achieve food and nutritional security in the year 2020. This scenario is based on the recommended food items by the ICMR (Indian Council of Medical Research) for the population in 2020 (Table 1).

Long-term projections involving extreme scenarios (high population growth and low population growth) are helpful in capturing a range of possible alternatives. Whether population is projected at 1272.167 (FAO), or at 1329.1 (standing committee on population) or 1420 million (Kumar, 1998), total foodgrains requirement to ensure a well-fed society in India vary between 245 million to 273 million tons. Consequently, the challenge is of raising production from 65 million tons to 90 million tons by the year 2000. To achieve this target while an annual production growth rate of 3.5 to 4.5 per cent is needed (Kumar 1998) the growth rate during the 1990s stalemated much behind the desired level at the rate of 1.8 per cent (Economic Survey 1999-2000).

The measures used earlier to increase production—accretion of agriculture and emphasis on irriga-

tion and chemical inputs in India have led to caustic environmental debasement with problems of soil salinity and pesticide mistreatment. Environmental problems are due to the fact that, at the time green revolution was adopted, sustainability was not the criteria. The only emphasis was on pumping in inputs so that production rose. It was a strong reductionism strategy not a total one. It was not sustainable. It did not incorporate forward and backward linkages.

**Table 1:** Food demand projection for 2020 based on the definition of food security

Food item	ICMR norm (grams/person/day)	well-fed India scenario for population of 1272.167 Million	well-fed India scenario for population of 1329.1 Million	well-fed India scenario for population of 1420 Million
Cereals as food	400	185.74	194.05	207.32
Cereals as feed	—	23.03	34.36	25.72
Pulses	41.34	19.20	20.05	21.47
Total food-grains as food and feed	—	227.97	248.66	254.51
7.5% seed & waste	—	17.10	18.65	19.10
Total foodgrains requirements	—	245.07	267.31	273.61
Milk	227.00	105.41	110.12	117.65
Meat	11.42	5.30	5.54	5.92
Eggs	7.21	3.35	3.50	3.74
Oils	16.83	7.81	8.16	8.72
Roots	55.58	25.81	27.00	22.32
Sugar	43.06	20.00	20.90	28.81
Soyabean	6.83	3.17	3.31	3.54

Source: Calculations based on ICMR (Indian Council of Medical Research) recommended food norms.

### Benefits and Risks of Gene Revolution

Biotechnology is improving the wealth, well-being and lifestyle of the privileged and creating more wealth in a few rich countries. Can this revolution also be harnessed to serve the food and nutrition needs of the world's poor? What are the opportunities, problems and risks involved with the new technologies and can they be managed?

Appropriate technology is the first step in feeding the hungry. Sixty to seventy per cent of the poor live in rural areas and depend directly or indirectly on productivity increases in agriculture. Biotechnology, if appropriately focused on solving small farmers' problems,

together with traditional research methods, better agronomic practices, and better markets and policies, may help these farmers to increase productivity. Biotechnology may help farmers to reduce production risks by making available crop varieties that are drought tolerant, pest resistant, and able to capture nitrogen from the air. Biotechnology can be used to increase the content of iron or vitamin A or to make other nutritional improvements in foods which may address serious and widespread nutritional problems among the poor in developing countries. Increased productivity will, in most developing countries, result in both higher incomes for small farmers and lower food prices. This is important for the poor, who typically spend 50 per cent or more of their income on food (Andersen et al, 1999). The social benefits of developing and applying appropriate biotechnology for small farmers include reduced risks from biotic and abiotic factors, increased yields, food that is more nutritious and easier to store, development of edible vaccines in staple foods, and protection of the environment through reduced use of fertilisers and pesticides and reduced pressure on land currently not under cultivation.

**Biotechnology may help farmers to reduce production risks.**

India is facing the problem of yield barrier. Yield can be raised substantially with the help of agricultural biotechnology. For example, Cornell University researchers have added genes from two wild rice relatives to the best Chinese rice hybrids and are getting 20 per cent to 40 per cent higher yields (Wilson, 1999). Agricultural biotechnology, which is scale neutral, can help Indian farmers to produce more from their diminishing resources by using, for instance, new crop varieties that are drought tolerant, resistant to insect and weeds and capture nitrogen from the air and are able to grow in stress conditions such as salinity and alkalinity and reduce their dependence on chemical inputs. GM crops can also make the farmers produce more nutritious food by increasing Vitamin A, iron and other nutrients in the edible portion of the plant (Andersen, 1999). In this way biotechnology can help to provide biodiversity through an increase in the productivity of the current agricultural land, which in turn can serve to protect wild lands that will be metamorphosed to farmland if the system were less productive (Swaminathan, 2000 and Trewaves, 2001).

In India, salt build up is resulting in seven million hectares of prime agricultural land losing productivity. Along with crops engineered to thrive in saline environ-

ments that are currently unusable for agriculture, transgenic plants tolerant to acidic soil, and those resistant to drought, will contribute to future food security and prevent further deforestation by preventing the loss of arable land through salinity and acidity.

**In India, salt build up is resulting in seven million hectares of prime agricultural land losing productivity.**

To cite an instance, cotton occupies only 5 per cent of India's land but cotton farmers roughly buy 50 per cent of pesticides used in India alone at a cost of Rs 16 billion annually, which has immeasurable impacts on environment and human health. Use of Genetically Modified crops is also important from the point of view of income generation. The increase in cotton yield as a result of use of Genetically Modified cotton seeds alone is expected to increase income of cotton farmers in India by \$ 5 billion or Rs 20,000 Crores (Business Standard, 2001).

Genetically improved products are subject to radical testing, while conventional varieties have never been subject to any such regulations for food safety and environmental impact. Thousands of field tests conducted so far on various genetically improved crops with more than one hundred new traits, or their commercial planting on 44 million hectares world wide, have failed to provide any serious evidence of food safety or environmental concern. Gene altered corn and soyabean products, including baby food, have now found their way into nearly 4,000 food products in American supermarkets. Yet not a single issue of food safety has been reported. It should be pointed out that American standards of food safety are the highest in the world. The regulatory agency, the Food and Drugs Administration, has one of the world's strictest standards, and thus enjoys considerable public trust.

Advances in agricultural biotechnology have created opportunities for efficient crop improvement. However, this process necessitates caution to prevent unforeseen problems associated with the adoption of new crop varieties. Biosafety issues need to be dealt with carefully. Comprehensive testing followed by open discussion among the different stakeholders would help create public confidence.

People in developed countries fundamentally distrust genetically modified foods. Without taking into consideration the benefits genetically modified foods may offer to poor people in developing countries. Thus,

the violent objections by some cannot be used as a basis for objection to this technology in India.

### Indian Share in Transgenic Crops

The first transgenic crop was approved for commercial release less than 10 years ago. The Flavr-Savr tomato, genetically engineered to delay softening so the tomato could ripen on the vine and retain its fresh pickled flavour, was introduced in the United States in 1994. It was a scientific success, but a colossal business failure (Marra, et al. 2002).

In those countries where planting approval has been granted and seed is available in sufficient quantities, farmers are generally adopting the new technologies fairly rapidly. US farmers have been the keenest adopters of transgenic crops, both in terms of absolute acreage planted and the share of the total harvested area of those crops for which at least one transgenic approval exists.

Seven years since the introduction of the first GM crop in the US, farmers in several countries where transgenic crops have been approved for planting, are devoting significant portion of acreage to them.

**Table 2:** Number and type of approval of GM crops in different countries

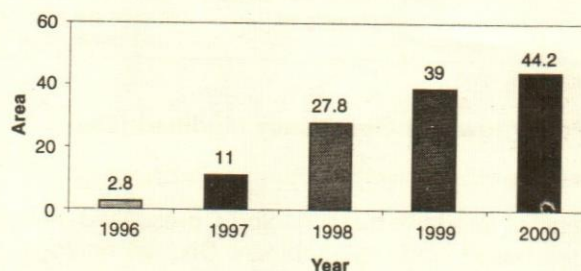
Country	Unconfined Planting	Feed Use	Food Use
United States	20	16	20
Canada	13	14	16
Australia	4	1	7
Japan	11	11	13
EU	4	3	3
Argentina	6	5	5
South Africa	2	2	2
Netherlands	0	2	2
Denmark	0	0	1
United Kingdom	0	1	1
Switzerland	0	3	3
China	1	1	1
Mexico	3	3	3
Brazil	1	1	1
Korea	0	0	1
Russia	0	0	1
Uruguay	1	1	1
Total	66	64	81

Source: Adapted from AGBIOS Inc. (2001)

By early 2001, more than 187 crop events involving nine basic phenotypic (Physical) characteristics were deregulated or approved for planting, feed or food use in at least one of 13 individual countries plus countries of European Union (Table 2).

The majority of approved events have been for food uses and over a fifth involved approval for food or livestock feed uses without planting approval, implying that livestock and feed producers in the relevant country must import the feed. Most of the approvals have been issued in Canada and the United States, with very few issued so far in developing countries.

In 1998, the global market for biotechnology products totaled at least US\$ 13 billion. About 80 products, most of them medically related, are in the market or nearly ready for it. In recent years, the fruits of two decades of intensive and expensive research and development in agricultural biotechnology have begun to pay off, approximately 44.2 million hectares of land were planted with GM crops in 2000 (Fig. 1).



**Fig. 1.** World Area under Transgenic Crops (million hectares)

Source: 1996-98 from (Serageldin 1999) and 1999-2000 (Mitchell, 2001)

The Mexican government received some technology free of charge from Monsanto (a multinational research company which had a US\$ 1.3 billion budget only for R&D programmes in agricultural biotechnology in 1998). Through Michigan State University, the Rockefeller foundation, and USAID, several US companies are working with the governments of Indonesia, Kenya, & Egypt to develop new crop varieties. How widespread these partnerships are and how many of them will focus on varieties relevant to developing nations will affect the utility of the biotechnology revolution for developing countries.

The current global BT opportunity is estimated at US\$ 30 billion and is expected to touch US\$ 150 billion by 2010. However, India's share is less than one per cent (US\$ 90 million). At present, some 2500 firms are engaged in BT activities worldwide, half of them in the US and the rest in Europe, Canada and Japan. The US accounts for three-fourths of the global market size, spending over US\$ 13 billion a year on R&D.

**Table 3:** Policy options toward GM crops

	Promotional	Permissive	Precautionary	Preventive
Intellectual property rights	Full patent protection, plus plant breeders rights under UPOV 1991	PBRs under UPOV 1991	PBRs under UPOV 1978, which preserves farmers privilege	No IPRs for plants or animals, or IPR on paper that is not enforced
Bio-safety	No careful screening, only token screening or approval based on approval in other countries	Case by Case screening for demonstrated risk, depending on intended use of product	Case by case screening also for scientific uncertainties owing to novelty of GM process	No careful case by case screening, risk assumed because of GM process
Trade	GM crops promoted for lower commodity production costs and to boost exports; no restriction on imports of GM seed or plant materials	GM crops neither promoted nor prevented; imports of GM commodities limited in same way as non GM in accordance with science based WTO standards	Imports of GM seeds and materials screened to retrained separately and more tightly than non-GM; labeling requirements imposed on imports, GM foods or commodities	GM seeds plant imports blocked; GM free status maintained in hopes of capturing export market premiums
Food safety and consumer choice	No regulatory distinction drawn between GM and non-GM foods when testing or labeling for food safety	Distinction made between GM and non GM foods on some existing food labels but not so as to require segregation of market channels	Comprehensive positive labeling of all GM foods required and enforced segregated market channels	GM food sales banned, or warning labels that stigmatise GM foods as unsafe to consumers required
Public research investment	Treasury resources spent on both development and local adaptations of GM crop technologies	Treasury resources spent on local adaptations of GM crop technologies but not on development of new transgenes	No significant treasury resources spent on GM crop research or adaptation; donors allowed to finance local adaptations of GM crops	Neither treasury nor donor funds spent on any adoption or development of GM crop technology

Source: Paarlberg, 2001.

### Indian Policy towards Genetically Modified (GM) Crops

Advent of modern biotechnology presenting new techniques based upon recombinant DNA technology, monoclonal antibodies and novel methods of cell and tissue culture has opened up new vistas. The tools are so powerful that they can modify a single gene on a chromosome. This could be capitalised through the development of transgenic crops with special reference to biotic and abiotic pressures, which are seemingly becoming insurmountable due to intensification of agriculture, prohibitive cost of amelioration and non-availability of ameliorants (NAAS, 1998). Biotechnology could be used in introducing environmental friendly diseases and pest resistance. It could help develop hardier plants with resistance or tolerance to drought, salt and herbicides. Plant character could be genetically altered to adjust maturation speed, increase transportability, reduce post-harvest losses as well as water content, stem size etc. All these aspects are of great relevance to poor farmers in low potential environments.

**The tools are so powerful that they can modify a single gene on a chromosome.**

Political leaders as well as scientists and technocrats in India have noticed the problems in the way of further growth in agricultural productivity and now routinely endorse the contribution that biotechnology, including transgenic crops, might make to sustainable increase of agricultural productivity and poverty reduction. Yet most of India's actual policies toward GM crops are far from promotional. The role of the government in diffusion of GM crops fall into five distinct areas including Intellectual Property Rights, Trade, Food Safety, Bio-safety and Public Research Investment.

**Table 4:** Policies toward GM crops in Brazil, China, India and Kenya, 1999-2000.

	Promotional	Permissive	Precautionary	Preventive
Intellectual property rights		Brazil	Kenya China	India
Bio-safety		China	Kenya Brazil India	
Trade		China	Kenya Brazil	India
Food safety and consumer choice	Kenya China	Brazil India		
Public research investment	Brazil India China		Kenya	

Source: Paarlberg, 2001.

**Table 5: Policies toward GM crops in India**

	Promotional	Permissive	Precautionary	Preventive
Intellectual property rights	-	-	-	Until India enacts its draft plant variety protection law and joins UPOV, IPRs not protected
Bio-safety	-	-	RCGM and GEAC have moved slowly on bio-safety approvals, fearing criticism from anti-GM NGOs.	-
Trade	-	-	-	GEAC has not formally approved GM commodity imports; efforts have been made to seek premiums for GM free products in export markets
Food safety and consumer choice	-	RCGM and GEAC require some testing of GM and non-GM foods; no separate Gm food labeling is required since GM foods are not officially on the market	-	-
Public research investment	Modest treasury funds are spent on independent GM crop development		-	-

Source: Paarlberg, 2000.

Paarlberg (2001) have steered a system (Table 3) to tabulate the actual policy choice toward GM crops.

He applied the system to the policy framework of China, India, Brazil and Kenya (Table 4).

In case of India he found that most of the actual policies toward GM crops are far from promotional (Table 5).

### Intellectual Property Rights

India has traditionally relied on its own public sector scientists and government extension agents rather than domestic or international private companies to develop and extend productive new agricultural technologies. While taking this approach India felt little need to offer IPR guarantees to private companies or plant breeders in the area of crop development (Paarlberg, 2000). By 1991, however, India's agricultural research establishment concluded it was necessary and prudent to move the nation's IPR policies closer to international standards (Selvarajan, Joshi, and O'Toole 1999). Accordingly, a draft Plant Variety Protection Act (PVPA) was submitted to parliament in 1993. This decision to move toward a minimal plant variety protection law resulted in an emotional debate in the Indian Parliament. While the first draft of PVPA was criticised by the private

seed companies as too weak, the NGOs claiming to represent farmers groups warned it was too strong and would allow professional plant breeders and private companies to appropriate some of the crop improvements that traditional farmers had been making for thousands of years. Consequently a revised draft was produced in 1996/97 to address this farmer's right issue. The Indian Cabinet then approved the revised draft in October 1997, but under intense NGOs' criticism Parliament continued to stall. A revised December 1999 version of the PVPA is currently working its way slowly through parliament (Government of India 1999). Pending final passage to PVPA, India's IPR policies toward GM crops must be classified as preventive. Partly because of these weak IPR policies, international life science companies interested in the Indian market for GM products have so far been willing to bring only hybrid GM varieties into the country. IPR protection is less critical of these hybrids because the valuable traits of the seed are mostly lost after the first planting (Paarlberg, 2000).

### Bio-safety

In the area of bio-safety, however, GM crops themselves were always the issue. The Indian government began issuing bio-safety guidelines for handling GM organisms in December 1989 (DBT 1990, 1998). These



guidelines were borrowed partly from the United States, and at the research stage they required screening of GM crop technologies only for risks that could be scientifically demonstrated (Ghosh, 1997, 1999; Ghosh and Ramanaiah, 2000). The guideline created two separate committees with policy authority: a Review Committee on Genetic Manipulation (RCGM) empowered to approve (or not approve) applications for all small-scale research activities on GM crops in India, and a Genetic Engineering Approval Committee (GEAC) empowered to approve (or not) large-scale research activities as well as actual industrial use or environmental release. The RCGM is established within the Department of Biotechnology (DBT) and naturally has a pro-research bias. The GEAC is chaired by the Ministry of Environment and Forests (MOEF) opening the way for a more precautionary approach to bio-safety questions.

So far the bio-safety approval system has been more cautious than permissive, as illustrated by the case of BT cotton. India's cotton farmers are plagued by bollworms that have become resistant to chemical sprays. Insecticidal BT cotton presents an alternative method to control bollworms, yet efforts by Monsanto/Mahyco since 1997 to gain bio-safety approval for BT cotton from RCGM and GEAC have repeatedly been slowed by NGO protests. By filing lawsuits against RCGM for authorising BT cotton field trials in 1998, and by sponsoring physical attacks against those field trials, anti-GM activist groups in India have transformed the bio-safety approval process into a highly politicised and, at times, paralysed policy struggle. India finally did approve large-scale field trials for BT cotton in July 2000, a move that pleased Monsanto/Mahyco but antagonised GM crops critics, who filed a new petition against the trials. The GEAC decision stopped short of approving BT cotton for commercial release, so on bio-safety it is still not legal for farmers in India to grow any GM crops.

**The bio-safety approval system has been more cautious than permissive.**

### Trade

To accompany its policy of not yet growing any GM crops commercially at home, India has also attempted so far to block most imports of GM commodities. In export markets, India is now using its nominal GM free status to seek price premiums. India is an exporter of soyabean meal and recently promoted its Soya, Sunflower, and Rapeseed meal exports as GM free when selling to markets in Indonesia,

Japan, Thailand, the Persian Gulf countries, and the Middle East (APBN, 2000). However, since most of these sales are for animal feed purposes rather than direct human consumption, price premiums have been difficult to secure. Nevertheless, India meal exporters have begun hoping that Asian countries, such as Thailand, which export chickens to the GM conscious European market, will soon see the advantage of buying feed from a GM free supplier such as India rather than from the United States.

### Food safety and consumer choice

Because India does not yet officially grow or import any GM foods, it has been able to get along with food safety policies that draw little or no distinction between GM and non-GM food ingredients. In 1998, however, India revised its GM crop bio-safety approval guidelines to require that GM seeds, plants and plant parts be screened for toxicity and allergenicity (DBT 1998). This new RCGM procedure, singling out GM, gives India a permissive rather than a fully promotional safety policy toward GM foods.

**India does not yet officially grow or import any GM foods.**

### Public research

The Government of India, through its Department of Biotechnology (DBT), has for more than a decade directed a small but steady stream of treasury resources toward the development as well as local adaptation of GM crop varieties. Between 1989 and 1997, DBT spent a total of nearly 270 million rupees from the treasury (roughly US\$ 6 million) on plant and molecular biology research which focused primarily on development of transgenic plants (Ghosh, 1999). In 1998-99, the total DBT research budget across areas (agriculture and non-agriculture) was 1040 million rupees (roughly US\$ 26 million). About 15 per cent of this, roughly 153 million rupees (or US\$ 3.8 million), went for plant biotechnology. DBT investments in transgenic plant biotechnology in 1998-99 totaled roughly 51 million rupees, or about US\$ 1.3 million. The resources that DBT receives from the planning commission and ministry of finance are quite modest, despite the fact that senior political leaders frequently list biotechnology as among the keys to India's future growth and prosperity. Because these investments have gone for development as well as local adoption, India's public research investment policies toward GM crops deserves to be classified here as promotional.

## Developing Biotechnology Policies

India is facing real challenges with a multitude of problems like poverty, hunger, economic inequality, ethnic strife, urban congestion, food and water shortages, institutionalisation of corruption, exploding population, and serious concerns about its water and food quality (Parkash, 1999). Governments deciding whether or not to invest in agricultural biotechnology need to determine where the most demanding needs and priorities lie and if biotechnology can meet those needs and fit those priorities. The key step is to ascertain the identity of the considerations in agriculture that customary methods has not been able to conquer and novel scientific findings that offer new ways out of the constraints. These priorities ultimately need to be set by aggregating the perspectives of economists, policymakers, scientists and the end users. Policies must amplify and escort research and technology development to resolve the problems of specific importance to the poor. These problems include diets with imperfect levels of energy, protein, and micronutrients, and yield losses due to biotic and abiotic factors. Research should focus on the crops of particular importance to small tillers of the soil and livestock breeders and poor consumers in India.

To forward biotechnological based methods into India's agricultural sector, research, bio-safety, and food safety, intellectual property rights, research funding, and delivery of products, need to be prioritised.

There are three ways to expand biotechnological research for the benefits of the poor. First, designate additional public resources to agriculture research, including biotechnology research that pledges large social gains. Second, expand private sector research for the poor by converting some of the social benefits of research to private benefits for the private sector. The public sector can allure the private sector to develop technologies for the poor by offering to buy the exclusive rights to freshly developed technology and make it available either for free or for a nominal charge to small farmers. The sum of the offer could be settled on the basis of expected social benefits. The third way to expand biotechnology research to assist the poor is to harbour intellectual property rights of the private research bureau that develops a particular technology. For example, seeds with infertile offspring, or that contract directly with the farmer, in both cases driving the farmer to buy new seeds every season. This would make it easier for the private sector to recuperate the returns needed to justify the research.

Effective national bio-safety and food safety regulations should be in place before biotechnology is broached into the agriculture system of India. Such regulation

should be specific to India's situation and resonate pertinent risk factors. The ecological risks policymakers need to assess include the spread of traits such as herbicide resistance from genetically modified plants to plants (including weeds) that are not modified, and build up resistance in insect population.

**Effective national bio-safety and food safety regulations should be in place before biotechnology is broached into the agriculture system of India.**

The four major elements of effective bio-safety systems are:

- Written guidelines that clearly define the structure of the system, the roles and responsibilities of those involved and the review process;
- The regulatory authorities themselves, who should comprise an in-country cadre of well trained individuals, confident about their decision making ability, and about support of their institutions;
- An information system that enables the bio-safety evaluation process to be based on up to date and relevant scientific information and the concerns of the community;
- Feed back mechanisms for incorporating new information and revising the regulatory systems as needed.

Research in agricultural biotechnology has to be conducted over a long period and without interruption. Uncertain financing therefore can severely interrupt the research process. Reasons reported for funding constraints include:

- Implementation of fiscal austerity policies;
- Lack of understanding of biotechnology among decision makers;
- Insufficient research impact;
- Dependency on fund from sole source, particularly government or donors, and
- Lack of political and financial support from agribusiness and from farmers and their organisations.

Public sector funding can be attracted by documenting and publicising research impacts,

developing strong and fluent client organisations that have political influence, building closer relations between biotechnology leaders and policy makers, and swelling the funding base to include environment and commerce departments. Strategic alliances between public and private sector entities can also expand the financial resources for agricultural biotechnology.

Decisions about the generation of products and their deliverance to users must be considered at an early stage of R&D programmes involving biotechnology, because product dissemination is affected by factors such as the costs of large-scale production, bio-safety and risk assessment, and public acceptance of the final product. Collaboration or joint ventures between the private sector and public institutes or universities is fundamental for successful product delivery. In some cases, specialised national or international organisations have facilitated technology transfers from public to the private sector leading to the diffusion of new products.

**Collaboration or joint ventures between the private sector and public institutes or universities is fundamental for successful product delivery**

One of the greatest achievements of India since the mid sixties has been the phenomenal increase of research based agricultural productivity that has fed millions and served as the basis of economic transformation in India. However, poverty continues to limit access to food leaving more than 200 million people undernourished. In addition, increased population, income growth, and urbanisation will spin sustained growth in food demand. Tackling these problems is closely related to agricultural growth; unluckily the underlying sources of agricultural growth during the past century have largely run their course. Thus, new sources of sustainable production growth must be found.

The 20th century was marked by marvellous progress in crop productivity inspired by Mendelian breeding. The 21st century will witness even more spectacular progress from a bright integration of Mendelian and molecular breeding. Modern biotechnology can intensify agricultural productivity in such a way that it further reduces poverty, improves food and nutrition security, and promotes sustainable use of natural resources.

In the year 2000 roughly 44.2 million hectares of land were planted with GM crops. Share of developing countries was approximately 24 per cent of the 44.2

million hectares. China has modified 141 crops genetically, approved 45 for field trials and released 31 for commercial cultivation compared to our development of only 16 GM plants, approvals of 10 for field trials and no commercial releases. Farmers here, too, appreciate the potential and importance of biotechnology. They no longer feel like waiting, as in evident in Gujarat and other states in the BT cotton case.

## Conclusion

Indian policies towards most issues related to biotechnology are far from being promotional. While it is promotional towards public research, it can be classified as preventive in case of Intellectual Property Rights and trade, precautionary towards bio-safety and permissive in case of food safety and consumer choice. In other words there are restrictions on the growth of biotechnology in India. The existing regulatory mechanism and lack of incentives on the application of biotechnology in agriculture and environment pollution control hamper the growth of biotechnology. For example, BT cotton has been accepted as a genetically modified crop in most parts of the world. We are all aware of the very poor yields of cotton here. The controversy surrounding BT cotton in Gujarat stems from the fact that we have been so slow in approving BT cotton. China has almost entirely changed to BT cotton. When we have enough information about the safety of BT cotton, there is no need to have such lengthy trials.

The violent objections to agricultural biotechnology in Europe can, therefore, not be used as a basis for objection to this technology in India. It is important to note that European countries are not only self sufficient in food but have a surplus and can, therefore, spend time on deliberation.

The first generation transgenic based on simple changes that add a single gene are successful and promise entirely new products—those with an improved protein or iron content, a high value addition.

Advances in agricultural biotechnology have created opportunities for efficient crop improvement. However, biosafety issues need to be dealt with carefully. Comprehensive testing followed by open discussion could help create public confidence. We would be better served if these problems are tackled using technology available to us, rather than let them be side-tracked because of fears of new technology.

## References

Andersen Per Pinstrup and Cohen Mark (1999), "Modern Biotechnology for food and agriculture: Risks and opportunities", in

- IFPRI Focus 2, International Food Policy Research Institute, Washington D.C.
- Anderson Per Pinstrup, Rajul Pandya-Lorch, and Mark W. Rosegrant** (1999), "World Food Prospects: Critical Issues for early 21st century", 2020 Vision Food Policy Report, International Food Policy Research Institute, Washington D.C.
- Andersen Per Pinstrup** October 27 (1999), "Biotech and the poor", Washington Post, Washington D.C.
- AGBIOS Inc. (Agricultural Biotechnology Strategies [Canada] Inc.) (2001), "Global status of approved genetically modified plants", <http://www.agbios.com>.
- APBN (Asia-Pacific biotech news) (2000), 4(8): 168.
- Bansil P.C.** (1998), "Demand for food grains by 2020: A monograph", Observer Research Agency, New Delhi.
- Bhalla G.S., Hazell, Peter, Kerr John** (1999), "Prospects for India's cereal supply and demand", Food, agriculture, and environment discussion paper 29, International Food Policy Research Institute, Washington D.C.
- Business Standard, Dec 25 (2001), "Nath Seeds, China Firm in Transgenic Cotton Pact", New Delhi.
- DBT (Department of Biotechnology), Ministry of Science and Technology, Government of India (1998), "Revised guidelines for research in transgenic plants and guidelines for toxicity and allergenicity evaluation of transgenic seeds, plants, and plant parts, New Delhi.
- DBT (Department of Biotechnology), Ministry of Science and Technology, Government of India, "Recombinant DNA safety guidelines, New Delhi.
- Economic Survey (1999-2000), Government of India.
- FAO (2000), "State of food insecurity in the world", Food and Agricultural Organisation of the United Nations, Rome.
- Ghosh P.K.** (1997), "Transgenic Plants and Biosafety Concerns in India", Current Science 72 (February).
- Ghosh P.K.** (1999), "Biosafety Guidelines: International Comparisons", in proceeding of the-workshop on genetically modified plants: benefits and risks, 24 June, TERI, New Delhi.
- Ghosh P.K. and T.V. Ramanaiah** (2000), "Indian rules, regulations and procedures for handling transgenic plants", Journal of Scientific and Industrial Research 59 (February).
- Government of India (2000), "Economic Survey 1999-2000", Finance Ministry, New Delhi.
- Kumar P.** (1998), "Food Demand and Supply projections for India", Agricultural Economics Policy Paper 98-01, Indian Agricultural Research Institute, IARI, New Delhi.
- Kumar P., Rosegrant M. and Hazell P.** (1995), "Cereal Prospects in India to 2020: Implications for Policy", International food Policy Research Institute, Washington DC.
- Marra Michel C., Pardey Philip G. and Julian M. Alston** (2002), "The pay offs to agricultural biotechnology: an assessment of the evidence", Environment and Production Technology Division Discussion Paper No. 87. International Food Policy Research Institute, Washington DC.
- McCouch Susan R.** (2001), "Is biotechnology an answer?" in Who will be fed in 21st century? Challenges for science and policy", Edited by Web K., Ballenger N., and Per Pinstrup Andersen, International Food Policy Research Institute, Economic Research Service of the US Department of Agriculture and American Agricultural Economics Association.
- Mitchell Lorraine** (2001), "Issues in Food Security: Biotechnology and Food Security", USDA, Economic Research Service, NAAS (1998).
- NAAS (2000), "Agricultural Scientists Perception on Indian Agriculture: Scene, Scenario and Vision", National Academy of Agricultural Science, New Delhi.
- Paarlberg Robert L.** (2000), "Governing GM Crop Revolution; Policy Choices for Developing Countries", Food, Agriculture, and the Environment Discussion Paper 33. International Food Policy Research Institute, Washington D.C.
- Paarlberg Robert L.** (2001), "Governing the GM crop revolution: Policy choices for developing countries," in the unfinished agenda, perspectives on overcoming hunger, poverty and environmental degradation, edited by Andersen Per Pinstrup and Pandya-lorch Rajul, International Food Policy Research Institute, Washington, D.C.
- Parkash C.S.** (1999), "Biotechnology and Agricultural Research", The Hindu, June 10, 1999, Chennai.
- Rosegrant M.R., Agcaoili M., and Perez N.** (1995), "Global food projections to 2020: Implications for investment", Food, Agriculture and Environment Discussion Paper 5, International Food Policy Institute, Washington D.C.
- Selvarjan S., D.C. Joshi and J.C. O'Toole** (1999), "The Indian private sector seed industry", Island publishing house for the Manila Rockefeller foundation.
- Serageldin Ismail** (1999), "Biotechnology and Food security in the 21st Century", Food and Agriculture News, <http://www.iatp.org>.
- Swaminathan M.S.** (2000), "Science in response to basic human needs", Science 28795452: 452.
- Swaminathan M.S.** (1999), "Genetic engineering and food security: Ecological and livelihood Issues", in Focus 2, International food Policy Research Institute, Washington D.C.
- Trewaves, A.J.** (2001), "The population/biodiversity paradox: Agricultural efficiency to save wilderness", Plant Physiology 125910: 174-179.
- Wilson T. Michel A.** (1999), "Wall Street Journal Europe", Aug. 18.

# Outbound Logistic Planning of a Process Industry

Suman Das, Kampan Mukherjee & B.S. Sahay

---

*Outbound logistics relate to the managerial activities focusing on the movement of finished goods from the manufacturer to the end consumer, using distribution networks. A case study has been developed on the fertiliser industry where urea is the main product. In a decontrolled situation wherein all subsidies are likely to be removed, the distribution planning for cost reduction of a fertiliser company makes it an interesting study. This assumes prominence due to the likely entry of foreign companies making the competition more stiff and also due to the fact that scope for reducing the cost of production is limited. In this paper, a mathematical model has been proposed taking into consideration the key cost elements of outbound logistics of this process industry viz. transportation cost, storage cost and handling cost.*

*Suman Das and Kampan Mukherjee are Professor and Head in the Department of Management Studies, Indian School of Mines, Dhanbad 826 004. B.S. Sahay is Professor in Management Development Institute, Gurgaon 122 001.*

Logistics was earlier used only for military purposes. However, it is gradually being looked upon as a tool for solving other complex real life problems, outbound logistics in a supply chain relates to the flow of materials and information in the downstream end, i.e. involving the manufacturer, distributor, retailer and end consumer.

The problem taken up in this study is quite relevant in the present economic scenario. The fertiliser industry in India is likely to go through a radical change in the current management and business environment. The Government of India under the Fertiliser Control Order controlled its production, distribution, pricing and quality. Subsidies to urea producers in India are set to surpass Rs 100 billion. In 1992, phosphatic and pottasic fertilisers were decontrolled and now urea is also likely to be decontrolled wherein all subsidies would be removed. In such a situation, all the manufacturers would have the liberty to choose their market territories and fix their prices.

Further, competition will also get intensified with the entry of foreign companies. Anticipating such a situation, the domestic manufacturers are now trying to identify and reinforce their markets. In case governmental subsidy is removed, they will have to resort to reduction of their distribution costs, i.e. the costs relating to outbound logistics of this supply chain, particularly, those of transportation, storage and handling, as these are the key components of the total distribution cost.

## Present Status of Fertiliser Industry

Agriculture is the prime mover of the Indian economy as it provides not only foodgrains to the ever increasing population, but is also a major source of employment and income.

Fertiliser is a vital agricultural input. Its production,

distribution, price and quality are regulated by the Fertilizer Control Order. Since the cost of production varies according to the availability of feedstock and capital employed, it is subsidised by the Government of India so that it is available to the farmers at a uniform controlled price throughout the country. There are about 78 production units in India and the volume distributed is 26.6 million tons per annum. Urea is the main fertiliser constituting approximately 60 per cent of the fertiliser material and is still under control and heavily subsidised, although the other two fertiliser nutrients viz. phosphatic and potassic fertiliser have been decontrolled since 1992. Across the country, the Government of India regulates distribution of urea through a supply plan drawn up on a six monthly basis by way of meetings and discussions held with fertiliser manufacturers. The cost of production, if in excess of sale price, is subsidised by the Government of India under the Retention Price Scheme (RPS) and the transportation cost, including the primary and secondary freight, is fully reimbursed. As such there is no special effort by any manufacturer to gain maximum market share.

**Urea is the main fertiliser and is still under control and heavily subsidised.**

The production of fertiliser is a continuous process whereas its requirement is seasonal and also area and crop specific. Fertiliser consumption varies widely between the two crop seasons of the country i.e. Kharif and Rabi. Roughly 60 per cent of the fertiliser offtake in a year is accounted for by the Rabi season and the rest 40 per cent, by the Kharif season. Five to six months in a year are off-season and it is necessary to store the product during this period.

Moreover, during the peak season, it is not practicable to despatch the fertiliser directly from the factory to the customer and more than 80 per cent of the production is distributed through godowns. In the fertiliser units having silos (storage space within the factory), the manufacturers tend not to store in silos but transport them to the godown. The retailer in turn maintains a feeder godown to ensure supply of fertilisers to the farmers at the right time and in right quantities. There are normally two types of godowns:

**Buffer Godown**—Whenever it is difficult to move stocks directly from factory to demand points, manufacturers move the stock first to a few selected convenient locations and then make further onward movements from these centres. These centres are known as buffer godowns.

**Feeder Godown**—Storage of fertiliser at points nearer to the area of consumption helps in responding quickly to customer demand and also reduces onward transportation. These storage points are termed as feeder godowns.

**Storage of fertiliser at points nearer to the area of consumption helps.**

### Issues relating to Decontrol of Price

Following the decontrol of phosphatic and potassic fertilisers in 1992, the Government of India received a recommendation from a high powered committee which made some of the following observations:

..... most of the inefficiencies of the present Retention Price Scheme arise from the fact that the system is non-competitive.

..... at present RPS allows unrestricted entry of high cost producers, which is its fundamental flaw. Further, the RPS does not allow older units to generate surpluses and modernise themselves and sick units to accumulate funds for restructuring themselves to regain health. The committee recommends discontinuation of unitwise RPS for urea units.

..... the removal of the system of equated freight would yield benefits in terms of more rational location of plants and savings in subsidy due to reduction in heads. Units will be encouraged to develop adjacent areas. The committee recommends that units should concentrate on developing adjacent compact areas to increase fertiliser use through a comprehensive package of services.

It is apprehended that under total decontrol of price and distribution, the manufacturers and importers will be focusing their attention to reduce the cost of distribution (comprising of transportation, storage and handling), which constitutes approximately 70 per cent of post-manufacturing cost. Since there will be no regulation on distribution, intense inter-unit competition is expected in areas with surplus in production. Domestic players will also face competition with the entry of international players particularly because international price of urea is approximately 60 per cent cheaper.

In an economic environment leaving little scope for volume growth and with strong competitive pressures on operating costs, resource allocation issues thus become a priority consideration.

## Market Segmentation

In view of limited scope for reduction in the cost of production in a competitive market, every manufacturer will try to minimise the transportation cost, which accounts for approximately 55 per cent of the total post-manufacturing or marketing cost. Market segmentation seems to be an appropriate strategy in managing the distribution in a more cost effective way. The market segmentation, often applicable for distribution of fertilisers, leads to the creation of the following market zones.

- Command Market
- Primary Market
- Secondary Market

The Command Market is one that is situated close to the plant. In this area, the customers are loyal to that particular manufacturer and the manufacturer is well aware of their consumption pattern, hence the demand is quite stable. This area is served directly from the plant by road and hence it is also referred to as the Economic Freight Zone where the cost of transportation, storage and handling are minimal. The domain of the Primary Market is larger and most often the distribution is carried out by a rail-road mix medium, wherein the primary distance is covered by rail and the secondary distance (e.g. from railhead to warehouse) is covered by road. The Secondary Market is the one that is to be served when demand in the command and primary market reduces (i.e. during the off-season). This market area is located relatively further from the plant and the market is expected to be tapped only during the off-season of the command and primary market. As the production process is continuous, the higher distribution cost in this secondary market (due to longer distance) is expected to offset the inventory holding cost at the plant that would otherwise have come into the picture during the off-season.

**The Command Market is one that is situated close to the plant.**

The basic transportation characteristics of fertiliser are as follows:

- Production of fertiliser is continuous.
- Consumption of fertiliser is seasonal.
- Its demand at the end-user's (farmer's) level is in small quantities.

- End-users can not hold heavy inventories and tend to buy within short notice. Hence warehousing at godowns become necessary.
- Production centres are in clusters.
- Demand area is distributed throughout the length and breadth of the country.
- Demand of fertilisers is guided by the extent of rainfall, credit availability etc. It is also subject to uncertainties like natural calamities.
- Being hygroscopic in nature, fertiliser readily absorbs moisture and deteriorates due to the formation of lumps. Thus the period of its warehousing is also limited.

**Being hygroscopic in nature, fertiliser readily absorbs moisture and deteriorates.**

## Supply Chain Management Viewpoints

The term supply chain was initially restricted only to the 'relational' activities between a buyer and seller. Such an approach focuses on the first tier purchasing operations of a firm and the relationships with suppliers that might be characterised by such arrangements as buyer/seller alliances and partnerships. A second view takes a broader outlook by including all upstream suppliers to a firm as part of the supply chain. The third view takes a value chain approach, in which all activities required to bring a product to the marketplace are considered as parts of the supply chain. This view adds manufacturing and distribution functions as part of the flow of goods and services in the chain. Sahay noted that in order to thrive in the 21st century, companies must collaborate with customers and channel partners, continually monitor demand and supply and measure the results leading to overall benefit of the channel as well as the gain of each player. Thus, the key in demand management is the continuous flow of demand information from customer and end user through distributor and manufacturer to supplier.

Unfortunately, not many study reports are available on the distribution system of the Indian fertiliser industry. Mahapatra did a commendable work in which he stressed the need for reducing the post-manufacturing cost thus effecting a change in the fertiliser distribution strategy. He also felt that cost optimisation and efficient management are the need of the hour. Tandon supported the fact that cost effectiveness would play a dominant role in fertiliser marketing. He has identified

the major components of marketing costs as transportation, storage and handing cost. Any structured approach of developing a mathematical model on the above problem, however, is yet to be reported.

**Cost effectiveness would play a dominant role in fertiliser marketing.**

**Proposed Logistics Model**

The Council of Logistics Management (CLM) has defined logistics as the process of planning, implementing and controlling the cost-effective flow and storage of raw materials, in-process inventory, finished goods and related information from the point of origin to the point of consumption for the purpose of conforming to customer requirement. The management of the movement of finished goods through the distribution network to markets for consumer use is the main focus of out-bound logistics.

The outbound logistic problem of a fertiliser plant may be described as the distribution planning exercise for transporting urea from the plant to various destinations using various modes of transport. The network in fact includes the downstream levels, i.e. from distributors to retailers and finally to end consumers. Fig. 1 is a typical diagrammatic representation of the above distribution network involving the various types of godowns.

In developing the above model, the following assumptions have been made.

- Production of urea is continuous.
- Storage takes place only at buffer and feeder godowns and not in plant and railheads.

- Loading of urea in the plant is mechanised; as such no handling charge is incurred.
- No direct shipment takes place from plant to buffer godowns.
- Primary transportation by road takes place only to those feeder godowns that fall within the economic freight zone.

Further, the distribution plan is based on the existing structure of the supply plan as regulated by the government of India. The godownwise requirements for a period of six months are established through negotiation and discussion among the manufacturers. Thus the model is based on a deterministic demand pattern, where the manufacturers seek for a least cost distribution plan for each month.

**The model is based on a deterministic demand pattern.**

The following model may be suitably used for a monthwise distribution planning decision which reflects a trade-off between transportation and handling cost, and inventory carrying cost.

- Let
- $C_j$  be the transportation cost (Rs/ton/km) from plant to railhead  $j$  ( $j = 1, 2, \dots, n$ );
  - $C_{jb}$  be the transportation cost (Rs/ton/km) from railhead  $j$  to buffer godown  $b$  ( $b = 1, 2, \dots, u$ );
  - $C_{jf}$  be the transportation cost (Rs/ton/km) from railhead  $j$  to buffer godown  $f$  ( $f = 1, 2, \dots, v$ );

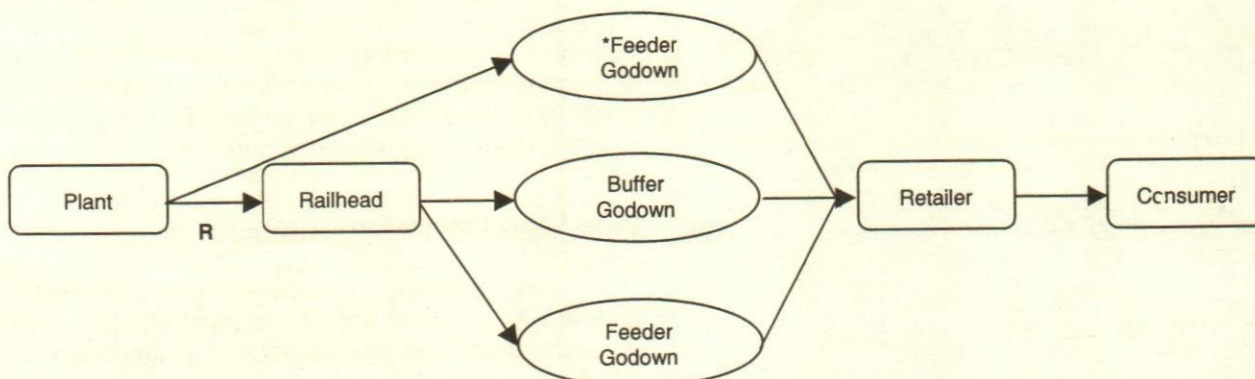


Fig. 1. Outbound Supply Chain of the Fertiliser Industry



$C_e$	be the transportation cost (Rs/ton/km) from plant to feeder godown $e$ ( $e = 1, 2, \dots, g$ ) located in the economic freight zone;	$y_b^m \leq k_b$ ; for all $b = 1, 2, \dots, u$	...(iv)
$x_j^m, x_{jb}^m, x_{jf}^m, x_e^m$	be the quantities (tons) to be transported during the month $m$ along the transportation routes as per the above indices, respectively;	$x_{jf}^m + y_f^{m-1} - D_f^m = y_f^m$	...(v)
$d_j, d_{jb}, d_{jf}, d_e$	be the distances (kms) corresponding to the transportation routes;	$y_f^m \leq k_f$ ; for all $f = 1, 2, \dots, v$	...(vi)
$S_b, S_f, S_e$	be the storage costs (Rs/ton/month) at the respective godowns;	$x_e^m + y_e^{m-1} - D_e^m = y_e^m$	...(vii)
$y_b^m, y_f^m, y_e^m$	be the quantities (tons) to be stored at respective godowns in month $m$ ;	$y_e^m \leq k_e$ ; for all $e = 1, 2, \dots, g$	...(viii)
$D_b^m, D_f^m, D_e^m$	be the demand from the distributors at the respective godowns in the month $m$ ;	$x_j^m, x_{jb}^m, x_{jf}^m, x_e^m \geq 0$ ; for all $j, b, f, e$	...(ix)
$h_{jb}, h_{jf}, h_e$	be the handling charges (Rs/ton/handling) at the respective locations;	$y_b^m, y_f^m, y_e^m \geq 0$ ; for all $b, f, e$	...(x)
$k_b, k_f, k_e$	be the respective godown capacities;		
$p^m$	be the allocated production (tons) of the fertiliser plant to this marketing area for month $m$ ;		

Then the problem may be stated as:

$$\text{Min} \left[ \begin{aligned} & \left( \sum_{j=1}^n C_j x_j^m d_j + \sum_{j=1}^n \sum_{b=1}^u C_{jb} x_{jb}^m d_{jb} \right. \\ & + \sum_{j=1}^n \sum_{f=1}^v C_{jf} x_{jf}^m d_{jf} + \sum_{e=1}^g C_e x_e^m d_e \left. \right) \\ & + \left( \sum_{b=1}^u S_b y_b^m + \sum_{f=1}^v S_f y_f^m + \sum_{e=1}^g S_e y_e^m \right) \\ & + \left( 4 \sum_{j=1}^n \sum_{b=1}^u h_{jb} x_{jb}^m + 4 \sum_{j=1}^n \sum_{f=1}^v h_{jf} x_{jf}^m + 2 \sum_{e=1}^g h_e x_e^m \right) \end{aligned} \right]$$

subject to

$$p^m = \sum_{j=1}^n x_j^m + \sum_{e=1}^g x_e^m \quad \dots(i)$$

$$\sum_{j=1}^n x_j^m = \sum_{b=1}^u x_{jb}^m + \sum_{f=1}^v x_{jf}^m \quad \dots(ii)$$

$$x_{jb}^m + y_b^{m-1} - D_b^m = y_b^m \quad \dots(iii)$$

The objective function generates the minimum logistic cost (that of transportation, storage and handle) for each month. The multipliers in the handling cost component of the objective function show the frequency of handling at different distribution segments.

Constraint (i) implies that the total production of the plant allocated for a month 'm' is not stored in the plant but is fully distributed either by rail or by road as primary transport. Constraint (ii) similarly implies that the total shipment reaching a railhead 'j' is further distributed either to buffer or feeder godowns without any storage at the railhead. Constraint (iii) indicates the supply-demand storage equilibrium at the buffer godown where  $y_b^{m-1}$  is the opening stock of that godown. Constraint (iv) indicates the capacity restriction of the concerned godown. Similarly, constraints (v), (vi), (vii), (viii) indicate similar restrictions for feeder and feeder (economic) godowns respectively. Constraint (ix) justifies that only unidirectional transportation is considered and constraint (x) represents the fact that backorder is not permitted.

The model is formulated for finding the optimal plan for distributing fertiliser through all the transportation linkages in every month, given an opening stock information at the beginning of the month and considering all cost components of the logistics plan. Thus, the model is to be made active at the beginning of every month for extracting relevant information.

### Case Study Discussion

In order to solve the above problem, the relevant dataset was collected from a company situated in Uttar Pradesh. Since fertiliser distribution is geographically dispersed to a large extent, we focussed on a particular zone, a part of which has rail as the primary transport and another that is directly served by road. The case

study represents a situation to justify the application of the proposed model.

Table 1 shows the monthly requirement data for the case study during the Kharif season. The distribution network is a representative situation as per the schematic diagram of Figure 1. Here we consider only one rail linkage i.e. single railhead, which meets the requirement of only one buffer godown and five feeder godowns in the primary market. The plant also directly serves two feeder godowns located at the economic freight zone by roadway transport.

**Table 1:** Demand (in tons) of distributors at different godowns during Kharif 1998

Month → Distrib. ↓	April'98	May'98	June'98	July'98	Aug'98	Sep'98	Total
b	550	920	1000	1300	2000	780	6550
f <sub>1</sub>	210	380	400	550	775	285	2600
f <sub>2</sub>	100	200	230	370	450	100	1450
f <sub>3</sub>	480	660	730	965	1295	505	4635
f <sub>4</sub>	600	830	905	1210	1625	630	5800
f <sub>5</sub>	160	220	245	325	455	160	1565
e <sub>1</sub>	200	290	310	420	580	200	2000
e <sub>2</sub>	150	200	250	300	450	150	1500

b – one buffer godown;

f – five feeder godown (f<sub>1</sub>, f<sub>2</sub>, f<sub>3</sub>, f<sub>4</sub> and f<sub>5</sub>);

e – two godowns located at Economic Freight Zone (e<sub>1</sub>, e<sub>2</sub>).

The relevant data relating to transportation and distribution to feeder godowns and buffer godown are included in Table 2. Remaining data for model parameters, including those of feeder godowns at economic freight zone, are given below.

**Table 2:** Logistic Details for primary market

Distrib.	Dist. from Railhead (kms)	Godown capacity (tons)	Opening Stock (tons)	Storage Cost (Rs/t/month)	Handling Cost (Rs/t/handling)	Transportation Cost (Rs/t/km)
b	16	1477	0	10	10.00	2.00
f <sub>1</sub>	55	200	0	6	6.75	1.10
f <sub>1</sub>	40	99	0	6	6.75	1.10
f <sub>1</sub>	75	438	42	6	6.75	1.10
f <sub>1</sub>	25	500	101.7	6	6.75	1.10
f <sub>1</sub>	60	250	50	6	6.75	1.10

Monthly production of the fertiliser plant to be distributed among the consumers (p<sup>m</sup>) is 4350 tons and distance of railhead from the plant is 163 kms.

**Table 3:** Results

Values	April, 1998	May, 1998	June, 1998	July, 1998
Optimal Logistics Cost (Rs)	702083.75	748975.93	747858.18	707017.50
Optimal amount of fertiliser to be transported (tonnes)				
Plant to railhead	3659.00	3860.00	3790.00	3630.00
Railhead to buffer godown	1703.7	1243.3	1000.00	916.00
Railhead to feeder godown (f <sub>1</sub> )	210.00	580.00	400.00	350.00
Railhead to feeder godown (f <sub>2</sub> )	199.00	200.00	230.00	370.00
Railhead to feeder godown (f <sub>3</sub> )	438.00	660.00	986.00	709.00
Railhead to feeder godown (f <sub>4</sub> )	998.00	730.00	905.00	1210.00
Railhead to feeder godown (f <sub>5</sub> )	110.00	446.70	268.30	75.00
Railhead to E.F.G.* (e <sub>1</sub> )	400.00	290.00	310.00	420.00
Railhead to E.F.G.* (e <sub>2</sub> )	291.00	200.00	250.00	300.00
Optimal amount of fertilizer to be stored during the months (tons)				
At buffer godown (b)	1153.70	1477.00	1477.00	1093.00
At feeder godown (f <sub>1</sub> )	0.00	200.00	200.00	0.00
At feeder godown (f <sub>2</sub> )	99.00	99.00	99.00	99.00
At feeder godown (f <sub>3</sub> )	0.00	0.00	256.70	0.00
At feeder godown (f <sub>4</sub> )	500.00	500.00	500.00	500.00
At feeder godown (f <sub>5</sub> )	0.00	226.70	250.00	0.00
At E.F.G.* (c <sub>1</sub> )	200.00	200.00	200.00	200.00
At E.F.G.* (C <sub>2</sub> )	141.00	141.00	141.00	141.00

\* E.F.G. – Feeder godown at economic freight zone.

Primary transportation cost (by railway) – Rs. 1.10/ ton/km.

Distance of e<sub>1</sub> from plant – 80 kms.

Distance of e<sub>2</sub> from plant – 75 kms.

No opening stock at feeder godowns at economic freight zone e<sub>1</sub>, e<sub>2</sub> is available.

Storage Cost at Economic Feeder – Rs 6/ton/ month.  
Godowns

Handling Cost at Economic – Rs 3.50/ton/  
Feeder Godowns handling.

The optimisation problem mentioned above is a linear programme with minimisation of total monthly logistic cost as objective function and constraints (i) to (x). For solving the problem, the Tora optimisation package has been used. The optimal result is shown in Table 3.

The solution of the model indicates how much is to be transported and how much to be stored at a particular location during a particular month and also the associated minimum total logistics cost. The table includes the distribution plan for four consecutive months from April'98 through July'98. Further analysis of the logistic cost may reveal the proportional cost components for transportation, handling and storage process. This may aid the managers significantly in taking an appropriate cost reduction strategy. It should be noted that the quantity stored at a godown during a particular month becomes the opening stock in the next month.

## Conclusion

Organisations are gradually turning to optimisation models to provide the answers to questions of when, where and how much resources should be allocated, given a clearly defined set of objectives. They seek to maximise the return on investment received from the resources allocated to various supply chain activities. Optimisation modeling improves the options by allowing the management to model the supply chain situations and then use the model to evaluate all the feasible options and combinations of institutional and physical facilities available to a company within the supply chain.

The proposed model, although applied for distribution of fertiliser, may be used by the management of any process industry with suitable and perhaps, minimal modification. Any standard optimisation software package may be used to solve such problems, as the model has been structured as well as established in a linear programme.

**The proposed model, may be used by the management of any process industry.**

One of the inputs to the model is the demand received by the manufacturer. However, demand could be stochastic in nature particularly in a competitive environment in which exact determination of demand is not possible. This may arise, once the government control is completely withdrawn and the demand is dictated by the market economy. In such a situation need will arise for the inclusion of stochasticity to the model converting it to a stochastic linear programme. Various possible scenarios may also be analysed applying stochastic simulation.

The model can further be modified to take the wide network of retailers into consideration and thus get a clearer picture of the functioning of the supply chain of this industry. This may result in a two-stage/level optimisation model and network analysis may be applied for clear structuring of the problem.

The proposed model incorporates a single objective, i.e. cost minimisation involving transportation, storage and handling. However, future possibility may be its remodeling as a multiple objective decision making problem. For example, another objective could be to improve the capacity utilisation of godowns.

Another area of great interest and scope is the study of the tradeoff between the transfer prices that could be arrived at between the demand and distribution cost in order to decide on the number of levels/echelons and facilities in distribution.

While the model considered the outbound logistics of a single plant, future studies could consider the case of multiple plants of a single manufacturer. Scope also exists in the study of supply chain efficiency of various manufacturers having different distribution strategies. In case the supply chain gets too long and complicated, a decomposition technique could be applied to conveniently solve the problem.

## References

- Cavinato J.L. (1992), "A total cost/value model for supply chain competitiveness", *Journal of Business Logistics*, 13(2).
- Chandra, Pankaj and Fisher M.L. (1994), "Coordination of Production and Distribution Planning", *European Journal of Operational Research*, 72.
- Davis T. (1993), "Effective supply chain management", *Sloan Management Review*, 34(4).
- Dobler D.W. and Burt D.N. (1996), "Purchasing and Supply Management: Text and cases" (6th ed.), McGraw-Hill, New York.
- Ellram L. (1991), "Supply chain management: The industrial organisational perspective", *International Journal of Physical Distribution Management & Logistics Management*, 21(2).

- 
- Gattorna J.L. and Walters D.W.** (1996), "Managing the Supply Chain – A Strategic Perspective", Macmillan, London.
- Lee H.L. and Billington C.** (1995), "The evolution of supply chain management models and practice at Hewlett-Packard", *Interfaces*, 25(5).
- Mabert, Vincent A. & Venkataraman M.A.** (1998), "Special research focus on Supply Chain Linkages: Challenges for Design and Management in the 21st Century", *Decision Sciences*, Vol. 29, No. 8.
- Mahapatra N.K.S.** (1991), "Challenges in Fertilizer Marketing", *Fertiliser News*, Vol. 44.
- Mahapatra N.K.S.** (1998), "Realignment of Fertilizer Distribution", *Supply Chain Management for Global Competitiveness* (ed. Dr. B.S. Sahay), Macmillan, New Delhi.
- Porter M.E.** (1985), "Competitive advantage: Creating and sustaining superior performance", The Free Press, New York.
- Ramaswamy V.S.** (1985), "A Study of Marketing of Fertilizers, Hope Press.
- Report of High Powered Fertilizer Pricing Policy Review Committee (1998), "Indian Journal of Agricultural Economics", Vol. 53, No. 2, April-June.
- Sahay B.S.** (2000), "Supply Chain Management in the 21st Century", Macmillan, New Delhi.
- Shukla D.K.** (1999), "Rail Fertilizer Interaction", *Fertilizer News*, Vol. 44.
- Taha H.A.** (1997), "Operations Research – An Introduction", Prentice Hall of India, New Delhi.
- Tandon M.K.** (1999), "Cost Effectiveness to Improve Profitability in Fertilizer Marketing", *Fertiliser News*, Vol. 44.
- 

*People forget how fast you did a job... But they remember how well you did it.*

– Howard W. Newton

# Organisational Development

Biswajeet Pattanayak & Rajnish Kumar Misra

---

*The impact of competition in the emerging global business scenario is being felt by Indian organisations as well. To become successful, it is important for organisations to improve their organisational processes and practices. Besides adopting advanced technology, they need to find out problems in existing processes and remove them to achieve success. One such method is through organisational development. This paper highlights the theories and steps involved in OD, substantiated with an experience of an Indian industry.*

*Biswajeet Pattanayak & Rajnish Kumar Misra are Professor & Research Associate respectively, Indian Institute of Management, Indore*

Organisations, all over the world, are facing excessive competition and adopting various strategies to capture large customer base. They are changing not for the sake of change but to fight out the intense competition with their counterparts. Change, which is well planned, can be regarded as development and in this context, change and development are used synonymously. Before proceeding further, it is important to understand the meaning of change and development.

Organisational change is the significant difference between the past and present state of affairs in an organisation. It may be planned/unplanned, continuous/discontinuous and incremental/decremental, depending upon how far it has affected the business process. But development is always a planned, incremental as well as continuous activity in an organisation. Thus, organisational development can be explained as a planned change brought about the processes in the organisation.

Organisational development activities appear to have originated in 1957 as an attempt to apply some of the values and insights of laboratory training to total organisations. Douglas McGregor working with Union Carbide is considered to have been one of the first behavioural scientists to systematically analyse and implement OD programming. OD efforts are relatively new but are becoming increasingly visible within USA, UK, Japan, Norway, Sweden and India. OD has been in the Indian Scene since 1968. Many public and private sector organisations like SAIL, TISCO, TELCO, IDPL, HMT, HAL and LIC have been applying the process of planned intervention techniques of OD.

French and Bell (1973) define OD as a long-range effort to improve an organisation's problem solving and renewal processes, particularly through a more effective and collaborative management of organisational culture with the assistance of change agent, or catalyst, and the use of the theory and technology of applied behavioural science, including action research. Organisational renewal is the process of initiating, creating and confronting needed changes so as to make it possible for or-

organisations to become or remain viable, to adapt to new conditions, to solve problems, to learn from experience, and move towards greater organisation maturity.

Golsmbiewski (1972) describes OD, in part, as a long-range effort to consciously introduce planned change into an organisation in ways that involve its members, both in diagnosis of problems and prescriptions of change. And according to Warren Bennis (1969), OD is response to change, a complex of educational strategies intended to change the belief, attitudes, values and structure of organisations so that they can better adapt to new technologies, markets and challenges, and the dizzying rate of change itself.

All these definitions have common attributes to define Organisational Development, which are that:

- It is a planned change.
- It is done throughout the organisation.
- Knowledge in behavioural science is required for doing this.

### Planned Change

Planned change has three phases—unfreezing, moving and re-freezing. In unfreezing, organisations make preparations for bringing about change by informing and educating the people so that they are prepared for change, initiating reduction of anxiety and resistance to change. This can be achieved through information sharing about the implications of change efforts. The second phase 'moving' is characterized by providing new behaviors that would be beneficial to the individual as well as the organisation. The third phase is characterized by re-freezing whatever new behavior has been learned in the second phase. Edgar Schein has proposed modifications to the model of planned change by Lewin as follows—the first phase is characterized by creating motivation and readiness to change through disconfirmation, anxiety/fear and, stage two focuses upon changing through cognitive restructuring of the person/organisation to view and judge activities from different perspectives after proper scanning of the environment. And stage 3 is characterized by refreezing the acquisition of knowledge and skill in the people vis-à-vis the client for utilizing it for enhancing success.

### Organisation Wide

Organization Development encompasses the whole organisation, which means that every individual, groups/teams and departments are covered in this massive change program. Moreover, according to the sys-

tems theory, every organisation works on the basis of input-throughput-output. The relationships between the three elements are cyclical. If there is change in any one of these elements, it would have impact on the other two. Therefore, if there is an environmental demand to enhance the quality of output, then the organisation will have to respond by either improving the quality of raw material or the production process (throughput) to achieve good quality output. Likewise, this change in throughput stage may be targeted upon the people processes, which will result in change in the management practices of the executives in the organisation adopted across the groups/team/department.

### Behavioral Science Knowledge

Organisation Development involves application of behavioural science knowledge to improve the human processes in the organisation. It targets the interpersonal relationship between members of the department/teams. It also focuses on improving the group/team interdependence so that they are able to reach organisational goals.

**Organisation Development involves application of behavioural science knowledge to improve the human processes in the organisation.**

### Characteristics of Organisation Development

- OD focuses on culture and processes—It tries to inculcate an environment of trust, openness, collaboration and pro-activity in the organisation and it helps the members to accept change whenever it comes.
- OD ensures collaboration between superiors and subordinates in managing the culture and processes within the organisation.
- Team formation and its effectiveness are targets of OD—Individual efforts are promoted through formation of teams, so that they can work collaboratively for achievement of the goals of the organisation.
- Organisation Development also emphasizes upon the participation, empowerment and involvement of people at all levels in the decision making process.
- OD targets each and every sub-system in the organisation.
- The role of the consultants is critical to OD effort as they impart skills and knowledge to people in the

organisation so that they work out their own course of action with his help. Thus consultants act as a catalyst to change process.

- To improve and enhance the organisation's success, OD utilizes the action research approach.

### **Pillars of Organisation Development**

There are three pillars, which are necessary for organisation development. They are –

- Organisational diagnosis
- Action research
- Interventions

### **Organisational Diagnosis**

Organisational diagnosis refers to identification of problems faced by every subsystem in an organisation. It involves gathering of information and analyzing it to find the underlying causes.

In order to facilitate the consultants and researchers in diagnosing the problem, Marvin Weisboard proposed a six box model, consisting of six levels. These six levels at which problems exist are – (i) Purposes: What business are we in? (ii) Structure: How do we divide up the work? (iii) Rewards: Do all needed tasks have incentives? (iv) Helpful Mechanisms: Do we have adequate coordinating technologies?, (v) Relationships: How do we manage conflict among people with technologies? and (vi) Leadership: Does someone keep the boxes in balance? All the respective boxes have both formal and informal ways of doing things. Formal ways are basically well-defined activities for each box and informal ways/activities which are not defined or included in the list. It happens that sometimes formal ways of doing things are not sufficient to help the people reach the goal. Therefore, they adopt informal ways of doing things. Identification of formal and informal ways/activities and their contribution in creating problems in the organisation helps the consultant in identifying the problem within these boxes. Weisboard also laid emphasis on thorough diagnosis before proceeding for intervention.

### **Action Research**

Actions here are the activities undertaken by the organisation to improve its functioning. Action research facilitates the organisation in understanding the dynamics of problems in the organisation and implementing workable solutions to make it a vibrant organisation.

**Action research facilitates the organisation in understanding the dynamics of problems.**

Action Research can be understood through two perspectives—as process and as problem solving approach. According to process perspective, action research is an on-going continuous series of events/activities within the organisation. It is a process of collecting, assimilating and analyzing data to identify the problem. Once the problems are identified, a series of activities are undertaken to solve it. Through feedback, information disseminated within the organisation is once again collected to find out which action has proved to be successful and which has not. These successful actions are modified to achieve larger percentage of success.

French & Shepard are also of the opinion that action research is a research with a purpose to facilitate the present to reach the future. In their opinion, action research is a problem solving approach with emphasis on goals and objectives. This can therefore be labeled as problem solving approach. There are three significant features to this approach—a scientific enquiry, collaboration between clients and consultants and enhanced understanding of organisation through this approach.

Action research has five critical cyclical steps—Perception of problem, Data collection to identify the specific problem, Analysis to zero-in on the problem, Action planning and implementation and Feedback to assess the success of action and modifying the action to solve the problem.

### **Interventions**

Interventions are series of structured activities carried out within the various parts of the organisation to make it effective. It has two aspects—intervening in organisational system and intervention as a strategic and planned action. The first aspect deals with organisational development process and the modification starts taking place at every level within the organisation (systems and sub-systems), and intervention as a strategic and planned action works at resolving difficulties by removing road blocks and building on strengths to enhance the effectiveness of the organisation.

Planned interventions can be made at two levels: (a) Techno—structural approach that relates interventions

into the technology (like task methods and processes) and the structure (like role—relationship) within the organisation. The focus of this approach is therefore to derive a fit between the technological configurations and the social structure of the work units. Job design targets the set of interrelated functions to make employees work effectively with optimal utilization of available resources. Job enrichment and enlargement refer to the vertical loading and horizontal stretching of responsibilities to make the job more challenging and interesting.

(b) Human processual approach targets upon improving the fit between human skills and processes within the organisation. The intervention therefore is made through participants in the organisational processes like communication, problem solving, decision making, through which they accomplish their own as well as organisational goals.

There are a number of intervention dealing with human processes like Process Consultation, Team building, Survey feedback, Grid OD activities and third party negotiation.

*Process Consultation* refers to understanding the processes by which things get done in the organisation and improving upon the processes to make the organisation effective. One such process may be the dynamics of formal and informal relationships, nature of communication that takes place between people, issues of leadership authority, group problem solving and decision-making. In process consultation a skilled consultant works with managers, individuals and groups in the system to develop process skills to diagnose, understand and resolve process related problems i.e., how to reach effective decision, resolving conflicts, sensitizing people about issues in emergence of conflicts, its facets and steps for solving it, to make the system more effective.

*Team building* refers to facilitating a small group of people with complementary skills who are committed to a common purpose, set performance goals, and approach for which they hold themselves responsible. This intervention is aimed at improving with intra- and inter-group effectiveness, may revolve around enhancing better interaction modes, sharing resources, and acquiring new skills for accomplishing the task of team vis-a-vis inter-teams.

**Team building refers to facilitating a small group of people with complementary skills.**

*Survey Feedback* refers to the use of questionnaires for collecting information and providing feedback to the organisation about the feelings and perception of the employees of the organisation. The survey provides useful data about the systems and members can work upon them on the basis of feedback generated through data to make the organisational system more effective. It is an effective intervention strategy because people develop a sense of ownership of the action built on those data to bring about the required changes.

*Grid Organisation Development*—This intervention technique was developed by Blake and Mouton (1969). It wants the total organisation to follow a six-phase change process for a duration of three to five years for the organisation to reach its self-defined state of excellence. In the beginning selected managers in the organisational system learn the concept of grid to assess their own leadership styles and are trained to be instructors to others in the organisation later on. At various phases, the managers sharpen their skills and leadership abilities, and the group develop both inter and intra-team interactions for making the organisation effective.

*Third Party Negotiation* refers to the intervention designed for improving inter-group relationships through better communication and interaction between various work groups in the organisation, reducing conflict, dysfunctional competition and increasing inter-dependence, collaboration and cooperation between work groups.

## Problems & Challenges

An organisation when starting OD intervention goes through different phases of problems and challenges. OD techniques and models need to be updated and developed to make the organisation more effective. In today's changing business scenario, the organisational development should give more emphasis on a proactive approach to prepare the organisations to face current challenges rather than focussing on problem solving approach. OD theorists and practitioners need to live in the future to design and develop the present of organisations.

**OD practitioners need to live in the future to design and develop the present.**

**Essar Steels Ltd.**

Essar Steels Ltd. is an integrated steel plant, located



at Hazira, Surat having 1600 executives producing hot rolled coils of 2.0 million tons per annum. The technology is highly advanced and the employees are intelligent and young. The average age of the executives is only 27 years. The employees attitude survey as an action research initiative, was conducted in April 1998 to identify, analyze and explain the dynamics of motivation, inner feelings and perception of all employees towards organisational and psychological variables. The findings showed that the work synergy was pretty low because of poor belongingness and lack of corporate pride among junior executives which in turn, weakened motivation to work and desire to continue in the organisation.

Keeping in view the findings, an OD intervention strategy was initiated. A 'ten days' executive leadership camp was organized at Sapputara—the only hill station of Gujarat. All the two hundred junior executives were exposed to this program in a batch of 20 each. This was completely a residential course. The focus of the whole programme was on development of work synergy, leadership, better organisational citizenship behavior and personality development. All the junior executives were covered in ten months in ten batches. After 4 - 5 batches, the results started showing on the shop floor in terms of increased interpersonal relationship, quick response to problems, reduction of down time, improvement in quality and ultimately enhanced the overall per-

formance and work synergy of the organisation. A systematic evaluation of the impact of this executive leadership camp was undertaken from the heads of each department, shift in-charge and the individual participants. The result of the evaluation showed that 87 per cent of the respondents were of the view that the camp had highly positive impact on the outcome mentioned earlier.

### Reference

- Bennis, W.G.** (1969), Organisation development: It's nature, origins and prospects. Reading, MA: Addison Wesley Publishing Corporations.
- Blake R.R. and Mouton J.S.** (1964), "The Managerial Grid", Texas: Gulf Houston.
- Cummings T.G. and Worley C.G.** (1993), "Organisation Development and Change", Ohio: West Publishing Company, 6th Edition.
- French W.L. and Bell C.H.** (1997), "Organisational Development: Behavioral Science Intervention", New Delhi: Prentice-Hall, 5th Edition.
- Golembiewski** (1972), In Pattanayak B. and Mishra P.K. (1999), "Change for Growth: Understanding Organisational Development", New Delhi: Wheelers Publishing.
- Lippit** (1999), In Pattanayak B. and Mishra P.K. "Change for Growth: Understanding Organisational Development", New Delhi: Wheelers Publishing.



*It is always safe to assume, not that the old way is wrong, but that there may be a better way.*

— Henry F. Harrower

# CRM: A Tool for Competitive Advantage

Ajay Pandit & A.K. Saini

---

*This article discusses new frontiers of CRM, particularly eCRM, its advantage and relevance as a major business asset and its incorporation into latest business models.*

*Ajay Pandit and A.K. Saini are with the Faculty of Management Studies, University of Delhi, Delhi.*

From ancient times, a phrase like 'Customer is God' has been around in the business world. What your customers think about the product or services you sell, the people who represent you or your company as a whole, is the ultimate measure of your success at the market place. A relatively new discipline called Customer Relationship Management (CRM) is primarily concerned with improving the effectiveness and efficiency of business operations. The new frontiers of the CRM vision, which makes use of the latest business models based on state of the art information technology framework (i.e. the internet), encompass a concept which is referred to as electronic customer relationship management (eCRM).

## Customer Relationship Management

CRM can be defined as a management discipline utilising specialised tools, technologies and techniques to facilitate the operation and improvement of front office business functions with the intention of optimising the total value derived through customer relationships. CRM is about developing win-win customer relationships by effectively managing the value exchange process between the company and the customers. CRM brings together many processes, scores of data and countless transactions. From data warehousing to resource planning to customer profiles to phone calls to Web sites to collections department, CRM co-ordinates individual enterprise functions. It is also referred to as one-to-one marketing or loyalty marketing which involves understanding the customers individually, interacting with them and customising the products and services to suit them.

According to Microsoft, "Customer Relationship Management is a customer focused business strategy designed to optimise revenue, profitability and customer loyalty". Customer loyalty is developed when the customer feels that the organisation cares for him. Organisations need to focus their entire efforts towards the customer to develop such a relationship. In the CRM process, 'Customer understanding' results in "Propen-

sity to Buy" and 'Relationship Management' increases "Propensity to buy from a particular supplier".

CRM Systems are specialised computing systems that leverage the power of digital technology to optimise an organisation's customer value exchange. They increase the effectiveness and personalisation of customer value delivery, thereby improving customer satisfaction and reducing operating costs.

**CRM Systems leverage the power of digital technology to optimise an organisation's customer value exchange.**

### **Electronic Customer Relationship Management (eCRM)**

In the last five years, a more powerful and robust interactive channel has emerged in the form of Internet. Internet provides the first affordable means to link people across geographical boundaries. This new interaction channel and its applications promise to ease the personal service bottleneck and extend the benefits of CRM to customers and partners. The electronic extensions to CRM systems are known as Electronic CRM (eCRM). Electronic CRM is the process of achieving customer satisfaction and loyalty by making use of the latest information technology tools such as the Internet. Customers making transactions through the Internet or those using e-commerce mode shall have to be served by eCRM. The basic aim of eCRM is to optimise an interactive relationship with the customers. Although most of the companies agree that eCRM is critical to their businesses, few understand exactly what it is and how to derive advantage from it.

Primary reasons for adopting CRM are:

- Rising cost of sales
- Increased global competition
- Dwindling margins
- Constant need for more information
- Ineffective sales/Account management
- Productivity and
- Customer care
- Changing Paradigms

The customer wants one stop shopping from multi-

divisional companies, easy-to-get status reports on what's happening with his order, speed up transactions over the telephone and more. The old paradigm was price, quality and service. The new paradigm is price, quality, speed, convenience, value, solutions, etc. In the new economy, the customer occupies the control seat. Delivering high quality service and achieving high customer satisfaction has been closely linked to profits, cost savings, and market share (Sager, 1994). Leading companies today are modifying their traditional measurements of corporate performance and are looking for new parameters (both internal and external) that includes the customer's perceptions and expectations.

To retain customers, the companies must have a stronger focus on measuring and managing the individual customer relationship. All the companies can be considered to be in the service business i.e. satisfying customer needs, which must be measured and tracked.

When customers enter into a relationship with an enterprise they have expectations of a specific return value. Not only must organisations deliver sufficient value to attract customers, but also they must satisfy customer expectations more completely than their competitors in order to keep them. To summarise, the companies must:

- Treat all customers alike
- Identify the breadwinners
- Retain good customers by giving them the best
- One-to-One Marketing
- 360 Degrees Customer Relationship i.e. Enterprise Wide Service
- Move From Satisfying A Customer To Delighting A Customer

### **A New Breed of Customer**

Modern information technology makes possible these close, 'customised' relationships that lock in customers for life by substantially enhancing the customer-perceived value of the product/service. Most companies today are under-utilising information technology but the winners will be those who will capitalise on available IT to meet the customer challenges facing their organisations.

Today successful companies are shortening the process cycle, and response time, reducing costs and developing innovative new products and services. The area of service becomes the differentiating factor. Im-

proving customer service through IT is one of the hot issues for information systems executives, according to Computerworld (Panepinto 1994).

While corporations have been learning about the inherent bottlenecks in the human service delivery channel, customers have been discovering the benefits of new service delivery technology. A generation of technology-savvy customers has had its expectations raised by service delivery mechanisms such as ATMs, debit cards, pump and pay gasoline, and self-service banking through the internet.

### CRM Systems

In the past, customers could engage in regular face-to-face interactions with their vendors. Today customers may occupy a geographic range that spans the world. Customers may interact with the organization through multiple separate communication customer channels and media. As a result, consolidating and co-ordinating the various, disparate customer interaction sources and formats has become a significant challenge.

Due to the large number of relationships to be managed and the finite capacity of front-office workers, organisations often have little or no information regarding the individual value preferences of their customers. (Fig. 1). This lack of detailed customer information virtually eliminates the possibility of providing a personalised value proposition. The solution to these challenges is customer relationship management systems (CRMS) which is a computing system that automates front-office business functions. CRM systems act as complementary mental assistants by leveraging the power of computer systems to improve an organisation's customer delivered value.



Fig. 1. Cross-functional Relationships

**CRMS which is a computing system that automates front-office business functions.**

By managing the complex logistics of service response activities, the CRMS becomes an efficiency multiplier, leveraging the processing power of modern computers to automate front-office work. Through the vast storage capacity of today's computer systems, the CRMS enhances the finite memory of front-office workers, making it possible to maintain intimate relationships with a virtually unlimited number of customers. The CRM systems must be – easy to use, intuitively designed, and quick to adapt to changes, provide customer's requested information almost instantaneously.

### Development of CRM Systems

Since business depends/starts from customers, therefore for an effective CRM System Development and Implementation, an organisation has to pass through the following stages to ensure success.

- Study and understand the customers: The organisation must develop an understanding of its customers through detailed analysis and interaction with the customers. This would entail identifying demographic profile, buying pattern and channel preference, market segmentation and customer valuation, etc. The organisation must provide a common repository to store contextual customer information. This ensures that all members of an organisation know the status of every relationship at any given point in time.
- Study, analyse and re-structure the organisation structure: The organisation needs to restructure its operations and activities through the Business Process Re-engineering (BPR) effort, keeping customer delight as the ultimate objective.
- Develop and customise the products: The development of the product must take into account the customer needs and requirements i.e. leads from the customer data.
- Maintain interaction with the customer: Interaction management means customer interaction must be a continuous process. This may take place not only through the sales and marketing channels but also through distribution, shipping, service, etc. Today, interaction management technologies facilitate

---

unified, multi-channel, multi-media communication with customers.

- Add value to the product: With every customer interaction, the product/services can be made more suited to the needs of the customer. Adding value means what customers perceive the value of product/service to be. This is influenced largely by quality of the product, convenience, speed, ease of use and prompt and effective service, not merely the price and discounts offered. The product value should add up every time an interaction with the customer takes place.
- Performance support: The organisation needs to ensure high quality product and services and should work for optimising convenience to the customer. This requires effective performance support to customers. Many customer interactions will involve requests for a service response, from requests for product information to requests for proposals to requests for support. The first step in responding to a customer is always preparing the response. Typically this is a knowledge-based activity and can often be augmented with automated performance aids. Examples of performance aids would be proposal generators, product configurations, marketing encyclopaedias and problem resolution systems.
- Relationship tracking: Once a significant change in the state of customer relationship has occurred, whether due to activities of service personnel or due to outside factors, a change of state should be recorded in the corporate memory. Transaction processing applications facilitate tracking activity using the organisational database.
- Make use of tools such as e-mail, internet to provide increased convenience to the customer. A customer today is able to place an order on the internet, do the sale and purchase transactions, make payments, order for loans, download digitised products (music, software, etc.) and now these services are also available on a telephone. Electronic commerce is giving way to mobile commerce which is possible through call centres.
- Process Management: Process management technologies are used to design and automate the execution of seamless, cross-functional business processes that ensure a customer request is carried through the organisation and processed in an effective manner.

### **CRM and Call Centres**

Many MNCs, specially in the fields of telecom, bank-

ing and financial services, and airlines, are setting up call centres all over the world. Some of these organisations are British Telecom, GE Capital. Lately Indian companies have also started setting up call centres. A call centre is a place that has adequate telecom facilities, trained consultants, access to wide databases, internet and other on-line support infra-structure in order to provide information and support to the customers on a real time basis. It may be physically visited by the customer or it may be a website on the internet. This is the most important channel of direct communication of a company with its customers. The call centres help in strengthening the confidence of the customers by providing a place to contact or visit for all types of queries, complaints, suggestions and other help required with an instantaneous response.

**A call centre has adequate telecom facilities, trained consultants and other on-line support infra-structure.**

Multiple departments in an organisation need to be able to look up customer records to see the most recent transactions with all departments, regardless of the means of communication. This means that departments like the help desk, marketing, sales and customer service must share one database.

### **Advantages of CRM**

The organisations that understand the criticality of their sales, marketing and customer support functions make use of CRM since these solutions enable them to accurately target prospects, improve sales productivity, decrease sales cycle, provide support and develop customer loyalty and hence increase the revenue base. The simple CRM systems empower both the management and the sales/marketing team with the latest and relevant information. It helps to collect, compile, and disseminate needed marketplace information when it is needed. This provides the benefits of better sales/marketing information, improved productivity, enhanced customer care, etc. The key benefits offered by CRM systems in general are to:

- Help increase sales due to better opportunity management
- Decrease cost of sales
- Enlarge loyal customer base
- Ensure high customer service standard

- Give a bird's eye-view of the activities in the organisation
- More systematic and scientific sales process, thereby higher hit rate
- Assist management in business decision making due to better reporting capability
- Ensures that the whole system becomes process driven and not personality driven
- Increase sales force productivity (for non eCRM systems)

The benefits to be derived from eCRM can be divided into Tangible and Intangible.

**Tangible Benefits:** These are the benefits that can be measured in physical terms or hard numbers.

Some of the tangible benefits are:

- Increase in time spent by sales personnel with existing customers per day (i.e. Increased no. of service calls, etc.).
- Increase in the number of new customer prospects pursued by sales team.
- Increase in time spent by sales managers in contacting customers and working with sales representatives on customer issues.
- Increase in timeliness of follow-up correspondence to customers/prospects.
- Increase in revenue per month per sales personnel.
- Increase in customer satisfaction.
- Easier access to valuable customer information for all employees.
- Better care for each customer by learning about their individual needs
- Fewer complaints.
- Cost effective customer service due to high scale of operation.
- Improved service quality.
- Improved profits or overall business results.
- Higher 'Close Rates' i.e. the speed of bringing a new business order to a close will improve and the time lag will shorten
- Improved communication within the company.

**Intangible Benefits:** These benefits can be measured by using a 'soft' criteria. Some of these are:

- Overall smoother functioning within the company
- Increased employee motivation and satisfaction
- Better trained and more skillful sales and marketing personnel
- More up-to-date information and easy access to the information
- Improved responsiveness to customer and prospect requests
- Improved image of the company
- Ability to differentiate your company from the competitors
- Improving the understanding and eventual control over selling and marketing expenses.

### Limitations Of CRM

A major bottleneck is in the human service channel. This is due to the limitation of human front-line workers and their traditional interaction techniques. With the increasing throughput of CRM systems, employee resources have become the new limiting factor on service productivity. While it is relatively straight forward to increase the scale and performance of computerised systems, it is more challenging to leverage scarce and expensive employee resources. Employees are still an organisation's most valuable resource. Employees exhibit unparalleled abilities to personalise customer relationships, to solve unique problems, to react to customer requests, and to engage in rich, beneficial information exchange. However, while employees are unmatched in terms of their service quality abilities, the human service channel also has significant weaknesses.

**With the increasing throughput of CRM systems, employee resources have become the new limiting factor on service productivity.**

Due to scarcity and expense of qualified front-line employees, the human channel is often unresponsive and unavailable when customers require service. Even in cases where human resources are available, they are often not deployed on particular classes of service requests because they are not cost-effective for low-value service response activities. Also the human service channel can be inconsistent and error prone, especially when applied to routine or monotonous service requests. Finally, a large portion of the human channel is

not represented by employees at all, but is composed of members of an organisation's indirect sales and service channel. A key inhibitor to service productivity is the co-ordination required between geographically and organisationally-distributed members of the service delivery channel.

### Managerial Issues

When companies start implementing the customer care strategies, a number of issues faced by them are:

- **Accountability:** Fix the accountability for customer relationships in the organisation.
- **Business Transformation:** The CRM must be properly understood and planned to result in the transformation of the business practices and focus.
- **Organisational Structure:** It needs to be modified so as to suit the relationship management process and bring in accountability.
- **Acquire managers with a vision who operate in a competitive environment i.e. finding products and services for customers and not finding customers for the products and services.**
- **Performance Evaluation/Measures of Business Success:** Defining appropriate measures of success will ensure that the CRM strategy is in tune with the business focus. Customer relationship management has largely escaped systematic measurement, and as a result its ability to deliver a profitable performance is often regarded sceptically and under-supported by senior management. A study by Purdue University researchers showed that 87 per cent of the Fortune 500 companies surveyed had the words "Customer Relationships" or "Customer Satisfaction" in their corporate mission statement, yet only 18% had implemented a method for measuring this elusive asset.

### Challenges

The success of CRM rests on both technology and organisational change. This change should start with understanding the profitability of each customer at a granular level and then actions can be planned to make use of other technologies to change management practices. A common challenge in an organisation is to develop a standard and commonly acceptable criteria for measuring and reporting the performance of CRM systems in various departments and divisions of the organisation. Depending on the focus, the success factors

are different such as response rate, number of contacts required to close a sale. The absence of this uniform criteria results in confusion and lack of consistency.

**A common challenge is to develop an acceptable criteria for measuring the performance of CRM systems.**

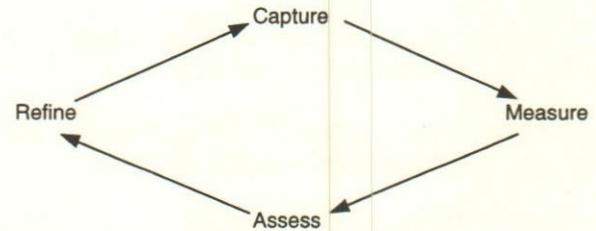


Fig. 2. Continuous Customer Evaluation

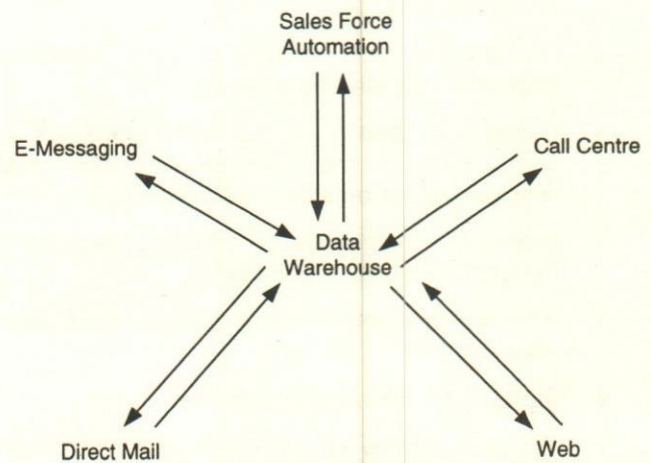


Fig. 3. Cross-channel view of the customer

The management should seriously consider the following for successful CRM.

- The management must define customer relationship in a way that can be measured and therefore managed.
- The top management has to be actively interested in the performance improvement of CRM.
- The organisation should adopt a plan to improve performance in a systematic way. The organisational plans should define the targets against which progress can be measured.
- The organisation should explicitly measure performance against plan.

- The organisation should have an effective performance feedback system for all levels.
- In CRM, the people are a major factor in achieving success, they need to be motivated to bring their brains and hearts to work and not just their bodies.

All transactions must be looked at as relationship building opportunities (Reichheld 1993). CEOs must recognise that sustained profitability comes from retaining customers through increased productivity and information technology, not just low wages. Since CEOs have the responsibility of generating profits for the company, the CEO must ensure that focus on the customers using IT must come back in terms of revenue, market share and profits. Studies have shown that companies like Citicorp which adopted the IT for customer relationship won market share and increased profits as a direct result of these investments. However, Citicorp showed no productivity gains because the company did not reduce costs or labour (Betts, 1993).

**Focus on the customers using IT must come back in terms of revenue, market share and profits.**

Moreover, we should be careful not to use IT to simply replicate the traditional business processes that affect customer relationships, but numerous innovations have to be incorporated to make the business proces-

ses simple to reduce costs and improve efficiency. A communication model which can provide this will look like the one shown in Fig. 3.

## Conclusions

In today's increasingly complex environment, customer relationship management is critical to corporate success. To be successful, a business must fulfil the client-vendor relationship throughout the customer life cycle to ensure that their customers as well as the organisation receive the benefits expected. CRM enables a company not only to retain its existing customer base and customising the products and services to suit them but also helps to attract new customers through superior customer satisfaction. In the future, the focus is going to shift from increasing the sales to increasing customer satisfaction.

## References

- Anton Jon** (1996), 'Customer Relationship Management: Making Hard Decisions with Soft Numbers', Prentice Hall, New Jersey.
- Betts M.** (1993), "Real IS payoff lies in business benefits", Computerworld, March.
- Ernst & Young Survey (1990), 'Biggest challenge for next five years', Electronic Business Magazine, March.
- Panepinto J.** (1994), 'Going out on a wireless', Computer world, February.
- Reichheld F.F.** (1993), "Loyalty-based management", Harvard Business Review, March-April.
- Sager I.** (1994), "The few, the true, the blue", Business Week, May 30. □



# Productivity Improvement in Ophthalmology

B. Venkatraman & U.S. Rao

---

*Production Planning and Control, Operations research, Just in Time, Cellular Manufacturing and Productivity improvement techniques have been extensively used in manufacturing organisations during the last several decades. In this paper, an application of Input/Output control, Assembly Line Balancing, Simulation of queuing process and Cellular Manufacturing concepts to the OPD section of the Ophthalmology department of a well known hospital has been described. The study illustrates that dramatic improvements in patient waiting time reduction (60 per cent), congestion reduction, patient satisfaction and hospital staff and doctors' productivity can be obtained by application of the well known productivity improvement techniques in hospitals.*

*B. Venkatraman is with Sri Sathya Sai Institute of Higher Learning (SSIHL), Prasanthinilayam. U.S. Rao is Principal and Dean, School of Business Management Accounting and Finance at SSSIHL, Prasanthinilayam.*

The hospitals being predominantly government supported welfare organisations in the earlier decades, have not been concentrating adequately on efficiency and cost effectiveness as much as commercial business organisations. With competition setting in with the arrival of private sector hospital ventures, business and efficiency orientation is being given importance. While competition is forcing hospitals in developed countries to become more efficient, reduced funds availability is forcing hospitals in developing countries to become more efficient.

Production flows, queues, inventory, Just in Time processes, Assembly Lines, Cellular Manufacturing—the notions associated with the factory floor are exactly what modern hospitals need. Manufacturing industries have used these ideas for decades and obtained dramatic improvements in productivity, cycle time reduction and inventory reductions.

The term operations management refers to the systematic direction and control of the processes that transform inputs into finished goods and services in both profit and non-profit organisations. As the figure below illustrates, production and operations management together comprise a system. Inputs include, human resources, capital (equipments and facilities), materials, land, energy and information.

The circles in the above figure represent the operations through which products may pass during the transformation process. Since the operations encompass a variety of different situations, the types of transformations vary as well. For example, in a factory the transformation would be physical or chemical. At an airline it would be locational, and at a hospital it would be physiological. The operations vary accordingly; a machine centre, two or more airport terminals, and a hospital room. The dashed lines represent two special types of input.

## Assembly line

Assembly lines, sometimes called flow or produc-

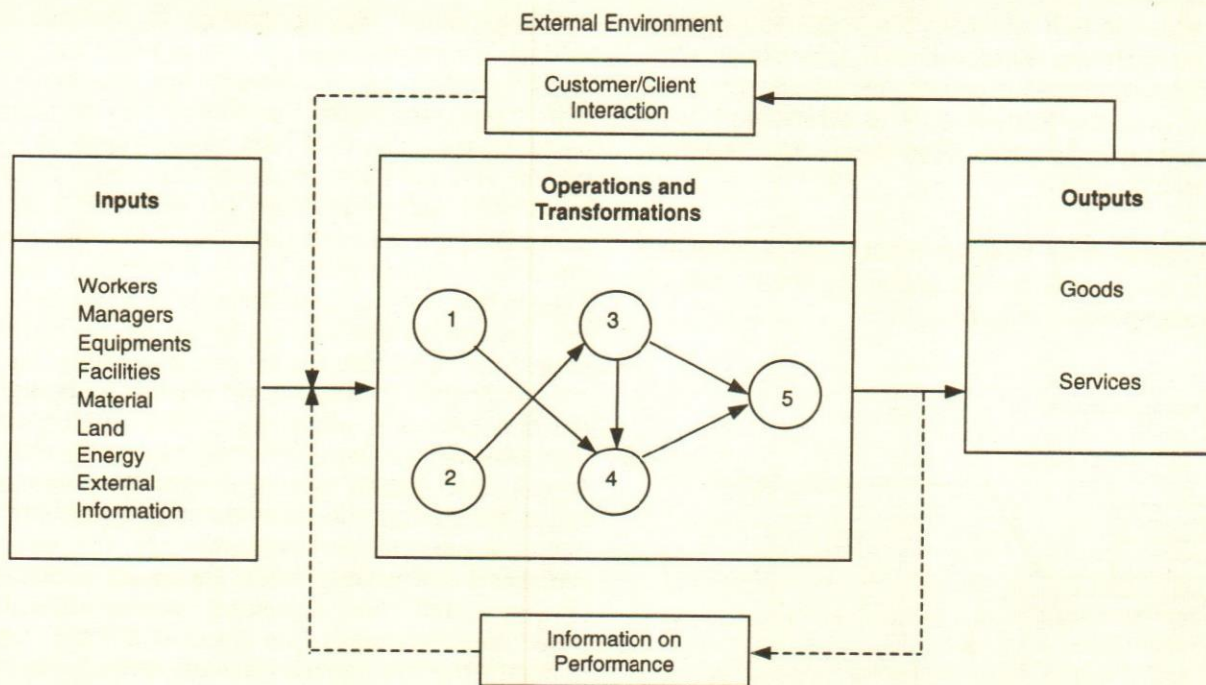


Fig. 1. The Production/Operations management system

tion lines, are undoubtedly the principal feature of mass production systems. Henry Ford is credited with developing the first assembly line in 1913, when he began manufacturing the model "T" Ford (Manus, 1983, Lee and Kim, 1989. Shin and Min (1991) define an assembly line as a sequence of work-stations connected by a material handling system; which is used to assemble components into a final product.

**Assembly lines are the principal feature of mass production systems.**

### Assembly line balancing

Wild (1971) states that the Assembly Line Balancing (ALB) problem is the problem of assigning tasks to workstations. Because tasks may require widely different times, the assignment of task-times to workstations is rarely equal. This leads to idle time at workstations. One of the objectives of ALB is to minimise this idle time. A secondary objective is balancing workloads across workstations so that no workstation has excessively high or low workloads. The assignment of load to workstations is done to insure that the Assembly Line can meet the demand rate. Thus each workstation is given a fixed amount of time to complete its task. Depending on task times and the demand rate it may sometimes be necessary to dupli-

cate one or more workstations. The duplication has the advantage of shortening the Assembly Line but may require more equipment and tooling. Parallel Assembly Lines have other advantages as well. Because each workstation has a larger amount of time to complete its tasks, more tasks can be assigned to the station thereby enriching the work content. Also if equipment problems occur at a station, other lines can continue to run. A single serial line would have to be shut down whenever there is a failure at any workstation.

### Purpose of assembly line balancing

For line flow process, the purpose of ALB is to ensure that the process time for each production stage (called Cycle Time—CT) is low enough to meet the required output rate—the most efficient configuration being the one where all the cycle times are equal and the product can be pulled through the system without the need for Work-in-Progress (WIP) inventory between the production stages (Greasley, 1996).

### Input/output control

Input/output control is a major feature of a manufacturing, planning and control system. Its major precept is that the planned work input to a work centre should never exceed the planned work output. When the input exceeds the output, backlogs build up at the work

centre, which in turn increases the lead-time estimates for the job upstream. Moreover, when jobs pile up at the work centre, congestion occurs, processing becomes inefficient, and the flow of work to downstream work centres becomes sporadic. (Pendlebury and Yeomans, 1995, Feguson, 2000).

The relationships between Input, Load, Output and Capacity may easily be visualised by the hydraulics analogy as shown in Fig. 2.

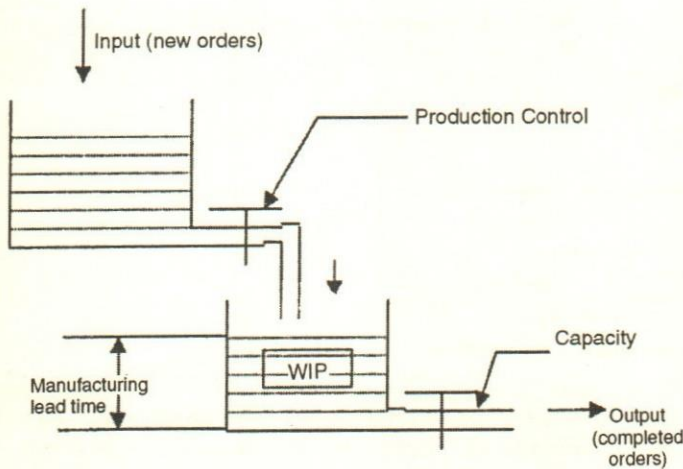


Fig. 2. Hydraulics analogy of I/O control method

Input is represented by the rate at which the water flows into the tank and is controlled by the input valve. Load is represented by the level of water in the tank and corresponds to WIP (Work-In-Progress) inventory or back orders. Output is the rate at which the water flows out of the tank. Capacity is the size of the output pipe, not the size of the tank. While capacity limits the maximum rate of flow, the actual output rate may be less than the capacity if the water level is low. The proper way to control this tank system is to regulate the input valve so that the output and inventory achieve the proper levels. One cannot push more water through the tank simply by opening the input valve, although this tactic is frequently attempted in factories and service operations. Once capacity is reached, the only way to get more output is to increase the size of the output pipe. Managers are well aware of the consequences of too little input: Low machine utilisation, idle labour, and high unit costs. What is often not understood are the consequences of too much input. In this case working capital will rise due to a larger WIP inventory, the average processing time to complete an order will increase as orders spend more time in queues, and the system performance will generally decline. It is often better to control input by back logging orders or even turning business away, if necessary, than to make futile attempts to push more through the system.

One popular way to attempt to increase output without increasing capacity is to expedite the WIP. Expediting is done by identifying critical jobs and rushing them through the facility. For example, an expeditor may place red tags on critical jobs, which should be worked on first. This is a shortsighted solution, which often does more harm than good. Every job expedited today may cause two jobs to be laid tomorrow. Expediting destroys the smooth flow of work; it is an antithesis of planning. Even in the best-managed operations, a little expediting may be needed when things go wrong; but expediting should not be substituted for proper planning, scheduling and control. One way to tell whether an operation is out of control is to count the number of jobs carrying rush stickers, red tags, or other expediting messages. Ralston Don (1996) feels that expediting indicates a failure to manage the relationship between input and output. A machine working continually with work to be processed still waiting would be called a bottleneck. Machines that have significant excess capacity are called non-bottlenecks. The objective of Input/Output is to control the flow and the inventory levels in the system to always make sure the bottleneck machine does not stop working due to non-availability of jobs because its output is directly related to the output of the system.

**Expediting destroys the smooth flow of work; it is an antithesis of planning.**

#### Relevance of manufacturing concepts to hospitals

As in manufacturing organisations, it is important to balance capacity at various stages of a service process to avoid bottlenecks. Balancing is probably even more important for service organisations, since manufactured goods do not complain about waiting, but people do.

In the late 1980s, managed-care organisations began negotiating lower fees and sharpened incentives in the U.S. Medicaid and Medicare followed this lead. In reaction to this austere environment, the \$400 billion-a-year hospital industry made almost every large-scale change it could think of, from mergers and acquisitions to slash-and-burn cost cutting. But none of these measures worked very well. It is then that they understood that production flows, queues, inventory, JIT process, Assembly Lines (AL), Cellular Manufacturing (CM)—notions associated with the factory floor—are exactly what modern hospitals most sorely need. Manufacturing industries have used these ideas for decades. More recently, service industries such as retail banking, fast food, and telecommunications have fol-

lowed suit. Now these techniques are being applied to hospitals.

Paul Mango and Lan Shapiro (2001) feel that in less than a year, a hospital can increase the number of patients it serves by as much as 20 per cent while eliminating lengthy wait times—gains that can be achieved by implementing the basic end-to-end process improvement tools that Ford and GM used in the early 1980s. They also go on to say that improving the process efficiency of a hospital begins with identifying the main stages in a typical patient's visit (Of course the stages may differ for each major category of patient), identifying potential bottleneck-places where the system is subjected to greater demand than it can handle—and alleviating them by balancing the components of the process, smoothing demand as far as possible and shifting capacity during peak periods.

Paul Mango and Lan Shapiro (2001) say that obviously a hospital is not an automobile factory, and people—especially sick ones—are less predictable than car parts. Nevertheless, hospitals, which usually have far fewer discrete stages to worry about than do major manufacturers, can often reduce their variability a good deal. Once it becomes clear where the problems lie, it is usually possible to eliminate them solely through better planning. Even a little bit of it goes a long way, since hospitals can often eliminate much of their idle capacity by reducing the variability of just three or four parameters in the system. Less variability means shorter waiting times, and that alone is a great boon to patients and doctors alike. They honestly believe that it is the benefits such as short waiting times and fast turn-arounds that can distinguish one hospital from another.

**Short waiting times and fast turn-arounds can distinguish one hospital from another.**

**The Input/Output control method**

The major aim of the application of input/output control technique to the OPD section was to reduce the length of the queues that tend to accumulate in front of certain rooms and thereby reduce congestion and waiting time for patients, bring more orderliness in the department and a greater level of satisfaction for the doctors, technicians, and the patients.

- When any patient comes to the OPD (Ophthalmology) section for the first time, he/she has to go through a set of processes. The sequence of

movements of the patients are:

- The patient comes to the "Waiting" area (at around 8.00-8.30 AM) where he/she gets registered (according to the token numbers).
- Once registered, the patient is sent for AR (Auto Refractometer) Reading and Vision test.
- At the end of the tests, the patient is asked to meet the doctor for further examination.
- From here, some patients are sent for "Best Corrected Vision with Glasses test" (BCVG) or for dilatation (to facilitate further set of tests to be done on them) by the doctors as the case may be.
- The patients who are satisfied with the glasses test go out (around 10 per cent) whereas the others are asked to go back and meet the consultant who had examined them before.
- The consultant does a secondary set of tests on them for diagnosing their ailment.
- At the end of the tests, the patient is classified into one of the four Clinics (Glaucoma, Cataract, Retina or Squint/Cornea) for further treatment.
- The appointment (date and time) for the second visit is then given to the patient and he/she goes out of the OPD section.

**Table 1:** Process times for the different OPD processes

Process No.	Process description	Time (Min)	Time (Min)	Time (Min)
		Min	Avg	Max
1.	Registration	2	3	5
2.	AR reading & Vision test	4	5	7
3.	Consultation	4	5	7
4.	Best Corrected Vision With Glasses (BCVG)	5	6	8
5.	Dilatation*	30	50	60
6.	Consultation	4	5	7
7.	Appointment (Second visit)	1	2	3
Total time (Including dilatation time)		50	76	97
Total time (Excluding dilatation time)		20	26	37

\* Dilatation is done only where it is required

Once the process was understood, the minimum, average, and maximum times required to perform each of them was obtained by asking the doctors and the technicians and also by direct observation (Table 1).

Also on a typical day, the queues (number of patients) in front of the different rooms were observed at regular time intervals and these were found to be as follows:

**Table 2:** Queues in front of different rooms in eye OPD on a typical day

Room	BCVG	ARRVT	ARRVT	CON	CON	Total
Time						
8.30 AM	4	-	2	4	4	14
9.00 AM	20	-	4	-	3	27
9.30 AM	20	2	5	2	10	39
10.00 AM	20	3	6	4	10	43
10.30 AM	25	4	6	8	15	58
11.00 AM	15	2	-	3	6	26

Total No. of OPD patients per day 207 patients  
 Average No. of patients in OPD 207/6 = 35 patients  
 CON-Consultant; ARRVT-AR reading and Vision Test; BCVG-Best Corrected Vision with Glasses

The timing of the OPD section of the ophthalmology department begins everyday at 8.30 AM and the patients are attended to till 11.30 AM. In the afternoons only check up in special clinics are undertaken. Tokens for 100 patients are issued for the ophthalmology OPD in the morning, at the entrance of the hospital. These token bearing patients come to the ophthalmology department at 8.00 AM and go through a series of processes starting with getting themselves registered (wherein a unique hospital number is given to each patient). They leave the hospital either after getting a prescription for spectacles or medication or after getting an appointment for additional checkups on another day.

### The calculation of batches

Taking into consideration that all the 100 OPD patients are catered to in 180 minutes approximately, the cycle time of the process was calculated as follows:  $180/100 = 2$  min (approx) per patient. Taking variability of the process into consideration, in an hour around 30 patients can be examined. This, along with the consideration that a buffer has to be maintained to prevent the case of doctors running out of patients led to the calculation of batch sizes of 35, 35 and 30 patients each to be allowed into the system every hour.

### The design of colour cards

To segregate the patients into batches, a system of colour cards was devised. Three types of colours were

chosen, one for the batch starting at 8.00 AM (token numbers 1 - 35), one for the batch starting at 9.00 AM (token numbers 36-70), and one for the batch starting at 10.00 AM (token numbers 71-100).

### The pilot implementation

The colour cards were made and with the help and support of the hospital staff, the design was implemented on an experimental basis in the OPD section of the ophthalmology department of the hospital on November 12, 2001. Patients were issued colour cards and all the patients other than the first batch of 35 were informed of their starting times (either 9.00 AM or 10.00 AM) and asked to report at that time. They were admitted in batches into the system according to the proposed design and the queues (in front of every room) were monitored closely.

### Observations and feedback

The results of the above study can be summed up with the help of a table (Table 3) that compares the figures of the total cycle time (eye check-up time + waiting time) for a patient before and after the implementation of the study.

**Table 3:** Comparison of pre and post I/O control implementation times

Particulars	When all 100 patients are admitted	When batches of 35,35 and 30 are admitted every hour
Eye check-up time (min)	30	30
Waiting time (min)	70	40
Dilation time (min)	40	40
Total time (without dilation) (min)	100	70
Total time (with dilation) (min)	140	110

**Table 4:** Percentage improvements of the new system over the existing system

Without Dilatation	30%
With Dilatation	20%

The percentage reductions in the total time required per patient for eye check-up after the implementation of Input/Output control method are:

Apart from the above-mentioned reduction in the waiting times of the patients, a lot of other positive feed-

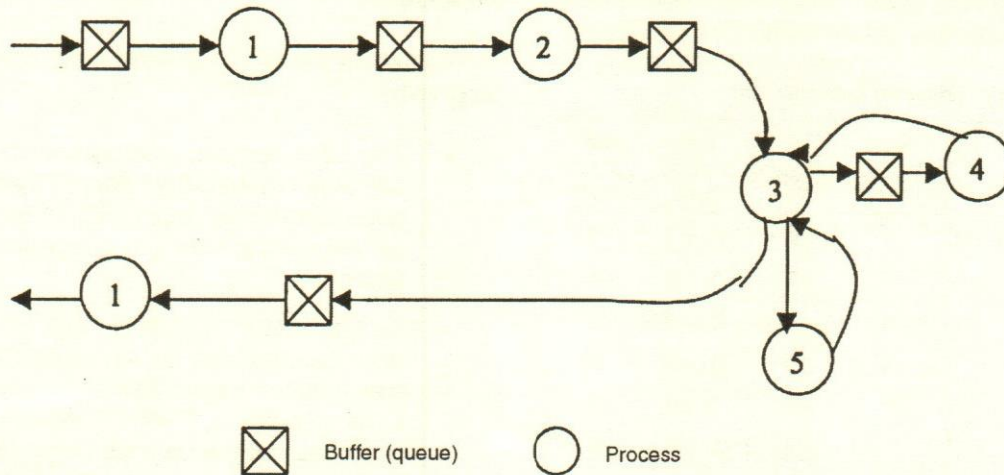


Fig. 3. OPD process as an AL

backs were received from the doctors, technicians, and the patients themselves. The doctors and the technicians did not feel any change in their workload on that day and the OPD (Ophthalmology) section appeared less crowded and a lot more spacious and organised. Many patients also perceived that they had to wait for a lesser amount of time in the queues and in the OPD section in the course of their treatment that day. The psychological impact that the reduction in waiting time had on them was quite remarkable.

### Suggestions for further improvement

The concept of Input/Output control can be further refined and made more effective by having half-an hour batches of 15 patients (each batch). This can be further improved by having a CONWIP (constant work-in-progress) method of 15 patients each where one patient is let inside the system (over and above the 15 patients already inside) only when a patient already being treated inside comes out of it or goes for dilatation.

The expected number of patients inside the OPD under the different cases were calculated and found to be as follows:

Table 5: Comparison of % reduction expected in patient waiting times

Type of control	Avg no. of patients in the system at any given time	AT	% reduction in patient waiting time
Without I/O control	80	100	-
With 1 hr batches	35	70	30%
With 1/2 hr batches	22	55	45%
With a CONWIP system	15	40	60%

AT - Average time to complete the check ups

### Assembly line balancing simulation

The simulation of the average waiting time of the patients between the processes in the Ophthalmology OPD (treating it as an Assembly Line (AL) (Fig. 3)) was carried out using @RISK software (@RISK 4.0).

The data for carrying out the simulation was entered in an EXCEL sheet. The major inputs to the simulation were the process timings for the different processes involved in the Ophthalmology OPD. The minimum, average, and maximum times of each process was collected from the hospital. Using the time distribution and random numbers, the process timings were generated for carrying out the simulation using @RISK 4.0 software.

### The simulation results

The process time values of Table 1 were used to simulate for the existing system and also for comparing the results obtained from them with the average waiting times and the queue lengths with the Input/output control methods. The average queue length between the different processes was calculated using the formula:

$$\text{Average queue length} = (\text{Average waiting time between processes}) / \text{Cycle Time.}$$

The results of the simulation that was carried out under the different cases is summarised below:

From the above table we find that still some amount of queue is maintained between some of the processes (which may apparently be contrary to the objectives of Assembly Line Balancing). However as the processes in the Ophthalmology OPD have variable times and some of the resources (like the doctors, technicians, etc.,) are bottleneck resources that have to be utilised fully it is

desirable to maintain small buffers in between the processes and especially before bottleneck processes.

**Table 6:** Comparison of simulated queue lengths

Condition	From (Process No.)	To (Process No.)	Avg. waiting time	Avg. Queue length
When all 100 patients are let inside.	1	2	25 ± 2	13
	2	3	5 ± 1	3
	3	4	27 ± 2	14
	4	5	25 ± 2	13
	5	6	0 ± 0	0
When 35,35 and 30 patients are allowed inside.	1	2	9 ± 0	5
	2	3	4 ± 0	2
	3	4	11 ± 1	6
	4	5	9 ± 1	5
	5	6	0 ± 0	0
When 15 patients are sent in every half-an-hour as a batch.	1	2	3 ± 1	2
	2	3	3 ± 0	2
	3	4	6 ± 1	3
	4	5	3 ± 1	3
	5	6	0 ± 0	0

### Interpretation of results

From the results of the simulation shown in the previous table (Table 6), we find that the total check up time including the waiting times reduces by 48 per cent when 1 hour batches (I/O control) are introduced and by 66 per cent when half-an-hour batches are introduced.

**Total check up time reduces by 48 per cent when 1 hour batches are introduced and by 66 per cent when half-an-hour batches are introduced.**

Using Cellular Manufacturing concepts revised layouts were drawn up for the Ophthalmology OPD section, requiring reallocation of doctors and test equipment to different rooms in the present building layout to reduce the distance traversed by the patients, making the OPD section more compact. The suggested revised layout with direct entrance from outside to the OPD section will also reduce patient overflow into other areas like the centre dome and corridors, thereby improving the appearance of the hospital.

### Conclusion

Based on the study the following conclusions can be drawn:

- The OPD section (ophthalmology department) can adopt input/output control system with one-hour batches to begin with to reduce queues, patient waiting time and congestion in the OPD section.
- As this system stabilises, it is felt that half-an-hour batches can be introduced to obtain further improvements. This can further be refined to incorporate a CONWIP system for the OPD processes where patients arrive just in time for their treatment process (according to the time slots given to them) to reduce patient waiting time by 60 per cent.
- Queuing simulation results of Assembly Line can be used to find the optimum number of patients in the CONWIP system to obtain the lowest queue length and total checkup time (including waiting time) while maintaining close to 100 per cent utilisation of the doctor's and technician's time.
- The study illustrates that substantial improvements can be obtained in hospitals by using well tested techniques so far used extensively in manufacturing organisations.

### References

- Feguson, Lisa A.** (2000), "Introduction to the Theory of Constraints", APICS, May.
- Greasley Andrew** (1996), "Using computer simulation for line balancing: A manufacturing case study", British Production and Inventory Control Society (BPICS), November.
- Lee, D.H. and Kim Y.D.** (1989), "The effects of product structure and sequencing on assembly shop performance", IJPR.
- Mango, D. Paul and Shapiro, A. Louis** (2001), "Hospitals get serious about operations", The McKinsey Quarterly.
- Mc. Manus and J. John** (1983), "Assembly line balancing – The state-of-the-art", BPICS, June/July.
- Pendlebury J. and Yeomans J.** (1995), "OPT – The challenge to decision makers", BPICS, June/July.
- Ralston Don** (1996), "A brief history of manufacturing control systems", American Production and Inventory Control Society (APICS), October.
- Shin D. and Min H.** (1991), "Flexible line balancing practices in a just-in-time environment", Production and Inventory Management Journal (PIMJ), Fourth Quarter.
- Wild R.** (1971), "The design of assembly or flow lines", Works Management Journal, January.

□

# Research Orientations of National Laboratories – Developmental Needs

Pulak Das

---

*Technological, social and business environments of Indian national laboratories are changing very rapidly. A brief analysis of the output characteristics of these national R & D systems indicate its proximity to the science side of the innovation cycle. In the changed economic and technological scenario, a national laboratory could play a more meaningful role if it reorients its activities to make it closely linked with the needs of one or more industrial organisations. This alliance building would demand new expertise and skill on the part of professionals. The article identifies and highlights the importance of some those skills.*

*Pulak Das is with the Human Resource Group, Indian Institute of Management Calcutta, Kolkata. Part of this article was presented in R & D Management conference, December 6-8, 1999, New Delhi.*

With an annual expenditure of \$1.8 billion and as many as 3,33,500 professionals to run various R & D establishments, India is one of the few countries in the developing world, which has been able to establish a fairly big research infrastructure to support its industrial development and other national goals. In terms of percentage of national income, she spends about 0.66 per cent of GNP in running her various R & D establishments (Research and Development Statistics 1996-97, 1999).

Off late, there has been a growing concern that though the country has been quite successful in setting a fairly sophisticated R & D infrastructure, yet in terms of realised value from this investment and in terms of its impact on the industry, it has not been that successful. Poor awareness on the importance of R & D in the industrial sector and non-industry focus of the Indian national R & D system are some of the reasons for this failure.

In the recent past, there have been rapid changes in technological, business and social environments of national R & D systems all over the world (Smith, 1997). In keeping with this trend, the Indian national R & D system is also undergoing a transformation (Gupta, et al, 1999). Instead of keeping it closer to the scientific frontier, there has been growing demand to bring it closer to the technological opportunities and industrial activities. The present study attempted to analyse the output characteristics of the Indian national R & D system to understand its current orientations and identified the developmental needs of its professionals to make them more market oriented and innovative.

## Facts

First of all, though India spends quite a good amount of money in running her various R & D establishments, yet only a small fraction of only 14 per cent of



this budget are actually used for promotion of industrial development (Research and Development Statistics 1996-97, 1999).

Secondly, though industry is the principal beneficiary from development of indigenous technology, yet it shares only 27 per cent of the financial burden of maintaining an R & D infrastructure in the country. Lack of in-house R & D facility in an industrial organisation not only affects its ability to develop newer technologies but also its capacity to make full use of whatever technology it imports from outside. This poor technology absorption capacity of the industry, is reflected very well in the composition of her export and import baskets. In value terms, only 25 per cent of her exports are from technology intensive sectors while as much as 72 per cent of her imports are due to import of technology intensive products and services (Science and Technology Pocket Data Book 1993, 1996). Patent is another area of major industrial concern. With the new WTO (World Trade Organisation) regime and IPR (Intellectual Property Right) laws becoming operational in world trade, many of her industries could be extremely vulnerable to various patent regulations and litigation in the coming days. Yet, her contributions to yearly patents are miniscule. In 1996-97, out of 907 patents sealed in the country, only 33 per cent were from Indians, the rest were from foreigners.

Though after economic liberalisation of the 1990's, R & D investment by private sector industries picked up a bit yet the industry as a whole still spends no more than 0.6 per cent of its annual sales turnover for its R & D, which is well below the percentage of sales turnover spent by industries of developed countries. Industrial investment in R & D is as much as 2 per cent of the sales turnover in the US and as high as 5 per cent in Germany (Jain & Triandis, 1997). Furthermore, as much as 72 per cent of the R & D units in private sector industries spend less than \$0.13 million annually to run them and employ no more than 20 professionals (Research and Development in Industry 1996-97, 1999). Such a small pool of professional manpower with an equally small budget for their employment can hardly undertake any major innovation. A small financial allocation further affects image, visibility and voice of these units in the strategic decisions of their organisation.

Along with poor awareness on the need for R & D in the industrial sector, there are evidences of low industry orientation and poor commercial awareness in the national R & D system also. There are ample proofs of such misplaced priorities in the output figures of Indian Government R & D systems. Though the institutional sector together spends 73 per cent of

the total R & D budget and employs 80 per cent of the total R & D manpower, yet it's share in selected industry oriented R & D outputs are far less than that of the industrial sector. It is interesting to note that as much as 90 per cent of the institutional sector budget is actually spent for running the national laboratories and only 10 per cent is spent for running the academic institutes (Pattnaik & Chaudhury, 2001). In 1995-96, the institutional sector collectively contributed only 35 per cent of total patents sealed, only 10 per cent of the new products developed, 21 per cent of the new processes developed, only 2.9 per cent of the new import substitutes developed and 27 per cent of the new design prototypes developed.

**Low industry orientation and poor commercial awareness in the national R & D system.**

At the same time when we look at publication oriented research outputs we find the contributions of the institutional sector are more impressive. As much as 89 per cent of the technical papers published, 84 per cent of new books written, and 70 per cent of technical reports written were from the institutional sector.

**Table 1:** Selected outputs per \$ 1 million of expenditure in institutional and industrial sectors in 1995-96

Output group	Institutional Sector No/ \$ Million	Industrial Sector No/ \$ Million
Patents Sealed	0.047	0.235
Products Produced	0.376	8.93
Processes Developed	0.376	3.71
Import Substitutes Developed	0.094	7.43
Design Prototypes Developed	0.235	1.79
Consultancy Services Rendered	5.55	3.15
Papers Published	10.53	3.34
Books Published	0.376	0.24
Technical Reports Published	2.82	3.10

\$ 1 = Rs 47.0 Assumed

Source: Research and Development Statistics 1996-97, 1999

Output per unit of budget expenditure could be used to compare the efficiency of different sectors and orientations of their professionals (Geisler, 1998). This has been calculated for 1995-96 and shown in Table 1. This table shows that by spending \$1 million, the institutional sector R & D produced 0.047 patent, 0.376 new product, 0.376 new process, 0.094 import substitute,

0.235 design prototype, 5.55 consultancy services, 10.53 paper, 0.0376 book, and 2.82 technical reports. The corresponding figures for the industrial sector were 0.235, 8.93, 3.71, 7.43, 1.79, 3.15, 3.34, 0.24, and 3.10 respectively. This shows that though the industrial sector collectively spends considerably less in running their R & D establishments, yet with an equal budget to run, they are more productive than their counter part in the institutional sector in all the output indicators except consultancy services and publication of paper. Even in the area of publications of books and technical reports, they kept their pace well in parallel with the institutional sector.

Though such a gross comparison of output numbers per unit of expenditure cannot do justice to different types of technological research and innovations pursued by different laboratories of these two sectors, yet it highlights very well their differential emphasis and priorities.

In terms of the job manpower development activities, the record of the institutional sector has not been that impressive either. In 1993-94, out of 22,621 S & T personnel who attended any kind of national and international seminar only 52.7 per cent were from the institutional sector. Out of 11,379 S & T personnel who attended any kind of national and international training programme only 36 per cent were from the institutional sector (Research & Development Statistics 1994-95, 1996). This indicates the industrial sector is more alert and active to understanding the developmental need of their scientific manpower than their institutional counterpart.

**Industrial sector is more alert to the developmental need of their scientific manpower than their institutional counterpart.**

A high percentages of paper and other publications oriented activities of the institutional sector, indicate that quite a substantial part of energy and efforts of the Government R & D system are directed towards writing technical papers and for providing Consultancy services. This also indicates that most of the R & D efforts of this sector are actually geared towards science or the know-how part of the value chain of industrial innovation. And, unless trade and non-trade relations between these laboratories and industrial organisations improve, the country cannot hope to achieve much industrial advantage out of the knowledge advantage of its national R & D system.

## Value Chain in R & D Product Development Cycle

A scientific and technological research could be directed towards different segments of the value chain of an innovation cycle. There is a wide difference in the potential for value addition from one's research effort in different segments of the value chain.

In the initial stage of creative idea generation, a scientific or technological breakthrough provides service to science and scientific communities only. Only specialists can find any use of those ideas. Even if the findings are published in a publicly available document, yet because of highly specialised vocabulary and terms used in such publications, its diffusion and dissemination are limited only among the specialists. Since at any point in time, the number of such specialists in the world are limited in number, the potential cash flow or value generation from even a very novel and socially useable idea could be extremely slow. Naturally, without a strong state support many institutes of this kind cannot run for long.

**In the initial stage of creative idea generation, a technological breakthrough provides service to scientific communities only.**

The cash flow or demand continue to remain low until the original idea or the ideas derived from it crosses the domain of specialists and enters an industrial territory. However, the language of business or industry are totally different from that of science. A business manager may not find any use for even a very novel technological idea unless it is expressed in terms of cost, market demand and potential revenue. Thus, there is a natural barrier of language and culture between science and business. In an industrial organisation, this gulf is often bridged by the link pin of engineers and technologists who convert new scientific ideas into tangible products or processes that are demanded by the society. Further, these products or process are made for the use of the common man or for the use of other industries where demands for these goods are not so much due to the novelty of science or technology that has gone into their design as for the services available from them. A domestic user or an industrial buyer of an engineering product or process looks at it as a package of services available in some ratio. Since all these services are available from many other existing products and processes, it is easy to compare the relative costs of services available from a new product with similar services available from any other existing product. In its

test for market acceptability a new product has to pass not only the test of service availability but also a test on its cost vis-à-vis other similar goods. Thus, a design engineer or a technologist working on an innovative product or process needs to balance the zeal of innovation and novelty of science with the cost of delivering such a unique package of services to buyers.

**A technologist working on product needs to balance of innovation with the cost of delivering such a package of services to buyers.**

Once a product or a process passes this test of cost and service availability, its demand grows quite rapidly simply because the number of people who understand and need its services are far more than the number of people who look for a new scientific idea or a newer explanation of an older problem. Further, unlike a scientific or a technological idea, which is intangible, an engineering innovation in product or process form has a tangible visible existence. Human capacity for retention and recall of an image is far higher than their capacity to store and use logical inference or linguistic explanation of a concept. This works to the advantage of an industrial innovator who may find a soaring demand for his/her innovation after it has taken a visible shape. Due to this coding advantage, signals from an useful and cost effective product or process diffuse at a much faster rate than that of a similar message of science. Once the product or process catches the imagination of a business manager, more investment pours in. Thus within a fixed period, the potential value creation from a new product or a process innovation, is far higher than that in the idea or science segment of an innovation.

There is another potential threat to a small R & D laboratory which pursues its research very much at the fundamental level. Moving a new idea from the frontiers of science and technology to the centre stage of an industrial market would entail a good number of additional tests and investigations. And, during many of these tests and investigations, a few new ideas or problems may catch the attention and imagination of the investigators, some of which may show higher promise both as science and as commerce. This distraction of a scientist's energy and dilution of organisational investment resources could bring both the researcher's energy and the organisational investment well below the threshold needed to bring an idea into the market. An R & D laboratory with limited financial resources can ill afford to go into all the new ideas that

crop up during the execution of any specific project.

Sometimes these tests proliferation are not so much on account of new findings from a laboratory as due to stringent regulatory and safety laws of the country. This is one of the reasons why in the recent past, inspite of considerable cost advantage of pursuing medicinal research, India failed to acquire very many pharmaceutical patents. No wonder the yearly R & D budget of some of the multinational pharmaceutical giants are to the tune of a billion dollars. The cost of bringing a new chemical entity into the market is more than \$350 million (MacFarlane, et al 1995)

**The yearly R & D budget of some multinational pharmaceutical giants are a billion dollars.**

### **Environmental Change in R & D Focus**

Technological, social and economic environments of Indian national laboratories are changing rapidly. New technologies are making the existing technology products and processes obsolete at a faster rate. At the social level, new value systems of current utility are challenging the age-old value systems of future orientations with increasingly sharper and bolder languages (Das, 2001). At the economic policy level, the Government is under increasing pressure to generate resource from its various capital reserves including scientific and technological expertise locked up either in public sector enterprises or in national laboratories. These environmental changes have significant effects not only on the kind of jobs that the national laboratories should be doing but also the way it should be done

### **Shift in Job Profile**

Expertise of a working professional depends not so much on what academic training he/she received in colleges and universities as on what job he /she had been doing in recent years. Job challenge is one of the important means of developing one's expertise and shaping one's attitude. Historically, many of the present day Indian national laboratories were started in a period when one of the principal priorities and tasks before the nation was how to develop enough number of well trained professionals in the shortest possible time and establish a culture of scientific temper and value among the masses. This set the major strategic goal and positioning policy of many of these laboratories. This also set the agenda and principal developmental opportunities and orientations of the professionals who were employed

there. Though on paper the strategic mission of these laboratories were to assist the industries in their technological requirements, yet in practice most of them worked more like any other academic institute with a high degree of public focus both for their funding as well as for their product outlet. The professional manpower development and performance evaluation policies were very much like that of an academic institute which historically always worked in the knowledge domain of the science and technology innovation cycle (Das, 1999). Since at that juncture of Indian economy, a quick development of a sufficient number of well-trained professionals was one of the most critical concerns and challenges, these operational deviations of the laboratories were considered very desirable.

**Mission of laboratories were to assist the industries in their technological requirements.**

However, over time two very important environmental changes happened in the Indian professional manpower market with very significant effects on both the factor and the product markets of the national laboratories. Firstly, since independence the country established many other specialised technical training institutes whose mandates were to produce good number of highly trained scientists and technologists. Secondly, economic restructuring and adjustment of big manufacturing organisations started spewing out a good number of technically trained professionals into the labour market. Even though national laboratories are still the major employers of research professionals yet they can no longer claim to be sole suppliers of technically trained manpower in the country. In fact, nowadays quite a few national laboratories are meeting a good part of their annual manpower requirements by hiring straight from the industry (Das, 2000). Thus the ecological niche in which these laboratories have been operating for so long has shrunk considerably. However, given the size and accumulated experience and expertise of these organisations, a strategic repositioning could be worked out whereby they would not be competing with the newly established specialised academic institutes yet would be contributing to the overall growth of the industry. One area in the innovation continuum of Indian industrial environment which has remained relatively unpopulated and poorly served for long is the technology product and process development space. Because of the small size of most in-house R & D facilities, there are a few industrial organisations which could pose a threat to any laboratory in the near future. Further, because such technology product or process focussed R & D

activities give more and quick visibility to professional competence and capabilities, this may create a more motivating and enriched culture within these laboratories.

**National laboratories are still the major employers of research professionals.**

### **Need for Strategic Alliance**

With growing investment in new technology development, technological research is likely to become more and more complex and more costly in coming days. The idea of a new technology may not always come from an R & D laboratory. It may come from a production shop or a marketing professional or even from an after sales service engineer. In order to tap these rich and varied resources, a business organisation not only needs all these different functional units under its fold but also a culture of creativity and innovation charging all its professionals irrespective of their departmental affiliation. It is highly illogical if not downright dangerous to claim that only the R & D department has authority and right to come up with new technical ideas which the organisation could nurture to reap an economic surplus. There are umpteen numbers of technological innovations where initial ideas actually came from outside an R & D laboratory (Pavitt, et al, 1990). This also highlights some of the inherent weaknesses of many of the national R & D laboratories in India. By design many of them stand alone with no production or marketing outfit attached to them to supplement and support their technical endeavour.

An industrial organisation without adequate number of active R & D professionals in its role, can hardly absorb let alone develop any complex technology from other organisations including R & D laboratories. Given that there are quite a good number of Government managed laboratories with sizable number of highly qualified professionals and a good number of industrial organisations with limited in-house R & D facilities, a strategic alliance between those laboratories and industrial organisations could bring about the much needed synergy and competitive edge to these industries.

However, unlike an open market transaction, strategic alliance between two organisations is a non-market contractual arrangement and is extremely fragile. It requires a high degree of strategic foresight, operational flexibility and temperamental tolerance on the part of leaders of these organisations and much

managerial skills to maintain it over a period of time. This is likely to be more so when one is trying to build an alliance between a Government laboratory and an industrial organisation. The orientation and culture of a Government laboratory and an industrial organisation are so distinct and different that unless the leaders of such alliances are highly skilled in negotiating their differences the half-life of such an alliance is likely to be very short.

**The orientation and culture of a Government laboratory and an industrial organisation are distinct and different.**

### **Identification of Developmental Needs**

Over time both the desired outcomes of a national laboratory and the way these goals should be pursued have undergone a significant change. Given that many of these laboratories and their professionals worked for so long in the knowledge domain of the technological space, implementations of such a major change in job profile and managerial process could not be easy. It would require considerable changes in orientation of the professionals and the culture of their laboratories which could only be brought about by initiating a change in the existing developmental process of their professionals and by purposeful communication with them. Though such training and development need not come at the cost of their technical expertise but could be organised more as a broadening exercise for enlarging their skill base and enhancing their confidence in dealing with non-technical matters as they move up in organisational roles. High technical expertise is a sine quo non for development of any complex technology. But technical skill alone cannot ensure success in interfacing with a business organisation where the fundamental operating principal is management of flow.

Scope for development of these required skills through the current job practices are very limited. In the existing set up of the national laboratories, a newly hired professional often works for a good number of years in various technical projects either as an independent investigator or as an associate member of a large team. The final outcome of these projects are often a technical paper or a report. The sheer technological challenge of these projects and uniqueness of their technical outcome are what motivate these professionals to acquire new knowledge and expertise. Since much of these activities were seldom linked with the need of any industrial or commercial organisation, most of these professionals rarely got any opportunity to develop their

potential to work as a partner to an industry. Even if some of the professionals had the inherent skill of managing relations with industrial organisations, yet continued non use of those skills may have affected their further development. With the growing size of national R & D and increasing complexity in their activities, research management has been found to be a new occupational role among the professionals in Australia (Turpin & Deville, 1995). Some authors expressed their dismay over thoughtless increase of research funds without giving adequate attention to their management (Macdonald, 1986). This issue of proper management of resources – both financial as well as human, is all the more important in a developing country because of high social cost of such resources. Relative to their counterparts in developed countries, a manager of a research facility in a developing country has to pay more attention to quick regeneration of these resources. Managers in developed industrial markets identified skill in general management, strategic planning, communication, problem solving and persuasion as very critical for innovation (Martell & Carrol, 1995). Considering the kind of training most R & D professionals in India receive in their academic programmes, some of the areas where additional development and exposure would be useful are:

- Skill in Problem Identification and Strategic Planning
- Communication Skill
- Customer Consciousness
- Skill in Cost and Financial Analysis
- Skill in People Management

### **Skill in Problem Identification and Strategic Planning**

Professionals often work in specific projects, which demand intensive knowledge in a particular area of science or engineering. Such specialisation provides high satisfaction to professionals and they often take the necessary initiatives to acquire new knowledge and expertise in their chosen area. However, such prolonged experience in a narrow area may not be very conducive and may be counterproductive for development of an understanding of why an organisation exists, what its missions are and which way it is heading. In order to develop a broad picture about one's organisation, one has to have some exposures in different areas in which it is active and the activities through which it relates with its external environment.

Every R & D organisation is linked with its technological, economic and social environments which are

changing constantly. No single organisation has much control over this evolution. At any point in time, this environment provides a fixed set of opportunities to exploit and a number of threats to reckon with. Before launching any major technology development project, an R & D manager needs to make an assessment of these external threats and opportunities which is then tempered with an estimation of one's internal resource strengths and weaknesses.

**Every R & D organisation is linked with its technological, economic and social environments.**

The life cycles of most high tech products and processes are diminishing every year. To stay ahead of competitors, an industrial organisation has to bring in newer and more improvised products and processes into the market place at a faster rate. The rules of the competition and the nature of the competitors are changing constantly. An R & D organisation mandated to be operating as a part of an industrial organisation cannot remain aloof of these environmental changes. No wonder continuing education and training of scientists and technologists are a few of the priority issues in industrial organisations of developed countries (McCormick, 1995). Many a time, a laboratory fails to play its role as an innovator to its parent or partner organisation not because, there is no innovative idea or idea generator, but because its R & D manager or leader is unable to spot a promising idea at the right time and master the courage to nurture it by additional investment and support to bring it to a market. Identification of a promising idea and unwavering courage of taking the risk of developing it by protecting both the idea and the idea generator from the ensuing conflict and rivalry among colleagues that often crops up in the wake of any major innovation are some of the important managerial qualities needed from an R & D manager.

**Industrial organisation has to bring in newer products and processes into the market place at a faster rate.**

With fast moving technological frontiers, the market is flushed with new ideas. Not all of them are good for further investment or investigation. But the ability to screen these ideas both for their technological challenge as well as for their business potential and the

courage to stick with the organisational decision of further investment in the face of an uncertain economic prospect are what are needed from a successful R & D manager. In an open economy, it is not only a race for grabbing the right idea before others but also a race against time to transform it into an economic fortune at the shortest possible time.

### **Communication skill**

As such scientists and technologists are inward looking and are more keen on deepening their knowledge in their chosen area of specialisation rather than broadening their skill in a related discipline. A diversified knowledge and skill to work in an interdisciplinary environment is one of the most important qualities of a successful innovator. While knowledge about the physical, chemical and biological world expand and accumulate through the process of analysis and induction, its use in a society expands only through the process of synthesis and integration. This is a synthesis not only of ideas from different disciplines but also a communion of people who are often originators or experts in diverse disciplines. Communication across subject and discipline boundary is one of the hardest challenges faced by an R & D Manager. Languages of communication from experts are often couched with terms and words that are highly idiosyncratic to a specific discipline which creates a natural communication barrier between experts trained in different disciplines.

**Communication across subject and discipline boundary is one of the hardest challenges faced by an R & D Manager.**

Communication with people across functional and organisational boundaries is essential not only for synthesis of ideas but also for delivery of an innovative product or process to outside users. Technology developers are often found to be preoccupied with the issue of technological compatibility while technology users look for service availability and reliability from a newly developed product or process. The wide gap between the concerns of product or process designers and its users could be bridged only by a good communicator.

### **Customer Consciousness**

Any technology product or process developed by an R & D team has to be exchanged with someone who

has a need for it and has the appropriate purchasing capacity to satisfy those needs. Again, because in a market there are many other similar products which jostle for customer attention, the demand for any new product could be highly volatile and transient unless it passes the test of quality and reliability like many other similar products.

A second issue about a market is its un-homogeneous nature in terms of location as well as the kind of customers it caters to. Any aggregate market could be decomposed into a number of markets with distinct demand profiles based on various customer characteristics and attributes. One of the important advantages of such customer based market analysis is that one could position one's product in such a way that there will be fewer competitors and there may be a natural barrier against further entry of new firms.

These are some of the standard management tools with which a scientist or a technologist trained and developed purely in science and engineering disciplines, could be completely unfamiliar. Though over time through repeated exposures to the needs of the organisation, he/she could develop some expertise in these tools, yet this learning process could be facilitated with some off-the-job exposures on the conceptual aspects of customer and market analysis.

#### **Skill in Cost and Financial Analysis**

Every new product and process development demands the use of organisational resources— manpower, infrastructure and finance which preclude their deployment for the development of any other product at the same time. With limited resources to go by, any organisation has to make a choice as to which projects and goals can be and should be pursued taking into account both long term business objectives and short term financial interests of the organisation. Because of wide flexibility of financial resources, most organisations use several financial evaluation criteria, for example, net return on investment, internal rate of return or pay back period to make a choice from among the many potential projects. Most market oriented R & D laboratories prefer these financial index based evaluation because it ensures recovery and augmentation of their financial resources on a continued basis.

**Most market oriented R & D laboratories prefer financial index based evaluation.**

Another advantage of an itemised cost analysis of a

research project, is that it facilitates calculation of the impact of price inflation of an item in the final cost of the product or process that is being developed. Though every additional dollar that goes into a product or process development project shows up as an additional cost of the final product, yet elasticity of the product cost towards price inflation of different items in the budget are likely to be different. This may facilitate more rational use of different resources in executing a project.

Further, while developing a new product or a process a laboratory may incur costs which may not show up in the price of the specific product directly but may add to the overhead budget of the organisation which raises the average price of all technologies developed by a laboratory.

Since cost of a new product or a process is an important criterion in its market success or failure, any market oriented R & D manager needs to have adequate skill in cost and financial analysis.

#### **Skill in People Management**

Perhaps there is no other skill than man-management which is alien to the training background of a professional yet so critical to his/her success as an effective technologist. Technological innovation is a product of human intelligence and ingenuity. Human resource is one of the most precious resources of an R & D organisation. Ability to acquire, develop and utilise these resources is one of the most important skills of leaders of these organisations. Given that most R & D laboratories have very limited number of high quality professionals, their deployment, development and preservation assume greater significance. While deploying human resources of a laboratory in a specific task, an R & D manager has to keep in mind that such deployment not only has a technical goal but also a human resource development goal. And, depending on the strategic needs of a laboratory, one may have to underplay the technical goal in favour of the human resource developmental goal. Growth and decline of many knowledge intensive organisations could very well be traced to their human resource policies and managerial styles of recent past (Jones, 1996).

**Man-management is alien to the training background of a professional yet critical to his/her success.**

Most scientists and technologists receive prolonged training in science and engineering. Prolonged ex-

posure and experience in working with objects and things mould their personalities in a certain way (Holland, 1985). Most professionals not only aspire for autonomy in their job but also cherish the emotion neutrality of their task environment. When working with many other persons within an organisational set up, too often he/she may find that these other persons react to the way they are communicated to or the way their services are being utilised. The peculiarities and volatility of these human responses could defy the high powered analytical tools of a professional. Without some exposure and training on how to work in an environment where the outcome of one's effort is probabilistic rather than deterministic, a scientist or a technologist could experience frustration and stress.

Further, failure to get compliance may push a professional to use his/her organisational position power to coerce people with its long run dysfunctional consequences. In developed countries, promotions of professionals above a certain level are often made contingent on their undergoing some training and development in these areas of management (Cordero et al 1994). Though, through the work place challenge and frustration, one could develop expertise and skill on how to manage people within an organisational set up, yet this in-house development could be accelerated and made more effective if a professional gets some classroom opportunities not only to acquire knowledge on human behaviour but also to analyse their experience and share their learning with other colleagues.

A third issue, regarding man management skill, is the ability to build a team of professionals and motivate them to work towards a common goal. While idea generation is an individual based skill, its conversion into a market oriented innovation entails team building. Dynamics of human behaviour in a group have been found to be quite different from their behaviour when they are alone. Managing this behavioural dynamics of a team of experts and directing their combined energy towards a common goal are a few of the difficult tasks of an R & D manager.

**Idea generation is an individual based skill, its conversion into a market oriented innovation entails team building.**

## Conclusion

India has made considerable progress in building an R & D infrastructure in the country. But much of the

state supported R & D efforts have so far been directed towards those segments of the innovation cycle where scope for value addition and value creation have been limited. This made national R & D not only very ineffective as a technological engine to industry but very much dependent on state support for its survival and growth. In a fast changing technological and economic environment, R & D professionals of national laboratories may have to reorient their research activities more towards market and industry. In order to achieve this reorientation, the national laboratories should give more attention to the management development needs of their professionals.

## References

- Cordero, Rene, Nancy DiTomaso, & George F. Farris (1994), "Career development opportunities and likelihood of turnover among R & D professionals", *IEEE Transaction on Engineering Management*, 41 (3).
- Das, Pulak (1999), "Restructuring of research and development services in the central Government: An evaluation of pay and performance reward system", Project Report submitted to Department of Science and Technology, Government of India. New Delhi.
- Das, Pulak, "R & D Task Characteristics and its relations to recruitment policies and long run recruitment outcome in a few national laboratories in India", Accepted for publication in *Manpower Journal*, 2000, October-December.
- Das, Pulak (2001), "Reward preferences of R & D professionals in Government Laboratories: Effects of Organisational Policies", *Hierarchical Positions and Educational Qualifications*, *Decision*, 28(1).
- Geisler, Elizer (1998), "The cost of Research", *Engineering Valuation and Cost Analysis*, 2.
- Gupta, Ashok K, H.R. Bhojwani, Rajender Koshal, & Manjulika Koshal (1999), 'Managing the process of market orientation by publicly funded laboratories: the case of CSIR, India', *Proceedings of 1999 R & D Management conference: R & D as a Business held in New Delhi between December 6-8*.
- Holland, J.L. (1985), "Making vocational choice", Englewood Cliff, N.J. Prentice Hall.
- Jain R. K. & H. C. Triandis (1997), "Management of Research and Development Organisations: Managing the unmanageable", John Wiley & Sons Inc.
- Jones, Oswald (1996), "Human resource, scientists, and internal reputation: The role of climate and job satisfaction", *Human Relations*, 49(3).
- Macdonald, Stuart (1986), "Theoretically sound: Practically useless: Government grants for industrial R & D in Australia" *Research Policy*, 15.
- MacFarlane F.G., Z.M. Kunz, L. Drasdof, C.L. Lumby & S.R. Walker, S.R. (1995), "Trends in world-wide R & D expenditure 1981-93", *Journal of Pharmaceutical medicine*, 5.
- Martell, Kathryn D. & Stephen J. Carrol (1995), "The role of HRM in supporting innovation strategies: Recommendations on how R & D managers should be treated from an HRM perspective", *R & D Management*, 25(1).
- McCormick, Kevin (1995), 'Career path, technological obsolescence



---

and skill formation: R & D staff in Britain and Japan', R & D Management, 25(2).

**Pattnaik, Binay Kumar & L. Chaudhury** (2001), 'Research Performance of Scientists in Academic Institutions in India: An Empirical Exploration' Science, Technology & Society, 6 (1).

**Pavitt, K., M. Robson, J. Townsend** (1990), "Technology accumulation, diversification and organisation in UK companies 1945-83", Management Science, 35(1).

Research and Development in Industry 1996-97, Department of Science and Technology, Ministry of Science and Technology, New Delhi, 1999.

Research and Development Statistics 1994-95, Department of Science and Technology, Ministry of Science and Technology, New Delhi, 1996.

Research and Development Statistics 1996-97, Department of Science and Technology, Ministry of Science and Technology, New Delhi, 1999.

Science & Technology Pocket Data Book 1993, Department of Science and Technology, Ministry of Science and Technology, New Delhi, 1996.

**Smith, Helen Lawton** (1997), 'Adjusting the role of national laboratories: Some comparison between UK, French and Belgian Institutions', R & D Management, 27(4).

**Turpin, Tim & Adrian Deville** (1995), 'Occupational role and expectations of research scientists and research managers in scientific research', R & D Management, 25, 2.

□

*Excellence exists in many dimensions—ideas, actions, inventions, leadership, moral wareness. No one is or can be excellent in all of these dimensions but everyone should strive to be excellent in some.*

— Lester C. Thurow

# Rehabilitation of Sick Small Scale Industry Units

P.R. Kulkarni

---

*Sickness in the SSI sector is a matter of serious concern. Industrial sickness tends to cause loss of production, very often leading to unemployment/loss of employment and resulting in blocking of scarce resources of banks/FIs, and entailing a loss of substantial revenue to the Government. The paper highlights the sickness in the SSI sector, reasons thereof; and remedial measures taken by the Government and Reserve Bank of India. The author has also suggested a new approach to prevent the sickness in SSI in the changed environment.*

*P.R. Kulkarni is General Manager, Small Industries Development Bank of India; presently on deputation with National Institute of Bank Management, Pune.*

Small scale industry (SSI) sector occupies an important position in the country's industrial economy and continues to enjoy priority in view of the sizeable contribution to industrial production, exports, creation of employment opportunities and wider geographical dispersal of industrial activities. As on March 2000, there were over 32 lakh small scale units in the organised sector manufacturing about 7,500 products. Some of them are based on local craft, skills and raw materials, while others employ highly sophisticated technologies to turn out products that compete even in international markets.

The contribution of small scale sector (including traditional sub-sector) to gross domestic product, export earning and employment generation has been consistently significant with the estimated production of Rs 6,77,814 crore constituting 37.94 per cent of GDP, export valued at Rs. 1,08,666 crore (70 per cent of exports) and providing employment avenues to 570 lakh persons in 1999-2000. While small scale industry has shown impressive growth, a disquieting feature is the growing sickness and Non-Performing Assets (NPAs) in the sector. The paper throws light on the magnitude of sickness in the SSI sector including the problem of NPAs. The magnitude of the sickness in the SSI sector has been examined, and the remedial measures taken by central/state governments, Reserve Bank of India and financial institutions. Finally, the paper concentrates on the new approach to be adopted for a timely package to be given for rehabilitation of viable SSI sick units.

## Industrial Sickness

Sickness and increasing NPAs in small and medium/large enterprises are a phenomenon which is not unique only to India. Everywhere in the world industries are facing tough competition. The increasing sickness has been causing concern to policy makers because of the production of assets lying unutilised/underutilised, the huge assistance from financial institutions/banks locked up in these units, and the adverse

impact on employment in the event of their closure. A small scale unit is considered as sick when either the principal or the interest in respect of any of its borrowal accounts has remained overdue or has become doubtful advance for a period exceeding 2 1/2 years and there is erosion of networth due to accumulated cash losses to the extent of 50 per cent or more of its peak networth during the preceding two accounting years. In case of tiny and decentralised sectors also, a unit may be considered as sick if it satisfies the above definition. However in the case of such units it is difficult to get data on financial particulars. Accordingly, a unit may be considered as sick if it defaults continuously for a period of one year in payment of interest or installments of principal, and there are persistent irregularities in the operations of its cash credit account with the bank. Based on these criteria, the RBI has made available data on advances to sick SSI units.

**RBI has made available data on advances to sick SSI units.**

As on March 1999, the total number of sick units in the portfolio of scheduled commercial banks stood at 3.09 lakh units involving an outstanding bank credit of about Rs. 19,464 crore; of this the number of sick units in the SSI stood at 3.06 lakh with an outstanding bank credit of Rs 4,313 crore accounting for 21.1 per cent of the total amount locked in the manufacturing sector alone. The following table shows the number of sick units since 1990 to 2000 and the amount of outstanding bank credit.

**Table 1: Bank Credit Outstanding in Respect of Sick SSI Units**

Year	No. of Units lakh	No. of Sick Units lakh	NBC to SSI Outstanding	BCO in Sick SSI	NBC Total	5 as % of 4	5 as % of 6	3 as % of 2
1990	19.38	2.18	15989	2427	95132	15.2	2.5	11.24
1995	27.20	2.69	25843	3547	169038	13.7	2.9	9.88
1998	31.21	2.20	38109	3843	218299	10.1	1.7	7.04
2000	32.25	3.06	48483	4313	246203	8.9	1.7	9.4

During the period March 1990 - March 1999, the number of sick units in medium and large industries is reported to have increased from 1461 in 1990 to 2792 to 1999 (i.e. by 9.11 per cent annually); while the number of sick SSI units increased from 2.18 lakh in 1990 to 3.06 lakh in 2000 (i.e. 4.03 per cent annually). At the end of March 1999, 99 per cent of the total sick units were in the SSI sector. Different parameters were used to define

what would constitute individual sickness among the small scale units. More than 70 per cent of the SSI units in the country are either proprietary or partnership concerns. These units do not have the compulsion to maintain books of accounts covering their financial status, performance and profitability. The average size of the unit is very small and they often plead that they have no organisational set up for employing qualified professionals for maintaining books of accounts. The result is that many of these units do not have reliable accounting data. In the absence of any reliable data, including the flow of data to banks and financial institutions, it would not be correct to conclude that SSI units classified as sick are really sick and are suffering from erosion in their networth.

**More than 70 per cent of the SSI units in the country are either proprietary or partnership concerns.**

The problem of sickness in the SSI sector needs some elaboration. The sickness among small scale industries is a topic that has been approached with unjustified alarm and increasing concern not only by the small scale units and their associations but even the banks, financial institutions, and government authorities. Numerically, 99 per cent of the sick industrial units are in the small scale sector. This by itself is no cause for alarm. The amount of funds (Rs. 4,313 crore, end of March 1999) blocked in the small industries was about 1.63 per cent of the total bank credit, 3.37 per cent of the priority sector advances and 8.01 per cent of the gross NPA. The percentage amount blocked in sick SSI units of the total outstanding of bank credit is apparently too small, but the number of units involved is far too many.

In the case of sick industrial units in the medium and large scale sectors, the total credit blocked at the end of March 1999 amounted to Rs. 15,151 crore which was as high as 4.65 per cent of the total net bank credit in that year. Since the medium and large scale units are normally set up as corporate entities, they are subject to discipline imposed by statutory authorities who ensure that information on capital structure of the units, reserves, the performance and working results, level of erosion, if any, in their networth, etc., is available after it is duly audited and published. The authenticity of information flow from the small scale units is deficient in several respects. Till recently the availability of relief to sick industrial units in the small scale sector in the form of concessional interest rate, waiver of certain components of interest, extending the payment period and sanction of additional assistance on liberal terms, like

lower interest rate and security margin, promoted many small scale units to get themselves diagnosed as sick so as to escape the enforcement of different laws by credit institutions and government authorities. Irregularity in the cash credit account is also considered as one of the criteria to decide whether the unit is sick or not in the absence of any reliable data. There is clearly a discernible downward trend in SSI sickness with the virtual withdrawal of relief measures for rehabilitation of sick units in small scale sector and the application of prudential norms. Banks and financial institutions are more than ever before conscious about the quality of their portfolio.

Even if the banks have underestimated, by a wide margin, the number of units that can be revived, there are still a small proportion of units that are reported as being sick. The data included units that were set-up under special programmes such as the SEEUY, SEPUP, SUME as also other state government schemes. Unfortunately, the RBI data do not distinguish between SIDO and non-SIDO units as also those set up under these special schemes. The amount outstanding against the non-viable units is less than Rs 1.38 lakh, while of viable units it is about 2.02 lakhs. Therefore, one cannot exclude the possibility that many of the large number of sick units and particularly unviable units are the creation of the mode of loaning wherein targets of a number of beneficiaries have overridden economic considerations, including viability and sustainability. Unfortunately, since these units are clubbed with those of the regular SSI units, a false picture of non-performing assets in SSI has emerged.

**Large number of sick units are the creation of the mode of loaning.**

The sickness in the SSI sector has been caused due to: (i) deliberate mismanagement with the intention to defraud financial institutions/banks or to divert funds to other units/persons or to obtain concessions that go with a unit being declared sick; (ii) delays/lack of coordination between the sources providing components of finance specifically between SFCs and banks; (iii) business conditions taking a downturn. The fourth reason for sickness in SSI sector is not entirely avoidable; but even here it is the inability of banks to judge correctly and deny those units which are doing badly requisite credit when there is a downswing in performance. It goes without saying that banks must understand the business of the clients sufficiently well to be able to judge and distinguish the temporary downswings from the permanent loss of competitiveness or lack of demand.

The reason for increase in sickness in SSI is also the lack of coordination between SFCs and banks. This is perhaps the most important from the policy point of view. A major flaw is in the present system of appraisal and sanction which, if rectified, can go a long way in preventing the NPAs, especially of new units. For all small units other than those at the very top of the spectrum, it simply does not make sense for more than one organisation to carry out the appraisal. For very small ones, the distinction between term finance and working capital finance is not meaningful. For the others, the process of appraisal by SFCs and banks separately is onerous not only because they carry out appraisal sequentially rather than simultaneously. Banks have typically accommodated the entrepreneur after the financial institutions have committed their funds. Since the bank's appraisal is purely formal, it gives them the confidence to go ahead. Thus the appraisal suffers the risk perception which instead of falling, actually rises. Banks should, therefore, try to give composite loans in a meaningful way.

#### **NPAs in Small Scale Industries**

Based on the Narasimham Committee on Financial Reform in 1991, the new concept of NPAs emerged, which is based on the record of recovery of interest and installments, irrespective of availability of security and networth of the borrowers. Based on this Committee, the RBI introduced prudential accounting standards for banks in April 1992. The essence of this system is the recognition of the record of recovery as the basis for classification of the advances portfolio of banks. It simply means that the bank could have in its portfolio two categories of advances: performing and non-performing. This could clearly throw light on the performance of the SSI sector.

**The new concept of NPAs is based on the record of recovery of interest and installments.**

As per the prudential norms, the SSI advances will be non-performing when the borrower fails to pay the interest and installments. Table 2 shows the relative position of NPAs in SSI within the priority sector. The total NPAs in SSI was Rs 7,984 crore as of March 1997, which increased to Rs 9,959 crore as of March 2000 accounting for 6.18 per cent growth annually (an increase of Rs 1,975 crores). In terms of proportion of NPA under SSI sector to gross NPAs in priority sector credit, it works out to be 36.43 per cent in March 1997, which increased to 42 per cent in March 2000 (an in-

crease of 5.57 per cent). The share of SSIs' NPAs of the PSBs to gross NPAs was 19.60 per cent as of March 1997, which got reduced to 18.69 per cent in March 2000 (a reduction of 0.91 per cent). The only good sign is that the NPAs in SSI sector are declining as percentages to total advances and advances to the SSI sector. The share of NPAs of SSI to NBC got reduced from 3.27 per cent in March 1997 to 2.62 per cent in March 2000.

**Table 2:** Non-Performing Advances in Small Scale Industries

Details	Year Ending March			
	1997	1998	1999	2000
Gross Advances (NBC)	244215	284972	325328	380077
Gross NPAs	43577	45653	51771	53294
% of Gross NPAs to Gross Advances	17.84	16.02	15.89	14.02
Priority Sector Credit	79131	91319	107200	127807
NPAs in Priority Sector	20775	21184	22607	23714
% of NPA in PSC to Gross NPAs	47.67	46.40	43.72	44.50
% of NPAs to PSC to NBC	8.51	7.43	6.95	6.24
Small Scale Industries				
Credit of SSI	31542	38109	42674	45788
NPA in SSI	7884	8833	9888	9959
% of SSI, NPA to Gross NPA	19.6	19.33	19.12	18.69
% of SSI, NPA to PSC	36.43	41.73	43.00	42.00
% of SSI, NPA to NBC	3.27	3.10	3.04	2.62

\* This data relates only to public sector banks.

Most of the SSI units at present are facing stiff competition because of the opening of the economy and WTO. Hence, innovative schemes/programmes need to be evolved so that the SSIs are not only promoted but they can thrive on their own. There is an urgent need to revamp the existing institutional framework supporting the SSIs to bring them in line with the need and requirements of this sector in the changed scenario. In short, much more needs to be done in the policies and programmes of the governments so that the institutions become a vehicle for ushering in an era of growth of SSIs. It is also essential that the units in the SSIs should have ready access to funding for modernisation to take advantage of the technological changes and pressures of market competition. Banks will have to design schemes, so that the units assisted by them will be able to produce quality goods which can face the competition, failing which it would add to their NPAs. The survey carried out by the SIDBI of OECF-assisted units indicates that 93.12 per cent of the financial assistance

provided by banks is to new units where the risk is very high. None of the banks are making any special efforts to provide assistance to strengthen the existing units by way of modernisation, expansion, diversification, or quality controls in order to prevent them from becoming NPAs.

**SSI units are facing stiff competition because of the opening of the economy and WTO.**

### Bankwise Analysis

Bankwise data on NPAs in SSIs show that the ratio of SSI NPAs to total NPAs in priority sector are above 50 per cent for 2 years (1999 and 2000) for some banks. The distribution of the PSBs according to the percentage of SSI NPAs to total NPAs in priority sector is given in Table 3.

Four public sector banks had more than 50 per cent of their priority sector NPAs coming from the SSI sub-sector in 1999 and 2000. As on March 2000, of the 27 public sector banks, 10 banks had less than 40 per cent of SSI NPAs to their total NPAs in the priority sector (this is less than the national average of 42 per cent).

**Table 3:** Distribution of the Public Sector Banks According to Percentage of SSI NPAs to Total NPAs in Priority Sector

Percentage of SSI NPAs to Total NPAs in Priority Sector	Position as on March-ending (Number of Banks)			
	1997	1998	1999	2000
Upto 20.0	—	—	—	—
20.1 to 30.0	2	1	1	1
30.1 to 40.0	15	12	5	9
40.1 to 50.0	9	11	17	13
50.1 to 60.0	—	3	3	3
Above 60.1	1	—	1	1
Average	36.43	38.68	43.00	42.00
Lowest	26.06	28.48	30.00	29.42
Highest	61.88	57.32	67.89	62.30

### Causes for Sickness and NPAs

Rarely does a unit fall sick due to one particular cause; it is generally a combination of factors which lead to the sickness of a unit. Some of the identified major causes of sickness in the small scale sector are:

paucity of adequate raw materials; working capital; delayed realisation of receivables particularly from units; marketing problems; management deficiencies, technology obsolescence; frequent power cuts/trippings, labour problems, etc.

The Development Commission (SSI) conducted the Second All India Causes of Sickness of SSI Units in 1988. Out of the total 10.55 lakh units surveyed, 3.01 lakh (38 per cent) sick units were closed due to financial problems, Marketing problems was given as the sole reason in another 15 per cent of the cases. Non-availability of raw materials was reported by another 6 per cent. More than 14 per cent cited one of the above reasons and rest of the units had closed for a variety of other reasons. In addition to this, quite a few studies on sickness in the SSI sector had been conducted in the past by RBI, FICCI and IDBI for identification of causes of sickness, and, consequently the account turning into non-performing assets, and for suggesting remedial measures. The study group appointed by RBI under the chairmanship of Dr P D Ojha in its report submitted in 1985 indicated, *inter alia*, that there was a gap both in respect of volume and nature of assistance *vis-à-vis* actual requirement of financial institutions and had recommended that this gap would need to be bridged by way of a soft loan assistance fund if they had to take up the task of nursing sick units on a large scale. This recommendation has so far not been acted upon by the RBI/government. Another committee constituted by RBI, under the Chairmanship of Shri A, Hasib for rehabilitation of sick units in SSI sector had submitted its Report in 1986. It made many specific suggestions including the norms to be adopted for considering a unit as sick as also for identifying the viability or otherwise of sick units or units showing signs of incipient sickness. FICCI survey on sickness in small industry (1988) indicates that 64 per cent of the respondents, out of 83 Small Industry Associations contacted, have expressed shortage/untimely receipt of working capital and heavy dependence on other sources and absence of well defined/regular markets as factors jointly causing sickness.

Whatever be the causes of sickness of an industrial unit, having been financially involved already and having the responsibility to recovering their dues, the task of initiating rehabilitation measures usually falls on the credit institutions/banks. In 1980, IDBI conducted region-wise studies through the Development Banking Centre of MDI, with a view to assess the incidence of sickness among small and medium scale units. These studies emphasised the need for taking preventive measures such as:

- Establishing a close rapport with entrepreneurs from initial stage onwards;

- Making a realistic assessment of the project cost and contingencies and bringing about improvement in appraisal standards;
- Close monitoring during the implementation and initial operational stages;
- Close coordination between banks and financial institutions, and institutions providing extension services.
- Making reasonable delegation of powers to officials at grassroots levels and equipping them through training for undertaking new responsibilities.

The RBI has also studied 800 large NPA accounts of 33 banks in 1999. The reasons for sickness and factors leading to NPA are as follows:

- Diversion of funds for expansion/modernisation/setting up of new projects/helping or promoting sister concerns.
- Time/cost overrun while implementing the project
- External factors like raw material shortage, raw material/input price escalation, power shortage, industrial recession, excess capacity, natural calamities like floods, accidents, etc.
- Business failure, like product failing to capture the market, inefficient management, strikes/strained labour relations, wrong technology, technical problems, product obsolescence.
- Business failure, non-payment/overdues, recession in other countries, externalisation problems, adverse exchange rate.
- Government policies like excise, import duty changes, deregulation, pollution control orders.
- Willful default, siphoning of funds, fraud, misappropriation, promoters'/management disputes.
- Deficiencies on the part of the banks, *viz.* in credit appraisal, monitoring and follow-up, delay in release of limits, delay in settlement of payments/subsidies by government bodies, etc.

The findings of all studies have more or less pointed out the major causes of doubtful/lost assets in SSI sector, *viz.* (i) wrong conception of projects with regard to choice of products, technology, location etc.; (ii) improper estimation of costs of project; (iii) delay in implementation of project; (iv) management deficiencies/dissension among the partners/promoters; (v) inadequacy/lack of infrastructural facilities; (vi) lack of marketing and selling arrangements; (vii) delayed payments;

(viii) frequent changes in government policies; (ix) delayed sanction and or disbursement of loan; (x) diversion of funds; and (xi) more particularly lack of adequate and timely working capital facilities. The SIDBI report on "Performance of SIDBI Assisted Units—1994-95" published in January 1998, also indicated more or less the same reasons for low capacity utilisation in SSI sector, which may eventually turn them into sick units.

### Remedial Measures

A number of measures have been taken by the Government of India, RBI and financial institutions from time to time for detecting sickness at the incipient stage and towards rehabilitation of viable sick units in the small scale sector. A special cell has been created in the RBI to function as a clearing house for information and also to act as a coordinating agency between the government, banks, financial institutions and other agencies. RBI issues operational guidelines from time to time with regard to rehabilitation of sick industrial units—small, medium and large scale—with specific reference to definition of sick units, viability norms as also the extent of reliefs and concessions which may be provided by the banks/financial institutions for implementation of rehabilitation packages in the case of potentially viable units.

With a view to reviewing the progress of rehabilitation efforts and enlisting the support of infrastructure and other connected agencies at the State level, RBI has constituted the State Level Inter Institutional Committees (SLIIC); though the meetings of SLIIC are convened by the RBI they are chaired by Industries Secretary of State Governments to ensure involvement of the government in rehabilitation efforts. The Standing Coordination Committee of RBI at the central level also monitors progress in this regard. In December 1989 RBI had undertaken a review of the working of SLIICs and thereafter issued revised guidelines to its officials as well as the Industries Secretary of State Governments to ensure that the meetings of SLIICs are held more frequently leading to expeditious implementation of unit-specific rehabilitation packages. RBI is also taking steps from time to time to activate the State Level Inter Institutional Committees. The other main decision such as to set up sub-committee of SLIIC in all states/UTs, to invite SSI entrepreneurs, bankers, and other concerned government departments to discuss and arrive at the rehabilitation package in the meeting of sub-committees to be held every two months and that of SLIIC every quarter, to set up district level committees of SLIIC in districts having SSI concentration, have been conveyed to all State Governments for implementation. Similarly, at the instance of SIDBI, SFCs have constituted a default

Review Committees/Rehabilitation Committees/Settlement Committees as a sub-committee of the Board to review accounts of defaulting SSI units on a case by case basis to arrive at rehabilitation packages. Nayak Committee set up by the RBI in 1991, dealing with the aspect of adequacy and timeliness of credit to SSIs had gone into the issue of sickness in detail. RBI has taken action on its recommendations relating to interest rate, for rehabilitation and prompt viability studies/nursing programmes.

**RBI has taken action relating to interest rate, and prompt viability studies/nursing programmes.**

The states like Andhra Pradesh, Bihar, Haryana, Himachal Pradesh, Jammu and Kashmir, Karnataka, Kerala and Maharashtra have declared incentives for rehabilitation as a matter of industrial policy. In Andhra Pradesh for example, the state government has liberally extended the facility of deferment of sales tax arrears for a maximum period of five years with one year moratorium, permission to sell excess land under the Urban Land Ceiling Act and deferment of power charge arrears on a case by case basis where these form part of the rehabilitation package for small units by commercial banks. In Haryana the actual reliefs may include exemption of sales/purchase tax, electricity dues, waiver of penalties, exemption of power cuts, rescheduling of payment of electricity arrears, and permission for sale of surplus land, and retrenchment of surplus labour.

In Himachal Pradesh, the rehabilitation package includes deferred payment of past sales tax due, cost of diagnostic study, 3 per cent interest rebate, preference in government purchase, allocation of 25 per cent extra raw materials, and 0.5 per cent sales tax. As part of the rehabilitation package, the Jammu and Kashmir Government provides 5 per cent subsidy on additional loans. Since most of the sick units' entrepreneurs are facing the problem of raising margin money, the Karnataka Government has decided to provide high margin (soft) assistance. In Kerala, as part of the rehabilitation package, the sales tax and electricity arrears will be

**Most of the sick units' entrepreneurs are facing the problem of raising margin money.**

received in easy installments, in addition, financial assistance will be given for the purchase of balancing equipment repayable in half-yearly installments at a concessional (7-5 per cent) interest. Maharashtra has set up a National Renewal Fund for funding the rehabilitation package.

The Government of India also operates (through State Governments) a margin money scheme for revival of small scale sick units to supplement the rehabilitation efforts of institutions and banks. Only those units which are considered potentially viable are eligible for a maximum assistance of Rs. 50,000 on a 50:50 basis with State Governments by way of a long term loan.

### **Financial Assistance**

On the basis of various expert Committees' recommendations, in 1997 RBI had issued guidelines to commercial banks for rehabilitation of viable sick SSI units. On the basis of these guidelines IDBI/SIDBI has formulated a comprehensive scheme of financial assistance for rehabilitation of sick industrial units. The assistance under the scheme is meant for sick industrial units for which proper rehabilitation packages have been drawn. However, mere funding of overdue installments or rescheduling of installments to tide over temporary financial difficulties of the units do not qualify for assistance under this scheme. Further, the units eligible for rehabilitation assistance should be capable of being restored to normal health within a reasonable time. The banks/financial institutions may ensure minimum promoter's contribution at 10 per cent of the additional long term requirements under the package in the case of tiny sector units and at 20 per cent for others. A flexible approach may be adopted to the debt equity ratio for the additional loan requirements. RBI has also issued detailed guidelines for the reliefs and concessions to be extended to potentially viable sick SSI units under rehabilitation. These include guidelines on interest on term loan, cash losses in the initial stages of the rehabilitation programme, waiver of the penal interest dues and payment of the principal dues, etc.

As has been stated, the viable sick SSI units may be facing problems in areas like raising margin money, marketing the products, or technology upgradation for improving the quality of products, or efficiency/increasing the profit margin. To help such units, the

**RBI issued guidelines to commercial banks for rehabilitation of viable sick SSI units.**

banks/financial institutions are in operation of the schemes under the National Equity fund Scheme. Equity type of support is made available to sick units in the tiny and small scale sectors including service enterprises which are considered potentially viable. The total outlay (existing and proposed) for rehabilitation should not exceed Rs. 25 lakhs. The minimum promoters' contribution expected is 10 per cent of the project cost. The collaterals are not required. The margin money will be provided to meet the gap in equity as per the prescribed debt equity norm, after taking into account promoters' contribution. Financial assistance is also made available in the Single Window Scheme (SWS) to potential viable sick units for rehabilitation. The working requirement for viable sick units can come under this scheme. Project covered under SWS can also be extended assistance under NEF, if they satisfy the eligibility criteria under both the schemes. For units covered under Credit Guarantee Fund Scheme (CGFS), subsequently becoming sick, credit for rehabilitation extended by the lender is within the credit cap of Rs. 50 lakhs.

The SSI units are facing the urgent need of technology upgradation in the liberalised and WTO environment. Their cash flows may be affected due to stiff competition. This will affect the repayments to banks/financial institutions. In such cases, there will be an urgent need for technology upgradation to produce quality goods and minimise the manufacturing cost. The Development Commission (SSI), Government of India, in association with SIDBI has in October 2000 formulated a scheme. *viz.* Credit Linked Capital Subsidy Scheme for Technology Upgradation for SSI Industries. A fund of Rs. 600 crores has been created in SIDBI. Under the scheme 12 per cent of the needed capital would be admissible on the loans advanced to the SSIs by scheduled commercial banks/designated SFCs/SIDBI for technology upgradation in certain selected sectors. For this purpose, initially 13 products/sub-sectors such as food processing, leather, IT (hardware), drugs and pharmaceuticals, auto-parts and components, electronic items, glass/ceramic items, dyes, toys, tyres, handtools, bicycle parts and foundries are included in the scheme for technology upgradation. The definition of technology upgradation for financial assistance means, induction of state-of-the-art or near state-of-the-art technology. It also means a significant set-up from the present technology level to a substantially higher one involving improved productivity or/and improvement in the quality of products or/and improved environmental conditions including work environment for the unit. It would also include installation of improved packaging techniques as well as pollution measures and energy conservation machinery. The financial assistance to units will be need-based. However, the maxi-



mum assistance, in the range of Rs 8 lakhs to Rs 40 lakhs, will be provided subject to the existing investment level of the unit.

**SSI units are facing the urgent need of technology upgradation.**

The existing units can also avail financial assistance under the equipment finance scheme to strengthen their operations. Assistance is provided to SSI units for acquisition of machinery/equipments, both indigenous and imported, which are not related to any specific project. This would facilitate modernisation/technology upgradation, expansion and diversification and quality improvement of the existing SSI units. The minimum amount of loan should not be less than Rs 25 lakhs per unit; no ceiling has been prescribed. In addition to this scheme, the SSI units can upgrade the technology to availing financial support under bills rediscounting scheme (equipments) as well as direct discounting schemes (equipment and components). Under these schemes, the SSI units can acquire machinery/additional balancing equipments on differed payment.

Those units which tend to be sick because of marketing problems can avail assistance from SIDB, NSIC and SSICs to overcome the problem. There are a large number of institutional networks which, besides undertaking promotional activities to strengthen and develop the existing units also provide training/consultancy and work as advisers. The industrial associations working in various parts of the country are also disseminating information on critical areas of operation of SSI units. They are also making available information on trade, economic and financial environment to enable SSIs face future challenges.

### **A New Approach**

While banks'/FIs' assistance to SSI sector over the years has been significant, it is found necessary to create a focal point for making available the totality of inputs required by the SSI sector in a more integrated and coordinated manner than what was being done so far. The problems of the SSI sector are multi-dimensional and complex. Provision of bank credit alone is not the panacea for all its ills. Non-financial inputs in the form of technical guidance, professional advice for achieving higher productivity, financial management and marketing and extension services are equally important for the healthy and orderly growth of the sector. Banks, financial institutions and government agencies have a com-

plementary role to play in assisting the growth of the SSI sector by adopting a promotional and developmental approach.

The most important method to detect early sickness is regular checking of the financial health of the unit. For monitoring the performance of units and ensuring their continuous profitable working, bankers must be made to evolve machinery and train personnel who can check the accounts of units every quarter with emphasis on: (i) items of production; (ii) persons employed; (iii) plant and machinery; (iv) production level; (v) sales; (vi) profitability; and (vii) inventory level. The field staff of the banks should have personal dialogue with the entrepreneurs and assess the shortcomings and problems with a view to providing timely guidance and assistance. This would help in improving the regular working of the units on profitable lines. Diversification, modernisation and expansion should be attempted whenever and wherever required.

**Diversification, modernisation and expansion should be attempted.**

As has already been mentioned earlier, the majority of units are sick/NPAs because of inadequate or untimely availability of finance for marketing/modernisation/technology upgradation and quality of the products. In most cases, the difficulties may be transitional and the units promise to become normal once the difficult phase is overcome. Rehabilitation is an arduous process calling for temporary sacrifices on the part of the concerned promoters, labourers, bankers, financial institutions as well as the government. It is a difficult task involving consensus from all on the package of concessions. By its very nature, it turns out to be a time-consuming process and a unit can ill-afford such loss of time.

But all sick units may not be revivable and need not be revived if the ultimate criterion of survival is long-term efficiency. If a unit has turned sick because there is no market and no prospect for the market to grow, providing assistance to it would amount to turning good money into bad. Banks and financial institutions have to

**Scheme of concessions may result in some kind of vested interest in perpetuation of sickness.**

carefully scrutinise all proposals for rehabilitation and select only those which are revivable. There is otherwise danger, that the scheme of concessions may result in some kind of vested interest in perpetuation of sickness. Therefore, determining potential viable units becomes important in view of the above situation.

Managing the sick units in the SSI sector is not at all a difficult task in the present system of accounting prescribed by the RBI. Banks and financial institutions may come across any account becoming non-performing in the initial stage itself while making provision for it. Preventing such an account becoming a doubtful/loss making account is possible by taking appropriate steps. Rehabilitation packages could also be thought of at this stage to prevent the unit from becoming a non-performing asset. For this purpose, there is need to make appropriate changes in the present policy guidelines issued to banks/financial institutions.

In terms of the guidelines issued by the RBI, an SSI unit may be classified as sick when any of its borrowal account has become a doubtful advance, i.e. principal or interest in respect of any of its borrowing has remained overdue for a period exceeding 2 1/2 years and there is erosion in the network due to accumulated cash losses to the extent of 50 per cent or more of its peak networth during the preceding two accounting years. The definition is very complicated and time-consuming for considering a unit as sick or weak. It is necessary to devise suitable machinery to detect sickness at the incipient stage so that corrective measures could be initiated well in time. In this regard, banks which provide the working capital finance are the best suited to pick up early warning signals through a watch on the operations in the working capital accounts, periodical stock statements, visits to factory, godowns, etc. Better communication and exchange of information between banks and term lending institutions will go a long way in not only detecting incipient sickness but also initiating concerted corrective action at the proper time. It is, therefore, suggested that financially weak potentially sick units should also be part of the definition of sick units. If any of the borrowal accounts of the units remain sub-standard for more than six months, i.e. principal or interest, in respect of its borrowal accounts has remained overdue for a period exceeding 6 months it should be treated as a potentially sick unit. Banks/FIs should identify reasons for financial weakness of the units and provide a suitable package of assistance. At this stage financial assistance schemes may be utilised to overcome problems like marketing, quality of products and technology upgradation. Banks/FIs may like to extend assistance to potential sick units for increasing their operational efficiency. One can also provide extension support to strengthen the units. The

viability of such units should also be judged on the basis of the quality of products produced and backed-up by technology. Further, any borrowal accounts of the unit remains sub-standard for more than six months, i.e. principal or interest in respect of any of its borrowal accounts has remained overdue for the period exceeding 1 year or if there is erosion in the net worth due to accumulated losses to the extent of 50 per cent of its net worth during the previous accounting year and if the unit is in commercial production for the last two years such units should be treated as sick SSI units as defined in the RBI notification dated October 22, 2001. This would enable banks to take action at an early stage for the revival of the unit. For such units rehabilitation packages as indicated in the RBI notification dated October 22, 2001 may be formulated subject to the condition of viability in terms of quality of products, availability of the market and status of the technology.

**It is necessary to devise suitable machinery to detect sickness at the incipient stage.**

In terms of the existing guidelines, a sick SSI unit may be regarded as potentially viable if it is in a position, after implementing a relief package spread over a period not exceeding 5 years from the commencement of the package, to continue to service its repayment obligations as agreed upon without the help of the concessions after a period of 5 years. The repayment period for the restructured (past) debts should not exceed 7 years from the date of implementation of the package. In the case of tiny/decentralised sector units, the period of reliefs/concessions and repayment period of the restructured debts are 2 years and 3 years, respectively. While on the one hand it could be reasoned out that the volume of commitment required to be serviced by the larger units would be much larger than those of SSI units, thereby justifying the longer periods, it is also a well-known fact that the ability of a small scale unit to generate accruals and service its commitments is correspondingly much lower than that of a larger unit. In these circumstances, it appears appropriate to prescribe periods of 7 years and 10 years respectively (for reliefs/concessions and for repayment

**The ability of a small scale unit to generate accruals and service its commitments is correspondingly lower.**

of the restructured debts) for SSI units on par with larger units or otherwise in case to case basis but not exceeding more than 7 years.

Relief from the central/state government could take various forms such as relaxation (total or partial) from power cuts, according status of relief to specific units, deferment of purchase/sales tax or grant of loan on soft terms against such deferments, excise relief, etc. It would accelerate the process of rehabilitation if broad criteria are laid down by state governments/state level agencies to provide certain reliefs/concessions to sick and weak small scale units. The DC (SSI) may evolve a common package which is acceptable to states/UT governments for rehabilitation of SSI units. Banks/FIs may be delegated power to provide the package alongwith financial assistance to potentially sick units since these units will retain employment and contribute to state domestic production.

A major problem commonly faced by small scale units has been the need to conform to the statutory requirements on the same lines as larger units. Legislations like Factories Act, PF Act and so on apply uniformly to all industries. These not only relate to labour welfare and social security but also to filing of various reports, returns and forms prescribed by the various statutes. Considering the organisational and financial constraints, small units are hard put to cope with the work involved. Implementation of the Prime Minister's announcement at the recent SSI Board Meeting to free tiny and decentralised units from all bureaucratic controls would set the pace for quicker rehabilitation of sick units in this sector. Likewise, a separate single legislation to cover small scale units would provide considerable relief. This matter would need detailed consideration by the Government of India.

**A separate single legislation to cover small scale units would provide considerable relief.**

### **Conclusion**

In the present liberalisation and WTO environment there is a possibility that more and more SSI units may be affected and may become potential sick units. There is a need to provide them financial assistance at this stage. In view of this situation 'definition of SSI sick unit' must include the potential sick units for providing rehabilitation. The Development Commissioner (SSI), Government of India, in consultation with State Governments should formulate a common rehabilitation package for such SSI units. The banks should be empowered to give the benefit of such packages to sick SSI units on behalf of the State Governments. The spread-over period of the package should be determined on case to case basis. For effective implementation, banks and financial institutions should delegate sufficient powers to various levels of functionaries. This will help to provide timely credit to the unit.

If the Indian SSI sector has to become globally competitive, the main issue which needs immediate attention are: setting up of technology information exchange, regular display of latest technologies, simpler procedures for technology transfer, availability of soft funding for upgradation and modernisation, competitive research and development facilities. This will also help to prevent sickness of SSI units in the country.

□

# Productivity in Agro Non Food & Non Agro Group

B.S. Prakash

---

*Using ASI data by CSO for the period 1979-98, the paper makes a comparative analysis of selected industrial divisions in the Non Agro and Agro Non Food segments for their structural change and productivity trends during the decade of the eighties and major part of the nineties. The paper points to the need for policy initiatives to boost their performance levels.*

*B.S. Prakash is Senior Research Officer, Institute of Applied Manpower Research, New Delhi-110 002.*

Recent studies focussing on dis-aggregated levels of industrial divisions record a revival in the performance of the manufacturing sector in the post-reform period in general (Burange, 1999) and of employment in the Organised Manufacturing Sector (OMS) in particular (Goldar, 2000). Both the studies (Burange, 1999 and Goldar, 2000) have focussed on the organised manufacturing sector (OMS). While the former examines the growth using the data for the period 1980-95 for the State of Maharashtra in particular, the latter takes an all India perspective using the data upto 1998. There is also evidence of increased productivity gains associated with increased capital intensity of production practices with the growth having been much faster for rural agro-based OMS units than their urban counterparts. The estimated growth rates (ACGRs) in productivity during 1992-93 to 1995-96 for agro-based manufacturing units (divisions 20-29) was placed at 10.8 per cent for rural units and 5.7 per cent for urban ones. For non-agro units (divisions 30-39) it was 10.8 per cent and 13.4 per cent respectively (Chadha G.K. 1999, pp 896-97). There is consistency in the productivity gains of rural OMS units for both the agro-based as well as the non-agro units (10.8 per cent for both during 1992-96). In this context, it is pertinent to note that the significance of analysing the performance of industrial groups with a rural-urban distinction raises certain critical questions in some respects. For instance, are the units merely conceptually or definitionally rural or are they operationally also really so? How far the observed growth of rural units are particularly attributable to any of the many policy prescriptions aimed at boosting rural industrialisation in general? To what extent the growth profiles reflect the impact on the quality of life of rural population *per se*? These are some of the questions to which answers are not readily discernible by an analysis of secondary data sets. There is, however, bound to be an impact of the same by way of 'trickle down effect' in which the indirect employment and quality of life benefits should be reaching most of the segments of the location/region. It also provides an indication of the

spread of industrial growth across the rural-urban divides with their resultant generation of demand induced employment and other developmental benefits for the neighbouring semi-urban and rural populace. This is also important in view of the fact that this sector's growth is vital to generate and sustain employment opportunities in several segments of the tertiary and unorganised sectors particularly in the context of a liberalised policy regime in which the pressures of competition could be decidedly better withstood by the organised sector units.

Using the data from the reports of ASI for the years 1979-98 this paper aims at bringing out a comparative profile of selected industrial divisions representing the two major OMS segments of Agro Non Food (ANF) and the Non Agro Group (NAG). The paper sketches the growth profiles of the "cotton textile division" under the former and the divisions of "basic chemicals & chemical products and machinery & equipments" under the latter. The rationale for the choice of these industrial divisions is based on the fact that in respect of employment and gross output the three groups together with that of 'food products segment' (fps) accounts for 44 per cent of OMS's employment share and 48 per cent of gross output consistently for the last 4 years (1995-1998). The growth profiles presented are in terms of the trends in the structural changes of seven important variables viz. number of units, employment (EMP), investment [i.e., Fixed Capital (FC)], capital formation, gross output, net value added (NVA) and profits. Annual Compound Growth Rates (ACGRs) are calculated by fitting semi-log curve by using the data for all the years (not just point to point) in the series. This is supplemented by an analysis of productivity trends in terms of three derived variables viz labour productivity as the ratio of NVA to employment, capital productivity as value added output per unit of fixed capital invested (i.e., NVA/FC) and capital intensity as proxied by capital labour ratio (i.e., FC/EMP). Additionally, in this context, the paper also aims at identifying the growth in labour productivity as attributable to one of the two factors of 'technology' or 'substitution of capital for labour' (i.e. capital deepening). Finally, considering the contributions of the labour and capital components of productivity as determining the total productivity structure (vis-à-vis the real or net value added output of the sectors) the paper tests for the hypothesis of structural stability/change during the last two decades of significant industrial and economic policy changes in the country.

### Number of Units (NU) and Employment

In terms of the growth in the number of units, in the pre-reform years of the eighties, the rural OMS units in

the Non Agro Group (NAG) grew at an impressively high rate of 9.4 per cent per annum. This is in sharp contrast to the 3.9 per cent growth in cotton textiles group and 3.2 per cent growth at the All Industries level (Table 1). Despite the more than two fold increase by the NAG in terms of the growth in their number of units, the corresponding growth rate in employment (4.3 per cent) was nearly the same as for the 'cotton textiles' group (4.2 per cent). Nevertheless, the growth rates in employment for both the groups was significantly higher than that at the All Industries level (1.5 per cent). This favourable trend for the rural OMS units in eighties continued to prevail in the nineties also. More specifically, the growth rates in employment registered at 5.1 per cent of the A Industries segment, 5.4 per cent for the Cotton Textiles group and 6.6 per cent for the Non Agro Group are significantly higher compared to the corresponding uniformly low growth rates of about 2 per cent in both number of units and employment for the urban OMS units in the nineties. In particular, since the growth rates in employment for the Cotton Textile group are negative for their urban units both during the pre-reform and the post-reform periods, the above trends are suggestive of a rural oriented growth uniformly for all the three groups or segments under focus.

**Table 1:** Growth in Number of Units (NU) and Employment (Empt.) by Location: 1981-98

Period	Location	All Industries		Cotton Textiles		Non-Agro Group	
		NU	Empt.	NU	Empt.	NU	Empt.
1981-90	Rural	3.2*	1.5*	3.9*	4.2*	9.4*	4.3*
	Urban	0.05	-0.8*	-1.6*	-5.1*	0.6	1.0*
1991-98	Rural	5.0*	5.1*	6.1*	5.4*	5.3*	6.6*
	Urban	2.1*	2.3*	2.1*	-1.9*	2.6*	2.3*

Source: ASI reports by CSO for different years.

Notes: (a) \*, \*\*, \*\*\* stands for significance levels for t-tests at 1 per cent, 5 per cent and 10 per cent levels respectively.

### Investment and Capital Formation

At the 'All Industries' level, the growth rate in investment (i.e., FC) for rural units increased from 9.9 per cent in the eighties to 17.0 per cent in the nineties (Table 2). The corresponding increase for the cotton textile group was more than three fold from 6.6 per cent in the eighties to 22.9 per cent in the nineties. The 'non agro group', in this respect, maintained a rather high investment level of around 17 per cent in both the periods of comparison. Proportionate increases are registered in the Gross Fixed Capital Formation (GFCF) for all three segments for the rural units from 8.3 per cent in the eighties to 20.1 per cent for all industries, 8.0 per cent to

19.8 per cent for Cotton Textiles and 11.6 per cent to 14.7 per cent for the Non Agro Group (NAG). The trend in this respect is thus conveying a healthy industrial environment, particularly, during the nineties. A somewhat relatively lower but significantly positive trend is generally evidenced for the urban units also [the growth rates in GFCF is nearly the same during the nineties for all three groups under focus—All Industries (10.4 per cent), Cotton Textiles (12.8 per cent) and NAG (11.7 per cent)]. Reading the investment trends in conjunction with those for employment presented above, the situation is revealing of an industrial climate marked for capital induced employment gains. An exception to this trend, that too mainly in respect of its pace (for a turn around is evidenced even in its negative growth rate) is noticed for the urban Cotton Textile units.

**Table 2:** Growth in Investment or Fixed Capital (FC) and Gross Fixed Capital Formation (GFCF) by Location: 1981-98

Period	Location	All Industries		Cotton Textiles		Non-Agro Group	
		FC	GFCF	FC	GFCF	FC	GFCF
1981-90	Rural	9.9*	8.3*	6.6*	8.0*	17.4*	11.6*
	Urban	6.0*	6.8*	5.1*	-2.4***	3.6*	7.0*
1991-98	Rural	17.0*	20.1*	22.9*	19.8*	16.7*	14.7*
	Urban	9.7*	10.4*	9.1*	12.8*	11.5*	11.7*

Source and Notes: As in Table 1

### Output and Net Value Added

Consistent with the trends evidenced above, the average annual growth rates in gross output and net value added are also high for the rural units. In respect of gross output, for instance, in the pre-reform years of the eighties the rural units in the All Industries segment grew at 23.2 per cent compared with the 25.2 per cent growth in the Cotton Textiles and 22.7 per cent growth in the Non Agro Group (Table 3). The corresponding growth rates in net value added were 29.7 per cent growth in the Non Agro Group (Table 3). the cor-

responding growth rates in net value added were 29.7 per cent, 39.2 per cent and 22.2 per cent, respectively. Although the growth rates for rural units in the nineties were not so high the growth rates in gross output for both the Cotton Textile and the Non Agro Group were equal (13.3 per cent) which was marginally higher than that for the All Industries (10.8 per cent). The growth rates in net value added in the nineties were 13.3 per cent for All Industries, 9.8 per cent for Cotton Textiles and 17.45 per cent for the Non Agro Group. In sharp contrast to these double digit growth rates for rural units the urban units have registered positive but single digit growth rates; a sole exception being 10.5 per cent growth in NVA for the Non Agro Group. It thus follows that notwithstanding the conceptual and operational exceptions of the rural units so far as their classificational connotation indicates the rural units are evidenced to have performed better in all respects than their urban counterparts.

**Table 3:** Growth in Gross Output (OUT) and Net Value Added (NVA) by Location: 1981-98

Period	Location	All Industries		Cotton Textiles		Non-Agro Group	
		OUT	NVA	OUT	NVA	OUT	NVA
1981-90	Rural	23.2*	29.7*	25.2*	39.2*	22.7*	22.2*
	Urban	3.5*	2.7*	-1.4***	-4.4*	5.2*	4.7*
1991-98	Rural	10.8*	13.3*	13.3*	9.8*	13.3*	17.5*
	Urban	6.8*	8.3*	3.8*	-2.0	8.6*	10.5*

Source and Notes: As in Table 1

### Profits and Efficiency

The growth profiles presented above are in absolute terms. Relating the growth in the key performance indicating variables to their 'number of units' and comparing the trends in the growth rates of their 'per unit ratios' with that of their 'profit' and 'efficiency' indicators we can get a picture on the performance of the groups in 'relative and real' terms. The per unit ratios for the three groups

**Table 4:** Growth in Per Unit Ratios of Employment (PUE), Gross Fixed Capital Formation (PU GFCF) and New Value Added (PU NVA) by Location: 1981-98

Period	Location	All Industries			Cotton Textiles			Non-Agro Group		
		PUE	PU GFCF	PU NVA	PUE	PU GFCF	PU NVA	PUE	PU GFCF	PU NVA
1981-90	Rural	-1.8*	5.1*	26.5*	0.3	4.1**	35.2*	-5.0*	2.3*	12.8*
	Urban	-0.9*	6.8*	2.7*	-3.4*	-0.8	-2.8*	0.4	6.3*	4.1*
1991-98	Rural	0.17	15.1*	8.4*	-0.7	13.7*	3.7**	1.2*	9.4*	12.2*
	Urban	0.14	10.4*	6.2*	-4.0*	10.6*	-4.1***	-0.3	9.1*	7.9*

Source and Notes: As in Table 1

under focus (Table 4) reveal a particularly negative trend in the performance of Cotton Textile group in many respects. For instance, firstly, their per unit employment (PUE) ratios reveal a declining trend from the eighties to the nineties. Second, the per unit NVA (PUNVA) ratios have registered a steep decline from 35.2 per cent in the eighties to 3.7 per cent in the nineties for the rural units (for the urban units it is still worse with a decline from -2.8 per cent in the eighties to -4.1 per cent in the nineties). Third, their per unit profits (PUPROF) are consistently negative. And fourth, their efficiency (EFF) indicator (i.e., NVA per unit output) has registered a decline both for their rural as well as their urban units (Table 5). Significantly, the corresponding ratios are indicative of a much healthier trend with their corresponding growth rates for the All Industries and the Non Agro Group revealing improved ratios between their pre-reform and post-reform years (Table 4 and 5). It thus follows that from a comprehensive and holistic perspective the performance of the Cotton Textile group observed earlier is not vindicated for its 'investment based, output linked and employment promotive' phase (marking a smooth transition from the eighties to the nineties) unlike that in the case of the All Industries and Non Agro Group segments. Further, the difference in the growth rates of per unit employment ratios of the industrial segments which is more marked for the 'All Industries' and 'non agro group' units in general (but more prominently for their rural units in particular) points to the fact that the expansion of these two segments is both in terms of their horizontal and vertical spheres. In other words, The employment expansion in the two industrial groups is attributable to a favourable industrial climate; a factor which is not proved to hold good for the Cotton Textile group as hypothesised before.

**Table 5:** Growth in Per Unit Profit (PU PRoF) and Overall Efficiency (EFF) by Location: 1981-98

Period	Loca-tion	All Industries		Cotton Textiles		Non-Agro Group	
		PU PROF	EFF	PU PROF	EFF	PU PROF	EFF
1981-90	Rural	14.8*	6.7*	-	14.0*	7.1*	-0.5
	Urban	-5.1*	-0.8*	-	-3.0*	0.8	-0.5
1991-98	Rural	15.3*	2.5*	-7.4	-3.5*	23.6*	4.2**
	Urban	15.8*	1.5*	-	-5.8*	15.2*	1.9*

Source: As in Table 1

**Note:** For 'cotton textiles' industrial group PROFs are negative for all the years. Hence their growth rates calculated here by the curve fitting method are not available as their logarithmic values are not defined.

Efficiency (EFF) is ratio of NVA to Output indicating value addition per unit of output.

### Labour Productivity and Capital Intensity

The growth rates in labour productivity for the rural

units in the eighties has been significantly higher when compared to those of the nineties: 28.2 per cent and 4.4 per cent and 8.3 per cent for All Industries, 35.0 per cent and 4.4 per cent for Cotton Textiles and 17.9 per cent and 11.0 per cent for the Non Agro Group (Table 6). The corresponding growths for the urban units are relatively lower but with an upward trend for the All Industries and Non Agro Group: from 3.5 per cent to 6.0 per cent for All Industries and 3.7 per cent to 8.2 per cent for the Non Agro Group. The urban units of the Cotton Textile group stand distinctly apart: not only was their growth in labour productivity the lowest in the eighties (0.7 per cent), it even slid to a negative growth in the nineties (-0.15 per cent). The high growth rates in LP for rural units in the eighties were accompanied by lower order growth rates for Capital Intensity (CI) [vis-à-vis the growth rates registered in labour productivity]: a mere 2.5 per cent growth in CI for the Cotton Textile group, 8.4 per cent for the All Industries and 13.1 per cent for the Non Agro Group. The trend in CI for rural units during the nineties has, however, steeply increased for the 'All Industries' (11.9 per cent) and Cotton Textile (17.5 per cent) units whereas for the Non Agro Group it was slightly less (10.1 per cent) than its level in the eighties. As this increase is accompanied by a substantial decline in labour productivity growth there is reason to infer that capital intensity for rural units have contributed to a relative decline in value added output and employment returns in the nineties. The increase in CI for urban units on the other hand (which is negligible at the All Industries level having increased marginally from 6.8 per cent to 7.4 per cent only put has shown more than 3 time rise for the Non Agro Group with its increase from 2.6 per cent to 9.3 per cent) is accompanied by modest increases in the returns of labour productivity gains for both these groups. The impact of capital intensity on labour productivity is thus vibrant and varied posing difficulties for making a direct assessment for their unequivocal gains. Nonetheless, a basic inference on relatively higher labour productivity growth during the pre-reform years of the eighties for the rural units and a fall in its growth during the nineties for all three segments under focus can still be drawn from the trends evidenced above.

### Technology versus Capital Deepening

The impact of capital intensity on labour productivity gains is, however, amenable for an analytical assessment in terms of its attribution to either 'technology' or 'capital deepening'. The implication of this assessment is that the growth in labour productivity is a reflection of the technology-in-use and the returns to capital turning negative which mark a stage when 'pure substitution of capital for labour' is signifying the growth in labour productivity. The empirical requirement is that

**Table 6:** Growth in Labour Productivity (LP), Capital Intensity (CI) and Capital Productivity (CP) by Location: 1981-98

Period	Location	All Industries			Cotton Textiles			Non-Agro Group		
		LP	CI	CP	LP	CI	CP	LP	CI	CP
1981-90	Rural	28.2*	8.4*	19.8*	35.0*	2.5***	32.5*	17.9*	13.1*	4.8*
	Urban	3.5*	6.8*	-3.5*	0.7	10.2*	-9.5*	3.7*	2.6*	1.1***
1991-98	Rural	8.3*	11.9*	-3.6*	4.4*	17.5*	-13.1*	10.98*	10.13*	0.85
	Urban	6.0*	7.4*	-1.4*	-0.15	10.97*	-11.12*	8.24*	9.28*	-1.04**

Source: As in Table 1; Note: LP = CI + CP (in their growth rates)

when "a positive growth in CI is accompanied by a rate of growth in LP higher than that in CI and the growth in capital productivity (CP or value added output per unit of fixed capital) is either rising or remaining unchanged" then the factor contributing for the growth in LP is identified as 'technology'. The growth in LP is attributed to a pure "substitution of capital for labour" (Ghose A K, 1994) Judged by this yardstick the trend for Cotton Textile group is seen to be on the same lines as for the All Industries segment. In other words, excepting for the rural units in the pre-reform years in all the other cases (i.e., the pre-reform years for the urban units and the post-reform years for both the rural as well as the urban units) the factor contributing for the rise in labour productivity is identified as 'capital deepening'. Significantly, the Non Agro Group holds out for a case of 'technology' as the factor contributing for the growth in labour productivity most prominently (for rural units in both the pre and the post-reform years and for urban units in the pre-reform eighties). In view of this, an exercise aimed at segregating the relative impacts of labour and capital components of productivity on the real value added output should be able to identify more directly the impact of labour productivity.

### Employment Elasticity

The elasticity of employment at the All Industries level has registered a distinct upward trend both with respect to value added output (NVA) and investment (FC). Further, the increasing trend is evidenced for both the rural and the urban units. Specifically, the increase for rural units is from 0.05 in the eighties to 0.38 in the nineties with respect to NVA and from 0.15 to 0.30 for FC (Table 7). The corresponding increase for urban units is even more noteworthy in view of its rise from negative ratios in the eighties to significantly positive ratios of nearly the same levels in the nineties. The trend in this respect is similar for the rural Cotton Textiles group NVA (which is, in fact, marked for significant gains as revealed by an increase in the elasticity from 0.11 in the eighties to 0.55 in the nineties) and both with respect to NVA and FC for the units of Non Agro Group. For the urban the units of cotton textile group, on the

other hand, there is a reaffirmation of declining response in employment. The trend in this respect for the urban units of Non Agro Group is one of near stagnancy. The situation for the latter is thus typifying of a phase in which growth is more specifically attributable to investment and productivity linked transition from the eighties to the nineties.

**Table 7:** Employment Elasticity with respect to Value Added Output (NVA) and Investment (FC) by Location: 1981-98

Period	Location	All Industries		Cotton Textiles		Non-Agro Group	
		NVA	FC	NVA	FC	NVA	FC
1981-90	Rural	0.05*	0.15*	0.11*	0.52*	0.19*	0.25*
	Urban	-0.14	-0.13*	1.0*	-0.67*	0.21*	0.28*
1991-98	Rural	0.38*	0.30*	0.55*	0.24*	0.36	0.39*
	Urban	0.27*	0.24*	0.31*	-0.16**	0.22*	0.20*

Source: As in Table 1

Note: Elasticities are estimated by fitting double-log curve using once again values for all the years in the series

### Structural Stability/Change

The relative impacts of changes in the labour and capital components of productivities on real value added output of the sectors is tested for their overall structural stability (or change) by means of a regression analysis here. The results of the test are indicative of significant structural change for both the rural and the urban of the All Industries group ( $F_{SS} = 7.8$  and  $7.6$ , respectively) (Table 8). The change is attributable to an 'impact of reforms' experienced by the units in nineties ( $F_{IR} = 5.4$  and  $5.9$ ). A common underlying trend that is evidenced in this respect (for both the rural and the urban units) is the positive impact of both the labour and capital components of productivity on the real value added output of the units in the pre-reform years. In the post-reform years of the nineties, however, the positive impact stands isolated only to labour productivity gains. The situation for rural Cotton Textile units is evidenced to be exactly similar to that of All Industries while for the units of its urban counterpart the period from the



**Table 8:** Regression Results of Productivity Model: 1982-98

Location/ Period	Co-efficients for IVs and Values of Key Test Statistics						F <sub>IR</sub>	F <sub>SS</sub>
	Intercept	LP	CP	T	Adj. R- Sq	DW		
<b>AI (Rural)</b>								
1982-98	-3.01 (-8.7*)	4.24 (6.6*)	1.2 (1.1)	0.05 (1.97***)	0.96	1.87		
1982-90	-2.4 (-8.6*)	1.82 (3.14**)	2.61 (2.59**)	0.02 (1.1)	0.95	2.04	5.4**	7.8*
1991-98	-3.3 (-7.9*)	6.4 (10.1*)	0.28 (0.18)	0.05 (1.67 <sup>⊗</sup> )	0.94	2.20		
<b>AI (Urban)</b>								
1982-98	-0.01 (-0.36)	1.0 (6.5*)	0.30 (1.64 <sup>⊗</sup> )	0.002 (2.6**)	0.91	1.04		
1982-90	0.02 (2.13***)	0.63 (6.2*)	0.88 (6.3*)	0.0002 (1.78 <sup>⊗</sup> )	0.98	2.68	5.9**	7.6*
1991-98	-0.13 (-1.56 <sup>⊗</sup> )	1.95 (4.97*)	-0.73 (-1.57 <sup>⊗</sup> )	0.01 (1.49 <sup>⊗</sup> )	0.95	1.95		
<b>CT (Rural)</b>								
1982-98	-2.07 (-5.8*)	1.89 (2.51**)	1.31 (1.78***)	-0.01 (-0.36)	0.88	1.90		
1982-90	-1.77 (-12.3*)	1.35 (3.32**)	1.48 (2.69**)	-0.03 (-1.84 <sup>⊗</sup> )	0.95	2.06	11.2*	4.61**
1991-98	-4.35 (-4.6**)	6.96 (3.2**)	1.68 (0.91)	0.13 (1.89 <sup>⊗</sup> )	0.75	1.54		
<b>CT (Urban)</b>								
1982-98	-0.06 (-4.8*)	1.0 (14.2*)	-0.05 (-0.65)	0.002 (2.6**)	0.95	1.25		
1982-90	-0.01 (-0.33)	0.83 (9.7*)	0.12 (0.59)	-0.004 (-0.80)	0.93	1.04	1.72	3.25***
1991-98	0.003 (0.08)	1.2 (12.8*)	-0.26 (-2.06 <sup>⊗</sup> )	-0.003 (-0.95)	0.99	2.55		
<b>NA (Rural)</b>								
1982-98	-2.6 (-21.1*)	5.65 (12.5*)	-1.02 (-1.9***)	0.01 (1.44 <sup>⊗</sup> )	0.95	2.78		
1982-90	-2.8 (-6.4*)	6.57 (4.2*)	-1.68 (-1.04)	0.03 (0.85)	0.85	2.58	0.27	0.19
1991-98	-2.5 (-10.9*)	5.53 (12.7*)	-0.86 (-1.6 <sup>⊗</sup> )	0.01 (0.49)	0.97	3.21		
<b>NA (Urban)</b>								
1982-98	0.004 (0.51)	1.29 (12.7*)	-0.08 (-0.55)	-0.0004 (0.42)	0.96	2.45		
1982-90	0.01 (0.43)	1.17 (6.5*)	-0.07 (-0.35)	0.00004 (0.02)	0.90	2.38	0.38	0.66
1991-98	0.01 (0.42)	1.36 (9.6*)	-0.02 (-0.09)	-0.0001 (-0.53)	0.99	1.71		

**Note:** Dependent Variable (DV) is NVA. In particular, for reasons of logarithmic values of RNVAI (vide end note 5) not being defined for the urban units, the DV for rural and urban units are LRNVAI and RNVAI respectively.

eighties to the nineties is marked for significant labour productivity gains. The urban units of the Cotton Textile sector, on the other hand, are noticed to have remained uninfluenced by the underlying changes in the policies due to reforms, unlike those in their rural units (F<sub>IR</sub> = 1.7 and 11.2, respectively). The situation for the Non

Agro Group, at the other extreme, is one of distinct structural stability for both their rural as well as urban units (F<sub>SS</sub> = 0.19 and 0.66). Additionally, as conjectured before, this segment (i.e., NAG) is also marked for the uniformly significant positive impact of labour productivity (on NVA) reaffirming thereby the influence of

'technology' as the dominating factor in bringing about the growth in real value added output during the period of both the pre-reform as well as post-reform years.

## Conclusion

As stated in the introductory lines whether there has been growth in employment in the sub-sectors studied at a level higher than that of the labour force growth, particularly in the post-reform years, and if so, are they backed by sustained productivity increase is the question which the paper has tried to address. The growth of the labour force during the post-reform period of 1991-98 has been at an average annual growth rate (AAGR) of 0.9 per cent for rural areas and 2.4 per cent for urban areas or at an AAGR of 1.3 per cent for the combined economy (IAMR, 2000). In contrast, during 1991-98 the All Industries segment in the OMS has registered an AAGR of 5.1 per cent for rural units and 2.3 per cent for urban units; the food products segment at 3.9 per cent for rural units and 1.1 per cent for urban units; the Cotton Textile segment at 5.4 per cent for rural units and -1.9 per cent for urban units; and the Non Agro Group at 6.6 per cent for rural units and 2.3 per cent for urban units. It thus follows that the sub-sectoral employment growth is higher for the rural units of all the three distinct segments under focus and if one were to ignore their rural-urban distinction the employment growth at the aggregate level is higher than that of the labour force growth for the combined economy.

An allied issue of interest in the context of employment growth is whether it is accompanied by corresponding increases in productivity. Once again the average annual growth rate in labour productivity during 1991-98 for All Industries is 8.3 per cent for rural units and 6.0 per cent for urban units. The corresponding growth rates for the sub-sectors under focus are: 5.1 per cent and 7.8 per cent for the Food Products sector group; 4.4 per cent and -0.15 per cent for the Cotton Textile group; and 11.0 per cent and 8.2 per cent for the Non Agro Group. Thus, only the performance of the Non Agro Group is seen to be above that of the All Industries average in this regard. In particular, the 'cotton textile' group seems to have lost somewhat on this front especially during the nineties although their employment growth for the combined sector (6.1 per cent) was above the corresponding 'All Industries' average growth of 3.0 per cent. To recall, the growth rate in labour productivity of rural 'cotton textile' units (which have actually shown the major growth in the sector vis-à-vis their urban counterparts) was 35.0 per cent in the eighties. Although this slid down to 4.4 per cent during 1991-98, it was achieved with a much broader base over the eighties. This fact needs to be accorded due weightage even while stating that the productivity in

the sector 'lost out somewhat' during the nineties. Additionally, the pressures of new economic policy changes leading to a competitive industrial environment should also have added to the relatively lower growth rates registered during the nineties. The trends are, thus, suggestive of some policy oriented support needed for the Cotton Textile group in particular. In this connection, it is pertinent to note that the government in its Approach Paper to the Ninth Five Year Plan records that:

the textile industry is unique in its diversity with regard to the scales of production, technologies of manufacturing and use of fibres. It has strong linkages with agriculture. From farmers producing cotton, jute and silk to artisans, self-employed weavers and the organised mills of different compositions, the industry economically supports millions of people. It accounts for about one-fifth of the total industrial production and one-third of overall exports from the country. It has demonstrated a satisfactory growth potential in the past and is poised for new challenges during the next decade. However, it will be imperative to develop the competitive strength of the industry with special emphasis on increase in productivity and quality upgradation of textile products.

To accomplish the targetted standards of growth the policy changes for manpower development envisaged states that: "educational and training systems will be reoriented towards improving their capability to supply the requisite skills and introduce greater flexibility in the training system so that it may become responsive to labour market changes". In this context, it is necessary to consider development of institutional support systems aimed at promotion of suitable self-employment ventures. The number of OMS units within the capital range of 'below Rs. 2.5 lakh' was 32.1 per cent of the total in 1997-98. The number of workers in these units amounted to 14.6 per cent of the total. Thus, the scope for encouraging self-employment ventures under employment promotion schemes like PMRY, SIDBI, NSIC etc., needs to be vigorously pursued in the present context of policy thrust. In addition, in order to be able to cope with the pressures of competition and improve the productive efficiency, measures like removal of fiscal barriers to domestic trade within the country, investment in regular training for skill upgradation, housing and schooling for children of factory workers, stepping up of infrastructural development, bringing about overall restructuring in the old institutional framework to provide for factors like easier credit, better marketing, aggressive thrust to export etc. are also required to be addressed (Serigupta, 2001). Indeed, it is in this light, the scope for employment planning needs to be viewed/reviewed in the present context.

## References

- Burange L.G. Economic and Political Weekly, (1999), "Industrial Growth and Structure: Manufacturing Sector in Maharashtra", Economic and Political Weekly, February 27.

---

**Chadha G.K.** (1999), "Trade, Technology and Employment: Some Missing Links in India's Rural Economy", Indian Journal of Labour Economics , Vol. 42, No. 4.

**Ghose A.K.** (1994), "Employment in Organised Manufacturing in India", Indian Journal of Labour Economics, Vol. 37(2).

**Ghose A.K.** (1999), "Current Issues of Employment Policy in India", Economic and Political Weekly, September 4.

**Goldar B.** (2000), "Employment Growth in Organised Manufacturing in India", Economic and Political Weekly, April 1.

Institute of Applied Manpower Research, (2000), "Manpower Profile: India Yearbook 2000".

Planning Commission, "Approach Paper to the Ninth Five Year Plan (1997-2002)", Government of India, New Delhi.

**Sengupta J.** (2001), "Time to Pull the Socks up", The Hindustan Times, Edit Page, January 2.

□

*The slow and patient work of refining and improving on existing technology will always be important. But what we need even more than the refinement of old ideas is the ability to develop new ideas and put them to work.*

– Henry Ford II

# Analysis of Sugar Industry in Punjab

P.S. Rangi & M.S. Sidhu

---

*This article discusses the problems of the sugar industry in Punjab, particularly in the light of the market reforms initiated in the economy since mid-1991. The total decontrol and privatisation of the sugar industry is forwarded as the solution.*

*P.S. Rangi is Senior Economist (Marketing) and M.S. Sidhu is Economist (Marketing), in the Department of Economics and Sociology, PAU, Ludhiana 141 004. The views expressed in the paper are the author's personal viewpoint and may not reflect the official policy of PAU.*

The sugar industry is the second largest traditional industry in India. At present, there are 423 sugar mills in operation in the country. India is the biggest sugar producer in the world. Sugar industry is the largest agro-based industry. Nowhere else is the interaction between the raw material suppliers (farmers) and the industry so complete as in sugar production (Gehlawat, 1990). A large cross-section of rural society is benefitted from sugar industry, directly or indirectly. In Punjab, the cooperative sugar mills alone had provided direct/indirect employment to about ten thousand workers (Sugarfed, 1997). There being no heavy industry in Punjab, small scale industries and to some extent, agro-based industries are going to be the mainstay of this State (Grewal and Rangi, 1982). Unfortunately, in case of several agricultural commodities, processing has not developed enough to make full use of the surpluses available in the State (Ibid).

The Johl Committee on Diversification of Agriculture in Punjab suggested in 1986 that the area under paddy and wheat may be reduced by 20 per cent. On the other hand, area under sugarcane, fruits and vegetables, oil-seeds, fodder crops, etc. may be increased to save Punjab agriculture from ecological disaster. Therefore, to encourage sugarcane cultivation in the State, new sugar mills were set up. Their number was only ten in 1985-86. At present, their number is 23. Majority of the sugar mills are in the cooperative sector. The performance of private sector sugar mills was better compared with the cooperative sugar mills in Punjab due to a relatively large scale of operation for the former (Kaur, 1998). Further, private sector sugar mills had the higher average daily crushing capacity. It was 2028.50 tons for the private mills compared with 1704.74 tons for the cooperative sugar mills (Ibid). Moreover, the production of sugar was also higher for the private sugar mills due to comparatively large number of working days and quantum of cane crushed (Ibid).

Most of the cooperative sugar mills in Punjab are in the red. During the year 2000, the State Government directed the Punjab Markfed to set up a sugar mill at

Malout in Muktsar district. This was mainly on account of poor financial health of Punjab Sugarfed. Banks are not willing to advance loans to the Sugarfed. Already, sugar stocks worth Rs 220 crore are lying with the Punjab Sugarfed which are likely to swell to unmanageable proportions due to negligible disposal of sugar from the State (Sareen, 2001). The slow disposal rate would make it difficult for the sugar mills to pay cane price to the growers in time. Hence, the ultimate solution lies in total decontrol and privatisation of the sugar industry. The present study has been undertaken to examine the problems and prospects of the sugar industry in Punjab. The paper is based mainly on data collected from reputed published/unpublished secondary sources. Notable sources of data are Statistical Abstract of Punjab for various years, Cane Commissioner, Punjab, Sugarfed and All India Sugar Mills Association, New Delhi. Further, the data published in reputed English newspapers have also been used.

**Ultimate solution lies in total decontrol and privatisation of the sugar industry.**

### Fluctuations in the Sugar Industry

Fluctuations in sugarcane acreage, production and supplies to the sugar mills have created problems for the sugar industry. The instability in production is reflected in gluts in cane supplies in some years and acute scarcity in others (Grover, 1987). There are many instances when farmers had to burn their standing sugarcane crop (Grewal and Rangji, 1982). Besides, such a situation of surpluses often leads to corrupt practices on the part of the officials responsible for arranging the supplies to the mills (Ibid). Empirical evidence in support of the above facts is available in Table I, which provides the data for cane crushed, sugar produced and the average number of working days for the factories for the Punjab state from 1970-71 to 1999-2000. The information about daily crushing capacity of cane and sugar recovery is also given in the same table. The number of sugar mills were only six during the year 1970-71. Their number increased to 21 in the year 1999-2000. Actually one cooperative sugar mill is lying closed, therefore, the number of mills has declined from 22 in 1998-99 to 21 in 1999-2000. One new sugar mill was set up by Punjab Markfed in 2000 at Malout in Muktsar district at the directive of the Punjab Government. Earlier, Punjab Markfed did not indulge in such processing enterprises. It is the first example of this type in the State.

A perusal of Table 1 indicated that the working days

**Table 1:** Cane crushed and sugar produced by sugar mills in Punjab, 1970-71 to 1999-2000

Year	No. of sugar mills	Daily crushing capacity (tons)	Cane crushed (000 tons)	Sugar production (000 tons)	Sugar recovery (percentage)	No. of days worked in a year
1970-71	6	5950-6200	560.8	48.6	8.60	115
1980-81	8	10000-10250	585.9	51.9	8.70	82
1990-91	17	35125	3102.9	278.2	8.87	117
1994-95	19	41266	3179.9	296.8	9.13	106
1995-96	22	24266	7372.8	644.2	8.65	105
1996-97	22	46766	6920.5	621.3	8.87	183
1997-98	22	46766	3659.9	338.1	9.05	90
1998-99	22	46766	3662.8	317.2	8.49	85
1999-2000	21	46766	4631.2	426.3	9.10	105

Source: Statistical Abstract of Punjab, Various Issues

**Table 2:** Statewise average recovery of sugar in India, 1990-91 to 1999-2000

States	1990-91	1997-98	1998-99	1999-2000
Andhra Pradesh	9.61	9.40	9.70	10.09
North Bihar	9.09	9.49	8.54	9.20
South Bihar	6.42	-	-	-
Gujarat	10.91	10.72	10.37	10.64
Haryana	9.44	9.24	8.78	9.27
Karnataka	10.25	10.50	10.50	10.64
Kerala and Goa	8.46	8.77	9.84	9.48
Madhya Pradesh	10.01	9.89	8.98	9.90
Maharashtra	10.76	11.13	11.16	11.39
Punjab	8.95	9.05	8.49	9.10
Rajasthan	8.44	9.55	7.99	7.56
Tamilnadu and Pondichery	9.10	8.40	8.79	9.17
U.P. Central	9.02	9.47	8.92	9.13
U.P. East	8.98	9.33	8.73	9.36
U.P. West	9.23	9.89	9.38	9.60
Others*	8.54	8.63	8.43	8.47
All India	9.85	9.95	9.87	10.20

\*Others included Assam, Orissa, Nagaland and West Bengal.

Source: Indian Sugar Mills Association, New Delhi.

of sugar mills were the maximum (183) during the year 1996-97. It was as low as 82 in 1980-81, 85 in 1998-99, 90 in 1997-98 and 105 each in 1995-96 and 1999-2000,

respectively. It is worthwhile to mention here that sugar recovery as well as working days in Punjab are less as compared to the national average. The data given in Tables 2 and 3 clearly indicated this. The sugar recovery in Punjab was 8.95, 9.05, 8.49 and 9.10 per cent during the years 1990-91, 1997-98, 1998-99 and 1999-2000, respectively. Against this, the All India recovery was 9.85, 9.95, 9.87 and 10.20 per cent during these respective years. The states like Andhra Pradesh, Gujarat, Haryana, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Tamil Nadu and Uttar Pradesh had higher sugar recovery vis-a-vis Punjab.

**Table 3:** State-wise duration of crushing season in India, 1990-91 to 1999-2000

States	1990-91	1997-98	1998-99	1999-2000
Andhra Pradesh	147	111	142	142
North Bihar	127	104	108	130
South Bihar	24	-	-	-
Gujarat	203	131	160	169
Haryana	205	117	129	136
Karnataka	155	126	171	174
Kerala and Goa	65	74	117	129
Madhya Pradesh	129	73	95	103
Maharashtra	193	138	162	176
Punjab	129	87	84	105
Rajasthan	99	99	97	94
Tamilnadu and Pondichery	204	170	206	185
U.P. Central	160	120	118	133
U.P. East	155	93	91	125
U.P. West	180	148	143	143
Others*	71	56	141	152
All India	166	123	141	152

\*Others included Assam, Orissa, Nagaland and West Bengal.

Source: Indian Sugar Mills Association, New Delhi.

Similarly, the working days at the national level were higher as compared to Punjab. The information given in Table 3 clearly indicated that the All India average of working days was 166, 123, 141 and 152 during the years 1990-91, 1997-98, 1998-99 and 1999-2000 respectively. Against this, Punjab's figure was 129, 87, 84 and 105 days in the respective years. The States like Andhra Pradesh, Gujarat, Haryana, Karnataka, Kerala, Maharashtra, Tamilnadu and Uttar Pradesh had more working days in comparison to Punjab. The less number of working days and lower sugar recovery add to the total cost of sugar mills and these mills become unprofitable. Due to these factors, the private sector is hesitant to set up new sugar mills in Punjab. It can be

concluded that the present environment is not conducive for the entry of private sector in sugar industry. At the same time, most of the cooperative sugar mills are in the red. A number of factors are responsible for this. Some of these factors are beyond the control of the sugar industry because the price of sugarcane to be paid by the mills to the farmers is fixed by the State Government. It is called State Advisory Price (SAP). The cane price is the major component of the cost of sugar. Higher the SAP, the higher will be the cost of sugar and vice-versa. The profitability of sugar mills is directly linked with such policy issues. In recent years, the SAP has increased significantly as shown in Table 4.

**Most of the cooperative sugar mills are in the red.**

**Table 4:** State advisory price of sugarcane in Punjab, 1990-91 to 2000-2001

(Rs per qtl)

Year	Early varieties	Mid-year varieties	Late varieties
1990-91	46	44	42
1991-92	49	47	45
1992-93	50	48	46
1993-94	62	60	58
1994-95	72	70	68
1995-96	77	75	73
1996-67	80	78	76
1997-98	82	80	78
1998-99	95	93	91
1999-2000	100	98	96
2000-01	100	98	96

Source: Cane Commissioner, Chandigarh, Punjab.

A perusal of Table 4 revealed that SAP of cane ranged from Rs 42 to Rs 46 per qtl during the year 1990-91. Within a decade, the sap more than doubled. It ranged from Rs 96 to Rs 100 per qtl in 1990-91. The market reforms initiated in the economy since mid-1991 may not be very successful if agro-processing industries have to pay very high prices for the raw material. Delicensing cannot go very far if SAP and zonal prices are artificially imposed and implemented (Alagh, 2001). The lack of flexibility for an individual unit acts as a major bottleneck to capacity expansion, capacity utilisation and cost reduction, completely divorcing it from any possibility of gaining in global competitiveness (Ibid).

**Table 5:** Stocks, production, consumption and export of sugar from India, 1960-61 to 2000-01

(lakh tonnes)

Year	Opening stock	Production	Imports	Total availability	Offtake for		
					Internal consumption	Exports	Closing stock
1960-61	7.42	30.21	-	37.63 (100.00)	20.87 (55.46)	1.94 (5.16)	14.82 (39.38)
1970-71	20.84	37.37	-	58.21 (100.00)	40.24 (69.13)	3.90 (6.70)	14.07 (24.17)
1980-81	6.45	51.47	1.53	59.45 (100.00)	49.70 (83.60)	0.60 (1.01)	9.15 (15.39)
1990-91	22.21	120.46	-	142.67 (100.00)	107.14 (75.10)	2.23 (1.56)	33.30 (23.34)
1991-92	33.30	134.04	-	167.34 (100.00)	112.70 (67.35)	5.62 (3.36)	49.02 (29.29)
1992-93	49.02	106.09	-	155.11 (100.00)	118.75 (76.56)	4.11 (2.65)	32.25 (20.79)
1993-94	32.25	98.33	20.00	150.58 (100.00)	119.60 (79.43)	0.10 (0.07)	30.88 (20.50)
1994-95	30.88	146.43	2.00	179.31 (100.00)	122.70 (68.43)	0.63 (0.35)	55.98 (31.22)
1995-96	55.98	164.51	-	220.49 (100.00)	131.26 (59.53)	10.21 (4.63)	79.02 (35.84)
1994-97	79.02	129.05	-	208.07 (100.00)	138.66 (66.64)	4.19 (2.01)	65.22 (31.35)
1997-98	65.22	128.55	9.35	203.12 (100.00)	148.39 (73.06)	0.69 (0.34)	54.04 (26.60)
1998-99	54.04	155.41	10.03	219.48 (100.00)	150.35 (68.50)	0.22 (0.10)	68.91 (31.40)
1999-2000	68.91	182.00	4.04	254.95 (100.00)	154.19 (60.40)	0.66 (0.26)	100.10 (30.26)
2000-01 (P)	100.10	181.10	-	281.10 (100.00)	160.00 (56.92)	8.00 (2.85)	119.10 (40.23)

(P) Means provisional.

**Note:** Figures in parentheses indicate percentages to total availability of sugar.*Source:* Indian sugar Mills Association, New Delhi.

### Problems of carry-over stocks

In recent years, the internal consumption of sugar within the country varied between 150 lakh tons and about 160 lakh tons. Against this consumption, the sugar production had been more than 180 lakh tons annually during 1999-2000 and 2000-2001 (Table 5). This had left a carry over stock of about 110 and 113 lakh tons in these two respective years. The exports of sugar from India were about 69, 22 and 66 thousand tons during the years 1997-98, 1998-99 and 1999-2000, respectively. However, during 2000-01, there was a quantum jump to eight lakh tons from meagre exports during the preceding three years. Brazil is the biggest exporter of sugar in the world. The other principal sugar exporting countries are Australia, Thailand, Cuba and France. Our sugar industry is not in a position to compete globally. The financial position of the central as well as the State Governments is already precarious. Hence, the government cannot afford to provide subsidy to the sugar exporters. The average international price of white sugar during the year 2000 was about Rs 998 per qtl quoted for the London market (US\$ 22.17 per ton). Our sugar mills/exporters are not in a position to face international competition due to higher cost of production. However, we can export sugar to the SAARC countries at competitive prices but the Pakistan Government

banned our sugar exports about two years back due to non-economic factors.

India imported about 10 lakh tons sugar annually in the years 1997-98 and 1998-99. The imports declined to about four lakh tons in 1999-2000. The higher production, lower internal consumption, meagre exports and large imports created a glut situation of sugar in the country during the last few years. On the carry over stock of sugar, each mill loses nearly Rs 250 per bag by way of interest on capital and reduced sale price (nearly Rs 100 per bag per year) in the market (Sareen, 2001). The sugar glut is likely to aggravate further as more and more farmers are adopting sugarcane cultivation in Punjab as it is currently being counted as one of the cash crops under diversification plans (Ibid). Interestingly, neither the Punjab Government nor the Punjab Sugarfed has any control over disposal of sugar from the State as the responsibility falls on the centre.

### Sugar policy in India

The sugar policy since 1970-71 in India is shown in Table 6. The percentage share of levy and free sale sugar was 70 and 30 respectively during the year 1970-71. Over time, the levy share declined whereas free sale quota increased. Upto 1980-81, the share of levy sugar

was 65. By 1985-86, this figure declined to 55 per cent. In 1990-91 and 1991-92, it was 45 per cent. From 1992-93 to 1999-2000, the levy sugar share was 40 per cent and free sale was 60 per cent. It was the policy of the Government of India to reduce the share of levy sugar in the post-reform period initiated since 1991. On January 1, 2000, the levy sugar share was further reduced to 30 per cent. On February 1, 2001, the Government of India decided to further reduce the levy share to 15 per cent and increased the free sale quota to 85 per cent. In the recent past, the issue price of levy sugar has also been significantly increased.

**Policy of the Government of India is to reduce the share of levy sugar in the post-reform period.**

**Table 6:** Statement showing the sugar policy and minimum statutory price of sugarcane in different years

Year	Policy	Levy	Free sale percentage	Minimum cane price (Rs/qrtl)	Linked to basic recovery
1970-71	Partial control	70	30	7.37	9.4
1975-76	-do-	65	35	8.50	8.5
1980-81	-do-	65	35	13.00	8.5
1985-86	-do-	55	45	16.50	8.5
1990-91	-do-	45	55	23.00	8.5
1991-92	-do-	45	55	26.00	8.5
1992-93	-do-	40	60	31.00	8.5
1993-94	-do-	40	60	34.50	8.5
1994-95	-do-	40	60	39.10	8.5
1995-96	-do-	40	60	42.50	8.5
1996-97	-do-	40	60	45.90	8.5
1997-98	-do-	40	60	48.45	8.5
1998-99	-do-	40	60	52.70	8.5
1995-2000	-do-	40	60	56.10	8.5
1.1.2000 to 30.9.2000	-do-	30	70	-	-
2000-2001	-do-	30	70	59.50	8.5
1.2.2001 to 30.9.2001	-do-	15	85	-	-

Source: Indian Sugar Mills Association, New Delhi.

It has been observed that SAP of sugarcane in Punjab was about Rs 40 per qtl higher as compared to the minimum cane price fixed by the Government of India. The latter was linked with the sugar recovery at the rate

of 8.5 per cent. At present, this figure is 9.10 per cent in Punjab. Therefore, high SAP is a major hindrance for the establishment of new sugar mills by the private sector in the State. The cooperative sector has no alternative except to follow the directions of the State Government from time to time. A recent study has rightly concluded that getting the government out of the business is only one aspect of market reforms and that is what the first and second generation reforms were all about (Baru, 2001). The third generation reforms have to be about making existing and planned public investment more productive (Ibid).

The Prospects of cooperative sugar mills in Punjab are not very optimistic keeping in view the prevailing market situation and the poor financial health of the mills.

### Cost of sugar

The data about cost of sugar at factor 'L' from 1990-91 to 1996-97 are given in Table 7. In the northern region consisting of Punjab, Haryana and Western Uttar Pradesh, there have been marginal differences in the cost of sugar. It may be attributed to the variation in cane prices in various states, sugar recovery rates, number of working days, pay scales of employees, power rates, transportation cost, etc. Even the national level data regarding the cost of sugar did not show any significant variation from these states. During the year 1996-97, per qtl cost of sugar was about Rs 1,031 at the All India level as compared to about Rs 1,018 in Punjab, Rs. 988 in Haryana and Rs 975 in western Uttar Pradesh.

**Table 7:** Statement showing the unit cost of sugar per qtl. Factor 'L', 1990-91 to 1996-97

(S-30 grade)

Year	Punjab	Haryana	Uttar Pradesh West	All India
1990-91	564.68	538.17	551.74	523.88
1991-92	597.81	577.20	602.76	577.17
1992-93	672.08	688.38	694.82	668.21
1993-94	755.03	762.35	779.69	746.06
1994-95	808.34	822.67	819.43	813.19
1995-96	846.48	905.69	929.63	909.62
1996-97	1018.01	987.89	974.91	1031.57

Source: Indian Sugar Mills Association, New Delhi.

### Levy price of sugar

The levy price of sugar in Punjab as well as India from the year 1994-95 to 1999-2000 was about Rs 775



per qtl in Punjab w.e.f. March 16, 1995. The levy price did not include excise duty levied by the government. This price was Rs 791 per qtl at the All India (average) level. The price of levy sugar was about Rs 1,077 and Rs 1,117 per qtl in Punjab and All India (average) level w.e.f. April 6, 2000. The variation in levy price may be attributed to differences in various cost components as already discussed. Keeping in view the policy of market reforms in the economy, the sugar industry may be decontrolled and all such policies of levy system and price fixation of sugar as well as cane may be thoroughly reviewed by the policy makers at the national and state level.

**The variation in levy price may be attributed to differences in various cost components.**

**Table 8:** Levy price of sugar excluding excise duty, 1994-95 to 1999-2000 (S-30 grade) Delivery into railway wagons (Rs per qtl)

Year	All India (Average)	Punjab
1994-95 (16.3.1995)	791.00	775.47
1994-95 (27.5.1995)	792.00	775.47
1995-96 (14.5.1996)	884.00	872.61
1996-97 (12.2.1997)	1009.00	1085.61
1997-98 (11.7.1998)	1022.00	1046.33
1998-99 (29.11.1999)	1052.00	1083.99
1999-2000 (6.4.2000)	1117.00	1076.75

Source: Indian Sugar Mills Association, New Delhi.

### Rates of excise duty

The information regarding rates of excise duty on levy and free sale sugar from March 1, 1970 to date is given in Table 9. In the early seventies, the gap between the excise duty was less on two types of sugar whereas since July 24, 1991, the gap is almost double. The excise duty on per qtl basis was Rs 71 on free sale sugar whereas it was Rs 38 on levy sugar. Since levy sugar is distributed through public distribution system (PDS) all over the country, therefore, the excise duty has been rationally kept low by the government to keep the issue price of sugar low. Apart from the usual excise duty, the sugar mills have to pay cess to the government under the Sugarcane Act, 1982.

### Issue price of levy sugar

The data regarding issue price of levy sugar from

**Table 9:** Rates of excise duty on sugar

(Rs per qtl.)

Period	Levy sugar	Free sale sugar	Nature of duty
From 1.3.1970	25.00	37.50	% ad valorem
From 1.12.1972	26.00	30.00	"
From 15.12.1973	20.00	37.50	"
From 1.3.1975	20.00	45.00	"
From 3.8.1976	15.00	45.00	"
From 1.11.1976	15.00	41.50	"
From 1.1.1977	15.00	45.00	"
From 16.11.1977	12.50	27.50	"
From 1.3.1978	12.87	28.50	"
From 16.3.1978	11.30	28.50	"
From 17.12.1979	13.175	23.775	"
From 1.3.1980	13.175	19.05	"
From 1.6.1980	13.175	15.90	"
From 1.8.1982	13.175*	11.25*	"
From 1.3.1983	38.00*	50.00*	Specific
From 9.11.1983	38.00*	50.00*	"
From 24.7.1991	38.00	71.00*	"

**Note:** Excise duty included both basic as well as additional excise duty.

\* Apart from the usual rate, the government has imposed a cess at the rate of Rs 5.00 per qtl. from 1.6.1982 to 31.10.1982 and Rs 14.00 per qtl. from 1.11.1982 onwards under the sugar Cess Act, 1982.

Source: Indian Sugar Mills Association, New Delhi.

1972 to 2001 in India are given in Table 10. The issue price effective from December, 1972 was Rs 2.15 per kg. In the first one decade up to 1982, it was increased by Rs 1.60 per kg. During the next one decade or so, it was more than doubled w.e.f. Feb. 17, 1993. Keeping in view the market reforms policy and to have to check on food subsidy, the issue price was enhanced at a faster rate in the last eight years. The price effective from March 1, 2001 was Rs. 13.25 per qtl. The increase in issue price has been on account of increase in cane price, processing cost, labour cost, transportation cost, power rates, capital investment, etc.

### Wholesale prices of free sale sugar

The wholesale prices of free sale sugar in the Delhi market from 1995-56 to 1999-2000 are given in Table 11. Delhi is a big consumption centre of sugar having a population of about 123 lakhs. Moreover, there is market integration and prices of the Delhi market reflect the entire northern states of India. Over the last five years, there was marginal increase in the wholesale prices of

sugar in the Delhi market. The inter-year and intra-year fluctuations were not very wide. The monthly price variation between the maximum and the minimum price was to the extent of Rs. 90, Rs 150, Rs 120, Rs 90 and Rs 115 per qtl during the years 1995-96, 1996-97, 1997-98, 1998-99 and 1999-2000, respectively, in the Delhi market. Keeping in view the cost structure of sugar, each quintal of sugar produced in Punjab carry approximately Rs 1100 as cost of cane alone and Rs 85 as excise duty and cess. After adding all other direct and indirect costs, i.e. processing costs, labour cost, interest on fixed investment, depreciation of machinery, cost of gunny bag, transportation cost, management cost, etc., the sugar industry is not a very profitable enterprise.

**Table 10:** Issue price of levy sugar in India, 1972 to 2001

Period (effective from)	Issue price (Rs per kg)
December 1972	2.15
1.3.1978	2.30
17.12.1979	2.85
1.12.1980	3.50
15.11.1981	3.65
1.12.1982	3.75
1.12.1984	4.00
1.4.1985	4.40
1.12.1985	4.80
15.12.1986	4.85
1.1.1988	5.10
1.1.1989	5.25
24.7.1991	6.10
21.1.1992	6.90
17.2.1993	8.30
1.2.1994	9.05
10.2.1997	10.50
1.10.1997	11.40
15.2.1999	12.00
1.3.2000	13.00
1.3.2001	13.25

Source: Indian Sugar Mills Association, New Delhi.

The installation of a new sugar mill in Punjab needs an initial investment of about Rs 50 crore including cost of land, buildings, plant and machinery. Therefore, price and cost structure of sugar industry is a big bottleneck for the setting up of new sugar mills in the State. There is very limited scope for the export of sugar from Punjab keeping in view unfriendly relations with Pakistan. Without the land route to gulf Countries through Pakistan, we cannot compete on account of low international

**Table 11:** Monthly wholesale prices of free sale sugar in Delhi market, 1995-96 to 1999-2000

(Rs per qtl)

Months/year	1995-96	1996-97	1997-98	1998-99	1999-2000
October	1380	1400	1470	1585	1600
November	1385	1380	1460	1585	1600
December	1380	1325	1470	1575	1685
January	1360	1325	1470	1585	1550
February	1330	1380	1470	1575	1590
March	1340	1380	1470	1510	1590
April	1350	1425	1485	1575	1585
May	1385	1425	1485	1585	1580
June	1370	1450	1535	1600	1570
July	1380	1470	1525	1600	1585
August	1420	1460	1530	1600	1600
September	1420	1475	1580	1575	1625
Price variation	90	150	120	90	115

Note: Sugar prices related to M-30 grade.

Source: Indian Sugar Mills Association, New Delhi.

sugar prices. The nearest sea-ports for Punjab within the country are in Gujarat and Maharashtra for which our exporters have to bear light transportation cost. Light government control over sugar industry is another bottleneck. Such policy measures act as disincentives for the private sector to expand. Diversification of agriculture will not be possible without the participation of the private sector on a very large scale in the State. The experience of the last 15-16 years clearly show this. The policy makers are talking of diversification of agriculture but area under paddy has increased by 9-10 lakh hectares since 1986. The environment for the private sector participation needs to be made conducive and existing policies may be changed accordingly on account of globalisation, privatisation and liberalisation.

**Installation of a new sugar mill in Punjab needs an initial investment of about Rs 50 crore.**

### References

- Alagh Y.K. (2001), "Sugarcane turns bitter-sweet", The Indian Express, Chandigarh, Vol. 25(111), November 27.
- Baru, Sanjaya (2001), "Back to the basics—2001 was a wasted year, tomorrow can be different", The Indian Express, Chandigarh, Vol. 25(140), December 31.
- Gehlawat J.K. (1990), "Indian sugar industry—A changing scenario"

---

in J.K. Gehlawat (Ed) Modernisation of Indian Sugar Industry, Arnold Publishers, New Delhi.

**Grewal S.S. and P.S. Rangi** (1982), "Sugar industry in Punjab", Problems and Prospects, Indian Sugar, Vol. 31(11).

**Grover D.K.** (1987), "An economic analysis of fluctuations in sugar industry with particular reference to Punjab", Ph.D. dissertation (Unpublished), Deptt. of Econ. and Sociology, PAU, Ludhiana.

**Kaur, Tejinder** (1998), "An economic analysis of the production and

processing of sugarcane in Punjab (A case study of Bhogpur and Jagraon Sugar Mills)", M.Sc. Thesis (Unpublished), Deptt. of Econ. and Sociology, PAU, Ludhiana.

**Sareen, Varinder** (2001), "Sugar glut sours Punjab cane growers' dreams", Hindustan Times, Chandigarh, Vol. LXXVII (330), November 28.

**Sugarfed** (1997), "Quality sweetness from Sugarfed", Chandigarh.



*There are risks and costs to programs of action. But they are far less than the long range risks and costs of comfortable inaction.*

— John F. Kennedy

# Trade Liberalisation & Indian IT Industry

Hina Sidhu

---

*The Government of India has recognised the software industry as a high priority industry and has initiated various actions for its growth. Although the software industry has been registering an annual growth of 50 per cent to 60 per cent since 1993-94, the increase in value terms has been path breaking. Majority of the Internet start-ups on the West Coast of the US are Indian. The Indian software companies are gearing up to grab opportunities available in areas like utilities, healthcare, retail, transportation; new services such as BPO, R&D Services, Internet related services, Mobile enablement and Security and Business continuity services.*

*Hina Sidhu is Senior Lecturer, Dept. of Economics, School of Social Sciences, Gujarat University, Ahmedabad 380 009.*

Immediately after independence, India concentrated on developing skilled, scientific and professional manpower by establishing government-funded educational institutions and polytechnics. The creation of facilities to encourage higher education and research has produced an army of administrators, technocrats and scientists in the country. It is estimated that India has over 4 million technical workers. Over 1,800 educational institutions and polytechnics train nearly 70,000 computer software professionals every year.

Extensive use of English in India, which is fast becoming the international business language, has helped the professionals of this country to rise to decision-making positions across the world. Increasing demand for the Indian professionals and software products all over the world has changed the mindsets of the Indian policy makers who now acknowledge that it is the knowledge industry that can accelerate the growth of the Indian economy.

## Pre-Liberalisation Policy

Soon after Independence, the Govt. of India introduced the Industrial Policy Resolution in 1948 which emphasised on steady increase in production and its equitable distribution. Considering the socio-economic goals, changes in the domestic and global market conditions from time to time, there has been considerable shift in the instrumentalities to achieve these objectives. The Industrial Policy was comprehensively revised in 1956 and modified through statements in 1973, 1977 and 1980. The Industrial Policy Statement of 1980 emphasised on the need for a competitive domestic market, technological upgradation and modernisation of the industrial sector. This policy laid the foundation for an increasingly competitive export base and attractive foreign investment in high-technology areas.

## Post-Liberalisation Policy

Prior to the New Industrial Policy (NIP) of July 1991,

India pursued an import-substitution and mixed, public-sectoral, licensing economy. Major areas like steel, heavy engineering, infrastructure, telecommunications, power and basic chemicals were reserved for the public sector. The areas open to the private sector were tightly monitored through licences, quantitative and capacity restrictions. Imports of any kind, including advanced technology, capital goods and raw materials required a number of approvals. Restrictions on the amount of royalties, technology transfer fees, high import tariffs and stiff foreign-exchange controls discouraged foreign investors.

India's New Industrial Policy (NIP), tabled in both the houses of parliament on 24 July 1991, established a dynamic relationship between domestic and foreign industry in terms of both technology and investment. Foreign investment was viewed from the positive angle of benefits accruing from technology transfer, marketing expertise, introduction of modern managerial techniques and promotion of exports. The NIP 1991 emphasised on competition, foreign participation and trade liberalisation. Since then a wide canvas of changes have been implemented or suggested in the fields of intellectual property, foreign investment, trade law, disinvestment in the public sector, financial sector reforms, easing of foreign-exchange controls and tax reforms.

The new Foreign Trade Development and Regulation Act 1992 repealed the Import-Export Control Act 1947. The new Act emphasises on the development of foreign trade by facilitating imports into and enhancing exports out of India while the 1947 Act prevented and controlled the imports and exports. The office of the Chief Controller of Imports and Exports has been replaced by the Office of the Director General of Foreign Trade. And the role of State Trading Corporations has shifted from routing canalised items to export promotion.

Quantitative restrictions (QRs) on imports except for consumer goods were removed in 1993. The Negative list has been reduced to very few items under the Prohibited, Licensable and Canalised lists. The Govt. of India has also negotiated with major trading partners for phased elimination of all remaining QRs by year 2003. Customs duties which used to be high have also been lowered significantly and are proposed to be comparable with East Asian levels by 2003.

**Quantitative restrictions (QRs) on imports except for consumer goods were removed in 1993.**

In 1996 the Govt. of India formulated a Strategic Plan for promoting exports. As per this plan, India should (a) concentrate on markets with a per capita income above \$20,000 (b) increase market share in the importing countries (c) expand product range in the existing markets (d) tap new markets and (e) detect the real reason if some market shows resistance.

### **Policy for Software Industry**

The Government of India has recognised the software industry as a high priority industry and has initiated various actions for its growth. In 1982 the government of India set up MAIT an apex body representing the hardware, training and services sector of the Indian IT industry. With the onset of liberalisation in India and the rapid growth of the IT Industry, the MAIT has consolidated its activities and focused on export promotion and attracting foreign investment into the Indian IT Industry.

A Software Development Promotion Agency has been set up to increase marketing of software exports in the international as well as domestic markets. A Software Technology Parks (STP) scheme under the Department of Electronics of the Government of India has been implemented to attract foreign investment and increase software exports. In addition to the aforesaid, the Export & Import (Exim) Policy 1997-2002 and other important policies which have contributed significantly to the growth of software industry in India are:

- Automatic clearance to FDI proposals upto 51 per cent.
- 100 per cent tax exemption on profits derived from software exports.
- Export Promotion of Capital Goods (EPCG) scheme allows import of capital goods at reduced import duty subject to export obligation.
- No import duty on software.

It is important to note that the software industry was the first to be brought on par with the non-tariff trade regime in keeping with the WTO spirit.

In 1998, the government of India formed the Prime Minister's (PMs) IT Task Force which consisted of eminent people from the government, industry, defence forces and research community. This task force has addressed problems such as the cost of personal computer (PC), connectivity and education and training related to IT. Accordingly, in July 1998 the Action Plan Part-I, dealing with software was prepared with 108 recommendations

which the government approved immediately. With a view to make India comparable to Taiwan, Malaysia, Singapore and others who are dominating the IT hardware markets of the world, the IT Action Plan Part-II containing 84 policy instruments for the development, manufacture and export of IT hardware was submitted to the government in November 1998. The Govt. of India approved most of the recommendations.

In 1999 the IT Task Force brought out a Basic Background Report (BR-3) on strategic policies aiming at making India an IT superpower. This report recommended a major shift from the earlier concepts and strategies and emphasised on the streamlining of procedures to create a healthy investment climate for encouraging proactive enterprises with marketing aggressiveness. BR-3 also recommended the merging of the Department of Telecom (DoT), Department of Electronics (DoE) and the Ministry of Information & Broadcasting (MI&B) under the single umbrella of the Ministry of Informatics in order to formulate effective plans and policies. The Govt. of India has accepted major recommendations of BR-3 like, approval for the National Telecom Policy (NTP-1999), formation of the Ministry of Information Technology (IT) and the passage of the IT Bill.

With the formation of a new ministry for IT, Govt. of India has taken a major step towards promoting the full potential of Indian professionals. The Ministry has identified major constraints and has initiated steps to overcome them.

**With the formation of a new ministry for IT, Govt. of India has taken a major step.**

The National Centre for Software Technology (NCST), an autonomous R&D centre under the administrative purview of the Ministry of Information Technology, Govt. of India, has been set up with the objective of carrying out R&D and contributing high quality education to the professionals in the IT industry.

Recently, an IT committee was set up by the Ministry of Information Technology, Government of India, comprising Non-Resident Indian (NRI) professionals from the United States to seek expertise and advice and also to step up U.S. investments in the Indian IT sector.

For rapid growth of IT sector in India, the Govt. of India is developing infrastructure for data communica-

tion. At present, high speed wide area communication is through the Satellite medium, Microwave systems and Fibre Optic lines. Recognising the importance of fibre optics, the Department of Telecommunications has laid more than 100,000 route kilometers of Fibre optic cables. These are mainly for low and medium speed fibre optic communication. With a heavy projected load in the coming years, the Prime Minister's Task Force on Information Technology has recommended to install at least 20,000 route kilometers of very high speed fibre optic lines, more than a 1000 times the bandwidth as compared to the existing fibre optic lines of the Department to Telecommunications. The Govt. of India has accepted these recommendations and started implementing a Project.

### **Growth of IT Industry**

The fields of Science and Technology like Nuclear Physics, Theoretical Physics, Molecular Biology, Astrophysics, Aeronautics Engineering and Space Science, to which India has contributed significantly, require extensive numerical computations with heavy use of computers. During the 1950s, India designed and built two computers—one called TIFRAC at the Tata Institute of Fundamental Research at Bombay and the other called ISI-JU developed jointly by the Indian Statistical Institute and Jadavpur University at Calcutta. The Indian Center for Development of Advanced Computers has also built a super-computer called PARAM because the US Govt. banned the export of CRAY Super computer to India for scientific purpose.

Computerisation in India began in the early 1960s with IBM taking the lion's share of the predominantly Governmental market. Other companies having presence in India were ICL, Univac and Burroughs. A noteworthy event in India's computer history occurred in 1976 when the Janta Party Govt. implemented an Act to restrict foreign ownership of India-based operations to 40 per cent. This led the IBM and others to move their operations out of India. IBM was supplying the main-frame systems which created protected domains in the United States and other western countries. Much of the success of Indian computer industry is attributed to the fact that in India the mainframe era never happened. However, in India the indigenous microcomputer industry developed steadily as it supplied open platforms like LINUX, PERL, APACHE at lower costs than the main-frame computers. Availability of IT professionals in different IT applications in India contributed further for providing wider choices to use different platforms like Intel, Windows and Unix and integrated all the functions and departments of the user organisations. In US and Europe where companies used main-frame and mini-

computer-based information systems, the transition to PC client/server alternatives was painful.

**Computerisation in India began in the early 1960s with IBM taking the lion's share.**

The Government of India set up MAIT to promote scientific, educational and IT industry. MAIT's activities are consolidated with special focus on export promotion and attracting foreign investment into the Indian IT Industry. However, the proliferation of UNIX and other client-server systems in the United States in the 1980s had created great opportunities for the Indian IT professionals. As such, during the 1980s the brain drain to the West affected the growth of the Indian IT industry. For a steady growth of the Indian IT sector, an autonomous organisation called the National Association for Software and Services Companies (NASSCOM) was formed in 1988 to work closely with the Government of India.

The general public came to know about the use of IT only after the computerisation of the railway passenger reservation system in 1986 that brought computers closer to the masses. And in the last few years it is the power of internet, E-Commerce and the thrust of the Government of India on IT education which has created an IT related environment around the common people, even in the rural areas. The Govt. of India has recognised that by marshalling our vast human, industrial and technological resources through development of the software sector, India can become a major player in the Global IT market.

The policy of the Government relating to adoption of information technology is the key driver for the demand of domestic IT products. For example, in USA, about 23 per cent of the domestic IT revenue is generated by the Government offices and public sector units. In India, in recent years, the Government spending on IT related items has increased significantly. Major sectors which are giving special thrust on the adoption of IT are the Central as well as State administrations, Banks, Financial and Insurance Institutions, Defence, Public Tax System, Ports, Customs, Telecom, Energy, and Educational sectors. Certain Indian states like Andhra Pradesh, Tamil Nadu, Maharashtra, and Karnataka have contributed considerably to total domestic IT spending. Besides the growth of IT industry in the aforesaid States, a number of other states like Gujarat, Kerala, Orissa, Delhi, Goa, Himachal Pradesh, West Bengal, Uttar Pradesh, Madhya Pradesh and Rajasthan have also initiated major drives for computerisation of

office records. The Government initiatives to encourage extensive use of IT in the state administration as well as the educational system will lead to making India a world class IT user. It is important to mention that 19 of the 26 state Governments have already announced their IT Policy and many others have formed high level Task Forces to proliferate the software and IT enabled services industry in their respective States.

### Software Sector in IT Industry

The IT industry has registered more than three fold increase during the last seven years i.e. from Rs 15,785 crore in 1993-94 to Rs 52,450 crore in 1999-00. At present there are around 150 major hardware players in the Indian IT Industry, supported by over 800 ancillary units and small time vendors engaged in sub-assemblies and equipment manufacturing. Software industry has rapidly emerged as an important sub-sector of the IT industry. The software industry has been recording appreciable growth in the last few years. Its share in total production of the IT industry has increased from nearly 11 per cent in 1993-94 to 46 per cent in 1999-00 (Table 1) and over 68 per cent in 2000-01 (Table 3).

**The IT industry has registered more than three fold increase during the last seven years.**

**Table 1:** Production of IT Industry in India

(Rs. Crores)

Item	1993-94	1995-96	1996-97	1997-98	1998-99	1999-00
Consumer Electronics	4,150	5,800	6,500	7,600	9,200	11,200
Industrial Electronics	1,770	2900	3100	3150	3300	3750
Computers	1,820	2225	2740	2800	2300	2500
Commn. & Broad. Eqpt.	3,150	2600	3000	3250	4400	4000
Strategic Electronics	500	1,075	1,300	900	1,300	1,450
Components	2,680	3500	3700	4400	4750	5200
Sub-Total (other than Software)	14,070	18,100	20,340	22,100	25,250	28,100
Software for Exports	1,020	2,550	3,700	6,500	10,940	17,150
Domestic Software	695	1,690	2,600	3,470	4,950	7,200
Sub-Total (Software)	1,715	4,240	6,300	9,970	15,890	24,350
Total (IT industry)	15,785	22,340	26,640	32,070	41,140	52,450

Source: Data Bank and Information Division, Ministry of Information Technology, Govt. of India, August 31, 2000.

The software industry in India has recorded nearly 22 fold growth in the last 7 years. Its turnover has increased substantially from Rs. 1,715 crore in 1993-94 to an estimated Rs 37,760 crore in 2000-01. Although the software industry has been registering an annual growth of 50 per cent to 60 per cent since 1993-94, the increase in value terms has been pathbreaking.

**Table 2:** Electronics Exports from India

(Fig. in crore Rs)

Item	1993-94		1999-2000	
	Amount	Share	Amount	Share
A. Computer Softwares	1020	47.9%	17150	92.4%
B. Others				
Consumer Electronics	250	11.7%	300	1.6%
Industrial Electronics	115	5.4%	200	1.1%
Computers	420	19.7%	240	1.3%
Communi. & Broadcast Equip with Strategic Electronics	98	4.6%	60	0.3%
Components	225	10.6%	600	3.2%
Sub-Total (B)	1108	52.1%	1400	7.6%
Total (A + B)	2128	100.0%	18550	100.0%

Source: Data Bank & Information Division, Ministry of Information Technology, Govt. of India, August 31, 2000

The Indian software industry has not only recorded exponential growth but has also moved up on the value chain. The industry has rapidly evolved from software development to integration and IT business consulting like brand management, web based and e-commerce related services. The high potential of the software industry to generate wealth, foreign exchange and employment has impressed the industrialists, businessmen, economists, bureaucrats, and even the general public. The share of the software sector in the total exports by the IT industry of India has increased from 48 per cent in 1993-94 to over 92 per cent in 1999-00.

The quality of Indian software products has played a key role in the attainment of high growth in exports. According to NASSCOM the Indian software industry has got international recognition for its software development. Out of the top 300 companies in India, more than 170 have acquired ISO 900 certification. As far as SEI CMM (Software Engineering Institute Capability Maturity Model) Level 5 is concerned, the Indian software industry has emerged as the real leader. There are only 23 IT companies in the world which have acquired the SEI CMM Level 5, of which 15 companies (65 per cent) have production facilities in India. The NASSCOM member companies in India which have acquired SEI CMM Level 5 include Motorola, Wipro, Zen-

sar, IBM, Infosys, CBSI, DCM ASIC, NIIT, CG Smith, Satyam, TCS, COSL, HCL Perot, I-Flex and NeST.

**Table 3:** Indian Software Industry (Rs Crore)

Year	Total IT Industry	Domes- tic Soft- ware Produc- tion	Domes- tic Soft- ware Market	Soft- ware Exports	b as % of a	d as % of b
	a	b	c	d	e	f
1993-94	15785	1715	695	1020	10.9	59.5
1994-95	16134	2605	1070	1535	16.1	59.9
1995-96	22340	4240	1690	2550	19.0	60.1
1996-97	26640	6300	2600	3700	23.6	58.7
1997-98	32070	9970	3470	6500	31.1	65.2
1998-99	41140	15890	4950	10940	38.6	68.8
1999-2000	52450	24350	7200	17150	46.4	70.4
2000-01	55400	37760	9260	28500	68.2	75.5

Source: (i) NASSCOM Statistics Feb. 2002.

(ii) Embassy India: India Information, India's Information Technology Industry.

An important reason for assigning importance to the software industry is the contribution it has made to foreign exchange earnings. Exports by the software industry have recorded about 28 fold increase over the 7 year period from Rs 1,020 crore in 1993-94 to an estimated Rs 28,500 crore in 2000-01. Though the annual growth in software exports has been impressive throughout, there has been a quantum jump since 1997-98. As a result, the share of software exports in the total revenue generated by the software industry in India has increased from about 60 per cent in 1993-94 to 76 per cent in 2000-01 (Table 3).

### Role of IT in Globalisation of the Indian Economy

In 1999-00, India exported software and services to 95 countries. Total exports of software from India during 1999-00 amounted Rs 17,150 crore of which nearly 62 per cent went to North America (USA and Canada), 23.5 per cent to Europe, 3.5 per cent to South East Asia, 3.5 per cent to Japan, 1.5 per cent to West Asia, 1.5 per cent to Australia and New Zealand and 4.5 per cent to other countries. Interestingly, India commands about 18.2 per cent market share in the global customised software market. The number of software exporting companies from India is increasing rapidly. In the year 1999-00 there were 1250 software exporting companies in India and their number has exceeded 1,600 by the end of 2000-01 indicating a growth of 28 per cent in one year. Tata Consultancy Services (TCS) with export revenues of Rs 1,820 crore in 1999-00, ranked first



among the software exporting companies in terms of revenue. In 1999-00 the share of the top 25 exporters was almost 61 per cent of the total export earnings of the Indian software and services industry. This clearly indicates that most of the software exporting companies do business on a small scale.

**In 1999-00, India exported software and services to 95 countries.**

During 1999-00 the offshore Services strengthened their dominance in the software exports. The share of offshore Services increased to more than 42 per cent of total exports, whereas on-site Services contributed about 58 per cent to export revenues. The growth is remarkable when one compares it with the status in 1991- 92, when the share of offshore Services was merely 5 per cent while the on-site Services dominated with 95 per cent of total software exports. Several US and European companies have set up their back office operations in India mostly in Bangalore, Chennai, and Pune. Adequate supply of skilled labour, low wages, cheap satellite communications and the internet services have influenced the decision of foreign companies to set up their back office operations in India. As such, joint ventures of the Indian companies with foreign companies are increasing. IBM has also entered the Indian market through a marketing tie up with the Tatas.

Influenced by the increasing presence of Indian software in the international market, many countries across the globe are establishing links with top IT universities and institutions in India to facilitate cross collaborations in R&D, and technical services. For example, Singapore has already signed a number of co-operation pacts with the Indian IT Institutes in Bangalore and Chennai, and some exchange programmes have already started. Singapore's IDA and Indian NASSCOM are facilitating Singaporean and Indian companies to co-develop products for the (a) Chinese market by tapping Singapore's marketing and cultural links with China and (b) US and European markets by tapping Indian contacts in the US and Europe.

The NIESA (NASSCOM's India Europe Software Alliance) Programme, supported by the Government of India has contributed significantly to the growth in software trade with Europe. UK was the most favoured destination of Indian software exports to Europe. As per NASSCOM's study, Europe has started recognising the competitive advantage that would accrue to the European economy by aligning with Indian software companies.

China has shown keen interest to step up cooperation with India in the field of IT for developing software solutions for Japan and Korea. The Chinese have also expressed interest in setting up joint ventures with India for the manufacture of computer hardware and components. The Chinese Prime Minister Zhu Ronghi during his visit to India in January 2002 said that the two Asian technology rivals could together dominate the global information technology market if they join forces in sharing expertise in hardware and software.

To increase software business with Japan, the NASSCOM has launched a Project NINJAS i.e. NASSCOM's India Japan Software Alliance. NASSCOM has also signed a Memorandum of Understanding (MOUs) with Israel, Singapore, Ireland, Mexico and Morocco for software exports to these new and emerging markets.

There is a shortage of IT related skilled manpower in some countries like Germany, Austria, UK, France, China and Italy. These countries have initiated the process of liberalisation of work permit and sourcing of skilled manpower from India. It is interesting to note that majority of the Internet start-ups on the West Coast of the US are Indian. Many Americans are giving their internet start-ups Indian names in order to corner some market share. Presently the Indian software companies are gearing up to grab opportunities available in areas like utilities, healthcare, retail, transportation, new services such as BPO, R&D Services, Internet related services, Mobile enablement and Security and Business continuity services. By developing required information infrastructure capable of supporting sophisticated, fast and cheap communication technologies, India has the potential to become the Asian hub for all services related activities in the region.

**Majority of the Internet start-ups on the West Coast of the US are Indian.**

Influence of the Indian software industry in the world can be felt by the reversal in the brain drain which took place since independence. Many successful IT savvy Indians in US and Europe are now returning to India to exploit the opportunities in the IT sector in India. Considering India's position in the global software market and the competency of Indian IT professionals, one can say that India has the potential to replicate in the software business, what Japan did to the international automotive market.

---

## Conclusion

The encouragement of foreign investment has been the key element in the liberalisation reforms in India. The Govt. of India has made it clear that India is actively seeking foreign investment especially in areas of high technology and infrastructure. Today the Indian software industry has been recognised as representing one of the very successful business modes in the world that can sustain high growth and competitiveness. The recent decision of the government like passage of the IT Bill in parliament, allowing 100 per cent FDI (Foreign Direct Investment) in B2B e-commerce transactions, allowing private ISPs to get international internet bandwidth through submarine cables and zero tax on e-commerce transactions will further boost the prospects of the Indian IT industry. India is acknowledged as a powerhouse for software development. China has a strong electronics manufacturing sector, Korea has broadband capabilities and Japan leads in many wireless innovations. India has the potential to become a global superpower in the knowledge economy.

## References

- Embassy of India: India Information, "India's Information Technology Industry".
- Govt. of India (1997-2002), "Export & Import—Exim Policy—Exim Policy.
- Govt. of India, (1991), "India's New Industrial Policy: Tabled in both the houses of parliament", 24 July.

Govt. of India, "Policy for Software Industry".

**Heeks Richard**, "India's Software Industry", Sage Publications, (Dehli).

**Heeks Richard** (1999), "Software Strategies in Developing Countries", Working Paper 2, Institute for Development Policy and Management, University of Manchester, UK.

International Trade Law & Regulation (1996), "Trade and Law Reforms", March.

**Joshi Akshay**, "Information Technology-Advantage India".

**Mohadjer Amin**, "India's billion dollar business".

National Association of Software and Service Companies (NASSCOM), Nasscom-Mckinsey (1999), "Study on the Indian Software and Services", Version-1.

National Association of Software and Service Companies (NASSCOM), Nasscom-Mckinsey (2002), "Study on the Indian Software and Services", Version-2, February.

National Association of Software and Service Companies (NASSCOM), Various Reports and Press Releases.

**Pant K.C.** (1999), "Deputy Chairman, Planning, Certain Aspects of Technological and Economic Developments in India—Preparation of India for the New Millennium", Address at the Kellogg School of Management, Chicago, U.S.A. on November 11.

**Sachs Jeffrey & Ashutosh Varshney** (2000), in Nirupam Bajpai, "India in the Era of Economic Reforms" April.

**T.E. Lim David** (2001), "Acting Minister for Information, Communications and Arts", (govt. of Singapore), Keynote Address at the World Economic Forum—India Economic Summit, December.

□

# Indian Agriculture: Pre & Post Economic Reforms

K. Pochanna

---

*This article attempts to determine area specific growth pattern of the agricultural performance in India by measuring trends in crop yield growth rate, rural employment, real wages in the agricultural sector, yield promoting factors and trends in exports of major agricultural commodities. These measurements over time and across the states have resulted in wide spatial and temporal variation in crop yield growth rates and instability among the states.*

*K. Pochanna is Associate Professor in Economics, Osmania University, Nizam College, Hyderabad.*

The economic liberalisation of the Indian economy during the early nineties gave increasing hopes to the agriculture sector. The policy makers who initiated the process argued that the opening up of the Indian economy would help in increasing employment and reduction of poverty. It was further assumed that the liberalisation process would lead to increasing efficiency of production and increase in aggregate agriculture output. Further, the signing of GATT accord during December 1994 would be instrumental in promoting multilateralism and increasing international trade in agriculture, other commodities and services. Now economic liberalisation has been in place for about a decade, it is worth while to undertake an evaluation of the impact of reforms on the Indian economy in general and more particularly, on agriculture sector.

There are several studies on Indian agriculture, analysing and measuring the growth of crop production in India as well as in the different states. Notable studies are Parathasarthy (1985), Mahendra Dev (1987), Rao (1988). Since 1991 onwards studies like Bhalla and Singh (1997) and Bhalla (2000) examined the impact of economic reforms on Indian agriculture. These studies also examined the link between growth and variability in productivity. Given the constraints of available data all the above studies have attempted either using the state or district as a spatial unit of analysis.

The specific objectives of this study are:

- To estimate the trend of food grain yields (growth rates) at National and State level to determine area specific growth pattern during pre and post-economic liberalisation period (ELP).
- To examine the changes in yield promoting factors including land-holding structures during the pre and post reforms period.
- To study the changes in rural employment and

agricultural wages during the pre and post-economic liberalisation period.

- To examine the trends of exports of major agricultural commodities during the pre and post reforms period.

The study is based on the secondary of data collected from the CMIE (Centre for Monitoring Indian Economy) Reports of various years. The study reckoned the period from 1980-81 to 1998-99. Growth of food grain yields are estimated by using the equation of the form  $\log y = a + b^t$  (where  $y$  = yield,  $t$  = time factor,  $a$ ,  $b$  = constants and coefficients). Fluctuations are measured by the coefficient of variation around the trend line (CVTL) which is defined below:

$$CVTL = \sqrt{\frac{\sum (Y_t - \hat{Y})^2 / n - 2}{\bar{Y}}}$$

Where  $\sum (Y_t - \hat{Y})$  = sum of squared residuals of the regression on  $Y$  on  $t$ , i.e., yield on time where  $Y$  is the estimated value of the linear time  $Y = a + bt$

$n$  = number of observation

$\bar{Y}$  = Mean of  $Y$

To assess the impact of economic liberalisation on performance of agricultural growth, the study period is divided into two sub-periods, namely, 1981-90 as Period I, 1991-99 as period II. Period I termed as pre-liberalisation and Period II termed as post-liberalisation period. The data on yield promoting factors, land holding structure, agricultural wages and employment, trends in exports of agricultural commodities are also studied by dividing the period as the pre and post liberalisation periods.

### Yield Performance

This section examines the state-wise yield performance of the food grain in India during the period 1980-81 to 1998-99. The estimated yield (trend) growth rates for food grains are given in Table 1.

The decline in the rate of growth of food grains was from 2.91 to 1.97 per cent per annum from the period I to period II. Among the states, yield performance is not uniformly spread across the states during the pre and post liberalisation periods. In terms of magnitude of yield growth rate except Gujarat, Rajasthan and Karnataka all the other states registered relatively lower growth rate in the post-liberalisation period as compared to pre-liberalisation. Punjab, Haryana, Utter Pradesh, Andhra

**Table 1:** Growth Rate in the yield of Food Grains

States	Period 1	Period II
Andhra Pradesh	2.8* (3.31)	2.23* (3.61)
Assam	0.53 (0.99)	0.54* (2.47)
Bihar	3.70* (3.44)	3.01 (2.42)
Gujarat	-2.70 (-0.86)	4.80* (3.08)
Haryana	1.83 (0.95)	1.52* (3.04)
Himachal Pradesh	1.14 (0.79)	0.89 (1.24)
Jammu & Kashmir	-0.72 (-0.53)	0.96** (1.72)
Karnataka	0.81 (0.83)	3.52* (4.16)
Madhya Pradesh	2.59* (4.01)	1.31** (1.72)
Maharashtra	1.39 (0.83)	1.58 (0.74)
Orissa	2.4** (1.65)	0.14 (0.097)
Punjab	2.90* (6.83)	0.96* (2.56)
Rajasthan	2.20 (1.25)	3.38** (1.74)
Tamil Nadu	3.60* (3.07)	0.89 (0.93)
Utter Pradesh	3.7* (6.43)	2.00* (4.97)
West Bengal	7.81* (2.03)	2.16* (3.78)
All India	2.91* (6.39)	1.97* (5.87)

**Note:** Figures in parentheses indicate t-values

\* Significant at 5 per cent level

\*\* Significant at 20 per cent level

Source: CMIE Reports

Pradesh, Bihar, West Bengal and Orissa registered a declined yield growth rate during the post liberalisation period. The yield growth rates was very low particularly, in case of Punjab (0.96 per cent) and Tamil Nadu (0.89 per cent), and Orissa (0.14 per cent). The slow growth in the post-liberalisation period among major states like Punjab and Tamil Nadu which have favourable agricultural infrastructure facilities, posed serious concern to the agricultural policy makers and requires a special attention.

India's food grains economy except states like Gujarat, Rajasthan and Karnataka has shown a significant deceleration of yield growth in post economic

liberalisation as compared to pre-economic liberalisation period. However, the dummy variables for estimating the shift in growth rate between pre and post liberalisation period were by and large insignificant.

### Instability in Food Grains

Issues relating to fluctuations in food grain production are important for several reasons. The price influence, the decision relating to acreage also influences the yield, through the use of other inputs to the crops other than land. In the present context of economic liberalisation and globalisation, it is aimed to put the market and market institutions as the prime movers in the development process replacing the state and public agencies in as many spheres as possible. This process of liberalisation also has influence on price and turn on yield and use of other inputs. The non-price factors which contribute to fluctuation in productivity (yield rate) are rainfall, and timeliness climatic condition, irrigation, use of biological chemical inputs and distribution of land holding. Yield variability could also very much depend upon the pattern of investment by which growth is brought about.

**The non-price factors which contribute to yield rate are rainfall, use of chemical and distribution of land holding.**

**Table 2:** CVTL of Yield

States	Period 1	Period II
Andhra Pradesh	2.90	2.07
Assam	1.57	0.59
Bihar	3.09	3.37
Gujarat	7.60	3.84
Haryana	7.04	1.96
Himachal Pradesh	4.75	2.19
Jammu & Kashmir	4.30	1.71
Karnataka	4.73	1.99
Madhya Pradesh	1.65	1.86
Maharashtra	3.90	4.63
Orissa	3.94	3.76
Punjab	2.07	1.74
Rajasthan	4.13	3.99
Tamil Nadu	4.13	22.93
Utter Pradesh	1.96	1.40
West Bengal	12.72	1.88
All India	1.48	1.00

In the present study the fluctuations are measured by a coefficient of variation around the Trend Line (CVTL) during the pre and post economic liberalisation period. The higher the CVTL the greater the instability and vice-versa. The estimated CVTL results are presented in Table 2. The table clearly reveals that at the national level the fluctuation in yield is high in Period I as compared Period II.

A comparison of yield variability across the states clearly exhibits that Bihar, Madhya Pradesh, Maharashtra and Tamil Nadu have higher variability in yield as compared to other states during the post-liberalisation period. The table clearly witnessed that yield instability or amplitude of fluctuation is less in most of the states in the post-liberalisation period as compared to pre-liberalisation period.

### Growth and Instability

Various studies examined the relationship between growth and instability and most studies reinforced the positive association between growth and instability. To examine this, CVTL estimates have been obtained for the two periods under consideration and presented in Table 3. When growth and CVTL moves in the same direction it implies that there is positive association and when growth and CVTL move opposite directions it implies that there is negative association.

At the all India level growth has declined from 2.91 per cent to 1.97 and instability declined from 1.48 to 1.00 between pre-liberalisation and post-liberalisation period. The direction between growth and CVTL exhibits a positive association. The positive association is observed with respect to seven states and the remaining states witnessed a negative association between growth and instability.

The details of yield promoting factors are presented in Table 4. The use of chemical fertilisers and expansion of credit and other inputs from 1980-81 to 1998-99 did not secure increase in production. The pace and pattern of change of these inputs adversely affected total factor productivity. Therefore, equity, efficiency and sustainability of the current approach become debatable. There was a sharp deceleration of total Gross Capital formation of Agriculture (TGCF) in total Gross Domestic Capital Formation (TGDCF) from 18.0 per cent to 9.4 per cent from 1980-81 to 1996-97. It is important to note that the percentage of capital formation by the public sector declined from 38.74 to 16.17 per cent from 1980-81 to 1995-96. Although private capital formation has increased it has not been able to compensate for the steep deceleration of public sector capital formation.

**Table 3: Yield Growth Rates and CVTL between Period I and Period II**

States	Yield Growth Rate in Period I and Period II	CVTL Between Period I and Period II
Andhra Pradesh	-ve	-ve
Assam	+ve	-ve
Bihar	-ve	+ve
Gujarat	+ve	-ve
Haryana	-ve	-ve
Himachal Pradesh	-ve	-ve
Jammu & Kashmir	+ve	-ve
Karnataka	+ve	-ve
Madhya Pradesh	-ve	+ve
Maharashtra	+ve	+ve
Orissa	-ve	-ve
Punjab	-ve	-ve
Rajasthan	+ve	-ve
Tamil Nadu	-ve	+ve
Utter Pradesh	-ve	-ve
West Bengal	-ve	-ve
India	-ve	-ve

+ve = positive, -ve = Negative

**Table 4: Progress in use of yield promoting factors during the period 1980-81, 1990-91 and 1998-99**

Inputs	1980-81	1990-91	1998-99
Distribution of certified seeds/quality seeds (lakh quintals)	25.01	57.01	70.00*
Consumption of Chemical fertilisers (000 tons)	5516	12546	16798
Consumption of pesticides (000 tons)	45.00	75.03	49.16
Flow of agricultural credit (Cooperative, commercial and regional and rural banks) (Rs. in million)	33,891	89,827	288,170*
% Share of total gross capital formation (TGCF) of agriculture sector in total gross domestic capital formation (TGDC) (At 1980-81 prices)	18.0	9.2	9.4*
% share of Public sector Gross Capital formation in TGCF of Agriculture sector	38.74	25.11	16.17
% share of private sector Gross capital formation in TGCF of Agricultural Sector	61.25	74.88	83.82

Note: \* refers to 1996-97

Source: CMIE Reports.

## Rural Employment and Agricultural Wages

The deceleration in yield growth rate is one facet of the emerging crisis in agriculture. The lack of work force diversification in India and increasing burden of work force in low productivity agriculture is yet another dimension of the crisis. To analyse the employment situation in rural India NSS surveys which are a most exhaustive source of information on employment situation will be used. The main aim is to compare the labour participation rate between pre and post reforms period. The present study termed the period 1983 and 1987-88 NSS Rounds as pre and 1999-2000 as Post reforms period According to NSS methodology the working population ratio (WPR) shows number of persons/person/day employed per thousand. Table 5 and 6 shows there has been a decline in both rural and urban labour force participation rate between the 50th Round (1993-94) and 55th Round (1999-2000). However, this fall in the proportion of population is more in rural as compared to urban areas. The number of persons employed or worker-population ratio in 1999-2000 has been the lowest as compared to the eighties. The most exhaustive measures of unemployment estimated by the NSS is based on the current daily status. These results are presented in Table 7. The unemployment rate has worsened between 1993-94 and 1999-2000. The results show that the nineties seems to have witnessed proportionately smaller number of people in work and higher unemployment rates in both rural and urban India.

A number of studies (Jose 1988, Acharya 1989, Bhalla 2001, Parathasarathy 1996 and Sundaram 2001) reported that the rising trend in real wage earning of agricultural labour in the eighties could not be sustained in the nineties. In view of the above observation made by different studies it is proposed to study the real wage earning the according to activities during the pre and post reforms period.

**Table 5: Location and Gender-wise number of person employed per 1000 persons**

NSSO Rounds	Rural		Urban	
	Male	Female	Male	Female
38th (1983)	547	340	512	151
43rd (1987-88)	539	323	506	152
50th (1993-94)	553	328	521	155
55th (1999-2000)	531	299	518	139

Source: NSS Reports, Government of India, New Delhi.

The main inference drawn is that except for rural females engaged in manual work in agriculture as a whole, the NSS Rounds offer no support for the hypothesis of a deceleration or slow down in rate of

growth of average daily wage earning of adult casual labourers during the period between 1994-2000, relative to the period 1983 and 1994.

**Table 6:** Number of Persons Employed (per 1000 population)

Year	Usual Status (Principal + Subsidiary)	
	Rural	Urban
1983	445	340
1987-88	434	337
1993-94	444	347
1999-2000	417	337

**Note:** Usual Status (principal + subsidiary)

**Source:** NSS Reports, Govt. of India, New Delhi.

**Table 7:** Unemployment Rates (per 1000 population)

Year	Rural		Urban	
	Male	Female	Male	Female
1983	75	92	90	110
1987-88	46	88	67	120
1993-94	56	67	56	104
1999-2000	72	73	70	94

**Source:** NSS Reports, Govt. of India, New Delhi.

**Table 8:** Rate of Growth of Real Wages of Rural Casual Labourers between 1993-94/1983 and 1999-2000/1993-94 (per cent per annum)

Activity	Rural Males		Rural Female	
	1993-94/ 1983	1999- 2000/ 1993-94	1993-94/ 1983	1999- 2000/ 1993-94
Manual Work in Cultivation	2.62	2.93	2.92	2.98
Manual work in other agriculture work	2.61	2.98	4.0	3.10
Manual Work in Agriculture	2.74	2.77	3.09	2.93
Non-manual work in agriculture	4.51	3.47	2.69	3.18
Casual Labourers in Agriculture	2.75	2.79	3.09	2.94
Casual Labourer in non-agriculture	2.39	3.70	4.08	4.07
Casual Labourer in all activities	2.51	3.59	3.18	3.19
Public Work	2.29	3.83	4.10	5.04

**Note:** Adjustment for inflation has been made by reference to consume price index for agricultural labourers.

Consumer price index for agricultural labourers.

(CPIAL): 1960-61 = 100; 1983 = 511; 1993-94 = 1147; 1986-87 = 100; 1993-94 = 194.74; 1999-2000 = 309.

**Source:** NSS Reports, Govt. of India.

This analysis is important to answer whether the rate of growth of rural wage has been raised or decreased during the liberalisation period. A comparable data on activity-wise average daily wage earning of adults brought together for the Pre (1983 NSS Round) and Post (1993-94 and 1999-2000 NSS Round) reforms period. The activities are distinguished in Table 8. It is evident that for all adult rural male casual wage labourers with the exception of non-manual workers in agriculture in all other categories the rate of growth of wages between 1999 and 2000 was marginally higher as compared to 1983 and 1994.

The details about the per cent distribution of working in primary, secondary and tertiary sectors in rural India are presented in Table 9.

**Table 9:** Per cent distribution of working by Broad Group of Industry in Rural India

Year	Male			Female		
	Primary	Secondary	Tertiary	Primary	Secondary	Tertiary
Principal status						
1983	77.2	10.2	12.3	86.2	7.8	5.7
1987-88	73.9	12.3	13.8	82.5	11.2	6.3
1993-94	73.9	11.3	14.8	84.7	9.1	6.2
1997	75.7	10.6	13.7	87.5	7.7	4.7
Principal and subsidiary status						
1983	77.5	10.0	12.2	87.5	7.4	4.8
1987-88	74.5	12.1	13.4	84.7	10.0	5.3
1993-94	74.1	11.2	14.7	86.2	8.3	5.5
1997	75.8	10.6	13.6	88.5	7.7	4.2

**Source:** NSS Report No. 442 (1999).

The share of male workers (principal and subsidiary status) in the primary sector in rural areas declined from 77.5 per cent in 1983 to 74.5 per cent in 1987-88 and in 1993-94 it was 74.1 per cent. In the primary sector the share of both male and female workers increased in the 1997 NSS Rounds.

### State-wise Changes in Real Wages

The average percentage change in real wages for unskilled agricultural labour during the pre and post economic liberalisation period is presented in Table 10. Data on State average wage rate for unskilled agricultural labour in the current prices are taken from the Ministry of Agriculture. The same have been converted into real wage by deflating with the State level Consumer Price Index Number for agricultural labour (CPIAL) with 1960-61 as the base. The new series of consumer Price

Index for agricultural labour with base 1986-87 = 100 were released with effect from November 1995. To maintain continuity with the old series of agriculture CPIAL, the old Series have been converted by using the linking factor of each State and the average for each state have been worked out on the basis of the converted series.

**Table 10:** Average per cent change in Real-wage for unskilled agricultural labour, in Pre and Post reform period

States	1981-91	1990-91
Andhra Pradesh	5.43	0.12
Assam	5.09	-1.93
Bihar	5.25	0.09
Gujarat	2.86	5.45
Karnataka	3.04	3.34
Kerala	2.59	8.06
Madhya Pradesh	6.51	1.78
Maharashtra	7.60	1.64
Orissa	5.29	0.79
Punjab	4.10	-0.13
Rajasthan	4.97	1.56
Tamil Nadu	2.46	6.07
Utter Pradesh	4.95	3.18
West Bengal	6.59	1.29
All India	4.68	2.04

Source: Mid-Term appraisal of 9th Five-Year Plan (1997- 2002)

**Note:** The real wage for unskilled agricultural labour for each state has been weighted by total agricultural labour of the state for working out all India average. The weighted average real wage for all India are based on 14 states. Having estimated weighted average real wage for all India percent change for the previous year has been worked out.

The average percentage change in real wage is increasing in Gujarat, Karnataka, Kerala and Tamil Nadu whereas other States show a declining trend during the post- liberalisation period as compared to pre-liberalisation period.

### Land Holding Structure

Improving competitiveness of the products can derive the real gain from economic liberalisation. This requires large investment in the rural infrastructure and creation of institutional arrangements for reaching the fruits of liberalisation to a small category of farmers. The consolidation holding and implementation of land reforms are instrumental for equitable growth in agriculture. The percentage share of operational holdings by size groups is presented in Table 11.

Table 11 clearly indicates that the number of opera-

tional holdings of less than 2 hectares increases from 70 per cent of total holding 1970-71 to 78 per cent, in 1990-91. These holdings control nearly 32 per cent operated area as against only about 21 per cent in the seventies. Over the last ten years, the numbers have obviously risen further (39 per cent in 2000-01).

**Table 11:** Percentage share of operational holding by size groups

Size groups	1970-71	1980-81	1990-91	2000-01*
<b>A. Number of operational holdings (per cent)</b>				
i. Small Farms (<2 hectare)	70	74	78	81
ii. Medium Farms (2-4 hectares)	15	14	13	12
iii. Large Farms (More than 4 hectares)	15	12	9	7
<b>B. Area operational holdings (per cent)</b>				
i. Small Farms (<2 hectare)	21	26	32	39
ii. Medium Farms (2-4 hectares)	19	21	23	25
iii. Large Farms (More than 4 hectares)	61	53	44	36

Source: Directorate of Economics and Statistics, Govt. of India, and Agricultural Census Reports  
\*2000-01 predicted figures.

### Agricultural Exports

At the end of the Eighth Plan (1996-97), the share of agriculture exports in total exports was 20.4 per cent and declined to 18.5 per cent in 1998-99. This raised some doubts about the impact of trade liberalisation on the economy particularly on gradual diversification of agriculture to non-agriculture sector and raising productivity and income. The pattern of exports of major agricultural commodities during the pre and post economic liberalisation period are presented in Table 12.

**Table 12:** Exports of Major Agricultural commodities

(Growth rates percentage)

Commodities	Pre-liberalisation Period	Post-liberalisation Period
Coffee	7.60	9.90
Tea	7.57	-0.62
Oil cakes	15.54	4.36
Cotton	-3.56	-12.08
Rice	5.52	2.78
Fish	19.12	11.17

Source: CMIE Reports



In the post liberalisation period except coffee all other commodities indicated a deceleration in the trend growth rate. The most important reason for deceleration in Indian agricultural exports is their increasing non-competitiveness.

## Conclusion

The analysis indicated that at all India level the yield growth performance consistently declined from period I to period II reaching a level of 1.97 per cent from 2.91 per cent. The results of instability (CVTL) show that the yield variability for the pre-liberalisation period is high as compared to post-liberalisation period.

The steep deceleration in the growth of food grains implies that improvement in crop yield will have to be the main focus of growth in agricultural production as there is little likelihood of increase in the new cultivated area. The most important reason for deceleration is a sharp decline in public sector investment in agriculture. Although private investment has increased it has not been able to compensate for the steep deceleration in public investment. There was a sharp drop in the number of people employed both in rural and urban India. Going by the usual status, only 417 of every 1000 in rural areas were employed as either primary or subsidiary workers in 1999-2000 compared to 444 in 1993-94. Moreover, this is a lowest level of employment in more than 20 years. The unemployment rates according to the daily status rose sharply between 1993-94 and 1999-2000 for men and women in the rural labour force.

In the post liberalisation period the decline in working population is more glaring in rural segments as compared to urban segments. The share of male workers (principal and subsidiary status) in rural areas declined from 77.5 per cent in 1983 to 74.1 per cent in 1993-94. But the trend was reversed during the latest NSS rounds (1997), and the share of male workers in the agriculture sector increased to 75.8 per cent. This shows that in the post-liberalisation period there is low employment generating potential in the secondary and the tertiary sectors.

The contention of trade-liberalisation or export promotion in agriculture sector is to create more employment to agricultural workers by gradual diversification from agriculture to non-agricultural occupation. But this contention is not supported by the post-liberalisation performance of exports of major agricultural commodities.

Finally, the above findings suggest that large investments are required in rural infrastructure, agricultural research, and in bio-technology and creation of institutional arrangements for reaching the benefits of economic reforms to all the cultivators including small category of farmers.

## References

- Acharya, Sarathi** (1989), "Agriculture Wages in India: A disaggregate Analysis", *Indian Journal of Agricultural Economics*, Vol. 44, No. 2.
- Alagh, Yoginder K.** (1980), "Growth of Crop Production 1960-61 to 1978-79, is it Decelerating?", *Indian Journal of Agricultural Economics*, 35(2), pp. 104-10.
- Bhalla G.S.** (2001), "Political Economy of India and Development in the 20th Century India's Road to Freedom and Growth", *Indian Economic Journal*, 48(3).
- Bhalla G.S. and Singh, Gurumali** (1997), "Recent Developments in Indian Agriculture: A State Level analysis", *Economic and Political Weekly*, 32 (13), pp. A2-A18.
- House hold consumer, expenditure and employment situation in India, NSS Report No. 442, (1999) Govt. of India.
- Jeemol, Unni** (1998), "Agriculture employment and poverty in rural India: A Review of Evidence", *Economic and Political Weekly*, March 28.
- Jose A.V.** (1988), "Agricultural Wages in India", *Economic and Political Weekly*, Vol. 23, No. 26.
- National Sample Survey Organisation Reports 38th Round (1983), 43rd Round (1987-88) 50th Round (1993-94) 55th Round (1999-2000) Govt. of India, New Delhi.
- Mahendra, Dev** (1987), "Growth and Instability in food Grains Production—an Intra-state Analysis", *Economic and Political Weekly*, September 26.
- Mahendra, Dev and Mungekar B.L.** (1997), "Maharashtra's agricultural Development—A Blue Print", *Economic and Political Weekly*, 31(13), pp. A38-A48.
- Mid-term Appraisal of 9th Five Year Plan.
- Parthasartha G.** (1996), "Recent Trends in Wages and Employment of Agricultural Labourer" *Indian Journal of Agricultural Economics*, Vol. 1&2.
- Parthasarathy G.** (1985), "Growth Rates and Fluctuations of Agricultural Production—A District-wise Analysis in Andhra Pradesh", *Economic and Political Weekly*, Review of Agriculture, June.
- Rao, Hanumanth C.H., Ray and Subba Rao** (1988), "Unstable Agriculture and Droughts", *Vikas Publications*, New Delhi.
- Savant S.D.** (1982), "Investigation of the Hypothesis of Deceleration in Indian Agriculture", *Indian Journal of Agricultural Economics*, No 4, Oct.-Dec.
- Sundaram** (2001), "Employment—Unemployment situation in the Nineties: some results from the NSS 55th Round Survey", *Economic and Political Weekly*, March 17.

□

# News & Notes

---

## Dimensions of Food Security

Seven food security indicators were developed by FAO following the food crisis in the mid-1970s (Table 1). These indicators, while confined to cereals, shed light on the present and future global food situation.

The first indicator, refers to the ratio of world stocks to world cereal consumption trends. A benchmark range set at 17-18 per cent<sup>1</sup> has been used by FAO to alert the global community of potential and/or impending shortfalls in world cereal supply. Since its acceptance as a food security indicator the ratio dipped below the threshold during two periods i.e., 14-15 per cent in 1973-76, and 14-16 percent in 1996-97. Though the main purpose of this indicator was to provide a measure of the physical availability of global supplies, yet it proved a good predictor of international price developments. However, the relationship between the benchmark indicator and international cereal prices has not always been consistent. During the 1979-80 and 1988-89 periods when the ratio was substantially above the 17-18 percent minimum range, international cereal prices rose and remained high. This was despite the availability of adequate physical supplies. More recently, the ratio of cereal carryover stocks to utilization in 2001 was shown at below the threshold: at a level comparable to those that were associated with the sharp price hikes observed in the mid-1970s and mid-1990s. However, international cereal prices continued to be depressed during the first half of the season, if not falling. FAO's recent revision resulted in a significant increase in the estimates for cereal stocks in China and hence the world estimate of cereal stocks. This develop-

ment further undermined the relevance of the benchmark ratio as an indicator of the status of global food security.

The second indicator measures the ability of the five major grain exporters namely Argentina, Australia, Canada, EC and the US to meet the import demand for wheat and coarse grains. It is the ratio of the sum of their grain production, imports and opening stocks to the sum of their domestic utilisation of grains plus exports (If the calculated value of the ratio is equal to 1, this indicates that the five major exporting countries would have completely exhausted their cereal inventories during their respective marketing years). Based on supply and demand indications for 2000/01, the ratio is estimated at 1.18, down slightly from the previous year but higher than the average of 1.15 during the mid-1990s.

The third indicator is the ratio of the volume of closing cereal stocks held by the five major exporters of wheat, coarse grains and rice to the total disappearance of these cereals (domestic consumption plus exports). Based on the FAO's latest estimates for 2000/01, the ratio for all cereals was expected to be 2 percentage points lower than the previous season but somewhat higher than the average for the period 1993/94-1997/98. Except for the EC and Canada, wheat production is estimated to have fallen, contributing to the smaller carryovers. For rice, a reduction in China's output after two consecutive years of bumper crops was largely responsible for the expected draw-down of its rice stocks by almost 6 million tonnes. Although closing coarse grain stocks could remain unchanged at 77 million tonnes among the major exporters, higher domestic use and exports were expected for 2000/01. Bumper crops in Argentina, the EC and the United States helped to maintain adequate coarse grain stocks to meet increased domestic and global demand.

The fourth indicator measures changes in cereal

---

1. A description of the original methodology can be found in FAO, *Approaches to World Food Security, Economic and Social Development Paper No. 32, Chapter II, pp. 19-37, Rome, 1983.* The establishment of the minimum safe level was in response to the serious food crisis that occurred in the mid-1970s, when production shortfalls in major exporting and importing countries combined with unexpected imports by the former USSR triggered a sharp rise in international cereal prices.

**Table 1: Changes in Food Security Indicators affecting Availability and Stability**

	Average 1993/4 - 1997/98	1998/99	1999/ 2000	2000/01*
1. World Cereal Stocks as a percentage of World Cereal Consumption Trends	No more in use by FAO			
2. Ratio of Five Major Grain Exporters' Supplies to Requirements**	1.15	1.22	1.20	1.18
3. Closing Stocks as a percentage of Total Disappearance of Major Cereal Exporters :				
Wheat**	17.0	23.5	22.4	19.1
Coarse Grains**	13.2	19.6	17.7	17.2
Rice#	64.3	64.6	64.7	61.5
Total	31.5	35.9	34.9	32.6
	Annual Trend Growth Rate	Percentage Change from Previous Year		
	1990-1999	1998	1999	2000
4. Changes in Cereal Production in China, India and CIS	-0.14	-4.92	2.22	-5.11
5. Changes in Cereal Production in LIFDC	1.98	3.26	0.85	-5.54
6. Changes in Cereal Production in LIFDCs less China and India	2.58	5.82	1.01	-1.68
		Percentage Change from Previous Year		
		1998/99	1999/ 2000	2000/ 2001!
7. Export Price Movements†	Wheat (July/June)	-15.8	-6.3	13.3
	Maize (July/June)	-15.6	-3.9	-4.6
	Rice (Jan./Dec.)*	0.5	-10.7	-25.5

Source: FAO

Notes: \* Forecast.

& Includes Wheat and Coarse Grains

\*\* Argentina, Australia, Canada, EC and the United States.

# China, Pakistan, Thailand, United States and Vietnam.

† Wheat : U.S. no.2 Hard Winter; Maize: U.S. no.2 Yellow; Rice Thai Broken (A1 Super).

• Rice Prices are based on the calendar year of the first year shown.

! For wheat and maize, changes in prices are based on seven-month averages only (July/January) compared to the corresponding period in 1999/2000.

production among the major cereal importing countries of China, India and the CIS against the trend and the preceding year. For 2000, the indicator points to a reduction by more than 5 percent after an improvement in 1999. China's production fell in all cereal categories in response to policy changes and weather problems. India experienced another year of bumper crops, especially for wheat, which could make it a net wheat exporter in 2000/01 for the first time in 6 years.

The fifth indicator focuses on changes in aggregate cereal production of the 80 developing countries called Low Income Food Deficit Countries (LIFDCs), which are most vulnerable to fluctuations in food supplies and international prices. For 2000, FAO estimates total cereal production in this group of

countries fell by over 5 percent compared to the previous year. The bulk of the reduction occurred in China and parts of Africa.

As production in China and India could heavily influence the overall magnitude of this indicator, the sixth indicator measures the changes in aggregate cereal production of the LIFDCs, excluding China and India. Using this measure, the reduction in total cereal output for this group of countries is not as steep (-1.7 per cent) as that when China and India are included (-5.5 per cent). In fact, many of the Asian LIFDCs had bumper cereal harvests in 2000 including Bangladesh, Indonesia, Pakistan and the Philippines.

The seventh indicator provides a comparison of ex-

port prices for the major cereals. Except for wheat, international cereal prices have continued to trend downward during the 2000/01 season. International wheat prices moved higher since the beginning of the season, reflecting stronger commercial import demand and the expectation of lower carry-over stocks in major exporting countries. However, the overall price increase proved limited due to large export supplies from a number of non-traditional sources such as India and Pakistan. Also, in some wheat importing countries, such as China, a domestic production shortfall was mostly met by a sharp draw-down of stocks rather than relying on more imports. For coarse grains, despite the anticipated expansion in world import demand, ample supplies in major exporting countries coupled with large sales from China and abundant supplies of competing feed quality wheat kept international maize prices under pressure during the first half of the season. World rice prices followed a falling trend in 2000 reflecting bumper crops in a number of traditional importing countries. As export availabilities were ample, the weakness of the market exacerbated competition among exporters which had a strong depressing effect on international rice quotations.

FAO suggests a somewhat tighter situation for cereal importing countries, with the general supply and demand picture pointing to a further reduction in stocks by the end of marketing seasons in 2001. On the positive side, international cereal prices could remain relatively weak, which would lessen the financial burden of those developing countries dependent on imports. Continued large maize sales from China, especially in the light of evidence of genetically modified (GM) maize in Japan and in the Republic of Korea, could continue to mitigate any upward pressure on international prices during the remainder of the season. In addition, policy measures under consideration in India to boost exports and in Indonesia, Malaysia and Nigeria to raise import restrictions, would further depress international rice prices.

Source: www.fao

Arundhati Chattopadhyay



*The person who says it cannot be done should not interrupt the person doing it.*

— Chinese proverb

# Book Reviews

**Globalisation and Labour Management Relations: Dynamics of Change**, authored by *C.S. Venkata Ratnam*, Response books (a Sage Books Division), New Delhi, pg. 336. Price Rs. 295/-.

The book is a very effective compilation on the relationship between the two pillars of Industrial Economy - Management and Labour. The role of Trade Unions has changed with the change in environment. Its traditional role, as we know, has been to protect jobs and real earnings, secure better working conditions, quality of work life, fight against labour exploitation and arbitrariness to ensure fairness and equity in the employment context. The role of Trade Unions now includes a multiplicity of objectives covering not only the immediate interest of their members but also entailing larger ideological and political questions. Some leftist unions even articulate their role as being to influence the type of economic system that exist in society. In the wake of a long history of union movement and accumulated benefits under collective agreements, a plethora of legislation and industrial jurisprudence, growing literacy and awareness among employees and the spread of a variety of social institutions including customers and public interest groups, the protective role has change qualitatively. Now the Trade Union role "remains in form, but varies in substance".

In the past, there was divergence in economic systems. Ideological and political roles guided the Trade Unions' activities and actions. But when the economic system the world over is converging towards market economy what role, if any, does ideology have now? The relevance of not just ideology but idealism, too, to act as governing principles and provide necessary checks and balances prevented extreme swings in the past.

The Indian experiences on Trade Unions' response to the changing environment and Globalisation is mixed. There are several examples, both in Public and Private sector organisations, where Trade Unions have extended cooperation in restructuring in order to make organisations more competitive and viable. There are

evidences that firms with unions are associated more with efficient production and productivity enhancement than non-unionised firms.

The emerging paradigm shift as a result of structural and other changes in the Indigenous economy and elsewhere point to the need for developing "High Performance Organisation Systems". In a global, competitive market-oriented economy, positive and change oriented work-culture means, among other things, producing more with limited resources. Notwithstanding our successes in respect of green, white and blue revolutions, as achieved in the frontiers of research, the changing technological and productivity lag in the Indian industry is too obvious. The evolving 'Lean, Mean, Green, Clean' organisations emphasise speed (of decision making), continuous upgrading, or updating of skills. But there is a popular notion among non-union circles in India that unions impede productivity and competitiveness. Agreements in the banking sector over computerisation (in Oct. 1993) are cited as example to defend this. But it is inappropriate to blame TUs, rather the management is equally responsible.

Today the changes have affect Trade Unions as well and the mindset regarding their activities is also on the wheel of change. Today Trade Unions are seen as both economic and social institutions firmly embedded in the large fabric of a constantly changing and evolving society. Dynamic unions are seen as concerned with the distribution as well as the level of economic benefits achieved through bargaining. Their economic policies are seen inducing a wide range of adjustments and innovations at the work place and they may devise economic policies to alter the market context within which they may bargain for their contributions in a globally changing environment.

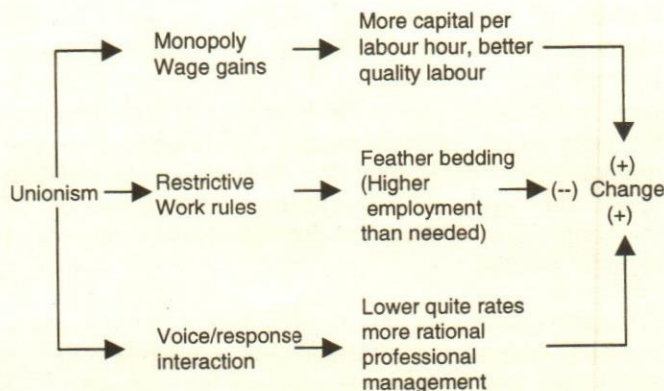
The positive effects of Industrial Relations on sustenance and coping with the external threats in line, are the following:-

- Reduced turnover and consequently higher

human capital retention by the firm.

- Training costs reduced.
- High morale and motivation.
- Proper communication on both directions.

The same is supported by Freeman & Medoff (1984) regarding Unionism and its role in change management relationship long back in a Harvard study:-



Today in India Trade Unions have the following agenda for meeting emerging threats and challenges:-

- Fight against corruption at all levels not only in industry but also in society.
- There is a need to democratise the functioning of Trade Unions/decision making at the Board level
- Undertake research studies and analysis as also conduct education and information campaign on issues sub-affecting workers and customers' rights.
- Professionalising TU cadres and enhancing their capacity to understand and proactively respond to challenges of changes in technology, structural adjustments etc. are vital.
- Demand for a right to information from management.
- Impress upon their members the need to improve work culture and efficiency through better production & productivity.

These issues are the background material for the author to put forth the labour management relationship in the mutually desired ways in the era of Globalisation. This book is divided into 11 Chapters on Labour-Management relations, dealing with the trend analysis of their historical developments in India, the Global Transition - trends and issues before IR, the cases of South and South-eastern Nations, emerged Global dimensions

in Structural Adjustments, Policies & Labour Laws, Social Dialogue between Labour & Management and the structural Adjustments worldwide viz-a-viz India with examples, discussions regarding alignment of Labour policy with the Economic Policy and Judicial activism, the adoption of ILO standards in India and the Paradigm shift in the economy.

This book is among the latest in the field to discuss the issue in such broad terms and an extensive way. The illustrations, examples and the Data provides exhaustive support on the arguments and understanding of the author. It should be recommended to all the Universities, Schools and Colleges where IR is studied as a subject. The future dimension of the book enables its acceptance among scholars to think about the relationship in a more constructive way.

Rajneesh Dalal  
Asstt. Director  
HRD Division  
National Productivity Council

**Agricultural Statistics in India, P.C. Bansil (ed.), CBS Publishers and Distributors, New Delhi, 2002, Page 786, Price: Rs. 395.**

The book deals with major issues relating to intricate aspects of agricultural statistical system in India and discusses in detail the nature, scope, development and availability of agricultural statistics in India.

This is the fourth edition by the same author. This edition has 31 Chapters and each Chapter deals with different areas of agriculture. Chapter 1 explains the nature and development of agricultural statistics from the nineteenth century to post World War II. It has also given information regarding the agricultural census in India and the need for a constitution of Indian Statistical Service for formulation and execution of agricultural development plans and their periodic assessment and evaluation. Constitution of various organisations for data collection and the formation of different agencies at district, state and central level for compiling as well as for analysing the data are discussed in detail in Chapter 2. Detailed and exhaustive information on population census for the ancient period to 2001 census is given in Chapter 3.

Classification of land utilisation area, i.e., cultivated, uncultivated and net sown areas in India are discussed in detail in a later Chapter. Role of the forestry sector in economy, its classification and information regarding organisational setup, employment, inventory, forest resources and products are outlined. Various methods

of collection of area and production statistics in different states of India for various crops are described as well as different steps taken to improve quality and timeliness of agricultural statistics with various problem area. Similarly, to estimate crop yields there are some methods and techniques that are explained in detail. Comparisons of area, production and yield for different crops state wise are also made. Crop forecasting methods and techniques for cereals, pulses, oilseeds and other crops are discussed in detail. Various methods of collection and need for improving the previous methods are also explained.

Information on the methods and techniques used for the estimation of area, production and yield for fruits and vegetables is given. A time series is drawn for comparing area and production of fruits and vegetables in different states. Similar comparison is also made across countries for major fruits and vegetables. Various sources of irrigation statistics and water management programme, water resources, water requirement of various crops and methodology of various irrigation census are also explained in detail. Agricultural census is dealt in total and an insight is provided on need and items on which data for various aspects are collected. The various agricultural census held so far and their methodology, expenditure, techniques used along the targets and achievements are explained.

The major input statistics are discussed. State wise and zone wise details of fertilizers, seeds and manures used for different crops is explained. Agricultural labour statistics and Livestock and Poultry statistics is discussed. Details of various surveys in different states about employment, wages and earnings of agricultural labourers are also explained in detail. Information is provided on All India livestock population census and increasing role of livestock along with livestock and poultry products in the national economy. Similarly fisheries statistics with area under culture and production in various states is discussed and the formation of National Sample Survey its objectives and significance. A list of subjects covered and reports brought out for the various NSS rounds is also given. Consumption and stocks of food grain are also explained in detail.

Number of surveys carried out in different parts of the country for different crops to collect information on the cost of production for various crops is discussed. Methods of estimation and deficiencies in the existing data are also dealt with in detail. Chapter 20 deals with agricultural prices. This chapter gives details on methods of wholesale prices, retail prices and average prices of various commodities in different states. Methods for Index number of commodity prices is discussed with detailed information on the background of

the earlier Indices of wholesale prices, revised Index numbers of wholesale prices and Consumer price Index numbers for various commodities.

Indices of area, cropping pattern, agricultural production and crop yield is given. Methods of linking of new series with old series for maintaining continuity in the index numbers is also explained and an insight into State Index numbers relating to Agricultural economy and fishery is provided. The state accounts are an extension of the system of national accounts to the regional level. Area, production, wholesale prices of agricultural commodities and disposition for fishes is provided in detail. The national income of a country can be measured in its three phases of production, income generation and final utilisation. In India, a combination of the three approaches is used for different sectors of the economy to arrive at the most plausible estimates of national income.

Weather systems and weather forecasting in India is outlined. Techniques of small area estimates and the development of IT applications and the networking of various departments is discussed. The miscellaneous statistics like rainfall, crop calendar, land revenue, agricultural income tax, marketable surplus, and demand projections are discussed in detail. The main shortcomings like gaps in coverage, lack of uniformity in definition and classification, defects in tabulation and processing, defects in primary reporting agency, defects in supervision, inspection and checking and lack of proper planning and co-ordination are explained.

The editors of this book have put tremendous effort in providing a comprehensive text for students and valuable guide to all those interested in studying agricultural statistics and using the knowledge in their individual professions. It will serve as a useful guide, handy reference and a rich source of information to researchers, policy and decision makers, administrators, planners, executives of banks and financial institutions and educated farmers.

Rajesh Sund  
Asstt. Director  
National Productivity Council  
New Delhi

**My Great India: Economic Development and Glaring Disparities, Brojendra Nath Banerjee, CBS Publishers and Distributors, New Delhi, 2001.**

Volumes have been published on the development experience of the Indian economy in the last two and a half score years. If the debate was centered around the

pitfalls of planning mechanism for the economic and social ills during the regulated economic regime of the first half a century, the role of the market in arbitrating the growth and development dominated the social spectrum in India over the last one decade of liberalisation. Irrespective of the views expressed verbally and in print on various fields of social and economic development—for its constraints and probable reorientation from time to time—these sectors carried their own respective paths and phases. Reasons were assigned alternatively to the assertiveness of endogenous (political) factors and the natural evolution of the exogenous ones. The outcome for obvious reasons has been poverty and deprivation—an exhibition of extremes where a few live in luxury while others survive in sub-human and abysmal conditions. The question often raised is that despite the voluminous literature on the developmental and distributional inequalities in the Indian national economy, nothing has been done about it. Everyone tries to project their own interests and the lack of a comprehensive approach to the understanding of economic and social problems and a wholesome initiative towards a solution must be one of the reasons for the continued development constraints in India. Hence it would not be worthwhile to investigate further the development approach of ruling regimes in the past but rather to assess the nature and structure of intellectual contribution extending to migrate the interrelated issues of growth, development and disparities—internally as well as internationally.

The book under review is an answer to the lack of comprehension, balanced thoughts and its sequential compilation. It succeeds in aligning the pitfalls and constraints in vital economic and social sectors. In an era of specialisation and micro fragmentation of growth and development topics the book provides a wholesome feast providing the background, process and scope of different economic and social sectors with its past, present and the future. As the title suggests the book deals with economic development and disparities, old and new economies for competitive advantages and growth prospects from a national perspective in a global market framework. The topics of discussion vary from political economy of development strategies by different ruling regimes from the communication and entertainment revolution to the integration of the national economy into the global market. Further it extends the topics of discussion on farm outputs and subsidies through the contemporary knowledge superiority acquired by India to the empowerment of women. It provides a one point reference to the diverging social and economic

development issues for understanding and undertaking corrective actions as the case may be.

It would not be an exaggeration to mention that the selection of topics for the book allows it to cover the different phases of India's development since independence. Many of the topics are symbolic of the vital economic and social interlinkages for internal and international comparisons. For instance, the section on the startling discovery of disparities in the age of connectivity, the book conveys the difference between the open (market) and the closed economic systems (regulations) for identifying internal and international dimensions of disparities. It perhaps helps the readers to convince themselves in their own terms of the scope for the next century in India. The book gives examples of the revolutionary developments in information, communication and entertainment areas. At the same time the book outlines the pitfalls in the agricultural sector to highlight its significance for the health and wealth of the public. Simultaneously, emphasis has been attached to industrial recoveries and enabling infrastructures for expansion and innovations.

While discussing the geography of hunger and disaster management, it is appreciable that the book devoted space to vouch for progressive taxation (internal resource mobilisation) irrespective of the customs and norms followed in the past. Though the reasons are not well articulated for the missed opportunities in the millennium budget, there has been mention of the political economy of international diplomacy in internal development and hence the inevitability of disparities at the international spheres. It would be essential to mention that well-researched appendices substantiate the arguments the book raises. Given the list of topics and the clarity of thought and narration exhibited, the intellectual and practical validity of this book is very high. The book is a one-point reference to the economic development and social issues, which were ignored or overlooked for long. The book proposes a new growth and development agenda to balance internal and international sectors, which obviously is crucial for the Indian economy in the new World Order. The simplicity of language and presentation style of the book makes it an interesting reading even to laymen.

C.S. Sundaresan  
Executive MD  
NDDB/Erode

□



# Annual Index: Productivity Volume 42, No. 1-4 (2001-02)

## Articles

- Agarwal, R.N.(2001) "Indian Engineering Firms : Globalization, Technical Efficiency & Export Behaviour". Vol. 42(1):106-114
- Agarwal, R.N. (2001) "Technical Efficiency & Productivity Growth in Central Public Sector Enterprises" Vol.42(2):289-297
- Batra S.P.(2001) "Marrying the Customer : A CRM Approach" Vol. 42(1):39-45
- Bhattacharyya, Dipak Kumar, (2001)"Re-engineering through Knowledge Management" Vol.42(3):393-398
- Bhattacharya, Dipak Kumar(2002) "Managing Supply Chain through BPO & HRO" Vol. 42(4):546-549
- Bhattacharyya, S.K. & Zillur Rahman,(2001) "Will e-tailing Overshadow Physical Retailing ?" Vol.42(3):399-404
- Bheda, Rajesh, Singla M.L. & Narag A.S., (2001)"Productivity in Indian Apparel Manufacturing Industry" Vol.42(3): 427-430
- Brahma, Gautam(2001)"Knowledge Management: Building Relevance Through Introspection" Vol.42(3):371-373
- Chaklader, Barnali,(2001) "Green Accounting Methodology for Global Corporate Sustainability" Vol. 42(1):156-160
- Chatterjee P.K. & Prasad A.,(2001) "Creating a Customer Driven Organization" Vol. 42(1):55-64
- Chiplunkar, Chandrashekhar, Deshmukh S.G. & Chattopadhyay R., (2001) "Observations on Indian Textile Industry" Vol.42(3):439-453
- Dalu, R.S. & Deshmukh S.G., (2001) "SWOT Analysis of Small & Medium Scale Industry: A Case Study" Vol.42(2):201-209
- Deshmukh, Umesh M., (2001) "Inventory Control Function in Sugar Cooperatives" Vol.42(3):467-473
- Dhawan, Sunil K., (2001) "Variations in Job Satisfaction with Age: Some Empirical Findings" Vol. 42(1):151-155
- Garg, Mahesh Chand (2001) "Knowledge Management: Emerging Perspective" Vol.42(3):374-379
- Gebretinsae Hailay, (2001) "Market Potential of Terapack Fruit Drinks" Vol.42(2):321-331
- Ghose, P.K. (2001) "Prospects for Biotechnology Industry in India" Vol.42(2):222-232
- Ghosh, A.K., (2001) "SMEs & Environment Protection" Vol.42(2):210-216
- Grover, D.K., Vatta, Kamal & Kaur, Gurpreet (2002) "Crop Diversification in Punjab" Vol.42(4): 665-668
- Guan, Peck Thian (2001) "Green Productivity & SMEs—Singapore's Experience" Vol.42(2):217-221
- Gupta, K.S. & Murari Krishna,(2001) "Employee Empowerment Impact on Employee Commitment" Vol. 42(1):99-105
- Gupta, K.S. (2001) "Empowerment & BPR: Exploring the Relationship" Vol.42(2):298-306
- Gupta, M.P. & Shukla, Sonal, (2001) "Implementation Issues in CRM: A Study in the Indian Banking Sector" Vol. 42(1):26-38
- Gupta, Pradeep,(2001) "Managing Knowledge Strategically in Globalized Era" Vol.42(3):358-361
- Han-Lin Li(2002) "SCM System in Taiwan's Electronic Industry" Vol.42(4):574-581
- Horng-Der Leu, Hong-Jea-Lai & Hsuan-Jung Chung, (2001) "CRM on the Internet: The Relationship between Customer satisfaction & Brand Loyalty" Vol. 42(1):46-54
- Joshi, Gopal. (2001) "Entrepreneurship Development for SMEs in the 21st Century." Vol.42(2):186-190
- Kannaiyan S., Ramasamy C. & Shanmugam T.R., (2001) "Accountability in Agricultural Education" Vol.42(2):307-317
- Khan, Sabah(2002) "Plastic Waste Management Options in India : An Environmental Evaluation" Vol.42(4): 659-664
- Kim, Moon-Kyum, (2001) "Venture Capital System in Korea: Development & Implications" Vol.42(2): 239-246
- Kodali, Rambabu, (2001) "Quantification of Total Productive Maintenance (TPM) Benefits Through AHP Model" Vol.42(2):265-273
- Krishnaiah, V.S.R.(2001) "Leveraging Knowledge for e-Business Success" Vol.42(3):413-417
- Kumar B. Ganesh (2001) "Determinants of Milk Productivity in Tamil Nadu" Vol.42(3):509-514
- Kumar D. Suresh & Ramasamy C., (2001) "Agroforestry & Household Time Allocation: The Case of Silvopastoral System" Vol.42(3):502-508
- Kumar, Vikas Garg, Dixit & Mehta, N.P.(2002) "JIT/TQM Quality Techniques in Indian Industries" Vol.42(4): 582-590
- Majumdar, Bhaskar, ,(2001) "Trade for India's Industrialization: Policies & Options" Vol. 42(1):123-131

- Mariappan, V. (2002) "Total Quality Education : A Model for India" Vol.42(4):597-604
- Mishra, Padmakali & Bhardwaj, Gopa (2002) "Motivational Behavior : Variation Across Hierarchical Levels" Vol.42(4):636-640
- Mishra, R., Lal, Sachin & Das, Suman (2002) "Introduction to Supply Chain Management" Vol.42(4): 531-534
- Murty L.S.,(2001) "Constraint Management - An Indian Case of Throughput Improvement" Vol.42(2):337-343
- Murugesan, V. & Thangamuthu, C.(2002) "Education in Entrepreneurship Development" Vol.42(4): 630-635
- Naceur Jabnoun & Anwar, Syed Aziz (2002) "TQM & National Culture : A Contingency Model" Vol.42(4):591-596
- Namboodiri, N.V. & Asokan, S.R.,(2001) "Forestry & Non-forestry Sectors in India: Aggregate Flows & Linkages" Vol. 42(1):132-136
- Nesa L'abbe Wu (2002) "SCM, ERP & the Internet" Vol.42(4):535-538
- Pailwar, Veena, (2001) "Foreign Direct Investment Flows to India & Export Competitiveness" Vol. 42(1):115-122
- Pailwar, Veena, (2001) "e-Commerce: Emerging Economic Implications" Vol.42(3):405-412
- Palanichamy, N Venkatesa, Palanisami K. & Shanmugham T.R., (2001) "Sustainable Management of Water in Agriculture & Commercial Sectors" Vol.42(3):491-497
- Panda, R.K.(2001) "Diversification in Agriculture: Issues & Future Action" Vol. 42(1):147-150
- Pant, Bhanu,(2001) "Measuring Investment Payoffs in Information Technology" Vol.42(2):281-288
- Parida, A.K. & Pal S,(2001) "Dynamics of Raw Jute Supply & Consumption" Vol. 42(1):137-141
- Pattanayak, Biswajeet, ,(2001) "Empowerment: A Tool for Improving Organizational Competitiveness" Vol. 42(1):94-98
- Pattanayak, Biswajeet & Misra, Ranish Kumar,(2001) "Knowledge Creation & Management" Vol.42(3):353-357
- Pradhan, Rabindra K., Mathur Purnima & Mishra Prvash K., (2001) "Manager's Health: Role of Emotional Literacy" Vol.42(3):454-460
- Prakash B.S.(2001) "Productivity Trends in Indian Manufacturing Sector" Vol.42(3):431-438
- Raghunath, S.(2001) "Managing Inter-organizational Alliances : The Challenge for SMEs" Vol.42(2):181-185
- Rahman, Zillur (2002) "Virtual Organization : A Stratagem" Vol.42(4):678-687
- Ramachandran, K. (2001) "How CRM Can Be Strengthened - Beyond the Hype" Vol. 42(1):19-25
- Ramasamy K, Kailasam C., & Geethalakshmi V., (2001) "Area, Production & Productivity of Sugarcane" Vol.42(2):318-320
- Ramasamy S. & Balasundaram Chellam, (2001) "Impacts of GATT on Indian Agricultural Biodiversity & Patenting Issues" Vol.42(3):498-501
- Ramasamy, R.(2001) "Intranets & Organisational Effectiveness" Vol.42(3):418-426
- Rao, S.R.,(2001) "Innovative Financing of SMEs - Role of Exim Bank" Vol.42(2): 233-238
- Raveendran, Ashita(2002) "Economics of Engineering Industry in Kerala" Vol.42(4):605-617
- Sabat, Hemant Kumar,(2001) "Managing Customer Relationships Through Modern Marketing Strategies: A Critique" Vol. 42(1):82-93
- Sabat, Hemant Kumar (2001) "Gaining Competitive Advantage Through Managing Knowledge" Vol.42(3):380-392
- Sabat, Hemant Kumar (2002) "The Mobile Wireless Supply Chain" Vol.42(4): 550-563
- Sadh, Ashish & Chitale, Soniya, (2001) "Customer Relationship Management & The Banking Industry" Vol. 42(1):65-81
- Sahay B.S., Singh Vinita & Gupta A.K. (2001) "Managing Customer Relationship: A Framework for SCM & CRM Integration" Vol. 42(1):1-10
- Sahay, B.S. & Gupta, Arun K.(2002) "Supply Chain Management in Indian FMCG Sector" Vol.42(4): 564-573
- Sardana, G.D.(2001) "SMEs: Changing Paradigm of Performance Measures" Vol.42(2):191-200
- Sekar, I. & Chand, Puran (2002) "Pulse Performance in India: A Spatial & Temporal Analysis" Vol.42(4): 674-677
- Seshaiah, S. Venkata & Srinivasula Raju D., (2001) "Vegetable Production in Andhra Pradesh: An Econometric Approach" Vol. 42(1):142-146
- Shah, Deepak. (2001) "Indian Dairy Industry: Present Status & Future Prospects" Vol.42(3):474-483
- Shanmugam, T.R. & Palanichamy, N. Venkatesa (2002) "Prioritization of Rice Productivity Constraints" Vol.42(4):669-673
- Sharma, R.R.K, Shrotriya Shobhit, Seliger G., Eggenstein Marion & Upadhyay Shivanshu, (2001)"Manufacturing Organizations: Concept & Trends from German & Indian Firms" Vol.42(2):274-280
- Singh, Ashima , Khan S.M., (2001) "Operating Effectiveness in Work Settings: The Case of Railway Officers" Vol.42(3):461-466
- Singh, Gurdev & Asokan, S.R. (2001) "Competitiveness of Indian Rubber Under WTO" Vol.42(2):332-336
- Singh, Joginder, (2001) "Changing Structure of Land Market in Punjab" Vol.42(3):484-490
- Singh, Kavita. (2001) "Managing Organizational Intelligence" Vol.42(3):362-370
- Singla, M.L. (2002) "Competing on e-enabled Supply Chains" Vol.42(4):539-545
- Steven Hung-Chi Wu, (2001) "IT Applications in SMEs-Impacts of e-Commerce & Corresponding Solutions" Vol.42(2):256-264
- Sujit, K.S.(2002) "Excess Capacity in cement Industry : Demand/Supply Constraints" Vol.42(4): 641-646
- Sunny , K.P. & Upadhyay, V. (2002) "Productivity Growth in Zonal Railways" Vol.42(4): 647-658
- Tuteja, S.K.,(2001) "Partnership for SME Development: Ancillarisation /Sub-contracting" Vol.42(2): 247-255
- Umashankar, Venkatesh(2001) "e-CRM - Issues of Semantics, Domain & Implementation" Vol. 42(1):11-18
- Vasal, V.K.(2002) "Corporate Reporting on Intangibles in India" Vol.42(4):618-629
- Watanabe, Ryoichi (2002) "Supply Chain Management - The Concept & Technology" Vol.42(4):525-530

## Book Reviews:

- "Accelerating Growth Through Globalization of Indian agriculture by K.P. Kalirajan, G. Mythili, U. Sankar (Eds.) MacMillan India Ltd., 2001, Pages 374, Price Rs.495 (Hard Bound).(Reviewer: Rajesh Sund)
- "Consumer and Quality" by D.B.N. Murthy, New Age International (P) Limited, pages 232, Price Rs.200.(Reviewer: Sankar Ghosh) Vol.42(4):696
- "Coping with liberalization" by Dr. S. Palande, Response Books, 2001, Pages 371, Price Rs.445.(Reviewer: Shankar Ghose) Vol.42(3):522
- "Corporate Crisis Management - Challenges for Survival" by S. Shive Ramu, Response Books: A division of Sage Publication India Pvt. Ltd. New Delhi, 2000, p. 260(Reviewer: K.G Varshney) Vol.42(2):345
- "Emotional Intelligence at Work" - A Professional Guide by Dalip Singh, Published by Response Books, A division of Sage Publications India Pvt. Ltd., 2001, Pages 198, Price Rs.195 (paper), Rs.375 (cloth).(Reviewer: Sonali Piri)
- "Energy Management Challenges for the next millennium" by Pradeep Chaturvedi, Concept Publishing, New Delhi, 2000, Pages 240, (Reviewer: P.V Ramprasad) Vol.42(1):164
- "Indian Economy: Problems of Development and Planning" by A.N. Agrawal, Wishwa Prakashan, New Delhi, 1999, pp. 740, Rs.215 (Reviewer: Suresh Chand Aggarwal) Vol.42(3):523
- "Informal Sector in India: Perspectives and Policies", by Amitabh Kundu and Alak N. Sharma (Eds.), Institute of Human Development (IHD) & the Institute of Applied Manpower Research (IAMR), New Delhi, 2001, Pages 440, price Rs.650.(Reviewer: V. Anil Kumar) Vol.42(3):520
- "Liberalization and Human Resource Management" by Arun Monappa and Mahrukh Engineer; Response Books, 1999, New Delhi, Price Rs.195.00 (Reviewer: G.D. Sardana) Vol.42(1):161
- "Organization Efficiency and Productivity Improvement", by P. Rameshan, Vikas Publishing House, New Delhi, 2001; Pages 140: Price Rs350.00 (Reviewer: G.D. Sardana) Vol.42(3):518
- "Protection in Indian Manufacturing: An Empirical Study" by Hasheem Nouroz, Macmillan India Limited, Delhi, 2001, pp. 230, price Rs.395. (Reviewer: Saikat Sinha Roy) Vol.42(4):694
- "Public Services through Private enterprise: Micro-privatisation for improved delivery" by Malcolm Harper, Vistaar Publications, New Delhi, 2000. Price Rs.450.(Reviewer: C.S Sundaresan.) Vol.42(1):166
- "Soil Conservation and watershed Management in Asia and the Pacific". By Asian Productivity Organisation, APO, Tokyo, 2000, p. 261(Reviewer: J.Agrawal )
- "Stress in Life and at Work" by Dr. Rita Agrawal, Response Books (A Sage Books Division), New Delhi; pages 281, Price Rs.225 (softbound) (Reviewer: Rajneesh Dalal) Vol.42(4):692
- "Training for Organisational Transformation, Part I and II" by Rolf P. Lynton and Udai Pareek, New Delhi : Sage Publications, 2000. 307+414 pp. Rs.225 and 275 paper back & hardbound.(Reviewer: Debi S. Saini) Vol.42(4):693
- "Wastewater Reclamation and Reuse", Edited by Jawad Al-Sulaimi, and Takashi Asano; New Age International (P) Ltd., 2000 Pages 314; Price Rs.750.(Reviewer: Dilip Kr. Bera) Vol.42(1):165
- Top Management Forum "Features of Excellent firms - Experience of Quality Award Winning Firms" by Asian Productivity Organisation, 2000, Pages:124, (Reviewer: V.K Sharma.) Vol.42(1):163

*You miss 100 percent of the shots you never take.*

– Wayne Gretzky

## Recent Releases from CBS

### Production Management

Jain, Prakash L

The book has been prepared to include all the relevant aspects of production management, giving particular attention to new trends in management techniques which can help to improve the performance and controlling of costs. Areas of project planning, quality control and management, workstudy, value engineering, operations and human resource development have been given elaborate coverage. New concepts like business process re-engineering, terotechnology, ergonomics and zero defect analysis have been briefly introduced.

2002, VI+296 pp  
ISBN: 81-239-0808-3

PB, Rs. 195.00

### Consumerism: Strategies and Tactics

Seetharaman, P & Sethi, M

The book provides a comprehensive coverage to all the diverse facets of the topic of consumerism. It not only traces the history and steady growth of consumerism as a social movement and a force to reckon with in the national economy but also details the development of consumerism in the Indian context. The book has five units covering various areas of consumer interests such as Money Management, Savings and Investments, Marketing and Wise Purchasing Habits, Consumer Credit and Credit Ratings, Consumer Laws and Redressal of Consumer Grievances, Consumer Aids etc. besides elaborating the various rights and responsibilities of consumers.

2002, XV+332 pp  
ISBN: 81-239-0807-5

PB, Rs. 195.00

### Management Information System

Khandare, S S

The book contains basic concepts of management information system and electronic data processing. The current information technology used in management information system is also discussed. The concept of database management and information technology used for MIS operation has been presented. The book provides the system analysis approach for solving problems in MIS. The use of various graphic and analytical tools have been discussed. The book also covers the packages used for RDBMS system and SQL in foxpro. The book throws light on artificial intelligence and expert system. The new emerging area of e-commerce is also covered in the book.

2002, XVIII+477 pp  
ISBN: 81-239-0778-8

PB, Rs. 235.00

### Agricultural Statistics in India, 4e

Bansil, PC

It discusses, in detail, the nature, scope, development and availability of agricultural statistics in India. It covers statistical organisations of central and state governments, population census, land utilization, forestry, area statistics, estimation of crop yields, production, fruits and vegetables, irrigation, agricultural census, major inputs, agricultural labour, commodity statistics, livestock and poultry, fisheries statistics, national sample surveys, consumption and stocks of foodgrains, cost of production, agricultural prices, index numbers of prices, indices of area, state index numbers, national income from agriculture, weather system and weather forecasting, small area statistics, internet based data exchange, research, world agricultural statistics, etc.

2002, XIX+786 pp  
ISBN: 81-239-0793-1

HB, Rs. 1595.00

### My Great India: Economic Development & Glaring Disparities

Banerjee, Brojendra Nath

This illuminating study by a distinguished scholar of economic development critically examines the economic scenario of India in almost all its ramifications in the context of country's technological developments. The author particularly studies the mahem on stock market, the old verses New economy, disparities, the information explosion, falling farm output and rising subsidies, industrial recovery and the problem of infrastructure, tax on rich farmers, hunger and disaster management, the millennium budget 2000, Indian women in changing society, etc.

2001, XV+400 pp  
ISBN: 81-239-0746-X

HB, Rs. 995.00

### Seed Quality: Basic Mechanisms and Agricultural Implications

Basra, Amarjit S (Ed)

The book focuses on various aspects of seed quality and integrates research at basic and applied levels, supporting high-quality seed as the basis of higher agricultural productivity. It is a compendium of knowledge with its clear perspective and balance in content of basic and applied aspects of seed quality. Its interdisciplinary focus makes it of immense use to students and teachers in many agricultural and botanical disciplines.

2002, (Reprint), XIII+389 pp  
ISBN: 81-239-0822-9

HB, Rs. 995.00

### Cotton Fibers: Developmental Biology, Quality Improvement

Basra, Amarjit S (Ed)

An excellent overview of all aspects of fiber from genetics to ginning. Each chapter provides a current prospectus on a specific aspect of fiber including a literature review on the topic. This book combines the basic information on the biology of cotton fibers with a wealth of new practical approaches to produce increasingly better quality and speciality fibers.

2002, (Reprint), XIV+388 pp  
ISBN: 81-239-0823-7

PB, Rs. 995.00

### Heterosis and Hybrid Seed Production in Agronomic Crops

Basra, Amarjit S (Ed)

2002, X+270 pp  
ISBN: 81-239-0817-2

HB, Rs. 995.00

### Herbs, Spices, and Medicinal Plants, Vol. 1

Craker, Lyle E & Simon James E (Eds)

This volume, published under the series "Recent Advances in Botany" Horticulture and Pharmacology Introduction to the scientific literature on herbs, spices and medicinal plants; chemotaxonomic aspects of essential oils; botanical nomenclature of culinary herbs and pothebs; biochemistry of monoterpenes and sesquiterpenes of the essential oils; the biochemical pharmacology of plant alkaloids; polyphenolic compounds with biological and pharmacological activity; production ecology of secondary plant products; the chemistry, pharmacology and commercial formulations of chamomile; and medicinal plants of Israel.

2002, (Reprint), VII+359 pp  
ISBN: 81-239-0812-1

HB, Rs. 995.00

### Herbs, Spices, and Medicinal Plants, Vol. 2

Craker, Lyle E & Simon James E (Eds)

This volume, published under the series "Recent Advances in Botany, Horticulture, and Pharmacology" contains contributions on pharmacologically active substances of Chinese traditional and herbal medicines; the alkaloids of the papaver section *Oxytona* Bernh; botanical characteristics of Ginseng, synergism and antagonism in the pharmacology of alkaloidal plants; vegetative propagation of aromatic plants of the mediterranean region, botanical nomenclature of commercial sources of essential oils, concretes and absolutes.

2002, (Reprint) XII+255 pp  
ISBN: 81-239-0813-X

HB, Rs. 995.00

### Herbs, Spices and Medicinal Plants, Vol. 3

Craker, Lyle E & Simon James E (Eds)

Published under the series "Recent Advances in Botany, Horticulture, and Pharmacology", this volume contains contributions of nine specialists from the various countries in the fields of culinary herbs and spices of Finland; pharmacokinetics of polyphenolic compounds. The biochemical basis of the hypoglycemic effects of some

plant extracts; advances in the agronomy and production of turmeric in India; plant flavonoid effects on mammalian cell systems; clinical applications of centella asiatica; an ecological approach to medicinal plant introduction.

2002, (Reprint) XI+220 pp  
ISBN: 81-239-0814-8

HB, Rs. 995.00

### **Herbs, Spices and Medicinal Plants, Vol. 4** Craker, Lyle E & Simon James E (Eds)

This volume, published under the series "Recent Advances in Botany, Horticulture and Pharmacology" contains contributions from 10 specialists on the potential of pesticides from plants; excerpts on the Chinese pharmacopoeia; phytogeographic and botanical considerations of medicinal plants in Eastern Asia and Eastern North America; Borage: a source of gamma linolenic, botanical nomenclature of medicinal plants.

2002, (Reprint) XI+267 pp  
ISBN: 81-239-0815-6

HB, Rs. 995.00

### **Seed Storage of Horticultural Crops** Dojjode, SD

This comprehensive valuable book contains methods and strategies to help farmers and breeders store seeds and maintain seed quality to produce the best possible plants. This informative volume examines topics such as germination, plant anatomy, and types of seeds, making it ideal for students and educators.

2002, (Reprint), XVI+270 pp  
ISBN: 81-239-0824-5

HB, Rs. 995.00

### **Environment 2001: A Global Challenge** Mathur, Ramesh, et al

The volume includes 19 papers on agriculture microbiology, radioactive waste, forestry, mining, pest management, toxicity, wild life and rural upgradation.

2002, XII+234 pp  
ISBN: 81-239-0786-9

HB, Rs. 1295.00

### **Handbook of Industrial Pollution and Control, 2 Vols.** Bhatia, S C

In four sections, these volumes provide a fairly comprehensive coverage of the multi-disciplinary nature of pollution and environmental aspects. Section I is devoted to basic concepts of pollution. Section II deals with chemical process and allied industries, which, like other industries, releases pollutants to the environments. Section III focuses on pollution prevention aspects of food processing and allied industries such as dairy, meat, poultry and seafood and edible oil industry. Various methods of recovery and reuse of milk by-products and prevention of dairy wastes are also discussed. Section IV explains the role of textile, man-made fibre, jute processing industry and measures to discharge these effluents.

2002, LXI+1184 pp  
ISBN: 81-239-0805-9 Vol. I 81-239-0806-7 Vol. II

HB, Rs. 1995 Rs. 1995

### **Mineral Nutrition of Crops: Fundamental Mechanisms and Implications** Rengel, Zdenko (Ed)

It is the first book to grasp the complexity of the soil water plant microbe interactions governing nutrient uptake and utilization by crops. It establishes a base at the single plant level, takes into account cells as well as plasma membranes of these cells, and then builds from there to include issues related to plant-pathology, soil microbiology, soil chemistry, hydrology, breeding and modeling.

2002, (Reprint), XIV+400 pp  
ISBN: 81-239-0816-4

HB, Rs. 995.00

### **Plant Viruses as Molecular Pathogens** Khan, Jawaid A & Dykstra, Jeanne (Eds)

37 specialists in various fields and from various countries make this a unique single volume. The book provides very interesting concepts regarding the use of molecular techniques to gain new insight into long-standing pathological issues, such as virus evolution, host adaptation, and epidemiology. It contains a good deal of information on plant viruses of importance in the tropics such as potyviruses, begomoviruses and some emerging plant viruses transmitted by fungal vectors. In all, it is a valuable collection of themes on the new art and science of plant virology.

2002, XVIII+537 pp  
ISBN: 81-239-0820-2

HB, Rs. 1495.00

### **Modern Trends in Environmental Biology** Tripathi, G

The book embodies all kinds of recent information in different aspects of pollution problems. The impact of environmental pollution on human health has been described. Ecohydrological features of the Holy Ganga river microbial contamination of water resources, conservation of coastal and island areas and effect of acid rain have been nicely elucidated. Environmental problems related to coal mines, and zone, pesticides, fossils, past biodiversity crisis have been vividly discussed. Effects of various toxicants on biological systems, metal poisoning, atmospheric reactions, chemical toxicity and health hazards, use of antidotes, biochemical monitoring and toxicity assessment have been thoroughly presented. Environmental sustainability, wetland management and role of vermitech in pollution abatement have also been given.

2002, X+411 pp  
ISBN: 81-239-0798-2

HB, Rs. 1495.00

### **Bioresource Technology** Tripathy G. (Ed.)

Bioresource genes are the product of 3000 million years of evolution. But it is only recently that their importance as the basis of livelihood and ecological safety have been realized by scientists.

Due to an unchecked population growth and rapid industrialization the bioresources are continuously under threat of fast depletion. There is an urgent need, hence, to create a general awareness of this aspect and introduce, when there is still time, future planning for the management of these life-supporting natural bioresources.

There has been a general dearth of literature in this specialised area. The Editor, seized of the problem and realising his limitation to handle such a vast range of application of these resources independently, has attempted this multi-authored work.

2002, X+378 pp  
ISBN: 81-239-0849-0

HB, Rs. 1195.00

### **Chemistry of Pesticides** Roy N.K.

In spite of constraints of natural resources such as land and water, the future demand of food, feed and fibre in the next two decades can be met only by ensuring higher productivity for which crop protection more than crop improvement holds the key.

During the last decade or so many universities have introduced new techniques in crop protection like application of recombinant DNA technology, plant breeding for durable resistance to pests and disease and harnessing of biocontrol agents to ensure effective and ecofriendly crop protection. In spite of all these efforts, chemical pesticides continue to be the kingpin of crop protection. This situation is unlikely to change for at least another two decades.

Pesticide chemistry is being taught in agricultural universities and several traditional universities both at UG and PG levels. But unfortunately in India no books suitable to syllabi are available. The present book attempts to give a holistic account of pesticide chemistry.

2002, XII+336 pp  
ISBN: 81-239-0854-7

HB, Rs. 1195.00

## **M/s CBS Publishers & Distributors**

4819/XI, Prahlad Street, 24, Ansari Road, Daryaganj, New Delhi 110 002  
Tel.: 3289259, 3266861, 3266867 • Fax: 91-11-3266838, 3276712  
E-Mail: cbspubs@del3.vsnl.net.in

*Just Released!*

**IMD's  
THE WORLD COMPETITIVENESS YEARBOOK 2002**

*The world's most authentic report on the competitiveness of nations*

**Partner Institute from India  
National Productivity Council**

- ★ Leading analysis of world nations' competitiveness
- ★ Cover 200 competitiveness criteria for 49 countries
- ★ Data from International, national, regional organizations and Executive Opinion Survey

**Designed for Top Decision Makers from Business,  
Government & Academia**

**Price: Swiss Frank 900/-.**

Limited copies available in Rupee terms at 20% discount.

**Contact**

**Dr. N.K. Nair  
Director (Research) & Secretary  
National Productivity Council**

Lodhi Road, New Delhi-110 003

Phone: 011-4618840/4690331-2-3

Fax: 91-11-4615002

E-mail: [npresearch@hotmail.in](mailto:npresearch@hotmail.in)

# Productivity

Announces

a

Special Issue  
(July–September, 2002)

on

'Six Sigma'

*Place your orders with*

Journals Division

**CBS Publishers & Distributors**

4819/XI, Prahlad Street, 24 Ansari Road

Daryaganj, New Delhi-110 002

Ph.: 3289259, 3266867, 3266861

Fax: 91-11-3266838, 91-11-3276712

E-mail: [cbspubs@del3.vsnl.net.in](mailto:cbspubs@del3.vsnl.net.in)