



Productivity

Vol. 48

January–March 2008

No. 4

Focus : Agriculture

New Fertilizer Policy under WTO

Production of Maize in Punjab

Farmers' Participation in Futures Trading

Validation of Cotton IPM Technology

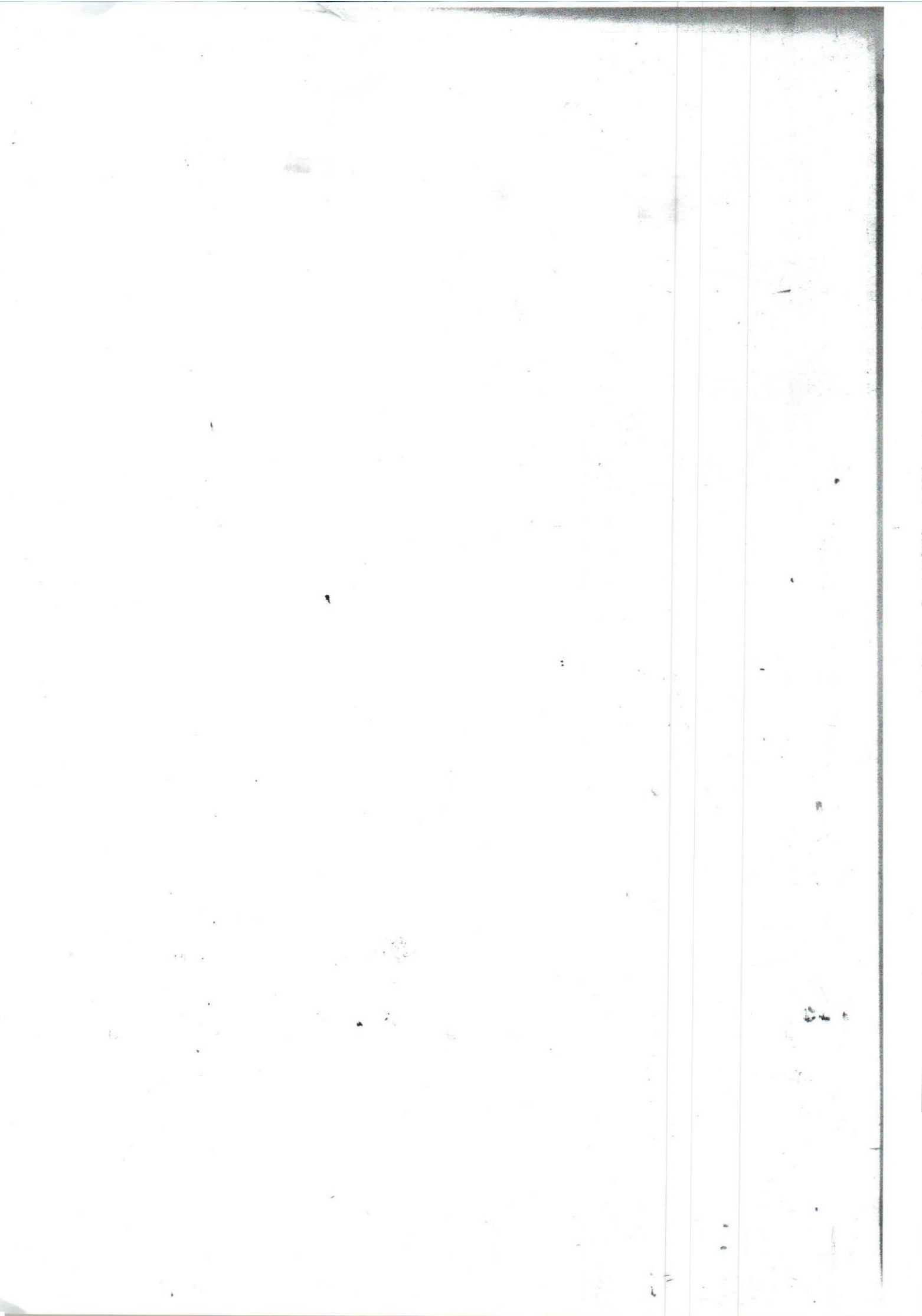
Globalization vis-à-vis Agrarian Crisis

Milk Production in Tamil Nadu

Supply Chain Management in Meat Industry

Indian Logistics Industry

Lean Manufacturing – Hurdles and Solutions



Productivity

A QUARTERLY JOURNAL OF THE NATIONAL PRODUCTIVITY COUNCIL

Vol. 48 • January–March 2008 • No. 4



CBS

CBS PUBLISHERS & DISTRIBUTORS

NEW DELHI • BANGALORE • PUNE (INDIA)

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) along with 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

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

Editor

V.K. Soni

Associate Editor

K.P. Sunny

Editorial Consultant

Payal Kumar

Subscription

<i>Inland</i>	: Annual Rs. 1200 Single Copy Rs. 300
<i>Foreign</i>	: Annual Airmail US \$ 100 Annual Surface Mail US \$ 90 Single Copy Airmail US \$ 25
<i>SAARC</i>	: Annual Airmail US \$ 50
<i>Countries</i>	: Annual Surface Mail US \$ 45 Single Copy Airmail US \$ 15

Productivity will be sent to all subscribers within each quarter. Editor, **Productivity Journal** may be contacted in the event of non-receipt within one month from the quarter.

All business correspondence to be addressed to:

Editor, **Productivity Journal**
National Productivity Council
Lodhi Road, New Delhi-110003
Telephone: 91-11-24607371 or 24690331
Fax: 91-11-24615002
Email: npcres@rediffmail.com

ISSN 0032-9924

Copyright © 2008 National Productivity Council

CBS PUBLISHERS & DISTRIBUTORS

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

BANGALORE : Seema House, 2975, 17th Cross
K.R. Road, Bansankari IInd Stage
Bangalore-560 070

PUNE : Shaan Brahmha Complex, Basement
Appa Balwant Chowk
Budhwar Peth, next to Ratan Talkies
Pune-411 002

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

Shift in Area, Yield and Production of Maize in Punjab — <i>Raj Kumar & S S Chahal</i>	...	349
Farmers' Participation in Futures Trading: Problems and Prospects — <i>S R Asokan & Anita Arya</i>	...	359
Socio-economic Impact Assessment of Promotion and Validation of Cotton IPM Technology in Punjab — <i>Joginder Singh & Harvinder Singh</i>	...	367
Globalization vis-à-vis Agrarian Crisis in India — <i>M.S. Sidhu</i>	...	377
Dynamics of New Fertilizer Policy under WTO — <i>Satish Chandra & Neena Sinha</i>	...	390
Greenhouse for Higher Productivity — <i>J C Paul & J N Mishra</i>	...	402
Economic Analysis of Milk Production in Tamil Nadu — <i>V Saravanakumar & D K Jain</i>	...	408
Supply Chain Management in the Indian Meat Industry — <i>Gyan Prakash</i>	...	415
Dynamics and Prospects of the Indian Logistics Industry — <i>Subrata Mitra</i>	...	425

Lean manufacturing – Hurdles and Solutions	...	431
— <i>Krishna Murari & K S Gupta</i>		
Human Resource Practices in the Indian Financial Sector	...	438
— <i>Kshitiz Garg, Rakesh Kumar Agrawal & Archana Tyagi</i>		
Book Review	...	451

Shift in Area, Yield and Production of Maize in Punjab

Raj Kumar & S S Chahal

The present study was conducted with the objective to analyze the performance of maize based production system and changes in cropping pattern brought about by technological development in Punjab. The decomposition analysis of maize production shows that yield contributed positively but its benefits could not be sustained due to continuous downward change in maize acreage, especially in the post-Green Revolution period. The assured market for paddy, which in turn ensures better returns from paddy cultivation under present price policy, has helped to squeeze out area from maize in favour of paddy crop in Punjab.

After wheat and rice, maize is the most important cereal grain in the world, providing nutrients for humans and animals and serving as a basic raw material for the production of starch, oil and protein, alcoholic beverages, food sweeteners and more recently, fuel. Its magnitude of usage in the form of human food, animal and poultry feed and as industrial end uses has given it the much-needed impetus for growth and demand.

Special crops grown primarily for food include sweet corn and popcorn, although dent, starchy or floury and flint maize are also widely used as food. Flint maize is also used as feed. Immature ordinary corn on the cob either boiled or roasted is widely consumed. Floury maize is a grain with a soft endosperm much used as food in most countries. The green plant, made into silage, has been used with much success in the dairy and beef industries. After harvest of the grain, the dried leaves and upper part, including the flowers, are still used today to provide relatively good forage for ruminant animals owned by many small farmers in developing countries. The erect stalks, which in some varieties are strong, have been used as long-lasting fences and walls.

Maize occupies a place of pride amongst the coarse cereal crops in India and it is emerging as the third most important crop after rice and wheat. It has been estimated that this crop has contributed Rs. 6000 crore annually to India's GDP and generates 4500 lakh man days of employment (Puri, 2001). The day is not far when maize would become the backbone of Indian economy, following the USA, where it is known as 'Golden Grain' and is a major agriculture crop. To meet the growing demand, per hectare yield of maize was estimated to rise to 2.36 tonnes by the end of 2020 in the country (Kumar and Singh, 2003).

The last decade of the 20th century witnessed extensive economic reforms in India, which in turn saw

Raj Kumar is Assistant Farm Economist and S S Chahal is lecturer at the Dept of Economics and Sociology, Punjab Agricultural University, Ludhiana

growing stocks of surplus wheat and rice. This, however, came at an associated cost of degradation of soil and depletion of water resources. Paroda and Kumar (2000) predicted that the area under maize would grow to meet the future food, feed, and other demands, especially in view of the booming livestock and poultry producing sectors in the country. Since opportunities are limited for further expansion of maize area, future increases in maize supply can only be achieved through the intensification and commercialization of current maize production systems. The changing global scenario is compelling policymakers to adhere to the regulations and obligations set by the World Trade Organization (WTO). The resulting new economic regime is expected to alter the economics of existing cropping systems, including maize, in terms of production, value addition, and trade.

The uneven growth rates in individual crops had led to the regional imbalances in rural prosperity depending upon the crops which each region is cultivating (Singh and Singh, 1999). It has long been recognized that partial productivity measures such as output per unit of individual inputs, are of limited use as indicators of real productivity change defined by a shift in a production function (Kumar and Mruthyunjaya, 1992). As far as the productivity of maize is concerned, India ranks nowhere in the world with a current yield of around 2 tonnes per hectare against the world average of over 4 tonnes. Sensing the emerging need, Government of India has embarked upon an ambitious programme under "Technology Mission on Maize" in the Tenth Five Year Plan (Kumar and Singh, 2003).

Methodology

The present study is based on the secondary data collected from published sources (Statistical Abstracts of Punjab, Agriculture at a Glance, etc.). To achieve the objective of the present study, all the nine major maize growing districts namely Amritsar, Gurdaspur, Jalandhar, Ludhiana, Hoshiarpur, Nawan Shahar, Ropar, Patiala and Kapurthala, together covering more than 70 per cent of the total maize area, were included in the study sample for an in-depth analysis of the problem. The secondary data pertaining to area, yield and production of the important crops of Punjab for the period 1950-51 to 2005-06 were collected from various issues of published secondary sources such as Statistical Abstract of Punjab; Agriculture at a Glance, etc. The time series data relating to the pre-sowing rainfall (average for the months of May and June), area under irrigation, farm-harvest prices of maize and paddy and cropping pattern for the nine major maize growing districts of Punjab were obtained

for the period 1950-51 to 2005-06 from *Statistical Abstracts of Punjab*.

The entire period was divided into four sub-periods to find out the shifts in cropping pattern in the state. Period I (1950-51 to 1965-66) called Pre-Green Revolution Period, Period II (1966-67 to 1985-86) called Post-Green Revolution Period, Period III (1985-86 to 1995-96) and Period IV (1995-96 to 2005-06) called Policy Reform Period (because new seed policy introduced in 1985/86 brought remarkable progress in the maize production in the country) as during the mid-1980s, the seed industry licensing policy was modified to attract greater participation of Indian companies.

Statistical Tools used for Analysis

Growth Analysis

The annual compound growth rates of area, production and yield of maize were estimated for each district for the above said four periods viz. Period I: 1950-51 to 1965-66, Period II: 1966-67 to 1985-86, Period III: 1986-87 to 1995-96 and Period IV: 1995-96 to 2005-06.

The growth model adopted is as under:

$$Y_t = AB^t$$

Where,

Y_t = Area/production/yield of maize for the year 't'.

t = Time variable (1,2,..., n) for each period.

A = Constant

Log transformation of the above function is:

$$\ln Y_t = \ln A + t (\ln B).$$

Where,

$$\ln B = \ln (1 + r)$$

$$r = [\text{antilog} (\ln B) - 1]$$

$$\text{ACGR} (\%) = [\text{antilog} (\ln B) - 1] \times 100$$

Students' t-test was used to test the significance ACGRs.

The Decomposition of Growth Analysis

The observed increase/growth in production of a crop can be decomposed into area effect, yield effect and interaction effect. The following additive scheme of decomposition has been used:

$$\Delta P = A_1 \Delta Y + Y_1 \Delta A + \Delta A \cdot \Delta Y$$

Where,

ΔP = Difference in average production during two periods.

ΔY = Difference in average yield during two periods.

ΔA = Difference in average area during two periods.

A_1 = Average area under maize crop during the base year.

Y_1 = Average yield of maize crop during the base year.

Thus, the changes in production (ΔP) were due to:

- (i) $Y_1 \cdot \Delta A$ represents an area effect,
- (ii) $A_1 \cdot \Delta Y$ represents yield effect, and
- (iii) $\Delta A \cdot \Delta Y$ represents an interaction of area and yield effect.

Acreage Response

In order to examine and identify the important price and non-price factors which affected area allocation to maize crop, the Cobb-Douglas type of model was applied as following:

$$A_t = b_0 (A_{t-1})^{b_1} (RY_{t-1})^{b_2} (RHP_{t-1})^{b_3} (NIA_{t-1})^{b_4} (R_t)^{b_5} (RYR)^{b_6} (RPR)^{b_7} (e)^{U_t}$$

For OLS estimation, take natural log of all the variables and convert the equation in linear form as:

$$\ln A_t = \ln b_0 + b_1 \ln (A_{t-1}) + b_2 \ln (RY_{t-1}) + b_3 \ln (RHP_{t-1}) + b_4 \ln (NIA_{t-1}) + b_5 \ln (R_t) + b_6 \ln (RYR) + b_7 \ln (RPR) + U_t$$

Where,

A_t = Acreage under maize crop in current year of the district

A_{t-1} = One year lagged maize acreage

RY_{t-1} = Previous year relative yield of maize crop with respect to rice

RHP_{t-1} = Previous year relative farm harvest price of maize crop with respect to rice

NIA_{t-1} = Previous year net irrigated area of the district

R_t = Average of rainfall of two pre-sowing months (May-June) of the current year

RYR = Relative yield risk of maize with respect to rice

(calculate relative yield of maize, then take standard deviations for three years and put the results for the fourth year)

RPR = Relative price risk of maize with respect to rice (calculate relative farm harvest price of maize, then take standard deviations for three years and put the results for the fourth year)

b_0 = Intercept

$b_1 \dots b_7$ = Elasticities/regression coefficients of respective independent variables

U_t = Disturbance term

Results and Discussion

Shift in Cropping Pattern

The data presented in Table 1 pertaining to four-time periods show that the area under all the crops increased due to the development of irrigation facilities and other inputs in the state during the period TE 1952/53 to TE 1966/67.

The profitability plays a major role in the adoption of any enterprise/crop and this has been proved true in the case of Punjab agriculture. As is clearly indicated by the results pertaining to the second period (TE 1967/68 to TE 1986/87), there was a major shift in area in favour of rice in five out of nine maize growing districts. There was an increase in area under maize in Jalandhar, Hoshiarpur and Ropar districts over this period to the tune of 0.6, 19.3 and 27.7 per cent respectively. An overall scenario clearly indicates that rice and wheat were the major gainers as far as shift in area was concerned. It can be seen that area under maize has declined substantially during the period TE 1986/87 to TE 1995/96 and 1995/96 to 2005/06. This area was directed to rice crop, as it was more remunerative and thereby more lucrative as compared to maize crop due to its more productivity along with assured MSP. The results clearly show that rice and wheat were the major gainers at the cost of other crops like oilseeds, cotton, sugarcane, etc. On the whole, the maize lost the ground in terms of its share in gross cropped area in the state and was substituted by other relatively profitable crops in the selected districts of Punjab.

Status of Maize Acreage in Punjab

The perusal of Table 2 reveals that area under maize

Table 1: Shift in Cropping Pattern in major maize growing districts of Punjab, TE 1952/53 to TE 2005/06 (Per cent)

Districts	TE 1952/53 to TE 1966/67					
	Rice	Maize	Wheat	Oilseeds	Sugarcane	Cotton
Gurdaspur	86.7	35.4	22.4	24.2	67.4	-24.5
Amritsar	135.3	58.7	19.4	122.9	16.9	29.3
Kapurthala	304.5	97.2	45.5	2216.7	16.3	10.5
Jalandhar	425.0	90.9	33.0	466.7	35.8	44.1
Nawan Shahar	NA	NA	NA	NA	NA	NA
Hoshiarpur	79.3	4.0	-6.5	144.4	-25.8	-4 7.5
Ludhiana	66.0	100.7	73.5	147.8	65.5	107.7
Patiala	293.6	14.5	39.4	258.7	1 17.4	91.4
TE 1966/67 to TE 1986/87						
Gurdaspur	160.6	- 31.6	60.6	- 9.2	- 20.9	-87.5
Amritsar	238.1	- 66.7	102.2	33.0	- 67.9	-86.4
Kapurthala	357.9	- 52.9	95.2	- 61.7	- 58.0	-82.5
Jalandhar	1473.1	0.6	67.4	- 58.1	- 16.7	-77.2
Nawan Shahar	NA	NA	NA	NA	NA	NA
Hoshiarpur	76.5	19.3	49.1	53.0	- 36.2	-62.5
Ropar	418.5	27.7	108.4	- 57.6	- 2.3	-69.2
Ludhiana	4687.6	- 47.1	72.4	- 81.8	- 65.2	-84.2
Patiala	474.0	- 63.0	127.3	- 49.1	- 58.4	-87.2
TE 1986/87 to TE 1995/96						
Gurdaspur	22.99	-27.42	6.55	-29.85	-0.38	0
Amritsar	29.13	-30.23	3.73	-8.12	103.13	108.93
Kapurthala	21.63	-15.79	2.78	-39.38	263.49	0
Jalandhar	-0.25	-52.35	23.08	-7.03	29.32	0
Nawan Shahar	NA	NA	NA	NA	NA	NA
Hoshiarpur	13.61	-7.11	-16.87	7.92	110.62	0
Ropar	39.29	-24.77	12.61	-25.00	10.28	0
Ludhiana	30.06	-83.53	-3.61	-55.09	44.52	0
Patiala	-4.34	-45.24	-19.09	-58.17	-34.54	100
TE 1995/96 to TE 2005/06						
Gurdaspur	3.00	-11.11	2.84	-42.13	26.68	0
Amritsar	8.98	-60.00	5.64	-81.34	-13.85	-94.02
Kapurthala	4.36	-37.50	1.80	-73.20	-21.40	0
Jalandhar	4.79	-50.62	-11.98	-71.43	-37.50	-100
Nawan Shahar	68.67	1.85	23.73	-1.79	-2.68	0
Hoshiarpur	2.99	-12.16	3.38	-4.59	36.55	0
Ropar	24.79	-10.98	4.80	-21.11	-43.50	0
Ludhiana	3.28	-35.71	-0.65	-56.00	-28.57	-97.5
Patiala	3.97	-43.48	4.46	-69.52	-32.52	-100

TE = Triennium Ending

during the TE 1952/53 was 254.7 thousand hectares, which increased to 399.7 thousand hectares during the TE 1966-67 in Punjab. Thereafter area declined to 284

thousand hectares in TE 1986/87 and then to as low a 180.33 thousand hectares in TE 1995/96 and 152 thousand hectares in 2005/06.

Table 2: Status of maize acreage in the major maize growing districts of Punjab, TE 1952/53 to TE 2005/06

Districts	Acreage (000'ha)				
	TE 1952/53	TE 1966/67	TE 1986/87	TE 1995/96	TE 2005/06
Gurdaspur	22.3	29.3	20.7	15.0	13.67
Amritsar	27.3	39.7	14.3	10.0	2.67
Kapurthala	7.7	13.7	6.7	5.3	3.33
Jalandhar	31.0	59.7	59.3	27.0	14.67
Nawan Shahar	-	-	-	18.0	19.00
Hoshiarpur	64.0	68.0	80.0	74.0	66.33
Ropar	-	29.0	36.3	27.3	18.67
Ludhiana	26.7	54.7	28.7	4.67	1.67
Patiala	33.7	36.3	13.7	7.67	3.67
Punjab	254.7	399.7	284.0	180.33	152.00

The area under maize has been declining substantially which may be due to a favourable price policy and assured marketing of rice crop. An inter district analysis shows that the highest maize acreage was in Hoshiarpur district (64 thousand hectares) and the lowest in Kapurthala district (7.7 thousand hectares) during the TE 1952/53. The area under maize has registered an increase in all the major maize growing districts in TE 1966/67 over TE 1952/53. The maize acreage varied between 13.7 (Kapurthala district) to 68 thousand hectares (Hoshiarpur district) during the TE 1966/67. There was an overall decline in area under maize during the TE 1986/87 for all the sample maize growing districts except for Hoshiarpur district, where it registered an upward trend. However, during the TE 1995/96 there was further decline in area for maize growing districts in Punjab. The highest area under maize was recorded in Hoshiarpur district (74 thousand hectares) and lowest in Ludhiana district (4.67 thousand hectares). The area under maize further declined in all the districts during the TE 2005/06 except in Nawan Shahar district where it remained almost same as in TE 1995/96.

Status of Maize Yield in Punjab

The results presented in Table 3 reveal that there was a continuous increase in productivity of maize in Punjab during the study period. The yield as such increased from 991 kg/ha in TE 1952/53 to 2587 kg/ha in TE 2005/06. The figures for the TE 1966/67, TE 1986/87 and TE 1995/96 were 1540, 1819 and 1836 kg/ha respectively. The inter district comparison clearly shows that the yield of maize was highest in the Kapurthala district (1556 kg/ha) and lowest in the Hoshiarpur district

(662 kg/ha) during the TE 1952/53. The higher yield in the former district could be attributed to better irrigation facilities as compared to the latter, where crop was taken on the marginal land, with heavy dependence on rainfall.

Table 3: Status of maize yield in the major maize growing districts of Punjab, TE1952/53 to TE 2005/06

Districts	Average yield (kg/ha)				
	TE 1952/53	TE 1966/67	TE 1986/87	TE 1995/96	TE 2005/06
Gurdaspur	837	1056	1731	1410	2089
Amritsar	1152	1314	2167	2243	2677
Kapurthala	1556	1313	2222	2327	3103
Jalandhar	1401	1886	2064	2322	3051
Nawan Shahar	-	-	-	1944	2758
Hoshiarpur	662	1503	1622	1782	2592
Ropar	-	-	1790	1557	2338
Ludhiana	1151	2160	1994	2070	3178
Patiala	853	1259	1725	1522	2166
Punjab	991	1540	1819	1836	2587

The results reveal that the yield of maize has increased further during the TE 1966/67. During this period the Ludhiana district lead with 2160 kg/ha. The lowest figure (1056 kg/ha) was recorded for the Gurdaspur district during the TE 1966/67. The yield of maize continued to show improvement even during the nineties. The highest figures were found to be 2222 in Kapurthala district (TE 1986/87), 2327 in Kapurthala district (TE 1995/96) and 3178 kg/ha in Ludhiana district (TE 2005/06). The above discussion clearly shows that the productivity of maize increased by more than 2.5 times during TE 1952/53 to TE 2005/06, which was mainly due to the extensive research efforts put in the development of improved and hybrid cultivars of maize in the state both in the public and private sector.

Status of Maize Production in Punjab

The results pertaining to the maize production bear testimony to the fact that in spite of ever increasing productivity levels, the production has decreased due to continuous fall in the area under maize. The results presented in Table 4 clearly exhibit that the production did increase from 251 to 616.3 thousand tonnes from the TE 1952/53 to TE 1966/67, which was made possible by the improvement in the maize productivity coupled with augmentation of area under maize during this period at the state level. The production data pertaining to the period after mid-seventies showed a persistent decline up to

the TE 1995/96 but afterwards it showed some improvement which was the result of increase in per hectare output of maize.

Table 4: Status of maize production in selected districts of Punjab during the period, TE 1952/53 to TE 2005/06

Districts	Production (000' tonnes)				
	TE 1952/53	TE 1966/67	TE 1986/87	TE 1995/96	TE 2005/06
Gurdaspur	18.0	31.0	36.0	21.7	28.0
Amritsar	32.0	52.3	31.0	22.0	11.0
Kapurthala	11.3	18.0	14.7	13.3	10.3
Jalandhar	42.7	110.3	124.0	58.3	40.7
Nawan Shahar	—	—	—	35.0	50.3
Hoshiarpur	42.3	103.7	129.7	131.7	169.7
Ropar	—	41.0	65.3	42.7	56.3
Ludhiana	30.3	119.7	56.0	9.7	9.7
Patiala	28.7	46.3	23.7	12.3	5.3
Punjab	251.0	616.3	519.3	329.3	397.7

It can be concluded that up to TE 1995/96 the effect of decline in area was more than the increase in productivity but after TE 1995/96 the effect of increase in productivity was more than decline in area under maize resulting in increase in the production. The maize production in the state declined to 519.3 thousand tonnes in the TE 1986/87 from 616.3 thousand tonnes in the TE 1966/67 in spite of the perceptible increase in the yield. Similar results were noticed during the TE 1995/96 when the production declined to 329.3 thousand tonnes compared to 519.3 thousand tonnes in the TE 1986/87. But during the TE 2005/06 the production increased to 397.7 thousand tonnes due to significant increase in productivity in spite of the decline in area. The decline in maize production could be attributed to the higher profitability of the competing crop namely rice because productivity of rice was appreciably higher as compared to maize, with marginal difference in their prices.

Growth Performance of Maize in Punjab

The compound growth rates (CGRs) of area, yield and production of major maize growing districts of Punjab are given in Table 5. The CGRs for area, yield and production were found to be 3.13, 2.60 and 5.81 per cent per annum respectively for the period 1950/51 to 1965/66 in the state. The corresponding figures for the period 1965/66 to 1985/86 were estimated to be -3.31, 0.74 and -2.59 per cent respectively. A similar trend was observed during the period 1986/87 to 1995/96 and 1995/

96 to 2005/06. All these CGRs were found to be significant statistically. This shows that the positive yield effect was more than offset by negative area effect on the production. The area under maize has shown upward trend during the period 1950/51 to 1965/66 both at the state level as well as in the major maize growing districts of Punjab. This happened due to reason that its competing crop, rice was cultivated on less area, as it requires more irrigation water compared to the maize, as the irrigative facilities were not so developed in the state at that time.

The statistically significant positive compound growth rate (CGR) of area under maize crop was found in the Hoshiarpur district (0.57 per cent) for the period 1966/67 to 1985/86. The CGRs of area under maize were found to be negative and significant statistically in the remaining maize growing districts in the state except Ropar where it turned out to be non-significant statistically during the above said period. Similarly the CGRs were found to be negative in all the districts for the period 1986/87 to 1995/96 and 1995/96 to 2005/06. These CGRs relative to area under maize in Punjab were highly significant during the above period. There was a persistent decline in area under maize during post *Green Revolution* period because the attention was shifted to the cultivation of wheat and rice in the state.

The productivity of maize has shown an all-round improvement in all the major maize growing districts of Punjab except Kapurthala during 1950/51 to 1965/66 and Ludhiana district during the period 1966/67 to 1985/86. This improvement could not help to boost the cultivation of maize on a large scale due to its lower profitability compared to rice in the state. The results pertaining to the maize production show that there was an erratic trend during the period 1950/51 to 1965/66. The CGR for the state as a whole for the period 1950/51 to 1965/66 showed that production increased at a statistically significant rate of 5.81 per cent annually. The CGRs of maize production during the period 1966/67 to 1985/86 were positive only in the case of Hoshiarpur (1.93 per cent) and Ropar (2.21 per cent) districts.

The CGRs were found to be significant statistically. The decline in production was highest in the Patiala district (-6.62 per cent) followed by Ludhiana (-5.07 per cent), Amritsar (-4.81 per cent), Kapurthala (-2.89 per cent) and Gurdaspur (-1.76 per cent) districts during the period 1966/67 to 1985/86. The CGRs were found to be significant statistically in all the districts except Gurdaspur. The rate of growth has even declined during 1966/67 to 1985/86 for the Jalandhar and Hoshiarpur districts compared to the preceding period (1950/51 to 1966/66).

Table 5: Growth performance of area, yield and production of maize in Punjab, 1950/51 to 2005/06

ACGR (%)

Districts	Time period			
	1950/51 -1965/66	1966/67 -1985/86	1986/87 -1995/96	1995/96 -2005/06
Maize Acreage				
Gurdaspur	0.88 ^{NS}	-3.60 ^{**}	-3.21 ^{***}	-1.55 [*]
Amritsar	3.04 ^{***}	-6.48 ^{**}	-2.36 ^{NS}	-8.67 ^{***}
Kapurthala	4.70 ^{***}	-4.82 ^{**}	-0.87 ^{NS}	-3.26 ^{**}
Jalandhar	4.27 ^{***}	-1.26 ^{**}	-4.78 ^{***}	-3.80 ^{**}
Nawan Shahar	NA	NA	NA	0.13 ^{NS}
Hoshiarpur	0.98 ^{**}	0.57 ^{**}	-1.21 [*]	0.43 [*]
Ropar	NA	0.48 ^{NS}	-2.94 ^{***}	-0.37 ^{NS}
Ludhiana	5.17 ^{***}	-4.18 ^{***}	-16.46 ^{***}	-2.81 ^{NS}
Patiala	0.38 ^{NS}	-6.18 ^{***}	-6.63 ^{***}	-9.12 ^{***}
Punjab	3.13 ^{***}	-3.31 ^{***}	-4.67 ^{***}	-1.11 ^{***}
Average Yield of Maize				
Gurdaspur	2.26 ^{NS}	1.91 ^{NS}	-0.55 ^{NS}	3.85 ^{**}
Amritsar	0.58 ^{NS}	1.78 ^{NS}	2.09 ^{NS}	2.99 [*]
Kapurthala	-3.48 ^{**}	2.03 ^{***}	5.84 [*]	3.50 ^{**}
Jalandhar	2.02	1.41 ^{***}	2.73 ^{NS}	3.77 ^{***}
Nawan Shahar	NA	NA	NA	4.19 ^{**}
Hoshiarpur	6.40 ^{***}	1.35 ^{**}	2.77 ^{NS}	4.39 ^{***}
Ropar	NA	1.72 ^{**}	2.52 ^{NS}	4.07 ^{**}
Ludhiana	3.42 ^{**}	-0.93 ^{**}	0.74 ^{NS}	4.23 ^{**}
Patiala	1.17	-0.47 ^{NS}	-1.61 ^{NS}	2.51 ^{NS}
Punjab	2.60 ^{**}	0.74 ^{**}	1.86 ^{NS}	4.02 ^{***}
Production of Maize				
Gurdaspur	3.16 ^{NS}	-1.76 ^{NS}	-3.73 [*]	2.15 ^{NS}
Amritsar	3.64 ^{**}	-4.81 ^{***}	-2.53 ^{**}	-5.60 ^{**}
Kapurthala	1.05 ^{NS}	-2.89 ^{***}	5.96 [*]	-0.72 ^{NS}
Jalandhar	6.38 ^{***}	0.14 ^{NS}	-5.61 ^{**}	1.62 ^{NS}
Nawan Shahar	NA	NA	NA	4.30 ^{**}
Hoshiarpur	7.44 ^{***}	1.93 ^{***}	1.03 ^{NS}	4.85 ^{***}
Ropar	NA	2.21 ^{***}	-0.67 ^{NS}	3.48 [*]
Ludhiana	8.76 ^{***}	-5.07 ^{***}	-18.33 ^{***}	1.36 ^{NS}
Patiala	1.56 ^{NS}	-6.62 ^{***}	-7.59 ^{***}	1.36 ^{NS}
Punjab	5.81 ^{***}	-2.59 ^{***}	-2.64 [*]	2.93 ^{**}

***, ** & * Significant at 0.01, 0.05 and 0.10 per cent level of significance.

NS: Non-significant.

The production of maize registered a fall in all the districts except in Hoshiarpur and Ropar districts during the period 1986/87 to 1995/96. It was interesting to note that production in these districts declined too in comparison to the preceding period. During the period 1995/96 to 2005/06 there was some improvement in the production of maize in Punjab with a significant CGR of 2.93 per cent.

This improvement was the result of significant increase in production of maize in Hoshiarpur (4.85 per cent), Nawan Shahar (4.30 per cent) and Ropar (3.48 per cent). However, the production declined by the rate of 5.60 per cent per annum in Amritsar district during this period which was the result of decline in area under maize crop by 8.67 per cent per annum during the period 1995/96 to 2005/06. In spite of the significant decline in area during this period the production in the state increased due to positive yield effect. The CGR of the average yield of maize was found to be statistically highly significant in almost all the districts under study except in Patiala during the period 1995/96 to 2005/06. The highest CGR for average yield of maize during this period was observed in Hoshiarpur district (4.39 per cent) followed by Ludhiana (4.23 per cent), Nawan Shahar (4.19 per cent), Ropar (4.07 per cent), Gurdaspur (3.85 per cent), Jalandhar (3.77 per cent), Kapurthala (3.50 per cent) and Amritsar (2.99 per cent) district. At the state level it was also found positively significant (4.02 per cent). The introduction as well as the adoption of improved cultivars was responsible in this increase in productivity of maize in Punjab.

Decomposition of Maize Production into Area, Yield and Interaction Effects in Punjab

The decomposition of maize production is presented in Table 6. The results clearly show that the area remained a major contributor to the increased production of maize in the period 1950/51 to 1965/66 in all the maize growing districts except Hoshiarpur in Punjab. The yield effect also contributed in increasing production in all the districts except the Kapurthala district during the above said period. An interaction effect in this district was also found to be negative (-13.8 per cent). In spite of the negative yield and interaction effects the positive area effect played a major role in increasing the production in the case of Kapurthala district.

The results pertaining to the decomposition of maize production for the period 1966/67 to 1985/86 indicate that the yield remained a major contributor to the increased production in all the major maize growing districts of Punjab except Ludhiana.

Table 6: Decomposition of maize production in Punjab, 1950/51 to 2005/06

Districts	Area Effect	Yield Effect	Interaction Effect	Increase (+)/ Decline (-)
1950/51-1965/66				
Gurdaspur	43.50	43.00	13.50	+
Amritsar	71.60	19.50	8.90	+
Kapurthala	131.40	-17.70	-13.80	+
Jalandhar	58.50	21.60	20.00	+
Nawan Shahar	NA	NA	NA	NA
Hoshiarpur	4.00	90.80	5.20	+
Ropar	NA	NA	NA	NA
Ludhiana	35.50	31.50	33.00	+
Patiala	12.60	81.20	6.30	+
1966/67-1985/86				
Gurdaspur	-182.00	399.10	-117.20	+
Amritsar	-157.10	158.50	-101.40	-
Kapurthala	-278.70	365.40	-186.70	-
Jalandhar	-5.40	106.10	-0.70	+
Nawan Shahar	NA	NA	NA	NA
Hoshiarpur	70.40	25.20	4.40	+
Ropar	42.50	46.00	11.60	+
Ludhiana	-89.30	-20.40	9.70	-
Patiala	-127.50	73.00	-45.40	-
1986/87-1995/96				
Gurdaspur	-67.84	-44.32	12.15	-
Amritsar	-109.96	14.27	-4.31	-
Kapurthala	-193.49	111.00	-17.53	-
Jalandhar	-112.97	27.21	-14.25	-
Nawan Shahar	NA	NA	NA	NA
Hoshiarpur	-253.74	165.5	-11.77	-
Ropar	-71.09	-38.42	9.52	-
Ludhiana	-100.75	4.58	-3.82	-
Patiala	-87.26	-23.26	10.52	-
1995/96-2005/06				
Gurdaspur	-35.06	151.94	-16.88	+
Amritsar	-114.84	37.10	-22.26	-
Kapurthala	-225.08	200.10	-75.05	-
Jalandhar	-144.19	89.49	45.30	-
Nawan Shahar	4.16	94.10	1.74	+
Hoshiarpur	-43.79	163.70	-19.91	+
Ropar	-32.61	148.96	-16.35	+
Ludhiana	NA	NA	NA	No Change
Patiala	-222.60	216.90	-94.31	-

It was found that in the case of Hoshiarpur and Ropar districts an area effect, yield effect and interaction effect were contributing positively towards increased production. In the remaining districts the strong negative effect of the area and interaction of area and yield nullified the positive effect of the yield on production. In Jalandhar district the strong positive yield effect nullified the negative effects of area and interaction on the production during the TE 1986/87 over TE 1966/67. The study of the production profile of maize for the period 1966/67 to 1986 revealed that maize production happened to increase in four selected districts namely Gurdaspur, Jalandhar, Hoshiarpur and Ropar. In the case of Gurdaspur and Jalandhar districts, the yield effect was quite strong as to offset the negative area effect and bring about an increase in production. The districts where the production has been found to decline are Amritsar, Ludhiana and Patiala. The analysis of maize production data corresponding to the period 1986/87 to 1995/96 revealed that in all the districts the production has fallen down. This fall in production could well be attributed to considerably negative area effect, which outweighed the positive yield effect in the case of Amritsar, Kapurthala, Jalandhar, Hoshiarpur and Ludhiana district. The reason behind decline in area under maize was that the farmers put more area under paddy due to its better support price improvement in irrigation facilities and better high yielding varieties as compared to maize.

However, in Gurdaspur, Ropar and Patiala districts both area and yield effects were found to be negative which resulted into decline in production during this period. The negative yield effect in these districts was due to the factor that maize was sown on marginal lands on those fields where irrigation facilities were not proper. The results pertaining to the decomposition of maize production for the period 1995/96 to 2005/06 indicate that the yield remained a major contributor to the increase in production in Nawan Shahar, Hoshiarpur, Ropar and Gurdaspur districts of Punjab. It was found that in the case of Nawan Shahar district an area effect, yield effect and interaction effect were contributing positively towards increased production. In the remaining districts the strong negative effects of the area and interaction of area and yield nullified the positive effect of the yield on production. In Gurdaspur district the strong positive yield effect nullified the negative effects of area and interaction on the production during the period TE 2005/06 over 1995/96.

The above discussion clearly shows that yield of maize improved in the state over time but its benefits could not be sustained due to continuous fall in the area under

Table 7: Acreage response of maize in the major maize growing districts of Punjab, 1967/68 to 2005/06

Variables	Districts								
	Gurdaspur	Amritsar	Kapurthala	Jalandhar	Nawan Shahar	Hoshiarpur	Ropar	Ludhiana	Patiala
Intercept	4.0651** (1.673053)	-1.8178 ^{NS} (2.387113)	0.3650 ^{NS} (1.89415)	-0.2186 ^{NS} (1.73912)	6.4641** (0.971098)	1.4956 ^{NS} (0.978889)	3.8314*** (1.14014)	-2.7997 ^{NS} (1.673961)	2.1629 ^{NS} (1.748763)
Lagged maize acreage (A_{t-1})	0.6228*** (0.137853)	0.5674*** (0.175838)	0.4427 ^{NS} (0.280433)	0.6244*** (0.16509)	0.0897 ^{NS} (0.236715)	0.5466*** (0.166517)	0.1858 ^{NS} (0.16490)	0.4458*** (0.121951)	0.7026*** (0.097042)
Lagged average yield of maize (Y_{t-1})	-0.4204** (0.168608)	0.2518 ^{NS} (0.303316)	-0.0248 ^{NS} (0.227529)	-0.0024 ^{NS} (0.211211)	-0.4897** (0.086056)	0.0395 ^{NS} (0.080605)	-0.1909* (0.106022)	0.2749 ^{NS} (0.201385)	-0.2674 ^{NS} (0.221302)
Lagged relative yield of maize w.r.t. Rice (RY_{t-1})	0.3959** (0.151242)	0.0017 ^{NS} (0.255944)	0.2385 ^{NS} (0.222487)	-0.3375** (0.159572)	0.5258** (0.082844)	0.0402 ^{NS} (0.090633)	0.0575 ^{NS} (0.076625)	0.2733* (0.150202)	0.1580 ^{NS} (0.153735)
Lagged relative farm harvest price of maize w.r.t. Rice (RHP_{t-1})	-0.0680 ^{NS} (0.093728)	0.0456 ^{NS} (0.183953)	-0.0191 ^{NS} (0.164813)	-0.0982** (0.123241)	0.0106 ^{NS} (0.017806)	-0.0090 ^{NS} (0.059486)	-0.0580 ^{NS} (0.091602)	-0.1469 ^{NS} (0.14476)	-0.1285 ^{NS} (0.099788)
Lagged net irrigated area of the district (NIA_{t-1})	-0.0002 ^{NS} (0.031104)	-0.4371** (0.204784)	-0.5461 ^{NS} (0.332742)	-0.4686** (0.173064)	-0.0989** (0.019775)	-0.0287 ^{NS} (0.02277)	-0.1051** (0.047275)	-0.6077*** (0.129815)	-0.2339** (0.098741)
Average of two months' (May- June) rainfall (R_t)	0.0525 ^{NS} (0.037245)	0.0211 ^{NS} (0.066892)	-0.0117 ^{NS} (0.022886)	0.0013 ^{NS} (0.041069)	-0.0301** (0.006413)	0.0296 ^{NS} (0.024448)	0.0709 ^{NS} (0.040158)	0.0837 ^{NS} (0.050635)	0.0293 ^{NS} (0.039925)
Relative yield risk of maize w.r.t. Rice of the district (RYR)	0.0073 ^{NS} (0.038469)	0.1020 ^{NS} (0.071814)	0.0297 ^{NS} (0.071385)	0.0019 ^{NS} (0.075908)	-0.0146 ^{NS} (0.015512)	-0.0091 ^{NS} (0.041026)	0.0971 ^{NS} (0.056283)	-0.100 ^{NS} (0.06458)	-0.0452 ^{NS} (0.039255)
Relative price risk of maize w.r.t. Rice of the district (RPR)	-0.0546 ^{NS} (0.045916)	-0.0400 ^{NS} (0.099099)	0.0011 ^{NS} (0.095957)	-6.1E-5 ^{NS} (0.075142)	0.0018 ^{NS} (0.024683)	-0.0604* (0.034039)	-0.0821* (0.048275)	-0.0135 ^{NS} (0.084169)	0.0269 ^{NS} (0.05948)
R ²	0.90	0.93	0.90	0.95	0.98	0.58	0.59	0.99	0.98

Figures in the parentheses are standard errors.

***, ** & * Significant at 0.01, 0.05 and 0.10 per cent level.

NS: Non-significant.

maize cultivation especially during the post Green Revolution period.

leads to less than one per cent increase in area allocated to maize crop in the current year in all the sample districts.

Acreage Response of Maize in Punjab

The results corresponding to acreage response of maize presented in Table 7 show that the lagged maize area has significant positive effect on the allocation of area to maize crop during the current year in most of the major maize growing districts of Punjab except Ropar, Kapurthala and Nawan Shahar. The results reveal that with one per cent increase in previous year's acreage

The coefficients of lagged maize acreage came out to be 0.7026, 0.6244, 0.5466, 0.5674, 0.6228 and 0.4458 per cent for Patiala, Jalandhar, Hoshiarpur, Amritsar, Gurdaspur and Ludhiana respectively. The results further reveal that lagged relative yield of maize with respect to rice has a significant positive effect on the allocation of area to maize crop in Gurdaspur, Jalandhar, Nawan Shahar and Ludhiana districts in which the area

under maize increased by 0.3959, 0.3375, 0.5258 and 0.2733 per cent with one per cent increase in the relative yield of maize with respect to rice in the above said districts respectively. The relative farm harvest price of maize with respect to rice does not have any effect on allocation of area in the favour of maize in all the districts except in Jalandhar district where its coefficient worked out to be 0.0982 per cent. It was interesting to note that with one per cent increase in net irrigated area the allocation of area to maize decreased by 0.4371, 0.4686, 0.0989, 0.1051, 0.6077 and 0.2339 per cent in Amritsar, Jalandhar, Nawan Shahar, Ropar, Ludhiana and Patiala district respectively. This shows that with improvement in the irrigation facilities area from maize is squeezed out in the favour of rice crop. The rainfall has not been found to have any significant effect on maize acreage in all the districts except in the case of Nawan Shahar district where its statistical significant negative effect was found. The results further reveal that relative yield risk of maize with respect to rice has no effect on the allocation of area to maize in all the major maize growing districts of Punjab. The relative price risk of maize with respect to rice affected the maize acreage negatively in Hoshiarpur and Ropar district at 10 per cent level of significance. It means that the one per cent variation in the relative price of maize with respect to rice resulted into 0.06 and 0.08 per cent decline in area under maize in the current year.

On the whole, all selected variables together explained more than 90 per cent of the variation in maize acreage in all the selected districts except Hoshiarpur and Ropar districts.

Conclusions

It was found that there was a major shift of maize areas to rice in all the maize growing districts due to higher profitability of rice as compared to maize in Punjab. There was continuous upward surge in the yield of maize, which seems to be the result of all effort put in for the development of improved and hybrid varieties of maize in the state. Decline in production can be attributed to a continuous decline in area under maize in spite of the increase in its productivity during the study period. The decomposition analysis of maize production shows that yield contributed positively but its benefits could not be sustained due to continuous downward change in maize acreage especially during the *post-Green Revolution period*. The decomposition results were found to be in conformity with the results of growth analysis in the state, which shows that yield has been a major contributor to

the increased maize production. The variability in the maize production at the state level has increased marginally, which could be attributed to the increased variability in its productivity over a period of time. The large maize acreage has positive and significant effect on the allocation of area to maize during the current year. A increase in the net irrigated area has negative and significant effect on the allocation of area to maize in Gurdaspur, Kapurthala and Amritsar districts. This shows that with the improvement in the irrigation facilities, the farmers were inclined to rice cultivation instead of maize. The assured market for paddy, which in turn ensures better returns from paddy cultivation under present price policy, has helped to squeeze out area from maize in the favour of paddy crop in Punjab, in spite of higher input requirements of paddy crop as compared to maize crop. The agriculture production system in fragile regions like Punjab, where groundwater is depleting very fast, needs to be diversified in favour of less water-requiring crops. The policy environment conducive to promote the cultivation of such crops. The promotion of contract farming, price incentive to grow less water-requiring crops particularly maize, increased public investments in related infrastructures are a few examples.

References

- Anonymous. 2003. Technological change and production performance in irrigated maize-based agro-ecosystem; the interplay of economic, technological and institutional factors. Research Report 2004-01, Division of Agricultural Economics, IARI, New Delhi 1-11.
- Chahal, S.S. and P. Kataria. (2003), "Maize cultivation in Punjab: Interplay of economic, technological and institutional factors. Research Report" (Mimeo). Department of Economics, Punjab Agricultural University, Ludhiana. November, 2003: 1-58.
- Government of Punjab. Statistical Abstracts of Punjab (Various issues).
- Kumar, P. and Mruthyunjaya. (1992), "Measurement and analysis of total factor productivity growth in wheat". *Ind. Jn. of Agri. Econ.* 47 (3): 451-458.
- Kumar, R. and N.P. Singh. (2003), "Maize production in India: grain in transition", Technical Bulletin, TB-ICN: 4/2003, National Project, Division of Agricultural Economics. IARI, New Delhi 1-162.
- Paroda, R.S., and P. Kumar. (2000), "Food production and demand in South Asia". *Agricultural Economics Research Review* (1):1-25.
- Puri, R. (2001), "Apathy of Indian maize industry". Culled from www.commodityindia.com. 1: 27-28.
- Singh, P. and A. Singh. (1999), "Dynamics of intra-sectoral changes in agriculture: A case study of Punjab and Bihar". *Bihar Jn. of Agri. Mktg.* 7 (1): 1-11.

Farmers' Participation in Futures Trading: Problems and Prospects

S R Asokan & Anita Arya

The main objective of this paper is to understand the mechanics involved in futures trading and explore whether an Indian farmer can really participate in the futures trading to manage the price risk.

S R Asokan is Assistant Professor, Institute of Rural Management, Anand, Gujarat; and Anita Arya is Assistant Professor, Sardar Patel Institute of Economic and Social Research, Thaltej, Ahmedabad, Gujarat

Risk and uncertainty are integral to the production environment of agriculture because the quality and the quantity of output that results from a given set of inputs are generally not known. Since agriculture is prone to events beyond the control of the farmers, such as weather, insects and disease, the production or yield risk is high. Price uncertainty is also a normal feature of farming. Agricultural operations are biological in nature hence, there is a considerable time lag between sowing and harvest. However, production decisions have to be made well in advance of realizing the final product. Market prices are not known at the time that these decisions have to be made. The consequence of incorrect anticipation can be potentially ruinous to the farmer.

Some risk management strategies such as crop diversification reduce the risk within the farm's operation. Crop insurance scheme is one way to protect against production losses. Contract farming offers an opportunity for the farmers to transfer the market risk or price risk to the buyer. Risk management is not a matter of minimizing risk but of determining how much risk a farmer can take given the alternatives and preferable tradeoffs (Harwood et al 1999). The Minimum Support Price (MSP) programme by the government is one of the ways by which Indian farmers are protected against market volatility. However, the price support programme is only available for major crops and not all crops are covered. Further, under the scheme it is difficult to balance consumer and producer interest (Ramasamy et al 2003).

Futures trading is another way through which farmers can have insulation against price volatility. It is an institutional mechanism to trade risk. In India, futures trading was thriving in many commodities till the 1960s before the government imposed a ban. In recent times futures trading has been revived and a large number of agricultural commodities such as basmati rice, *chana*, pepper, castor seed, cotton, *jeera*, maize, mustard,

sesame, turmeric, potato, rubber, etc., besides several edible oils, are traded. There are three national exchanges and several regional exchanges which are active in futures trading. A primary use of future contract involves shifting risk, say, from a farmer who desires less risk (the hedger), to a party who is willing to accept the risk in exchange for an expected profit.

Future Contract

A future contract is an agreement priced and entered on an exchange to trade at a specified future time a commodity or other asset with specified attributes (Harwood et al 1999). To make trading possible the exchange specifies certain standardized features, including the quantity to be delivered, delivery month, delivery location, acceptable quality or grades of the commodity. It is important that future contracts are standardized because it enables the traders to focus on one variable, namely price. Standardization makes it possible for traders anywhere to trade in these markets and to know exactly what they are trading.

There are a number of ways future contracts can be used in marketing agricultural commodities. Future contracts can be a temporary substitute for an intended transaction in the cash market that will occur at a later date. This is called hedging. Hedging is buying and selling futures contracts as a protection against unfavourable price changes. A short or selling hedge is used when the farmer plans to sell a commodity at some future date. The farmer is concerned that the price may fall at that time in the spot market. A long or buying hedge is used when the farmer plans to buy a commodity at a future date as he expects the price might increase at that date in the spot market.

Futures Trading

We will try to understand the mechanics of hedging by an example of a hypothetical farmer in Punjab growing potato and trading it on the Multi Commodity Exchange of India (MCX) platform. This example is based on the CFTC's material, "The Economic Purpose of Future Market" for wheat and suitably modified to understand the trading in the MCX. The contract specification of MCX for the potato future is given in Appendix I. The farmer can sell a potato future contract on the MCX platform for delivery of a standard quality and quantity of potatoes in the month they would be sent to the market. If the crop is sown in October the farmer can sell them for a price that would be prevailing at the time of harvest i.e. in the month of February. If after having sold a future contract potato prices fall on the physical market below

the level at which he sold on the future, he can either deliver the potato against his contract or because the contract is standardized close out his position by buying out an equal number of futures contracts. The price of the futures contract might have fallen as the physical price declines to reflect the value of potatoes delivered to the market. The difference between the price at which he sold and the price at which he purchased is the benefit the farmer got by trading in the future.

Suppose our farmer in Punjab plants five acres of potatoes in October with an expected production of 300 metric tonnes. At the time the February price of potatoes the farmer guesses would be say, Rs 350 per quintal. The farmer feels that he can earn a reasonable profit at that price. Since farmers have no control over price, by sowing potatoes the farmer is essentially betting that the price of potatoes will not decrease between the planting and harvest time. He can hedge this bet by selling in the futures at the current futures price quoted which is Rs 350 per quintal. Since the contract specification at MCX is for 30 MT and the farmer expected a production of 300 MT from his five acres, he would sell one future contract

The initial margin for a hedger and the maintenance margin on the contract are 6 per cent per contract (see Appendix I). The farmer would need to deposit at least Rs 6300 with a clearing organization to cover the margin for the contract sold (i.e., 6% of Rs 350 × 300 quintals). Every day the contract would be marked to the market. That is, if the market moves in the farmer's favour (if prices decline) on a particular day the farmer's margin account would be credited with the accrued profit of that day. On the other hand, if the future price rises the margin would be debited with the accrued losses. In case at any time the margin account falls below Rs 6300 the farmer would be required to deposit an additional amount to bring back the account to Rs 6300. This process goes on, let us say, till the crop is harvested. The farmer sold 30 MT he expected and the crop in general had been good, as it is a normal year (that is, other potato farmers also got good yield), hence the price had declined to Rs 300 per quintal. The farmer has 30 MT of potatoes with him and he has sold 30 MT at the futures market. Now the farmer can unwind his position in two ways. One is to make delivery as per the terms of the contract. In this case delivery location is the cold storages in Agra. This means the farmer has to incur transportation cost from his village in Punjab to Agra. This would be prohibitively costly.

However, most of the futures contracts are liquidated by squaring off the position rather than delivery, as the mechanism to deliver may be inconvenient to the farmer.

The farmer in our example can take an equal and opposite position in the futures market by buying one contract at the current price of Rs 300 per quintal. The farmer's margin account increased by Rs 15,000 (Rs 50 per quintal x 300 quintal or 30 MT). The futures trade has given the farmer a profit of Rs 50 per quintal. The farmer can sell the potato he has harvested at the nearby mandi at the spot price of Rs 300 per quintal. Considering that the farmer had received Rs 350 per quintal in the futures market even though he sold the potato for Rs 300 per quintal in the spot market, he had effectively received Rs 350 per quintal for his crop. The hedge in this instance was successful.

On the other hand, if the price of potato rises to Rs 400 per quintal the farmer will lose Rs 50 per quintal on the future but will be able to sell the potato at Rs 400 per quintal in the spot market. Thus the effective price he receives would be Rs 350 per quintal. This does not mean the hedge was not successful. Sometimes the price goes up and sometimes down with hedging, however, the farmer will be at least aware of his returns despite the volatility of price (Table 1).

Table 1: Mechanics of hedging

Activities of the Commodity	Futures Transactions
Sowing of 5 acres of Potato in October expecting a reasonable price of Rs 350 per quintal	Buy in October a futures contract of potato for delivery at the rate of Rs 350 per quintal
January end, harvest the potato get 30 MT from 5 acres	No change in the position
In February sell the Potato at the spot market in the nearby mandi for Rs 300 per quintal	On February buy one contract of potato for Rs 300 per quintal
Spot market loss of Rs 50 per quintal for 30 MT Rs 15,000	Future market gain Rs 50 per quintal for 30 MT Rs 15,000

Farmers and Futures Trading

Theoretically it is possible, as described above, for the farmer to hedge against price risk using futures contract. However, farmers' participation in futures market even in advanced economies is low (Turvey and Baker 1990; Collins 1997). This is mainly because of "lack of know how, lack of collateral for margins, small scale of operations and too cumbersome to execute, monitor and administer hedging transactions by small producers" (Larson et al 1998). It is unrealistic to expect that farmers in India are going to use futures as a tool of risk management (Kabra 2007). Let us examine the factors that hinder the farmers in participating in the futures trading.

Membership Fee

To participate in futures trading it is necessary that one becomes the member of the commodity exchange or trade through members. The cost to become a member is very very high (Table 2). The admission fee alone in MCX is Rs 5 lakhs and 10 lakhs for the two categories of members, whereas it is Rs 15 and 25 lakhs in NCDEX. Besides, there is the annual fee, maintenance charges, VSAT cost, etc. Therefore, farmers had to go through the firms or individuals who are already members to take part in the trade. This involves commission to be paid to the firm. The larger the traded volume the commission would be proportionately lower but in case of the farmer who is not a speculator the trading volume would be low dictated by his land size and expected yield. Therefore, the cost would be high for him.

Marked to Market Margin:

Commodity exchanges require its members to deposit and maintain in their accounts a certain minimum amount of funds for each open position held. These funds are known as margin and represent a good faith deposit that strives to provide protection against losses in the market. The clearing house collects margins directly from the members of the exchange, who in turn, are responsible for the collection of funds from their clients. Therefore, the farmer had to maintain a deposit of the amount as specified in the contract with his firm for each of his position. As the margin is marked to the market, that is, daily fluctuation in the price is calculated and adjusted to the account, the farmer had to deposit additional money whenever such a situation arises.

Technology

The commodity is traded online so there are a large number of buyers and sellers (sort of perfect competition) and no individual influences the price. This helps in correct price discovery—one of the major roles of the commodity exchanges. For the farmer to track the prices and take part in trading he must not only have some preliminary understanding of computers and internet, but also have access to them nearby his village. No need to emphasise the point on computer literacy and rural connectivity to highlight the handicap farmers faced to really participate in trading in futures market.

Lot Size and Delivery

The exchange specifies the lot size for each contract for different commodities (Table 3). If the farmer is not delivering the commodity at the end of the contract period but decides to square off the position as the potato farmer

Table 2: Membership fee in the two major commodity exchanges (amount in rupees)

Details	MCX*		NCDEX	
	Trading-cum-clearing member (deposit based)	Institution clearing member	Trading-cum-clearing member	Professional clearing membership
Admission Fee	5,00,000	10,00,000	15,00,000	25,00,000
Interest Free Security Deposit	50,00,000	50,00,000	15,00,000	25,00,000
Processing Fee	10,000	10,000	5,00,000	
Annual Subscription	50,000	50,000	—	1,00,000
Annual insurance fee	5,600	5,600	—	—
VSAT cost	1,65,000	1,65,000	—	—
Advance maintenance charges	—	—	50,000	1,00,000
Net worth requirement	—	—	5,00,00,000	5,00,00,000

* MCX has another category called trading-cum-clearing member (non-deposit based) where the admission fee is 10 lakhs and the security deposit is 15 lakhs

Source: www.mcxindia.com and www.ncdex.com

in our example, lot size may not be an issue for the farmer. Say a potato farmer near Agra takes a futures contract to hedge against the risk and at the end of the contract period he may wish to deliver at the designated cold storage, then lot size is going to be a deterrent for the farmer to participate in the trade. In case crop production is affected due to the vagaries of the weather, pest or disease and is lost, the farmer had to buy the crop and deliver it to the designated cold storage. The contract also specifies the quality of the commodity (see Appendix I) to be delivered. Therefore, it is the responsibility of the farmer to ensure the quality of his crop to meet the specification mentioned in the contract. There are costs involved for assaying the quality which has to be borne by the farmer.

Role for an Aggregator

In order for futures trading to be really used as a risk management tool for the benefit of the farmers it is often suggested to have an aggregator. These aggregators can pool the requirement of the farmers and canalize them in exchange platform. For this the aggregator has to be a neutral player: he should not have any trading interest but earn a fee from such transactions (Ravikumar 2005). It could be a producer's cooperative, an NGO or farmers' association. The key issue in making available hedging instrument to farmers, especially small farmers, would necessarily mean building institutions that will allow retailing of risk management instruments to them (Larson et al 1998). In other words, there needs to be institutional arrangements so a large entity can pool risk from many small farmers and hedge them. The Task Force on

Plantations in its recently submitted report to the Government of India recommended forming of cooperative by small growers to trade in futures (Subramani, 2007). The proposed system would allow the aggregation price risks of these producers.

Constraints for an Aggregator

Though there is role for an aggregator, there may be several constraints that might confront it to effectively pool the requirements of the farmers and manage the risk in the exchange platform. Let us take a scenario of 200 farmers with an average holding of 6 acres coming together to form a cooperative or association to act as an aggregator for the purpose of hedging against price risk. Let us assume the farmers are taking two crops in a year—basmati rice and potato. The production is say 100 tonnes of basmati rice with the yield of 7 quintals per acre and 900 tonnes of potato with a yield of 6 quintals per acre from the 150 acres owned by the farm members. The cooperative must first open a trading account with a firm (brokerage) having a membership in the exchange. As is evident from Table 2 it would be very costly even for a cooperative. The lot size of the future in rice is 10 MT per contract. The cooperative can enter into future for 10 contracts of rice and assuming that the price is Rs 1200 per quintal the value for 100 tonnes is Rs 12,00,000 at 8 per cent initial margin (as per the contract specification of the exchange) the cooperative need to deposit Rs 96,000 with the firm. The expected production of potato from the 150 acres of the members is 900 tonnes. The cooperative can trade in 30 contracts at the rate of 30 MT per contract. Assuming a price of Rs 350 per quintal the 30 contracts value would be

Rs 31,50,000 and the cooperative at six per cent initial margin needs to deposit Rs 1,89,000 with the firm. For the two crops the initial margin worked out to be Rs 2,85,000 and for each farmer it is Rs 11,400. This seems to be a reasonable amount. As the cooperative also need to maintain the marked to market margin farmers must be in a position to pay the additional sum required as and when required.

The cooperative needs to invest in infrastructure facilities such as computer with VSAT connection with UPS power backup to operate in the village. This is technically feasible as demonstrated by the ITC's e-choupal initiative (Annamalai and Rao 2005). However, considering the size of the farm and the volume traded it may not be financially viable for the members to invest on the facility.

Before trading at the beginning of each crop season the members should work out the cost of cultivation and arrive at a consensus on the expected returns to enable the cooperative to lock in on an agreed price in the future. In case the price falls in the spot market member farmers would be happy. The cooperative would buy equal number of contracts to close or square off the position. The accrued differential that is between the spot price and the futures is credited to the cooperatives trading account. The cooperative then distributes the amount in proportion to the land holding and yield. The farmers sell their harvest in the spot market at the declined price but as they got the accrued amount from the cooperative due to the hedging operation they would be getting effectively the original price at which they agreed to lock in. In case the price rises in the spot market and the society by buying squares off the position, now the resultant loss should be paid by the cooperative and the farmers are expected to pay in proportion to their land holding and yield.

Let us take the example of potato we used for the single farmer. If the locked in price is Rs 350 per quintal and the current price is Rs 400, the society by squaring off incurs a loss of Rs 50 per quintal and had to pay the exchange Rs 450,000. The member farmers sell their potato at Rs 400 per quintal and are expected to pay the society Rs 50 per quintal to pay off the exchange. This is difficult to achieve as members may not pay the society. They may understate the yield to pay less to the society and over state the yield if they had to get the accrued benefits of hedging. With the kind of cooperative spirit and few success stories it would not be pragmatic to think cooperatives or farmer's association can successfully play the role of an aggregator for a long period on a sustainable basis.

"Hedgers must have a mind set that says I got what I expected therefore I am satisfied even when they could have done better without hedging or a fellow farmer gets a better price." (Murra N.D.). It would be hard to expect an individual farmer in a cooperative setting to have such a mind set.

In case the cooperative follows the delivery model the quality specification as defined in the contract would be difficult to maintain across the 25 farmers. Further, apportioning the cost of assaying that is quality test among the members in proportion to their land holding or yield would not be easy. The quality specification for potato by MCX can be seen in the appendix. Objectively maintaining quality and rewarding the member had been a major weakness of the producers' cooperatives in India. If the lot is rejected on quality grounds the member may accuse the cooperative of bias. Further, it would be difficult for the cooperative to ensure the lot size if the farmer is not replacing his rejected lot by purchasing from outside or paying the cooperative to make good the shortfall from other sources. A similar situation might arise when there is a crop failure as the member farmer had to arrange for the crop with the quality specification mentioned in the contract to enable the society to fulfill its obligation with the exchange.

Table 3: Lot size for some commodities as specified in the contract of two exchanges

Crops	MCX	NCDEX
Wheat	10	10
Rice	10	10
Tur	10	10
Chana	10	10
Urad	10	10
Soybean	10	10
Groundnut		10
Mustard	10	10
Jeera	3	3
Pepper	1	1
Potato	30	15
Castor	5	10

Source: www.mcxindia.com and www.ncdex.com

To sum up, it is theoretically possible for the farmer to manage price risk through futures trading. However, in practice farmers even in advanced countries are not using futures to hedge against risk. In India apart from lack of technical know how, small size of holdings resulting in high transaction cost dissuade the farmers to trade in

futures. The suggestion to have an aggregator who can pool the requirements of the farmers and trade in the exchange platform, though an attractive proposition, has its own set of constraints. At best futures market may be helpful to farmers indirectly by way of better price discovery rather than for risk management.

References

- Annamalai K and Sachin Rao** (2005) The ITC's E-Choupal Story: Profitable Rural Transformation in C.K. Prahlad The Fortune at the Bottom of the Pyramid, Wharton School Publishing.
- Collins Roberts** (1997), Towards a Positive Economic Theory of Hedging, American Journal of Agricultural Economics, Vol.79 No 2.
- Harwood J., R.Helfner, K.Coble, J Perry and A. Somwaru** (1999) Managing Risk in Farming: Concepts, Research and Analysis Agriculture Economic Report No 774 Economic Research Service USDA.
- Kabra, Kamal Nayan,** (2007) Commodity Futures in India, Economic and Political Weekly, March 31. Vol. XLII No 13.
- Larson D, P Varangis and N Yakubi** (1998) Commodity Risk Management and Development Working Paper 1963, World Bank Washington DC
- Murra G. A** (n.d). Futures Contract-Basic www.cals.artzona.edu/arec/wemc
- Ramasamy Bharat, Shamika Ravi and S.D. Chopra** (2003) Risk Management in Agriculture Discussion Paper 03-08. Indian Statistical Institute Delhi
- Ravikumar P H** (2005) Trading in Dematerialised Warehouse Receipts: Opportunities for Banks and Other Financiers, Financing Agriculture October-December Vol. 37. No.4.
- Subramani** (2007) Allow Small Growers to Hedge Risks in Future Markets Business Line 3rd March.
- Turvey C and T. Baker** (1990), A Farm Level Financial Analysis of Farmers Use of Futures and Options Under Alternative Farm Program, American Journal of Agricultural Economics, Vol. 72. No. 4.
- www/cftc.gov The Economic Purpose of Futures Market

Contract Specification of Potato by the MCX

Symbol	POTATO
Description	POTATOMMY
Contract available for trading	
March	16th August of last year to 15th March of contract year
April	16th September of earlier year to 15th April of contract year
May	16th October of earlier year to 15th May of contract year
June	16th March to 15th June of contract year
July	16th April to 15th July of contract year
August	16th May to 14th August of contract year
September	16th June to 15th September of contract year
October	16th July to 15th October of contract year
Trading	
Trading period	Mondays through Saturdays
Trading session	Monday to Friday: 10.00 a.m. to 5.00 p.m. Saturday: 10.00 a.m. to 2.00 p.m.
Trading unit	30 MT
Settlement/Base Value	Rs. per quintal - Ex-Cold Storage, Agra district excluding mandi tax and other levies.
Lot Size	3797
Tick size (minimum price movement)	10 paise
Buy price limits	4%
Sell price margin	6%
Special Margin	In case of additional volatility, a special margin of such percentage, as deemed fit, will be imposed immediately on both buy and sale side in respect of all outstanding position, which will remain in force for next 2 days, after which the special margin will be relaxed.
Delivery period margin	25% of the open position during the delivery period.
Maximum Allowable Open Position	Client level – 15,000 MT Member level – 45,000 MT or 15% of the market-wide open position, whichever is higher For near month contracts the following limits will apply one month prior to the expiry date: Client level – 1,500 MT Member level – 4,500 MT
Delivery unit	30 MT with a tolerance limit of 5%.
Delivery center(s)	Ex-cold storage, Agra. Delivery can be effected from MCX approved cold storage only.
Quality specification/Deliverable grades	Potato of 3797 variety, with matured and thick skin, stored in cold storage (farm-fresh potatoes not allowed for delivery), free of common scab & Blight, confirming to the following standards.
Minimum size (measured from at one side by way of passing through sieve)	4 cm – 8 cm
Maximum size	If Below 4 cm and above 8 cm exceeds 5%
Maximum length (cuts measuring > 1 cm long and depth ≥ 2 mm wide)	
Maximum weight upto	3% maximum
Minimum weight	Above 3%
Maximum weight per potato	
Maximum weight upto	2% maximum

Rejected	Above 2%
Black scurf (<i>chitri / makhi</i>) on the surface area	
Acceptable up to	4% maximum
Rejected	Above 4%
Rotten and dry potato	
Acceptable up to	2% maximum
Rejected	Above 2%
Damaged skin / Bruised potato	
Acceptable up to	1% maximum
Rejected	Above 1%
Shriveled potato	
Acceptable up to	4% maximum
Rejected	Above 4%
Potato sprouts more than 5 mm	
For March to June	
Acceptable	3% maximum
Rejected	Above 3%
For July onwards	
Acceptable	6% maximum
Rejected	Above 6%
Physical impurity in the form of soil and Stone:	
Basis	0.5%
Acceptable between	0.5% — 2%
Rejected	Above 2%
Frost Bitten Potato (Hyper Cooled)	
Accepted	0.25%
Rejected	Above 0.25%

Source: www.mcxindia.com

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

– Paul J Meyer

Socio-economic Impact Assessment of Promotion and Validation of Cotton IPM Technology in Punjab

Joginder Singh & Harvinder Singh

Validation of Cotton IPM Technology in Punjab was an effort to improve the farm economy in the cotton belt and save water and other environmental degradation. This study was carried out to assess the socio-economic and environmental impact of this technology. It revealed significant improvement in cotton yield, cost reduction by way of timely and relevant information on IPM aspects, minimizing health hazards, better soil health, apart from other positive impacts. This study shows that cotton-based industries should be stakeholders in the R&D process for development of cotton crop.

Joginder Singh is Consultant and Harvinder Singh is Programme Associate at Sir Ratan Tata Trust, Mumbai

The state of Punjab has witnessed spectacular growth in the agricultural sector as a result of increase in cultivated area, increase in cropping intensity and productivity per hectare. The growth in agricultural sector has recently started decelerating. The CGR in average yield of rice and wheat, which was 5.29% and 2.31% during the 1970s, has slowed down to 1.04% and 0.88% during 1991-92 to 2005-06 respectively.

Due to constraints of light soil and brackish underground water in the southwestern districts of the state, it was most suitable for cotton crop in the *kharif* season. It emerged to be the potential cotton belt of the country. Since the mid-nineties, the area under crop has shown rapid fall in yield mainly due to serious attack of insect-pests and diseases. Thus the profit margin from the crop has sandwiched between falling yield and rising cost. Certain blocks shifted over to paddy, which created even more of a problem for revival of the cotton crop. The crop area, hovering from 4.5 to 7.6 lakh hectares in Punjab, is important not only for tackling the economic misery of farmers but also for diversification of state agriculture. The introduction of Bt gene in the cotton strains has given a ray of hope to the revival of the crop. For a number of years, the farmers of this belt have been endeavoring to procure unrecommended and unspecified Bt seed from other states of the country. For the last three years the Bt varieties have been developed and recommended for the area but farmers are still resorting to high plant protection measures. Considering the importance of the crop, the Sir Ratan Tata Project on Promotion and Validation of Cotton IPM Technology in Punjab, was initiated in March 2005 for two years. The Department of Agriculture Punjab as a nodal agency chalked out the plan to supply the farmers with pheromone traps to monitor the pests and spray pumps apart from regular surveillance of pests. Information to the farmers is passed on by

village scouts and directly by agriculture experts in training camps, field days, field visits organized for this purpose, distribution of pamphlets and by conducting meetings at information centers set up for this purpose.

IPM (Integrated Pest Management)

IPM takes a holistic view of agricultural production and tries to minimize the use of chemicals (to minimize the build up of resistance) by exploiting the trade off between chemical inputs and 'natural' inputs through careful monitoring (scouting) of pest population, manual picking of eggs, larvae, encouragement of the natural predator population, thinning of plants and use of plant growth regulators to reduce the pest carrying capacity of the crop, regulating the time of planting and harvesting and a host of other measures (Kishor, Natin M. 1992).

Cotton crop is attacked by a large number of insect pests and diseases which may broadly be categorized as Boll worms, e.g. American Bollworm, Pink Bollworm, Spotted Bollworm; Sucking pests, e.g. Jassid, Thrip, White fly, Mealy bug; Foliage feeding pests e.g. Leaf rollers, Tobacco caterpillar; Soil pests, e.g. Termites and a number of diseases like Leaf curl, root rot, leaf spot, wilt. Various crop management measures such as cultural practices, mechanical methods, frequent monitoring of pests, use of minimum pesticides and timely control are generally recommended. Sex pheromone traps were tried under the project to monitor bollworms and tobacco caterpillars.

It was considered important to carry out the socio-economic impact assessment of the project as de-facto and post-facto analysis. Though it is difficult to exactly capture and quantify the impact of all the factors, the important ones include improvement in income, savings, investment, ecological parameters, educational aspects, etc., on the target group of population and suggest ways to improve its effectiveness in terms of laid down objectives:

1. To highlight the socio-economic characteristics of cotton farming and farmers in Punjab.
2. To bring out the impact of the project on socio-economic and environmental parameters of cotton belt of Punjab.
3. To analyze the improvement in the knowledge of the farmers regarding cotton production and marketing aspects.
4. To study the operational problems of the project and suggest possible improvements.

Methodology

Under the project there were 56 villages selected in Phase I and the same number in Phase II, from 28 blocks of seven cotton growing districts of the Punjab state. From each district, 20% of villages were randomly selected for this study. In other words, 12 villages in each phase were selected. From each village, all the ten farmers adopted under the project were taken. Thus in all, 240 farmer (120 project farmers from Phase I and 120 farmers in Phase II) were taken for this study. Another 20 farmer i.e. ten from each of two villages selected at random out of eight villages adopted under this project by Punjab Agricultural University, were also taken.

To have a clear picture of the impact of the project, comparable sample of non-project farmers was also taken. From the sample of 26 project villages covered, random sample of 16 villages was taken and 10 other farmers, not covered under the project with a similar resource structure, were taken. Another 8 villages not covered under the project were also selected from the neighboring villages. Thus 10 farmers from each of these villages comprised a sample of 240 non-project farmers.

The data concerning resource base, crop pattern inputs and information received under the project are consequently economic, educational and environment benefits derived by the farmers etc. were obtained from personal interviews with the farmers. The Agriculture Development Officers, scouts and other key respondents of the villages were also interviewed for the benefits and constraints of the project and other vital information of the village.

Trend in Cotton Production

Driven mainly by price, average yield and cost production, the area under cotton in Punjab has observed violent fluctuations from 759 thousand hectares in 1988-89 to 450 thousand hectares in 2002-03. As may be viewed from Fig. 1 the cotton area in the state has witnessed some visible kinks, which were used to segregate distinct periods of growth. The past three and a half decade period could thus be divided into four periods:

Period 1: During the period 1970-71 to 1983-84, the area under the crop increased at a CGR of 3.66% although the yield showed a decline at 3.19%. The trend in cotton crop on the whole is guided by American cotton, being the main cultivar of cotton in the state.

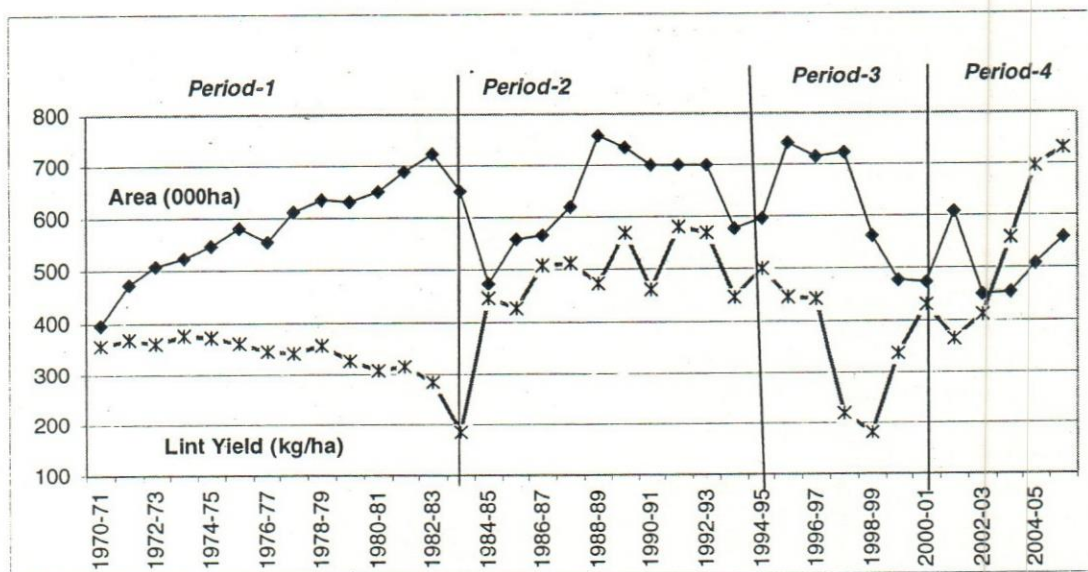


Fig. 1. Area and average yield of cotton in Punjab

Period 2: The growth in area slowed down in the next decade (1984-85 to 1994-95) having approached the saturation level but showed some recovery in yield.

Period 3: Most serious problem of fall in yield and area by CGR of 3.96% and 4.23% respectively resulted in significant annual decline in production of 8.02%.

Period 4: In the new millennium, average yield of the crop has shown startling increase at CGR of 20.55% and consequently area under American cotton has increased while the *desi* cotton area dipped further. This is because *desi* cotton is pushed to the marginal lands as profitability of American cotton improved with the further development of irrigation facilities.

Within the state, the crop is concentrated in only even districts of the state, namely Ferozepur, Faridkot, Muktsar, Moga, Bathinda, Mansa and Sangrur. The block-wise picture indicates that wherever the water is brackish and sweet groundwater could not be explored and soil is sandy, the concentration of cotton is more. Thus only 21 blocks account for 85% of cotton production in Punjab.

Sustainability Issue

Due to serious attack of pests, particularly *Heliothis*, the yield of cotton crop declined in 1993-94 and touched the lowest ebb (180kg/ha) in 1998-99. On the other hand, the cost of plant protection increased resulting in squeez-

ing of profit margins. As an alternative to cotton in areas of less water constraint, the farmers tasted paddy cultivation, which constantly picked up due to its higher and stable yields and price. However, the problems concerning over-exploitation of ground water, deteriorating soil health, increasing pest resistance etc. have raised the sustainability issues of paddy crop as well since the yield is on the decline and cost is escalating. Majority of the farmers have gone in for submersible motors, increasing the cost still further. Recently, the cotton crop has re-entered in the crop pattern of the area due to the introduction of Bt varieties and resource conserving IPM technologies to control pests through proper monitoring and encouraging biological control.

Socio-economic Background of Farmers

Farm Size

An average owned farm size was estimated to be 4.87 hectares in case of project farmers and 3.77 ha in case of non-project farmers and the corresponding operational area was 6.34 ha and 4.59 ha. The leased in area was about one-fourth of the operational holding. In case of farmers covered under the project, the farm size was relatively higher indicating thereby some bias in selection of farmers possibly due to better cooperation expected from such farmers. The average rent came to Rs 33 thousand/ha. The land rent varied from village to village depending upon quality of land, location, availability and quality of water etc. It is interesting to note that average land rent and average return from cotton

Table 1: Source of irrigation

Category	Tubewells with Monobloc motors				Tubewells with Submersible pumps				Diesel operated tubewells				Canal irrigated
	No.	Area	HP	Depth	No.	Area	HP	Depth	No.	Area	HP	Depth	Area
Project farmers	50	1.70 (26.9)	6.4	90	30	0.68 (10.7)	8.7	266	99	3.06 (48.2)	8.8	119	5.02 (79.1)
Non-project farmers													
Non-project villages	33	1.07 (22.1)	6.4	103	35	1.19 (22.6)	10.6	293	53	1.34 (27.7)	8.0	0	3.52 (72.7)
Project villages	41	1.19 (26.7)	7.2	108	23	1.07 (24.0)	10.0	221	76	1.89 (42.4)	9.7	0	4.17 (93.5)
Overall Non-project farmers	38	1.15 (25.1)	6.9	106	27	1.11 (24.2)	10.2	245	68	1.71 (37.2)	9.1	0	3.95 (86.1)

No. Indicates number of tubewells/100 farmers

Area indicates average area in ha covered by the source/farm

Figures in parentheses are percentages of operational holding

HP means average horsepower of the motor

Depth indicates the average depth of bore in feet

were almost matching. The main reason for high land rent is that a significant number of farmers having excess capacity of power and labour, compete for leasing in of land.

Water Resource

The most crucial natural resource of the area is quantity and quality of water. Apart from scarcity of water, the ground water is brackish having high quantity of salts and if applied continuously, can cause the soils saline, rendering them unfit for cultivation. Therefore, canal water is the main source of irrigation. But the canal water is seasonal, inadequate and uncertain to synchronize with the time of requirement. Therefore, it is supplemented by tubewell water, an assured source. Tubewells are operated by electric motors or diesel engines. Electric power for irrigation, being free of cost is cheaper and is thus preferred over diesel. About 50 mono-bloc electric motors per 100 project farmers and 38 per 100 non-project farmers were thus reported, covering about one-fourth of cultivated area (Table 1). Such tubewells were increasingly replaced by the submersible tubewells as the water table in the area is going down at a fast speed and water from deeper aquifer is of better quality. About 35% of electric tubewells with the respondents were submersible and 65% were monobloc. There was frequent shut down of electricity due to short supply, which has led to a need for an alternative source of power i.e. diesel to lift water. The diesel engines are often used to draw water from the bores. There were 99 such diesel engines/100

project farmers and 68 diesel engines/100 non-project respondents. Yet a sizable number of farmers pumped out water with the help of tractors.

Source of Draft Power

Inflating labour bill, increasing seasonality of farm operations, intensive cultivation of land, as a symbol of social status and declining work culture has necessitated fast mechanization of state agriculture. Broadly speaking the ownership of a tractor has a strong correlation with the size of operational holding. Therefore, as many as 78% project farmers had tractors and in case of non-project farmers, as many as 62% respondents owned tractors. The remaining farmers had to depend upon hired tractor power. As per common practice 40 to 50 farmers kept one bullock to carry out lighter operations such as transport of fodder and farmyard manure etc.

Crop Pattern

Obviously, cotton is the major *kharif* crop of the area. On project as well as non-project farms, about 55% of cultivated area was under cotton crop of which only a fraction of the area is under *desi* cotton (Table 2). Paddy, a non-traditional crop of the area, has come to occupy about 30% area. Fodder crops cover about 6% area while the remaining area is shared by a number of other crops such as pulses, oilseeds, maize, sugarcane, guar, fruits and vegetables. During the *rabi* season wheat was the most predominant crop.

Table 2: Cropping pattern and average yield of major *kharif* crops

Category	Percent area under the crops						Average yield q/ha		
	Am. Cotton	Desi cotton	Paddy	Fodders	Pulses and oilseeds	Other kharif crops	Am. Cotton	Desi Cotton	Paddy
Project farmers	53.5	1.1	29.4	6.4	1.3	8.4	23.2	15.9	69.3
Non-project farmers									
Non-project villages	56.2	0.0	30.0	5.9	4.1	3.8	21.0	-	73.2
Project villages	52.8	1.1	28.9	6.3	1.7	9.2	21.9	12.5	64.5
All non-project farmers	54.0	0.7	29.3	6.1	2.6	7.3	21.7	12.5	67.4

Farmers' Perceptions about Crop Shift

The shift in crop pattern from paddy to cotton in the area is a consequence of genetic improvement. The process of change has been hastened by the project through demonstration of IPM technology and providing inputs and timely information about cotton crop.

In case of trade off between paddy and cotton, the farmers mostly favoured cotton crop, stressing upon the following reasons:

1. Income spread due to four pickings rather than in one stroke as in case of paddy helps regulating family expenses and servicing debt repayment.
2. Better spread and regular use of labour on cotton from land preparation to marketing without creating much problem of labour shortage.
3. Female labour, particularly family labour gets utilized properly in picking operation which is labour intensive and farm women supervise the women labour more effectively.
4. Cotton sticks as fuel reduces domestic expenditure when compared with paddy straw, which is burnt by the farmers causing air pollution.
5. Shortage of electricity for irrigation sometimes increases the cost of irrigation for paddy significantly through diesel engines.
6. Tractor use on cotton is less and thus farmers can do away with less machinery lowering indebtedness of farmers.
7. Deep quality water, which is scarce in supply, is available and the more the area that can be put under cotton, the less area is under paddy without creating problem of soil salinity.

The increase in area under cotton has acted as a booster for revival of cotton-based industries that were virtually closed down due to fall in availability of cotton as raw material. Now it is time for such industries to contribute in terms of R&D for the revival and sustainability of cotton crop.

Varietal Shift

In plants genetic make-up (quality of seed) and optimization of gene technology contribute 50 to 60% to yield (Choudhary & Laroia, 2001). Till 2001-02 there were some very specific varieties of cotton adopted by farmers, but recently with the introduction of Bt cotton in Southern states of India, the farmers of Punjab started buying seed from these states ignoring the recommendation of Punjab Agricultural University (PAU) and met with some success. Since 2004-05 PAU had recommended Bt varieties such as RCH134, RCH317, MRC6301 and MRC6304 that are gaining importance. But the problem of high cost of seed has to be cared for. Most of the varieties raised by farmers were unspecified but still RCH134 and MRC6301 are getting popularity among farmers. During a survey, the respondents spelled out a few scores of names of different varieties of cotton.

As much as 39.7% cotton area was under recommended Bt varieties in Punjab, 10% was under hybrids and the remaining 50% came under the non-recommended varieties. Thus in all 96 varieties were reported during the survey (Chahal, 2006).

Extent of Damage to Cotton Crop caused by Pests

Cotton crop accounts for 45% of pesticides and 58% of insecticides used in India. The major culprits are the bollworms and jassid (Choudhary & Laroia, 2001). Farmers were asked about the extent of damage caused by pest and diseases in terms of probability of occurrence of each type of pest and damage caused during the

attack. The analysis indicated that out of the total loss due to pests and diseases, bollworms played the most destructive role, causing damage of about 60 to 70%. About one-fourth of the crop has been the victim of the American bollworm only. Pink bollworm and spotted bollworms were also reported to have caused extensive damage. As reported by farmers, the population of American bollworm has significantly gone down with the introduction of Bt varieties of cotton.

Next in importance of their seriousness were the sucking pests such as jassid, thrip and white fly, together damaging crop to the tune of 25 to 40% in different categories of farmers. In case of non-project farmers the loss caused by such pests was much higher than non-project farmers. The obvious logic was timely control of sucking pests with proper pesticides and recommended doses, particularly the white fly, with the advice of agricultural specialists directly and also through scouts.

Termites as soil pests are reported to have caused some damage by attacking seed and root portion of the plant mainly in rain-fed areas of the belt. Similarly some diseases such as leaf curl, leaf spot etc. were reported on cotton crop, but it was difficult for the farmers to spell out and estimate the extent of damage caused. However, emergence of new pests such as mealy bug, tobacco caterpillar, dusky bug, red cotton bug etc. in some areas has become a cause of worry.

Impact of the Project

Inputs Supplied and Information Shared

The farmers selected under the project were provided some pheromone traps, a spray pump with nozzle and an IPM kit through the department of agriculture, Punjab. The farmers selected by PAU under the same project were not provided with any of these inputs. The pheromone traps were supposed to monitor the pest population rather than to capture the moths of bollworms and tobacco caterpillars. The supply of other inputs also generated more heat than light. The quality of spray pumps were reported to be poor and were not well accepted as they provided for only a section of the village society.

The information centers manned by scouts and displayed with posters was quite educative. Monitoring of pest population by the village scouts, constant interaction with agricultural experts through regular meetings, organizing field days and training workshops had a significant impact on adoption of package of practices, particularly in minimizing the number of sprays on cotton

crop. There is thus strong need to strengthen the information system so that farmers get timely guidance to improve productivity and reduce cost not only of cotton but cotton based crop system as a part of IPM strategy. Therefore, late wheat, gram, *sarson guara*, other pulses and oilseeds, fodder crops may be covered.

Operation-wise Technical Information availed by the Farmers

On different aspects of crop production and marketing, farmers were equipped with technical information (Table 3). Although they were practically well versed with all the operations it was essential to disseminate improvement in technology, particularly new high yielding varieties and associated agronomic practices, timeliness of operations, etc. Evidently, the farmers in the project indicated to have received adequate technical information of pest management, seed varieties, sowing time and nutrient management, less information on seed availability, seed treatment, water management and weed control; and lack of information on picking, grading of produce and practices impacting proper marketing. Another typical feature was that PAU experts provided much more comprehensive information covering seed availability, seed treatment, sowing time, picking, grading and marketing to the farmers as well.

Table 3: Technical information from the farmers under the project
(Percentage of farmers)

Practices	Project farmers	Non-project farmers		
		NPV	PV	Overall
Varieties	86.2	13.8	27.5	22.9
Seed rate	34	6.3	7.5	7.1
Seed treatment	48.9	5	18.1	13.8
Sowing time	68.1	8.8	13.1	11.7
Planting technique	76.6	13.8	14.4	14.2
Nutrient mgt.	82	10	15.6	13.8
Water mgt.	44.8	6.3	7.5	7.1
Weed mgt.	24.1	6.3	4.4	5
Pest mgt.	94.7	13.8	20	17.9
Picking	5	0	1.9	1.3
Grading	7.6	0	0.6	0.4
Marketing	1.9	0	1.3	0.8
Removal of sticks	3.4	0	1.3	0.8

During a meeting, the farmers were apprised of the importance of natural enemies of pests such as spiders, birds, ladybird beetle, frog, wasp, etc. which farmers, in general, were able to spell out such information during interviews. Regarding the name of banned pesticides,

nic cotton, bio-fertilizers response was not that engaging. The technical information percolated to the project farmers of the project villages. But in the case of non-project villages the information was available, except for the villages neighbouring the project villages.

Average Crop Yield

With respect to many of the socio-economic parameters stated above, there seems to be little variation in different categories. The average yield of major crops, particularly cotton across the categories of farmers, provides a strong indication of positive economic impact of the project. The yield of seed plus lint of American cotton, the major crop of the area, averaged out to 23.2q/ha in case of project and non-project respondents respectively. A similar yield gap can be observed in the case of *desi* cotton and paddy crops. Thus a visible yield gap of 1.5q/ha has to be underlined here. Further, a category-wise split up of yield followed. The farmers selected by the Department of Agriculture, Punjab, reported an average yield of 22.5q/ha and those covered by PAU reported an average yield of 26.6q/ha. A higher yield in the case of non-project farmers of project villages over those of non-project village farmers by about one q/ha, further indicates the positive impact of the project.

Economics of Cotton Crop

The total operational costs from American and *desi* cotton in case of project farmers averaged to Rs 24312/ha and Rs 19575/ha respectively. Taking the corresponding average yield of seed cotton as 25q/ha and 17.5q/ha and prevailing market price of Rs 2000/qlt along with value of cotton sticks, the return over operational cost was estimated at Rs 30687/ha and Rs 21425/ha, which can probably be compared with paddy crop. In case of non-project farmers, the return over operational cost from American cotton was estimated to be Rs 24300/ha. In spite of the profitability of the crop is still higher due to gainful employment of family labour rather than use of hired one, and reduction in cost of seed by about Rs 2250/ha by procurement from Gujarat, making commercial alternative use of cotton sticks such as domestic fuel, sale to brick kilns/brick units, ploughing in the field. The cost of Bt seed used in Punjab needs to be lowered and made at least comparable with the one procured from other states. Agencies dealing with seed production should look at this seriously.

Farmers' Perceptions about Impact of Project

When compared with the project, yield improvement and cost reduction in case of cotton crop in the area were

appreciable due to introduction of Bt strains. Specific information was sought from the respondents, such as that in the absence of the project, what could have been the reduction in yield, enhancement of cost and quality deterioration if any, leading to and hence lower price of seed cotton. As a consequence of the IPM project, the yield improved by 1.86q/ha (Table 4). Similarly, the cost reduction averaged to Rs 3662/ha. Thus on an average, the income increased by about Rs 7000 per hectare. The area under cotton on an average farm worked out to be 3.39ha, enhancing the farm income by Rs 25025. The increased income could be used for repayment of old debts, investment in farming and non-farming businesses and raising the consumption expenses. In spite of economic stress suffered by the farmers, they gave a lukewarm response when asked about the possibility of shifting out of the agricultural sector and starting another business. Another impact of the project could be improvement in quality of cotton by IPM. The produce should thus fetch higher price by following recommended practices, particularly less use of pesticides, but currently no such indication was specifically available as the price of cotton was not based on the quality test. Although some improvement in price was reported due to quality, it was just an estimate. The impact of IPM did not remain confined to cotton crop only. Some other crops also showed a good impact, for example paddy yield also improved by about 2q/ha (from 67.4/ha in case of non-project farmers to 69.3q/ha in case of project farmers).

Not only the project farmers, but also non-project farmers of the project villages and the farmers of neighbouring villages gained on both counts of yield improvement of about 33 kg/ha valued at Rs 660/ha and cost reduction by Rs 433/ha, enabling them to enhance the income by Rs 1100/ha or about Rs 3000/farm household.

Table 4: Farmers' perceptions about impact on yield, price and cost of production

Category	Yield improvement (qt/ha)	Price increase (Rs/qt)	Cost reduction (Rs/ha)
A. Project farmers			
Overall	1.78	36.78	3406
B. Non-project farmers			
Non-project villages	0.53	9.25	702
Project villages	0.23	2.30	298
Overall	0.33	4.63	433

Direction of Expenditure pattern

A pertinent question was posed to the respondent farmers, that as a result of enhanced income through change in crop pattern, yield improvement, cost reduction, etc.; what would be the possible direction to prioritize the spending pattern. This is essential to understand the real impact of the project. For example, if the increase in income is to boost only wasteful expenditure, the impact may not be encouraging. The results presented in Table 5 show that repayment of debts (specifically of non-institutional sources) is the topmost priority of 63% farmers. The farm economy of the area is still heavily indebted, although it is on the revival stage after witnessing an economic turmoil which led to a number of farmer suicides.

Next in importance was investment on livestock, reported by 20% respondents. Apart from this, 8% and 4% farmers intended to invest on farm machinery and land respectively. Another significant feature of productive investment was that about 4% farmers wanted to invest in non-farm occupations as they wanted to migrate from agriculture. Perhaps with a similar intention, expenditure on children education was another impressive item as presented under 'consumption' head.

Table 5: Expenditure of increased income by project farmers

Purpose	% Farmers
Repayment of debt	63.2
Investment in	
Livestock	19.8
Machinery	8.2
Purchase of Land	4.2
Non-farm	3.8
Consumption	
Social ceremonies	20.1
Education	43.1
House	12.1
Liquor	0.2
Others	31.3

Due to multiple responses the percentage is more than 100.

As stated above, it is very difficult to significantly cut down on consumption expenses, yet 20% farmers had expenditure on social ceremonies. Similarly, expenditure on construction and repair of houses was to be made by about 12% respondents. There was some expense on

liquor consumption, but information on this seemed to have been somewhat suppressed.

Environmental Parameters

Water is the most precious resource, which is over exploited in the state of Punjab. The cotton belt is no exception to this. The area under cotton is now increasing by replacing paddy crop, due to which water saving is obvious. For example, American cotton uses only 10 irrigations instead of 25 by paddy crop. The farmers have already invested a huge sum of money on installation of submersible pumps and diesel engines for lifting deep water. Thus complete shift from paddy to cotton may not be there, but there was an effort to strike a balance between paddy and cotton crops in the region. The agricultural specialist guided farmers not only in terms of irrigation of cotton, but also in rationalizing water to paddy crop. Thus about 55% farmers were of the view that water saving has taken place (Table 6). However, most of the farmers reported that the water table was falling in the area.

Table 6: Response of farmers about impact of project on environment (percentage of farmers)

Parameter	Positive impact	No impact	Negative impact
Water saving	45.0	55.0	0.0
Soil health	86.6	9.2	3.8
Air pollution	87.4	11.8	0.4
Human health	94.5	4.6	0.8

Majority of farmers (87%) reported that soil health had improved by balanced use of fertilizers; particularly by the spray of urea and super phosphate. Not only was there a change in crop variety, but also on the advice of agricultural experts, there was a decline in the use of pesticides, causing less air pollution, and a reduction in the unnecessary built up in soil and drainage waters, some of which had a positive impact on human health. This information about precautions to be taken while buying and spraying the right type of pesticides at a proper time and according to Economic Threshold Level (ETL), as well as masks and spray nozzles provided in the IPM kits, were found to be useful and acted as safeguards from a human health point of view. As reported by about 87% farmers, it had a positive impact in minimizing air pollution as well. The cases of poisoning due to pesticide use were significantly higher 5 to 6 years ago, but they have now gone down due to less use of pesticides. The educative role of agricultural experts and scouts on handling of poisonous insecticides has further minimized the health hazards. The nozzle with downward spray, more

ring of pest population for ETL-based decision, whether spray or not and constant advice of extension workers are mentioned by the respondents as having a positive impact on human and animal health.

Impact on Resource Employment

The labour use has increased as a result of increased area under cotton. The operations such as weeding, picking and removal and transport of cotton sticks are labour intensive while most of operations in paddy are completely mechanized or have to depend upon migrant labour. Female labour requirement, in particular, has gone up significantly. Only additional production requiring additional picking labour can be attributed to the project. For example, additional payment to female labour by about Rs 400/ha led to higher earnings of labour families, but there was a reduction in labour use on spraying about Rs 200, which did not lead to equality in income distribution. By and large, there was no impact on the use of machinery except less use of spray pumps.

The overall economic prosperity in the region will have positive secondary and tertiary impacts.

Scope of Group Formation

Although a majority of respondents opined that picking up only 10 farmers in the village creates some social cohesion, yet in general they visualized the positive impact of the project. Various suggestions were given to provide wider coverage for such experiments. For example it was suggested that pheromone traps should be widely spread throughout the village to monitor pest attack, spray pumps of better quality should be given and along with cooperatives/farmers' clubs/information centres custom hiring, scouts and information centres should be regular features of the area covering more than the number of existing and potential crops such as gram, mung, wheat, guara, fruit and vegetable cultivation and allied enterprises like dairy, bee-keeping, poultry. Arrangement for supply of seed of good and recommended varieties at reasonable prices should be ensured as a part of IPM.

Summary and Suggestions

Initiated by the Sir Ratan Tata Trust, Mumbai, the project 'Promotion and Validation of Cotton IPM Technology in Punjab' was made operational through the Directorate of Agriculture, Punjab and Punjab Agricultural University, Ludhiana. Secondary data on area, average yield and production of cotton in Punjab were collected which indicated that 21 development blocks from

the six south-western districts having brackish groundwater, cover about 85% of cotton area. The area under cotton in the state has been fluctuating from 4.5 to 7.5 lakh hectares. Paddy has come to occupy a significant part of the total cultivated area during the mid-nineties due to failure of cotton in the belt. In this process, groundwater in some areas was over-exploited through submersible tubewells, posing problem of salinizing the soil and raising serious sustainability issues.

A socio-economic impact analysis was carried out by taking a sample of 260 farmers covered under the project, 160 non-project farmers from villages covered under the project and 80 farmers from non-project villages. The analysis of the primary data showed that an average operational holding was 6.3 ha and 4.6 ha in case of project and non-project farmers respectively, of which about one-fourth is under tenancy with an average annual rent of Rs 33 thousand/ha. Canals irrigated about 80% area and about 87% had electric/diesel operated tubewells as a source of irrigation to supplement canal water with groundwater water. Totally rainfed area was virtually non-existent. About three-fourths of farmers owned tractors. The sample farmers had about 54% area under cotton and 30% under paddy in the kharif season.

Cotton crop was attacked by a variety of serious pests. Notably, bollworms were stated to damage the crop to the tune of 62% while sucking pests accounted for one-third of the total damage due to pests. Introduction of Bt cotton has minimized the damage due to bollworms. IPM strategy has played an important role in lowering the damage further. Monitoring of pests, providing guidance in terms of improved agronomic practices, suggesting suitable pesticides on the basis of ETL of pests, have proved to be educative for the farmers and fruitful for the crop.

An effort was made to quantify the economic impact of the project. It was also brought out that the income of an average farmer increased by about Rs 7000/ha (due to improvement in yield by 1.78q/ha and cost reduction by about Rs 3400/ha). The non-project farmers also reported to have gained by about Rs 1100/ha (due to increase in yield by 0.33q/ha and reduction in cost by Rs 433/ha). Thus on the farm as a whole, project and non-project farmers appeared to have gained Rs 24,000 and Rs 27,000 on these two counts respectively. The increased income was stated to be used for repayment of debts, purchase of livestock and for social ceremonies. The project also had a significant impact on environmental parameters such as human health, encouragement of biodiversity through population of natural enemies of

pests, water saving, improving soil health and checking air pollution. Increase in employment of landless labour for hoeing operation increased, but substitution of labour for less number of sprays was evident. Particularly, the earning of women labour due to picking of cotton improved by about Rs 300/ha.

The problem of indiscriminate use of pesticides, unwarranted sprays, using type and dose of pesticides on the advice of dealers rather than agricultural experts, was reduced. The population of friendly insects like ladybird beetle, wasp, spiders, etc has increased significantly, helping in biological control of pests. Not only was it helpful for the cotton crop, but also for other crops in the area such as wheat, *sarson*, *metha*, vegetables, gram, etc. Beekeeping, which was a remote possibility in the area due to high use of pesticides, started taking place at a number of places. Due to available variety of flora in the area it can be taken up as an important supplementary and complementary enterprise, having direct and indirect effect on income improvement. The serious effect on human and animal health was commonly reported in the cotton belt. The incidents of poisoning while spraying, air pollution, indiscriminate spraying of portions of plants consumable for animals and human beings, has significantly declined.

The population of a large variety of pests such as dusky bug, red cotton bug, tobacco caterpillar, mealy bug, white fly, etc. remained suppressed due to heavy sprays of pesticides like synthetic parathyroid, but now they are emerging as serious pests in certain pockets of cotton belt endangering the sustainability of the cotton crop. This

calls for research and extension systems to be vigilant through regular surveillance of such pests. The cotton based industries should be stakeholders in the R&D process for development of cotton crop.

The concept of village scouts in the project has proved quite cost effective, apart from some of them having developed as entrepreneurs. They have played a pivotal role in the fast dissemination of technology and become effective contact points for any such oncoming dissemination process for rural development. Some of them have developed as entrepreneurs to take up related business activities.

References

- Birthal, P.S.** (2003), "Economic Potential of Biological Substitutes for Agrochemicals", Policy Paper 18, NCAP, New Delhi.
- Choudhary B. & Laroia, G.** (2001), "Technological Development and Cotton Production in India and China", *Current Science*, 80(8)
- Department of Economics, Punjab Agricultural University, Crop prospect surveys of Cotton, Ludhiana, Annual reports.
- Economic & Statistical Organization, Punjab, Various issues, Statistical Abstract of Punjab, Chandigarh.
- Gandhi, V.P.** (2006), "The Adoption and Economics of Bt Cotton in India", W.P.No. 2006-09-04, IIM Ahmedabad.
- Kishor, Natin M.** (1992), 'Pesticide Externalities, Comparative Advantage and Commodity Trade: Cotton in Andhra Pradesh, India'. Policy Research Working Paper, WPS 928, World Bank.
- Ministry of Agriculture, Govt. of India, Comprehensive Scheme of Cost of Cultivation, Various Reports.
- Punjab Agricultural University, Ludhiana Package of Practices for Kharif crops of Punjab, 2006.

Enter every activity without giving mental recognition to the possibility of defeat. Concentrate on your strengths, instead of your weaknesses... on your powers, instead of your problems.

– Paul J Meyer

Globalization vis-à-vis Agrarian Crisis in India

S. Sidhu

farm sector in India started showing a slow-down in post-reform period of the 1990s. Farmer suicides, growing indebtedness and stagnant food production, coupled with declining crop productivity signalled an agrarian crisis. This paper examines the agrarian crisis in the context of globalization of the Indian economy, and discusses whether this crisis was due to globalization or other factors.

Sidhu is Senior Economist (Marketing), Department of Economics and Sociology, Punjab Agricultural University, Ludhiana.

Globalization evokes extreme responses: to some it is a ticket to a brave new world; to others it is nothing short of doom and distortion (Rangarajan, 2007). This is a debate that has frowned on moderation (ibid). Globalization means free cross-border movement of information, goods, services, capital and people. It is more than just about economics. The economic reforms were initiated in India during the year 1991. The present Prime Minister Dr Manmohan Singh was the Finance Minister at that time. The economic policy shift is known as Liberalization, Privatization and Globalization (LPG). Later India also became one of the founder members of the World Trade Organization (WTO).

A debate started in the country in the early 1990s about the impact of globalization on the Indian economy in general and the agriculture sector in particular. The farm sector started showing slow-down in the post-reform period. Now the question arises whether all the problems being faced by the Indian agriculture are on account of globalization or whether some other factors are equally responsible for them. There is no second opinion that the agrarian crisis has deep roots and that it poses a big challenge for the policy planners and agricultural scientists to find a reasonable solution. Farmer suicides, growing indebtedness and stagnant food production, coupled with declining crop productivity signal a farm crisis that can no longer be ignored. Agriculture underpins both the economy and society and there can be no sustainable growth or national well-being unless this regression is reversed (Verghese, 2006). Per capita rural incomes have fallen and the urban-rural gap has widened (ibid).

The average yields of various crops are low across the country. Even agriculturally developed states like Punjab, Haryana and Western Uttar Pradesh are facing the problem of stagnation in both production and productivity. Moreover, growing pressures of population and

Table 1: Export and import of agricultural commodities vis-à-vis total national exports and imports during 1991-92 to 2005-06

(Rs. in cro

Year	Total national exports	Agricultural Exports	% agricultural exports to total national exports	Total national imports	Agricultural imports	% agricultural imports to total national imports
1991-92	44041.81	7838.04	17.80	47850.84	1478.27	3.09
1992-93	53688.26	9040.30	16.84	63374.52	2876.25	4.54
1993-94	69748.85	12586.55	18.05	73101.01	2327.33	3.18
1994-95	82673.40	13222.76	15.99	89970.70	5937.21	6.60
1995-96	106353.35	20397.74	19.18	122678.14	5890.10	4.80
1996-97	118817.32	24161.29	20.33	138919.88	6612.60	4.76
1997-98	130100.64	24832.45	19.09	154176.29	8784.19	5.70
1998-99	139751.77	25510.64	18.25	178331.69	14566.48	8.17
1999-2000	159095.20	25313.66	15.91	215528.53	16066.73	7.45
2000-01	201356.45	28657.37	14.23	228306.64	12086.23	5.29
2001-02	209017.97	29728.61	14.22	245199.72	16256.61	6.63
2002-03	255137.28	34653.94	13.58	297205.87	17608.83	5.92
2003-04	293366.75	37266.52	12.70	359107.66	21972.68	6.12
2004-05	356068.88	39863.31	11.20	481064.11	22057.49	4.59
2005-06	454799.97	49802.92	10.95	630526.77	21025.54	3.33
CGR 1991-92 to 2005-06	16.46	12.35		18.00	20.08	

Note: CGR means compound growth rate in per cent per annum. All CGRs. are from 1991-92 to 2005-06 and all are significant at 1 per cent level.

Source: Govt. of India (2007)

lack of commensurate non-farm employment have reduced the average size of operational holdings from 1.57 hectares in 1990-91 to 1.41 hectares in 1995-96. This further declined to 1.32 hectares in 2000-01. The division of agricultural land among family members over the years resulted in the creation of a large number of small land holdings across the country, in which farming has become unviable due to the low volume of produce (UNI, 2004). In this context, some experts say there is a need to revisit the existing laws and land reform measures to discourage the division of land below the economically viable size of five or eight acres per family (ibid). Without providing alternative avenues of employment and income to marginal and small farmers, it is not a realistic proposition. It may be stated that nearly one lakh farmers and their family members committed suicide between 1998 and 2003 mainly due to economic distress (Patranobis, 2006). The statistics give a glimpse of the crisis that devastated the rural economy. Even in Punjab, 2116 farmers committed suicide during the last 15 years (Nibber, 2004). This figure has been officially admitted by the Punjab Government (ibid). On the other hand, the farmer organizations claimed that 2860 farmers committed sui-

cide from 1990 to 2006 on Mansa, Moga, Bathin Muktsar, Ferozepur, Faridkot, Sangrur and Ludhiana districts of the state (Mohan, 2006). In this paper an attempt has been made to examine the issue of agrar crisis in the context of globalization of the Indian econo

Data Base

The data used in this paper has mainly been taken from reputed published sources. Notable among them are the Agricultural Statistics At A Glance and Economic Survey. The information published in reputed English newspapers has also been used.

Results and Discussion

Globalization vis-à-vis exports and imports of agricultural commodities

The Government of India has inverted its trade policy setting an annual export target of US \$ 300 billion for 2009. The five-year policy announced by the U

Table 2: Share of India's total exports and imports and agricultural exports and imports in gross domestic product at factor cost (At current prices), 1991-92 to 2005-06

(Rs. in crore)

Year	Total GDP at factor cost (Rs crore)	Total Exports	% share of total exports in GDP	Total imports	% share of total imports in GDP	GDP from agriculture and allied (Rs crore)	Exports of agricultural products	% share of exports in GDP from agriculture and allied products	Imports of agricultural products	% share of imports in GDP from agriculture and allied products
1991-92	589086	44041.81	7.48	47850.84	8.12	185712	7838.04	4.22	1478.27	0.80
1992-93	673221	53688.26	7.97	63374.52	9.41	208265	9040.30	4.34	2876.25	1.38
1993-94	781345	69748.85	8.93	73101.01	9.36	241967	12586.55	5.20	2327.33	0.96
1994-95	917058	82673.40	9.02	89970.70	9.81	278773	13222.76	4.74	5937.21	2.13
1995-96	1073271	106353.35	9.91	122678.14	11.43	303102	20397.74	6.73	5890.10	1.94
1996-97	1243546	118817.32	9.55	138919.88	11.17	362605	24161.29	6.66	6612.60	1.82
1997-98	1390148	130100.64	9.36	154176.29	11.09	387008	24832.45	6.42	8784.19	2.27
1998-99	1598127	139751.77	8.74	178331.69	11.16	442494	25510.64	5.77	14566.48	3.29
1999-2000	1761838	159095.20	9.03	215528.53	12.23	446515	25313.66	5.67	16066.73	3.48
2000-01	1902998	201356.45	10.58	228306.64	12.00	449746	28657.37	6.37	12086.23	2.58
2001-02	2090957	209017.97	10.00	245199.72	11.73	487063	29728.61	6.10	16256.61	3.11
2002-03	2249493	255137.28	11.34	297205.87	13.21	472679	34653.94	7.33	17608.83	3.45
2003-04	2523872	293366.75	11.62	359107.66	14.22	533642	37266.52	6.98	21972.68	4.11
2004-05	2855933	356068.88	12.47	481064.11	16.84	536629	39863.31	7.43	22057.49	4.11
2005-06	3250932	454799.97	13.99	630526.77	19.40	595058	49802.92	8.36	21025.54	3.53
CGR	12.58	16.46		18.00		8.13	12.35		20.08	

Source: 1) CMIE (2004), 2) Govt. of India (2007). CGR means compound growth rate in per cent per annum. All CGRs are from 1991-92 to 2005-06 and all are significant at 1 per cent level.

Government focuses on agricultural exports, with an emphasis on generating employment (HT Correspondent, 2004). India's share in the world's exports was 0.5 per cent in 1990 which increased to 0.7 per cent in 2000, 0.86 per cent in 2003 and 0.9 per cent in 2004. The exports of agricultural products from India were more than double the imports of agricultural products during the year 2004-05 and 2005-06. The detailed information in this regard is given in Table 1.

A perusal of Table 1 revealed that agricultural exports were to the extent of about 18 per cent of the total exports from India in 1991-92, which declined to about 11 per cent in the year 2005-06. The agricultural exports have increased in absolute terms from about Rs. 7838 crore in 1991-92 to Rs. 49803 crore in 2005-06. But the rate of growth of agricultural exports was 12.35 per cent per annum as compared to 16.46 per cent per annum for total national exports in the post-reform period.

It may be noted that the percentage share of agricultural imports in the total national imports has increased

from about three per cent in 1991-92 to about eight per cent in 1998-99, but gradually again declined to about three per cent in 2005-06 with variation in other years. The CGR of agricultural imports was high (20.08 per cent per annum) as compared to 18.00 per cent per annum for total national imports during the same period.

Some years ago, the USA's Ambassador to India pointed out that the USA is one of the world's most open economies, and India one of the most closed (ENS Economic Bureau, 2004). While India has a trade surplus of US \$ 857 million with the USA in 2003, it took America six years to increase agricultural exports to India to touch a modest US \$ 309 million in 2003 (ibid). These figures speak for themselves. Hence, we can say without hesitation that India has gained by becoming a member of WTO as far as the international trade is concerned.

Share of Exports and Imports in the GDP

The information regarding share of total exports and imports as well as agricultural exports and imports in the

total GDP and GDP from agriculture and allied respectively is given in Table 2. The share of total exports in the total GDP was 7.48 per cent in the year 1991-92, which increased to 13.99 per cent in 2005-06. Similarly, the share of total imports in the GDP increased from 8.12 per cent to 19.40 per cent in the same period. Thus, the share of international trade which was about 16 per cent in the total GDP in 1991-92, increased to about 33 per cent in 2005-06.

A perusal of the data in Table 2 showed that the share of agricultural exports in the GDP from agriculture and allied products was to the extent of 4.22 per cent in the year 1991-92 which increased to 8.36 per cent in 2005-06. Similarly, the share of agricultural imports in the GDP from agriculture and allied products increased from only 0.80 per cent to 3.53 per cent in the corresponding period. It is interesting to note that rates of growth of national exports and exports of agricultural and allied products were higher as compared to the growth rate of overall GDP and GDP from agriculture and allied products, respectively in the post-reforms period. A similar trend was observed in case of imports. On account of liberalization, privatization and globalization of the Indian economy, the growth rate of GDP (at factor cost at 1993-94 prices) has increased in the post-reform period. The growth rate of GDP was 1.3 per cent in the year 1991-92 which increased to 9.2 per cent in 2006-07 (Tata Services Ltd, 2007). There is overwhelming evidence in favour of the export-led hypothesis if one looks at cross-section studies alone. The results of studies by Michaely (1977), Heller and Porter (1978), Balassa (1978), Ram (1985, 1986) and Feder (1983) support the view that export growth promotes overall economic growth. The post-reform experience of the Indian economy also supported the viewpoint of these studies (Sidhu, Singh et. al., 2005).

Impact of India's Trade on Global Prices of Rice and Wheat

The international food grain market is quite thin and is oligopolistic in nature. Entry of a big player like India can affect world prices (Bhattacharyya and Pal, 2000). This is particularly true for products where India has a large market share. A study in this regard (Parikh, 1998) based on simulation of the Basic Linked System (BLS) has estimated the impact of changes in world prices due to India's entry in these markets for rice and wheat (Table 3). As a consequence of India's entry in both export and import markets of rice and wheat, the prices will change substantially. Moreover, the change, both in the export and import scenario is going to affect India adversely (ibid). The above scenario is mainly for non-basmati rice. Regarding the export of basmati rice, our position is com-

paratively better because there are only two main exporters, i.e. India and Pakistan in the world.

Table 3: Percentage change in world price due to India's trade in rice and wheat

Quantity traded (Million tonnes)	Rice		Wheat	
	Imports	Exports	Imports	Exports
0.5	4.02	-3.69	0.57	-0.57
1.0	8.18	-7.11	1.56	-1.14
1.5	12.47	-10.26	2.27	-1.70
2.0	18.31	-11.87	2.98	-2.27
2.5	24.01	-12.94	3.55	-2.70
3.0	32.46	-14.42	4.26	-3.27
3.5	40.24	-16.16	4.97	-3.84
4.0	51.84	-17.64	5.68	-4.40
4.5	59.96	-19.05	6.53	-4.63
5.0	72.10	-20.52	7.24	-5.40

Source: Parikh (1998)

Imports of Foodgrain: A necessity or Luxury

Market access is one of the pillars of the Agreement on Agriculture (AOA) under the WTO regime. There has been a lot of debate on this single issue during the last 13 to 14 years. The experience of the post-WTO period indicated that India had been a net exporter of cereals. The data given in Table 4 clearly shows that except during the year 1993 and 1994, India has been a net importer of cereals. There is no doubt that we are importing about two million tonnes of pulses annually but it is a necessity for the country. It may be stated here that production of pulses in India was about 13 million tonnes in 1985-86. It is almost at the same level even after two decades but our population has increased by more than 35 crore during this period i.e. between 1985 and 2005. The per capita availability of pulses was about 42 grams per capita per day in 1991, which declined to 31.5 grams in 2005. Therefore, the import of pulses by India is not a luxury but a necessity. Similarly, the availability of foodgrain which was 510 grams per capita per day in 1991, had declined to about 422 grams in 2005. Due to the import of 55 lakh tonnes of wheat in 2006-07 and about 13 lakh tonnes in 2007-08, there is a lot of criticism of the Union Government by the vested interests. But critics of this decision of the import of wheat forget that wheat production had declined from 76.37 million tonnes in 1999-2000 to 69.35 million tonnes in 2005-06. Similarly, the actual buffer stock of wheat was 6.2 million

ble 4: Net availability of cereals and pulses in India, 1991 to 2005

Year (1)	Population (million) (2)	Cereals				Net avail- ability (million tonnes) (7)	Pulses Net avail- ability (million tonnes) (8)	Per capita net availability per day (grams)		
		Net production (million tonnes) (3)	Net imports (million tonnes) (4)	Change on Govt Stocks (million tonnes) (5)	Net avail- ability (million tonnes) (6 = 3+4+5)			Cereals (8)	Pulses (9)	Total (10)
1991	851.7	141.9	(-) 0.6	(-) 4.4	145.7	12.9	468.5	41.6	510.1	
1992	867.8	136.8	(-) 0.7	(-) 1.6	137.7	10.9	434.5	34.3	468.8	
1993	883.9	145.8	(+) 2.6	(+) 10.3	138.1	11.7	427.9	36.2	464.1	
1994	899.9	149.6	(+) 0.5	(+) 7.5	142.6	12.2	434.0	37.2	471.2	
1995	922.0	155.3	(-) 3.0	(-) 1.7	154.0	12.7	457.6	37.8	495.4	
1996	941.6	147.1	(-) 3.5	(-) 8.5	152.1	11.3	442.5	32.7	475.2	
1997	959.8	162.0	(-) 0.6	(-) 1.8	163.2	13.0	466.0	37.1	503.1	
1998	978.1	156.9	(-) 2.9	(+) 6.1	147.9	11.7	414.2	32.8	447.0	
1999	996.4	165.1	(-) 1.5	(+) 7.5	156.1	13.3	429.2	36.5	465.7	
2000	1014.8	171.8	(-) 1.4	(+) 13.9	156.6	11.7	422.7	31.8	455.4	
2001	1033.2	162.5	(-) 4.5	(+) 12.3	145.6	11.3	386.2	30.0	416.2	
2002	1050.6	174.5	(-) 8.5	(-) 9.9	175.9	13.6	458.1	35.4	494.1	
2003	1068.2	143.2	(-) 7.1	(-) 23.2	159.3	11.3	408.5	29.1	437.6	
2004	1085.6	173.5	(-) 7.7	(-) 3.3	169.1	14.2	426.9	35.8	462.7	
2005	1102.8	162.1	(-) 7.2	(-) 2.4	157.4	12.7	390.9	31.5	422.4	

Note: Net production has been taken as 87.5 per cent of production, 12.5 per cent being provided for seeds, feed requirement and waste.

Source: Economic Survey, 2006-07

pressures against the buffer stock norm of 8.2 million tonnes in January 2006.

Hence, we can say that the import of wheat, pulses etc., is a necessity for the country. It has nothing to do with globalization. In case sufficient foodgrain is not available, it can result in social unrest and various other problems for the economy. We should always bear in mind that 27.5 per cent of our population lives below the poverty line, and that their per capita monthly expenditure is less than Rs. 356.3 in rural areas and Rs. 538.6 in urban areas.

Rural Structure in India

Two prominent features of the Indian economy have recently changed over the last few decades. These are:

- An overwhelming proportion of the Indian population lives in rural areas and a vast majority of them are dependent on agriculture.
- There is no significant diversification of the rural economy.

According to the 2001 Census, 72.2 per cent of the population of the country lives in rural areas. There were about 106 million operational holdings in 1990-91 which increased to about 116 million in 1995-96 and about 121 million in 2000-01 (Table 5). Since alternative sources of employment are not there, therefore, the number of operational holdings has been increasing over time. About 63 per cent of the operational holdings comprised marginal farmers operating less than one hectare area in 2000-01. This figure was about 51 per cent, 55 per cent, 56 per cent, 58 per cent, 59 per cent and 62 per cent in 1970-71, 1976-77, 1980-81, 1985-86, 1990-91 and 1995-96, respectively. It is generally recognized that a large majority of the cultivators in the country are marginal farmers. However, what is noteworthy is the fact that a progressively increasing share of cultivated land is farmed by this group (Vyas, 2007). At present, about 19 per cent of the area is operated by the marginal farmers.

The number of small farmers is about 19 per cent of all the holdings. Therefore, the small and marginal farmers constitute about 82 per cent of the total holdings. Together, they operate about 39 per cent of the area. On the other hand, the large farmers are just about one per cent of the total holdings but they operate about 13 per

Table 5: Distribution of operational holdings in India, 1990-91 to 2000-01

Category of holding	No. of Operational Holdings (Million No.)			Area Operated (Million ha)			Average size of Operational Holding (ha)		
	1990-91	1995-96	2000-01	1990-91	1995-96	2000-01	1990-91	1995-96	2000-01
Marginal (Less than 1 hect)	63.36 (59.44)	71.18 (61.59)	76.12 (63.00)	24.89 (15.04)	28.12 (17.21)	30.09 (18.81)	0.39	0.40	0.40
Small (1.0 to 2.0 hect)	20.09 (18.84)	21.64 (18.72)	22.81 (18.88)	28.83 (17.42)	30.72 (18.81)	32.26 (20.18)	1.43	1.42	1.41
Semi-Medium (2.0 to 4.0 hect)	13.93 (13.06)	14.26 (12.34)	14.09 (11.66)	38.38 (23.18)	38.95 (23.84)	38.31 (23.96)	2.76	2.73	2.72
Medium (4.0 to 10.0 hect)	7.58 (7.11)	7.09 (6.13)	6.57 (5.44)	44.75 (27.04)	41.40 (25.35)	38.13 (23.85)	5.90	5.84	5.80
Large (10.0 hect and above)	1.65 (1.55)	1.41 (1.22)	1.23 (1.02)	28.66 (17.32)	24.16 (14.79)	21.12 (13.20)	17.33	17.21	17.1
All Holdings	106.64 (100.00)	115.58 (100.00)	120.82 (100.00)	165.51 (100.00)	163.36 (100.00)	159.90 (100.00)	1.57 (100.00)	1.41 (100.00)	1.32 (100.00)

Note: Figures in parentheses indicate percentage to the total.

Source: 1) Govt. of India (2004), 2) Govt. of India (2007)

cent of the area. The average size of the operational holding is also declining over time. It was 1.57 hectares in 1990-91, which declined to 1.41 hectares in 1995-96 and 1.32 hectares in 2000-01. The average size of the operational holdings of the marginal, small, semi-medium, medium and large farmers was 0.40, 1.41, 2.72, 5.80 and 17.18 hectare, respectively during the year 2000-01. The size of operational holdings is not only small but there are 2.7 parcels in each of these small and marginal farms on account of continuing fragmentation, unrelieved by corresponding consolidation (Verghese, 2006). Besides, the irrigated area is just 40 per cent; therefore, farmers cannot grow two crops in a year. Consequently, the cropping intensity is also low, i.e. about 135 per cent. These constraints have their impact on the employment and income of the farmers as well as the agricultural labour. The scenario discussed above has nothing to do with the globalization of the Indian economy. India has for long had its own internal problems and globalization has become an easy target responsible for all the ills in our economy in general and agriculture sector in particular. Even Prime Minister Dr Manmohan Singh has recently admitted that there is "no-one-size-fits-all" solution to the problems being faced by the farmers of the country (Anonymous, 2006).

Decline of Area per Agricultural Worker

Over time, the population of the country has increased. Our population was 361.1 million in 1951 which increased to 1028.7 million within five decades, i.e. in 2001. In July 2007, the population has reached to the

level of 1130 million. Similarly, the rural population increased from 298.6 million in 1951 to 742.6 million in 2001. Thus, the rural population increased by 44 per cent over the last fifty years. It has put pressure on resources. Land is the backbone of the agriculture.

The data given in Table 6 indicated the decline in net area sown and gross cropped area per agricultural worker in India from 1951 to 2001. The number of agricultural workers has almost doubled in this period. Similarly, the number of agricultural labourers has increased four times during the corresponding period. The net area sown has increased from about 119 million hectares in 1951 to about 141 million hectares in 2001. Over the three decades (1971 to 2001), the net area sown almost constant around 140 million hectares. The gross cropped area was about 132 million hectares in 1951 which increased to about 186 million hectares in 2001. In this way, the cropping intensity increased from 111 per cent in 1951 to about 132 per cent in 2001. The increase in the cropping intensity has become due to increase in net irrigated area from 18 per cent in 1951 to 40 per cent in the corresponding period.

Due to increase in the number of agricultural labourers, the net area sown per agricultural worker had declined from 1.70 hectares in 1951 to 1.32 hectares in 2001. Similarly, this figure declined from 1.70 hectare to 1.32 hectare for the agricultural worker during the same period. Over time, the gross cropped area per agricultural worker has also declined. This is one of the fundamental issues being faced by Indian farmers.

Table 6: Net area sown and gross cropped area per agricultural worker in India, 1951 to 2001

Particulars	Years					
	1951	1961	1971	1981	1991	2001
1. No. of cultivators (million)	69.9	99.6	78.2	92.5	110.7	127.3
2. No of agricultural labourers (million)	27.3	31.5	47.5	55.5	74.6	106.8
3. Total workers (million)	97.2	131.1	125.7	148.0	185.3	234.1
4. Net area sown (million ha)	118.75	132.20	140.27	140.00	143.00	141.16
5. Gross cropped area (million ha)	131.89	152.77	165.79	172.63	185.74	185.71
6. Net area sown (ha)						
a) Per cultivator	1.70	1.33	1.79	1.51	1.29	1.11
b) Per agricultural labourer	4.35	4.20	2.95	2.52	1.92	1.32
c) Per cultivator and per agricultural labourer (combined)	1.22	1.01	1.12	0.95	0.77	0.60
7. Gross cropped area (ha)						
a) Per cultivator	1.89	1.53	2.12	1.87	1.68	1.46
b) Per agricultural labourer	4.83	4.85	3.49	3.11	2.49	1.74
c) Per cultivator and per agricultural labourer (combined)	1.36	1.17	1.32	1.17	1.00	0.79

Source: Govt. of India (2007)

The overcrowdedness in the agriculture sector gave birth to the problem of unemployment, underemployment, low labour and farm productivity, etc. Keeping all this view, the Union Government has initiated the National Rural Employment Guarantee Scheme (NREGS) in 200 districts across the country on February 2, 2006. Under this scheme, 100 days manual unskilled work is assured to each rural household (for one adult family member). This programme has been extended to another 130 districts in 2007-08. From April 2008, all the 595 districts of the country will be covered under this scheme. It will cost around Rs. 20,000 crore annually to the government. This programme is a right step in the right direction to provide employment and enhance income of the rural masses. Moreover, it is the one of the several important measures taken by the government to find a solution of the agrarian crisis in the country.

Capital Formation in Agriculture

It is strange that in a country where 60 per cent of the workforce draws its sustenance from the land, the government attention in this sector in terms of public investment is quite insignificant (Adil, 2002). The investment in agriculture was Rs. 14836 crore in 1990-91 which increased to Rs. 54539 crore in 2005-06 (Table 7). The share of public investment was about 30 per cent in the former year which decreased to about 24 per cent in the later year. The investment in agriculture as a per cent of GDP declined from 1.92 in 1990-91 to 1.26 in 1998-99. In the later years, there was some improvement and it

was 1.9 from 2003-04 to 2005-06 (each year). It may be stated that no major irrigation project of the national importance like the Bhakhra Dam has been started in the post-reform period. Besides financial constraints, there are also interstate disputes over sharing of river water. Such disputes are hindering the progress of irrigation projects all over the country. A delay of few years escalates the cost of irrigation project and adversely affects the agricultural sector. Some vested interests also oppose the irrigation projects in the name of environment (Sidhu and Vatta, 2004). The input use in the agriculture sector is also related with irrigation. The better input use result in higher productivity of various crops. In Punjab, about 97 per cent of the net area sown is irrigated, therefore, the use of chemical fertilizers is also high, i.e. about 210 kg per hectare as compared to about 105 kg at the national level. As already stated, the irrigated area is just 40 per cent in the country.

Consequently, the productivity of almost all the crops in Punjab is high as compared to others states. Moreover, this small state with just 1.53 per cent of the geographical area of India contributes about 60 to 65 per cent of wheat and 35 to 40 per cent of rice in the central pool. Therefore, we can say that food security of the country is in the hands of Punjab farmers. Food security of a country is as important as the defence security. Irrigation alone will play pivotal role to ease the agrarian crisis but the government must play a leading role in this direction. Already, an additional sum of Rs. 25,000 crore has been provided during the Eleventh Five Year Plan under the

Table 7: Gross capital formation in agriculture sector of India, 1990-91 to 2005-06

Year	Investment in agriculture (Rs crore)			Share in agricultural gross investment (per cent)		Investment in agriculture as a per cent of GDP at constant price
	Total	Public	Private	Public	Private	
Old Series (at 1993-94 prices)						
1990-91	14836	4395	10441	29.60	70.40	1.92
1995-96	15690	4849	10841	30.90	69.10	1.57
1996-97	16176	4668	11508	28.90	71.10	1.51
1997-98	15942	3979	11963	25.00	75.00	1.43
1998-99	14895	3870	11025	26.00	74.00	1.26
1999-00	17304	4221	13083	24.40	75.60	1.37
New series (at 1999-00 prices)						
1999-00	43473	7716	35757	17.7	82.3	2.2
2000-01	38735	7155	31580	18.5	81.5	1.9
2001-02	47043	8746	38297	18.6	81.4	2.2
2002-03	46823	7962	38861	17.0	83.0	2.1
2003-04	45132	9376	35756	20.8	79.2	1.9
2004-05	48576	10267	38309	21.1	78.9	1.9
2005-06	54539	13219	41320	24.2	75.8	1.9

Source: Economic Survey, 2006-07

National Agricultural Development Plan. Besides about Rs. 4900 crore has been allocated for the National Food Security Mission. The target of this mission is to increase rice, wheat and pulses production by 10, 8 and 2 million tonnes respectively during the next four years. The government has also fixed a target of four per cent growth rate for the agriculture sector during Eleventh Five Year Plan. Without four per cent growth of GDP in the farm sector, it will be a difficult task to sustain 9 per cent GDP growth rate of the Indian economy in future. Now, the agriculture sector has drawn the attention of the policy planners at the highest level in the country.

Slowdown in Foodgrain Production

In the recent years, the foodgrain production has almost become stagnant. It was about 213 million tonnes in 2001-02 but due to a severe drought in 2002-03, it declined to about 175 million tonnes. Again, it increased to about 213 million tonnes in 2003-04 but fell to about 198 million tonnes in 2004-05. It was about 209 and 212 million tonnes in 2005-06 and 2006-07, respectively. Due to stagnation in the production, India was forced to import wheat in 2006-07 and 2007-08. The CGR of foodgrain production was about 2.85 per cent per annum from 1980-

81 to 1989-90 (Table 8). It declined to 2.02 per cent per annum from 1990-91 to 1999-2000. It further fell to 1.1 per cent per annum in the period from 2000-01 to 2006-07. Similarly, the CGR of production of all the principal crops declined from 3.19 per cent per annum from 1981 to 1989-90 to 2.29 per cent per annum in the period between 1990-91 and 1999-2000. It increased to 2.2 per cent per annum from 2000-01 to 2006-07.

It is worthwhile to point out here that production and productivity of cotton has shown remarkable progress with the introduction of Bt-cotton in the period between 2000-01 and 2006-07. The CGR of production and productivity of cotton was 16.39 per cent and 15.43 per cent per annum, respectively in this period. It is a direct benefit of globalization of the Indian agriculture. The recovery of cotton crop has improved the economic well-being of farmers. In spite of high cost of seed, the net returns from Bt-cotton are high as compared to the non-Bt cotton. The production of cotton was just 9.52 million bales in 2000-01. Due to introduction of Bt-cotton, the production jumped to 21.04 million bales in 2006-07. With globalization, it might have been a difficult task to achieve such a high level of cotton production. On this account, India also became a net exporter of cotton in the recent years.

Table 8: Compound growth rates of area, production and yield of principal crops in India during 1980-90, 1990-2000 and 2000-06 (Base: TE 1981-82=100)

(% per annum)

Crop	1980-81 to 1989-90			1990-91 to 1999-2000			2000-01 to 2006-07		
	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield
1. Rice	0.41	3.62	3.19	0.68	2.02	1.34	-0.39	1.15	1.53
2. Wheat	0.46	3.57	3.10	1.72	3.57	1.83	1.18	0.41	-0.76
3. Coarse cereals	-1.34	0.40	1.62	-2.12	-0.02	1.82	-0.51	1.72	2.54
4. Total cereals	-0.26	3.03	2.90	0.04	-0.02	1.59	-0.01	0.99	1.97
5. Total pulses	-0.09	1.52	1.61	-0.60	0.59	0.93	2.17	3.15	1.02
6. Total foodgrains	-0.23	2.85	2.74	-0.07	2.02	1.52	0.38	1.19	1.74
7. Sugarcane	1.44	2.70	1.24	-0.07	2.73	1.05	0.11	-0.15	-0.25
8. Total oilseeds	1.51	5.20	2.43	-0.86	1.63	1.15	-1.42	6.25	6.89
9. Cotton	-1.25	2.80	4.10	2.71	2.29	-0.41	0.84	16.39	15.43
10. Potato	2.90	5.17	2.20	3.84	5.44	1.54	2.48	0.71	-1.74
11. All principal crops	0.10	3.19	2.56	0.27	2.29	1.33	0.93	2.61	3.07

Source: Govt. of India (2007)

Farm Indebtedness in India

Indebtedness is one of the major factors for farmer suicides and the agrarian crisis in the country. It is estimated that livelihood of 60.4 per cent of rural households in the country is agriculture (Prabhu, 2005). Out of about 89 million farm households in India, about 43 million farm households (48.6 per cent) were under debt according to the Survey Report of the National Sample Survey for the period, i.e. January to December, 2003 (Table 9). The farm indebtedness is the highest in Andhra Pradesh (82.0 per cent) followed by Tamil Nadu (74.5 per cent), Punjab (65.4 per cent), Kerala (64.4 per cent), Karnataka (61.6 per cent), Maharashtra (54.8 per cent), Jharkhand (53.1 per cent), Rajasthan (52.4 per cent), Gujarat (51.9 per cent), Madhya Pradesh (50.8 per cent) and West Bengal (50.1 per cent).

It may be mentioned here that Punjab farmer households bear the maximum debt in the country (Anonymous, 2005). The average household debt figure in the state comes to Rs. 41576 against the national average of Rs. 12585 (ibid). This figure of farm indebtedness in Punjab seems to be very low because recent reports put the debt burden against Punjab farmers is now in the range of Rs. 30,000 crore which work out at about Rs. 3.00 lakh per farmer household (Dhaliwal, 2007). The major factors for farm indebtedness are crop failure, over capitalization, rising cost of cultivation, almost stagnant minimum support prices (MSP) for various crops in

general and wheat and paddy in particular, small size of holdings, etc.

A micro level Picture of Farm Indebtedness in Punjab

A study was conducted by Punjab Agricultural University Ludhiana to estimate the indebtedness of the farmers in Harkishanpura village of Bathinda district (Punjab) where all the 89 farm households were under debt (Rangi, Sidhu and Sachdeva, 2004). A resolution, perceived to be the first of its kind in poverty struck villages of the nation, was passed by the village panchayat in May, 2002, when four families whose heads had allegedly committed suicide over the last two years, proposed to sell themselves to clear their debt (Sharma, 2002). Astonishingly, these families were joined by the entire village, which has been reeling under heavy debt for the past decade (ibid).

The information about total, per holding and per acre debt of the respondents is given in Table 10. The total amount of debt outstanding against the farmers of this village was about Rs. 2.88 crore during the year 2001-02. The per holding debt of the village was to the extent of Rs. 3.23 lakh. The amount of debt was also related with the farm size. The per holding debt of marginal, small, semi-medium, medium and large farmers was about Rs. 1.38, Rs. 1.84, Rs. 2.82, Rs. 4.79 and Rs. 10.60 lakh respectively. The per holding debt of medium and large

Table 9: Estimated number of rural households and indebted farmer households in states

State	Estimated Number of Rural Households ('00)	Estimated Number of Farmer Households ('00)	Estimated Number of Indebted Farmer Households ('00)	% of Farmer Households Indebted
Andhra Pradesh	142512	60339	49493	82.0
Arunachal Pradesh	15412	1227	72	5.9
Assam	41525	25040	4536	18.1
Bihar	116853	70804	23383	33.0
Chhattisgarh	36316	27598	11092	40.2
Gujarat	63015	37845	19644	51.9
Haryana	31474	19445	10330	53.1
Himachal Pradesh	11928	9061	3030	33.4
Jammu & Kashmir	10418	9432	3003	31.8
Jharkhand	36930	28238	5893	20.9
Karnataka	69906	40413	24897	61.6
Kerala	49942	21946	14126	64.4
Madhya Pradesh	93898	63206	32110	50.8
Maharashtra	118177	65817	36098	54.8
Manipur	2685	2146	533	24.8
Meghalaya	3401	2543	103	4.1
Mizoram	942	780	184	23.6
Nagaland	973	805	294	36.5
Orissa	66199	42341	20250	47.8
Punjab	29847	18442	12069	65.4
Rajasthan	70172	53080	27828	52.4
Sikkim	812	531	174	38.8
Tamil Nadu	110182	38880	28954	74.5
Tripura	5977	2333	1148	49.2
Uttar Pradesh	221499	171575	69199	40.3
Uttranchal	11959	8962	644	7.2
West Bengal	121667	69226	34696	50.1
UTs	2325	732	372	50.8
All India	1478988	893504	434242	48.6

Note: Report No. 498(59/33/1), Situation Assessment Survey of Farmers: Indebtedness of Farmer Households, National Sample Survey 59th Round (January-December 2003).

Source: Government of India (2007)

farmers was more as compared to other categories of the farmers because the former category had more capacity to take credit. On the other hand, the amount of debt on per acre (operated area) basis was more in case of marginal, small and semi-medium farmers. As the farm size increased, the amount of debt on a per acre basis declined in most of the cases. The debt per acre was to the extent of about Rs. 35,000 for all categories of farm-

ers. This figure was about Rs. 61,000 for marginal farmers, Rs. 49,000 for small farmers, Rs. 34,000 for semi-medium farmers, Rs. 31,000 for medium farmers and Rs. 32,000 for large farmers. The amount of debt was about 285 per acre less in case of large farmers as compared to the medium farmers. This marginal difference may be attributed to the fact that there were only two large farmers in the sample as compared to 30 medium farmers

Table 10: Total and per holding amount of debt of the farmers of Harkishanpura village (Bathinda district) of Punjab: 2001-02

Farm category	Total amount of debt (Rs)	Number of respondents	Amount of debt (Rs)	
			Per holding	Per operated acre
Marginal	1657000	12	138083	61370
Small	3866200	21	184105	49358
Semi-medium	6764000	24	281833	33793
Medium	14355000	30	478500	31356
Large	2120000	2	1060000	31642
Total/average	28762200	89	323170	34636

Source: Rangji, Sidhu and Sachdeva (2004)

The major reason of debt was failure of cotton crop for more than a decade in the state. Another noteworthy feature of this village is its location. It is at the tail end of the canal irrigation distribution system. Hence, it is deprived of its legitimate right over canal irrigation due to mismanagement by the Irrigation Department of Punjab Government. The underground water of the village is brackish which is unfit for crops. It may be stated that yield of cotton in Punjab declined from 592 kg per hectare (in terms of lint) in 1991-92 to just 180 kg per hectare in 1998-99. Consequently, the cotton production in the state fell from 25.05 lakh bales to only 6.04 lakh bales in the corresponding period. Due to failure of cotton crop, the area also declined from 6.15 lakh hectares to 4.57 lakh hectares in the same period.

Sources of Outstanding Debt

The farmers of Harkishanpura village have taken credit from seven different sources. The information in detail is shown in Table 11. As already discussed, the per holding debt was to the extent of Rs. 3.23 lakh. Among various sources of debt, the commission agents provided the maximum credit (about 48 per cent) followed by commercial banks (about 17 per cent), cooperative banks (about 12 per cent), Land Mortgage Bank (about 10 per cent), PASS (about 7 per cent), relatives (about 4

Table 11: Per holding sources of outstanding debt of the farmers of Harkishanpura village (Bathinda district) of Punjab, 2001-02

(Rs. in thousands)

Source of credit	Farm Category					Total
	Marginal	Small	Semi-medium	Medium	Large	
Commission agents	63.33 (45.86)	89.62 (48.68)	146.46 (51.97)	233.33 (48.76)	275.00 (25.94)	154.01 (47.66)
Commercial banks	29.08 (21.06)	25.51 (13.85)	28.79 (10.22)	88.23 (18.44)	370.00 (34.91)	55.76 (17.25)
Cooperative banks	5.42 (3.93)	35.79 (19.44)	36.50 (12.96)	51.50 (10.76)	120.00 (11.32)	39.07 (12.09)
Land Mortgage banks	22.08 (15.99)	18.00 (9.78)	37.92 (13.45)	37.17 (7.77)	160.00 (15.09)	33.57 (10.39)
Primary Agri Service Society	12.33 (8.93)	6.73 (3.66)	24.25 (8.60)	32.67 (6.81)	105.00 (9.91)	23.13 (7.165)
Relatives	5.00 (3.62)	5.42 (2.94)	6.46 (2.29)	29.37 (6.14)	20.00 (1.89)	14.04 (4.35)
Friends	0.84 (0.61)	3.03 (1.65)	1.45 (0.51)	6.33 (1.32)	10.00 (0.94)	3.57 (1.10)
Grand total	138.08 (100.00)	184.10 (100.00)	281.83 (100.00)	478.50 (100.00)	1060.00 (100.00)	323.17 (100.00)

Source: Rang, Sidhu and Sachdeva (2004)

cent) and friends (about 1 per cent). The preference for the commission agents was on account of traditional social relations of the farmers with them. Moreover, no paperwork was required in getting credit from the commission agents. As already stated, the farm inputs like chemical fertilizers, insecticides/pesticides, seeds, etc. were also purchased by the farmers from the commission agents on a credit basis. At the same time, the farm produce was sold by the farmers to the public and private agencies/traders through these commission agents. Although the rate of interest charged by the commission agents was high, i.e. 24 to 30 per cent per annum, the farmers' preference was evident from the data given in Table 1.1. It is worthwhile to point out here that another study on rural credit and indebtedness in Punjab has also revealed that commission agents provided 46 per cent credit to the farmers in the year 1997 (Shergill, 1998).

The farm category wise data indicated that except for large farmers, the commission agents were the major source of outstanding debt for the farmers of Harkishanpura village. The large farmers in the sample had taken only about 26 per cent of their total credit from this source. Their major source of credit was commercial banks, which was 35 per cent. The share of relatives and friends was less in almost all the farm categories. This was on account of the fact that their relatives and friends in Punjab and elsewhere were also themselves facing economic hardships. It is a common phenomenon that one person's

relatives and friends belong to the same strata of society in most of the cases (Rang, Sidhu and Sachdeva, 2004). It is a healthy social practice that relatives and friends of all the farmers of Harkishanpura village were still helping them financially in the hour of their economic distress. All categories of the farmers had obtained credit from commercial, cooperative and land mortgage banks in varying degrees.

The scenario of agrarian crisis in India discussed above clearly indicates that its roots are within the economy and that globalization alone is not responsible for it. To put the entire blame on globalization for all the ills of the agriculture sector is a myth, not a reality. Besides, the problems of marginal and small farmers are more complex vis-à-vis large and medium farmers. The policy planners at the national and states level may formulate policies related with the agriculture sector keeping in view the interest of marginal and small farmers who constitute about 82 per cent of the total cultivators in the country.

Prime Minister Dr Manmohan Singh noted recently that debt waiver has "far-reaching implications" on the banking and financial system of the country. In the long run, the stability of the banking and financial system of a modern economy cannot be compromised and any solution would have to factor this in (Anonymous, 2006). Therefore, various political parties and farmers' organi-

zations may not insist on debt waiver as solution of the problem of farm indebtedness and agrarian crisis.

Conclusions

Globalization means free cross-border movement of information, goods, services, capital and people. Globalization is more than just about economics. A debate started in the country in the early 1990s about the impact of globalization on the Indian economy in general and agriculture sector in particular. The farm sector started showing a slow down in the post-reform period. Farmer suicides, growing indebtedness and stagnant food production coupled with declining crop productivity signalled a farm crisis that can no longer be ignored. The average yields of various crops are low across the country. Even agriculturally developed states like Punjab, Haryana and Western Uttar Pradesh are facing the problem of stagnation in both production and productivity. Moreover, growing pressure of population and lack of commensurate non-farm employment has reduced the average size of operational holdings from 1.57 hectares in 1990-91 to 1.41 hectares in 1995-96. It further declined to 1.32 hectares in 2000-01. The division of agricultural land among family members over the years resulted in the creation of large number of small land holdings across the country, in which farming has become unviable due to low volume of produce.

Nearly one lakh farmers and their family members committed suicide between 1998 and 2003 mainly due to economic distress. The statistics give a glimpse of the crisis the devastated the rural economy. Even in the agriculturally developed state like Punjab, 2116 farmers committed suicide during the last 15 years. Indebtedness is one of the major factors for farmer suicides and the agrarian crisis in the country. Out of 89 million farm households in India, about 43 million farm households (48.6 per cent) were in debt in the year 2003. The farm indebtedness is the highest in Andhra Pradesh (82.0 per cent) followed by Tamil Nadu (74.5 per cent), Punjab (65.4 per cent), Kerala (64.4 per cent), Karnataka (61.6 per cent), Maharashtra (54.8 per cent), Haryana (53.1 per cent), Rajasthan (52.4 per cent), Gujarat (51.9 per cent), Madhya Pradesh (50.8 per cent) and West Bengal (50.1 per cent).

Punjab farmer households bear the maximum debt in the country. The average household debt figure in the state comes to Rs. 41,576 against the national average of Rs. 12,585. The major reasons for farm indebtedness are crop failure, over capitalization, rising cost of cultivation, almost stagnant minimum support prices (MSP) for

various crops in general and wheat and paddy ticular, small size of holding, etc. The scenario of agrarian crisis in India clearly indicates that its roots are in the economy and globalization is not alone responsible for it. To put the entire blame on globalization for ills of the agriculture sector is a myth, not a reality. Besides, the problems of marginal and small farm are more complex vis-à-vis large and medium farm. More policy planners at the national and states level need to formulate policies related with the agriculture sector keeping in view the interest of marginal and small farmers who constitute about 82 per cent of the total cultivated land in the country. Debt waiver is not a solution to the problem of farm indebtedness and agrarian crisis.

References

- Adil, M. (2002), Low investment in farm, *The Economic Times*, Delhi, Vol. 42 (208), November 1, p-7.
- Anonymous (2005), Damned by debt, *The Tribune*, Chandigarh, Vol. 125 (134), May 16, p-10.
- Anonymous (2006), No one solution to farmers' problem, Minister, *The Economic Times*, Chandigarh, October 10, p-10.
- Balessa, Bela (1978), Export and growth, further evidence, *Journal of Development Studies*, 5 (2), pp 181-89.
- Bhattacharyya, B and P. Paul (2000), Food security in India: context of Agreement on Agriculture: in proceedings of seminar on WTO vis-à-vis Punjab Agriculture, held at PAU, Ludhiana, on May 27, pp 35-42.
- CMIE (2004), National Income Statistics, Economic Intelligence Group, Mumbai.
- Dhaliwal, Sarbjit (2007), Centre should attend to Punjab woes, *The Tribune*, Chandigarh, Vol 127 (262), Sept 10, p-13.
- ENS Economic Bureau (2004), India's economy a closer look, *The Indian Express*, Chandigarh, Vol 27 (15), 13, p-3.
- Feder, G (1983), On exports and economic growth, *Journal of Development Studies*, 5, pp 59-73.
- Govt. of India (2007), Agricultural Statistics At A Glance, Department of Agriculture and Cooperation, Ministry of Agriculture, New Delhi.
- Heller, P.S. and R.C. Potter (1978), Export and growth: a re-investigation, *Journal of Development Studies*, 15, pp 93-103.
- HT Correspondent (2004), Farm focus in new trade policy, *Times*, Chandigarh, Vol 80 (209), September 1, pp 1-2.
- Michaely, M (1977), Export and growth: An empirical investigation, *Journal of Development Economics*, 4, pp 49-53.
- Mohan, Megha (2006), Death by debt for Punjab farmers, *The Indian Express*, Chandigarh, Vol 29 (337), September 8, p-1.
- Nibber, G.S. (2004), Over 2000 farmers' suicides in Punjab in 5 years: Report, *Hindustan Times*, Chandigarh, Vol 10, October 22, p-2.

- Parikh, K.S.** (1998), Food security- individual and national, in (ed) Isher Judge Ahluwalia and I.M.D. Little, India's economic reforms and development-Essays for Manmohan Singh, Oxford University Press, New Delhi, pp 253-79.
- Patranobis, S** (2006), In shining India, debt killed a lakh, Hindustan Times, Chandigarh, Vol 82 (118), May 19, p-9.
- Prabhu, Nagesh** (2005), Debts driving Karnataka farmers to suicides: Survey, The Hindu, Delhi, Vol 128 (38), September 18, p-6.
- Ram, Rati** (1985), Exports and economic growth: some additional evidence, Economic Development and Cultural Change, Vol 33 (2), pp 415-25.
- Ram, Rati** (1986), Government size and economic growth, a new framework and some evidence from cross section and time series data, American Economic Review, Vol 76 (1), pp 191-203.
- Rangarajan, C** (2007), Who is afraid of globalization? The Economic Times, Chandigarh, Vol 3 (269), January 15, p-11.
- Rangi, P.S., M.S. Sidhu and J. Sachdeva** (2004), Farm indebtedness in Punjab: case study of a village in distress, Research report, Department of Economics, PAU, Ludhiana, pp 1-56.
- Sharma, Amit** (2002), Village for sale, any buyers? Hindustan Times, Chandigarh, Vol 78 (135), May 15, pp 1 & 6.
- Shergill, H.S.** (1998), Rural credit and indebtedness in Punjab, Mimeograph series-IV, Institute for Development and Communication, Chandigarh, pp 1-95.
- Sidhu, M.S. and Kamal Vatta** (2004), New technologies and Indian agriculture in the 21st century, Man & Development, Vol 26 (1), pp 47-65.
- Sidhu, M.S., Sukhpal Singh and T.K. Dhaliwal** (2005), Export and import of agricultural products in India: an appraisal of post-reform period, The Indian Economic Association 88th Annual Conference, Conference Volume, Part 1, pp 226-39.
- Tata Services Ltd. (2007), Statistical Outline of India- 2006-07, Department of Economics and Statistics, Bombay House, Mumbai.
- UNI (2004), Concern over small land holdings, The Tribune, Chandigarh, Vol 124 (143), May 24, p-16.
- Verghese, B.G.** (2004), Sustainable growth- farm crisis brooks no delay, The Tribune, Chandigarh, Vol 126 (217), August 7, p-10.
- Vyas, V.S.** (2007), Marginalized sections of Indian agriculture: The forgotten millions, The Indian Journal of Labour Economics, Vol 50 (1), pp 1-16.

No institution can possibly survive if it needs geniuses or supermen to manage it. It must be organized in such a way as to be able to get along under a leadership composed of average human beings.

– Peter F. Drucker

Dynamics of New Fertilizer Policy under WTO

Satish Chandra & Neena Sinha

This paper examines the dynamics of the Indian Fertilizer Policy under relevant provisions of the GATT 1994, SCM, AA and TRIM. The scheme of the New Fertilizer Policy is examined under six major principles of GATT 1994 and then under SCM in the light of DSB decisions.

Satish Chandra, an IRTS officer, was formerly Director in the Department of Fertilizers, Ministry of Chemicals and Fertilizers, Government of India. He is doing his PhD under the guidance of Neena Sinha of Guru Govind Singh Indraprastha University, Delhi, on the implication of WTO subsidy regime for the agriculture sector, with specific reference to the Indian fertilizer industry.

The hyphenated New Fertilizer Pricing Policy (NFPP) for Urea and Concession Scheme/Policy for decontrol of fertilizers, germinating from the womb of the Retention Pricing Scheme (RPS), intended to phase out RPS in three stages by grouping urea-manufacturing units into six categories based on the feedstock used and plant vintage (Government of India, Ministry of Chemicals and Fertilizers, Department of Fertilizers, letter No.1201/98-FPP dated January 30, 2003.)

Stage-I commenced from 1st April-2003 for one year followed by stage-II for two years – ending on 31st March 2006. Stage-III was to commence from 1st April 2006 but actually became operative from 1st October 2006 (DOF Circular No. 12012/3/2006-FPP(II-8th March 2006) Department of Fertilizers, Ministry of Chemical & Fertilizers, Government of India, New Delhi).

As per the NFPP, the urea plants in each group will be paid a retention price based on the product weighted average of the retention prices of the urea group. The new policy, while encouraging efficient use of parameter of international standards based on the use of the most efficient feedstock, and state of art technology intends to ensure viable rate of return to urea units. Naphtha and fuel oil-based plants have to convert to gas or other cheaper mood of feed-stocks within three years and after that there will be one rate of payment for all the urea plants. The NFPP partially decontrol urea production and sales of urea up to 50% of installed capacity (as assessed) of each unit (Annual Report 2006-07, Department of Fertilizer, Government of India, New Delhi).

But, all fertilizer units are to sell urea, whether decontrolled or controlled (allocated under Essential Commodity List) to Indian farmers as per the MRP fixed by the government. The Maximum Retail Price of urea is fixed by the Government of India under clause 3 of Fertilizer (Control) Order, 1980.

order 1985, Gazette Notification order No. GSR 758 (E) dated 25th September 1985.

The urea manufacturer can export if they produce more than 110% of the capacity and the government does not require the same for domestic consumption. With regard to subsidy payment, there is no difference in RPS and NFPP, as both the schemes choose industry as a conduit to defray subsidy to farmers as a differential of production-cost and maximum retail price fixed by the Government. Almost a similar system of subsidization has been adopted for potassic and phosphatic fertilizers based on differential of indicative MRP and normative cost of production or import. Thus the existing fertilizer policy insulates both farmers and industry from the invisible market hand. But it is proving to cost heavily to the exchequer, which may not sustain the present methodology of fertilizer subsidization for infinite. It is estimated that actual disbursement of fertilizers subsidy may be more than Rs. 240 billion in 2006-07. According to FAI sources the actual payment of fertilizers subsidy in 2006-07 may cross Rs 240 billion.

However, a new subsidy regime has been brought in mainly through the WTO (Kaul 1999). Agreement on Subsidies and Countervailing Measures (SCM) read with the Agreement on Agriculture (AA), has introduced a new rule-based legal regime of subsidies and countervailing measures. Now the members are required to ensure the conformity of their laws, regulation and procedures with their obligations to the WTO (Para 4 of Art.XVI of Markesh Agreement Establishing the World Trade Organization, the legal texts, the Results of the Uruguay Round of Multilateral Trade Negotiations), which prohibits use of subsidies specific to industry or enterprise or those contingents on export performance or domestic consumption over imports. The new rule-based regime of subsidies and quasi-judicial dispute settlement procedure as detailed under WTO, limit policy space for a Member State to deploy instrument of subsidies for their economic needs (Palmer, David and Petros C. Mavroidis 1999). Consequently, the Member countries have lost the freedom of choice in using subsidies and countervailing measures as an effective instrument for their economic development. Indian Fertilizers Policy, which reimburses differential of groups cost of production and MRP for urea producers, or normative cost and indicative prices of decontrolled fertilizers, impedes imports by encouraging domestic production and restricts export of Urea in violation of the SCM, GATT 94 & TRIM Agreements.

This article will examine the Dynamics of Indian Fertilizer Policy under relevant provisions of the GATT 94, SCM, AA and TRIM. First the scheme of New Fertilizer

Policy is examined under six major principles of GATT 94 and then under SCM in the light of DSB decisions. Next relevant provisions of AA are seen in relation to fertilizer policy and then its implications under TRIM.

General Agreement on Tariff and Trade 1994 (GATT 94)

Most Favoured Nation Treatment

The embryonic New Pricing Policy Letter No.12019/5/98-FPP dated January 30, 2003, Department of Fertilizers, Ministry of Chemical & Fertilizers, Government of India) for urea manufacturers, has sprouted from the womb of unit based Retention Pricing Scheme (Retention Price-cum-Subsidy Scheme, 1977: Gazette Notification (Resolution) No.166. (24)/77-FDA dated 01.11.1977), which raised the country's annual urea consumptions to over 20 million tonnes (Fertilizers Statistics, 2004-2005.

The NPP like its predecessors intends to subsidize urea consumption through the fertilizers industry and bridge the demand-supply gap through imports without discriminating or favouring any particular source of fertilizers. The producers and importers have to sell urea at MRP (Rs. 4830/per tonne) fixed by the Government. The differential of groups' production cost, which ranges from Rs. 5159 of gas-based plant (KRIBHCO) to Rs. 14686-naphtha-based plant (MFL-Madras), and MRP (Rs. 4830/per tonne) is reimbursed to them (Annual Report 2005-06, Department of Fertilizers, Ministry of Chemical & Fertilizers, Government of India, New Delhi). In case of imported urea the difference of landed price, which is currently around Rs. 13000/per tonne and MRP of Rs. 4830/per tonne is reimbursed. Almost the same principle is adopted for subsidization of decontrolled fertilizers, but the rate of subsidization is periodically updated in consonance with price fluctuation at international market. The current MRP of DAP is Rs. 9350/per tonne and the subsidization rate is Rs. 4215/per tonne of indigenous DAP and Rs. 3843/per tonne of imported DAP (S-5/2004-Shipping issued by the Department of Fertilizers, Ministry of Chemical and Fertilizers, GOI). There is no restriction on sourcing of the imports. But does it passes the litmus test of non-discrimination, as stipulated under the principle of MFN enshrined in Art. I of the GATT 94, which is the subject of evaluation. The MFN obligation requires Member States to treat all the goods coming from other WTO Members on equal terms and accord immediately and unconditionally the privilege, favour or advantage granted to the product of one country to the products of other Member states (Article I:1 of GATT 94). So absence of any embargo on import of decontrolled

fertilizers (DAP/MOP) on private trade account or controlled fertilizer (urea) by the nominated State Trading Agencies and equal subsidization are in conformity with the MFN obligation. However, import of urea from M/s Oman India Fertilizer Company (OMIFCO) by M/s IFFCO and KRIBHCO on pre-fixed rate, as guaranteed by the Government of India, may not be so. India is importing urea through nominated State Trading Agencies, who are to operate on commercial considerations. These State Trading Agencies buy urea through open tenders on a lowest quotation basis. They move it as per the movement orders issued by the government and sell it at notified MRP (The Fertilizer (Movement control) order, 1973 Gazette Notification No. SRO 249(E) dated 25th April 1973, The Fertilizer Association of India, 10 Saheedjit Singh Marg, New Delhi, Clause 3 of this order, inter alia, says "No person shall export or attempt to export, or abet the export of any fertilizer, of which allocation is made by the Government, from any state, except with the authority of Department of Fertilizers.")

The differential in landed cost of urea and MRP is reimbursed to them. So, if these Agencies are forced to import urea from M/s OMIFCO at a prefixed rate, and if the same rate is higher than the then prevailing prices at international market, they may run the risk of violating the principle of commercial considerations. This may amount to a favour to the product (urea) coming from Oman and thus constitute an infringement of MFN obligation, only if it is purchased at higher price as compared to international prices. And even if IFFCO & KRIBHCO are notified as State Trading Agencies to bring in urea from M/s OMIFCO to India, such imports will contravene the pronounced scheme of urea import being denial of equal opportunity to other Urea Producers (Notification of Public Notice No. 2 (RE-2003) 2002-03 dated 31st March '03, Ministry of Commerce & Industry, Government of India). Besides, in such a situation, the Government may be forced to subsidize urea import from OMIFCO at a higher rate compared to import from other sources of Middle East Asian Countries. This is a MFN violation as imported urea from Oman and from other countries being 'like product' will not be treated alike (Japan Alcoholic beverage case; EU-Asbestos case, www.wto.org.). In case an import from OMIFCO is cheaper compared to other countries, it may not absolve itself from the criticism of undue subsidization at the cost of imports from other countries. The MFN principle does not authorize subsidized imports from any country at the cost of other Member States. The underlying principle of non-discrimination is as explained by the Appellate Body in Canada – Autos "The object and purpose [of Article I] is to prohibit discrimination among like products originating in or destined for different countries. The prohibition

of discrimination in Article I: 1 also serves as an incentive for concessions, negotiated reciprocally, to be extended to all other Members on an MFN basis." (WT ANALYTICAL INDEX: GATT 1994, General Agreement on Tariffs and Trade 1994 accessed on 28.8.200 www.wto.org.).

In this case the Appellate Body found the prohibition of discrimination under Article I: 1 includes both de-jure and de facto discrimination. This view was also taken in the EC-Banana III case. The Appellate Body also held that the Canadian import duty exemptions granted to motor vehicles originating in certain countries were consistent with Article I: 1. This was accepted by the Panel in Indonesia – Autos when it held that the exemption of import duties and sales taxes to those automobiles which met certain origin-neutral requirements was inconsistent with Article I:1. On this analogy imports from Oman, particularly at a price higher than that prevailing in the international market, may entail de-facto favour on account of higher subsidization compared to imports of urea from other sources. This may be MFN violation, the said measure (indirect subsidization to full production of Oman India through imports), may not accord same treatment immediately and unconditionally to urea import from all other Members, as required under Article I:-1 of the GATT 1994. So India will be failing to fulfill its obligation under Art.1:1 of GATT 1994, which says '...any advantage, favour, privilege or immunity granted by any member to any product originating in or destined for any other member shall be accorded immediately and unconditionally to the like product originating in or destined for the territories of all other member states'. However, some may say that most of the urea exporters are adopting dual feed-stock pricing policy to secure cheaper gas to their domestic urea producers and not the members of the WTO, so no breach of any principle flowing to Members under the GATT94. But this argument is not tenable as Saudi Arabia has already joined the WTO, and Russia as well as other erstwhile member countries may soon accede to the WTO. Besides, Members are obliged to discharge their obligation by virtue of their own WTO membership and not because of others. Nevertheless, India can negotiate the issue of dual pricing with these countries at the time of negotiating their accession to the WTO to safeguard the interests of its domestic urea producers.

One vantage point may be that urea import from Oman to India through government procurement. Article I:1 of Agreement on Government Procurement (Agreement on Government Procurement, World Trade Organization: The legal Texts, The Results of the Uruguay Round of Multilateral Trade Negotiations).

des that this Agreement applies to any law, regulation, procedure or practice regarding any procurement by entities covered by this Agreement. Since India is not the signatory of the Agreement on Government Procurement (AGP), it is not constrained to follow MFN obligation in government procurement. But the protagonist of this theory forgets that MFN obligation as stipulated under Art. I of GATT 94 do not have any such exception.

National Treatment

The principle of national treatment, Article III of GATT 1994, is of fundamental importance in succession of MFN to ensure non-discriminatory treatment to imported products after their entry in the importing country. The MFN treatment puts the products of all trading partners on equal terms with one another, whereas the principle of National Treatment equates those products with the 'like products' of the importing country itself. It says that once imports have passed the national frontier (and in so doing have paid whatever import duty is imposed) they must be accorded treatment 'no less favourable than like products of national origin in respect of all laws, regulations and requirements affecting their sale or offering of sales, transportation, distribution, purchase or use (Article III of the GATT 1994). However, the NPP will favour domestic urea over imported urea, as later will be marketed under CA allocation, whereas part of indigenous urea will be sold in free market. Thus it will deny national treatment to urea importers, despite being like domestic urea, in managing their distribution and development of stable market network. In addition the NPP and concession scheme will continue to discriminate consumption of imported urea and DAP over like domestic products by way of differential subsidies (Subsidy on domestic production higher than subsidy on imported urea due to low prices in international market. Subsidy on imported fertilizer is equal to amount of differential of landed cost of imported urea and M.R.P. fixed by the government. On domestic product it is equal to differential of groups average cost of production and M.R.P. fixed by the government). This will be a violation of the national treatment as like products are to be treated alike, as held in the Japan Alcoholic Beverage case. The subsidization of domestic production at a differential rate, to ensure reasonable returns to producers, enables them to discount MRP in depressed market condition to maintain their market share or liquidate their production. On account of discounts, as per a rough estimate, the Indian fertilizer industry had lost, on an average, Rs. 6 to 7 billion per year over the last few years. But urea/DAP importers cannot indulge in price war in absence of assured returns as import subsidization is a function of the landed cost and MRP. The landed cost need not ensure reasonable returns. Thus

differential subsidy hurts the importer in a depressed market and pre-fixed MRP does not allow them to get compensated in a buoyant market. Thus the New Pricing Policy is not consistent with India's commitment to Paras 4 and 9 of Article III of the GATT. Nevertheless in the light of Para 8(a) of Article III of GATT 1994, it may be argued that urea imports being government purchase, are out of the purview of national treatment of Article III of GATT 1994. But the Government of India is not the end user of these purchases and the same are traded in the open market. So it may not satisfy the conditionality of the Government procurement as stipulated in Para 8(a) of Article III of the GATT 1994. Similarly, the National Treatment, with the exception of Para 8(b) of Article III of GATT 1994, will not be applicable on account of subsidy being extended to both domestic and imported fertilizers; whereas this clause protects exclusive subsidization of the domestic industry. Besides, this exception offers protection only against the violation of the national treatment and not from the obligations under other provisions of the General Agreement or the Agreement on SCM.

One may also argue that as per the Art. XVIII:3 of the GATT 1994, developing countries are permitted to deviate temporarily from the provisions of the General Agreement to grant the Government assistance required to promote the establishment of a particular industry with a view of raising general standard of living of its people. But Para 4(a) of the Art. XVIII of the GATT 1994 limits this right by qualifying that a Member, the economy of which can only support low standards of living and is in early stage of development, shall be free to deviate temporarily from the obligations of other articles of this Agreement. And for that, a Member who falls in the category of 4(a), has to take recourse provided in Para 13 by notifying requirement as per Para 14 which meets the objectives of Para 13 of Articles XVIII of the GATT 1994. Since the Indian economy does not satisfy this conditionality, it may not be entitled to claim exemption from the MFN and National Treatment obligation.

Publication and Administration of Trade Regulations

The W.T.O. aims at achieving transparency in International trade relations by obligating members to notify changes in their trade regulations affecting sales, distribution, and transportation etc.; (Article X of the GATT 1994) with the objective of enabling governments and trade to become acquainted with them. New pricing policy demonstrates the government's resolve to bring transparency in the fertilizer sector by removing bureaucratic hurdles. The group-based concession is certainly an improvement over the unit-based R.P.S. which has always

been criticized for being cost plus and favouring inefficiency (C. H. Hanumantha Rao, 1998). New policy will give weightage to energy consumption norms, but still have some frills of RPS due to subjective interpretation in fixing energy norms, calibrating escalation/de-escalation in variable costs and modulation of groups in stage—II/III on account of reduction in capital related charges. The policy is short of detailing a complete road map for reforming fertilizer subsidy. It intends to review the experience of stage I & II to spell out a future course. So the transitory nature of the new policy may keep the industry in lurking doubts and fail to induce fresh investment in the fertilizer sector. Besides, the new policy may be criticized for exhibiting derisive lack-lustre approach in tackling the subsidy issue as per the WTO commitment, while leaving scope for desirable steps to instill much needed confidence and certainty in fertilizer sector (U.S. Jha, 2001).

General Elimination of Quantitative Restrictions

Member states are obliged to refrain from imposing quotas, licenses or other measures, except duties or taxes, restricting import or export or sale of any product from or to any other member states (Article XI of the GATT 1994). Since the New Pricing Policy does not accord indigenous urea producers a right to export freely, it is contrary to the obligations of Article XI of the GATT. However, the producers of the decontrolled fertilizers are now free to export their product, on observance of some conditions, without prior approval of the Government of India. Thus the Indian Fertilizers Policy for controlled fertilizers is inconsistent with the provision of Article XI of the GATT 1994.

State Trading Enterprises

The Exim policy (1st April, 1997-31st March, 2002, Public Notice No.2 (RE-2003) 2002-03 dated 31 March 2003, and 1 April 2003, Ministry of Commerce & Industry, Government of India, New Delhi), was in discharge of India's obligation to the W.T.O. principle of free trade and removal of trade barriers (Article XI of the GATT 1994). Consequently India removed Quantitative Restriction (QR) on imports of urea on government account but restricted urea import through nominated State Trading Agencies to protect the domestic industry (Public Notice No.2 (RE-2003) 2002-03 dated 31 March '03, and 1 April '03, Ministry of Commerce & Industry, Government of India).

These agencies are to make purchases or sales, involving imports or exports, solely in accordance with commercial considerations, including price, quality, avail-

ability, marketability, transportation and other conditions of purchase or sales. These enterprises shall act in non-discriminatory manner and shall afford the enterprises of other countries adequate opportunity, in accordance with customary business practice, to compete for participation in such purchase or sale (Notification No. (RE-2001) 1997-2002 dated 31st March 2001, Ser No.166 Exim Circular No. 310-210-PO, Subject to Para 4.8 of Exim Policy, Ministry of Commerce & Industry, Government of India). In this context, the New Pricing Policy (N.P.P.) may draw flak. First, it is not clear whether imported urea will be marketed freely on commercial consideration as proclaimed in the Exim Policy or continue to function under the E.C.A allocation system violation of Article III of GATT 1994, requiring member countries to give national treatment to imports. Second, urea importing state enterprises will remain dependent on the Government assessment about the need of import rather than banking on commercial considerations which are deeply entwined with the rate of concessions and marketing area, assigned to state enterprises through allocations and movement orders under the EC Act (Under importing State Trading Agency are authorized to market and sell urea in a particular state during specific time period through movement orders & allocations issued by the Department of Fertilizer, Government of India).

Thirdly, the import of urea from M/s Oman India Fertilizers Company at a pre-determined rate may be a violation of the provision of Article XVII of GATT 1994 in regard to the State Trading Agency, which are to operate on commercial considerations. If the arrival of the Oman India product is to be treated as import, it has to be routed through State Enterprises, which are bound to operate on commercial consideration. In that case, how will the price of urea from Oman India, if the then obtaining price in international market are lower than long-term buy back prices, as agreed to under the Oman-India agreement be purchased by State enterprises supposed to operate on commercial considerations? Similarly, the view that Government imports are in accord with GATT 1994 provisions, and that India is not a signatory of Agreement on Government procurements, is also a moot point. Propagators of this view tend to overlook the fact that the end users of urea are Indian farmers and not the Government of India per-se, which acts only as facilitator of imports. So, in the light of Article-31 of VCLT, a harmonious interpretation may not tend to treat urea import as a commodity for Government consumption without stipulation of Government procurements under Article 8 (a) of GATT 1994 and keep them away from the violation of national treatment. Besides, some may say that the Middle East and erstwhile Russian Block Countries are not the members of the W.T.O., so imports from C

dia will not be violative of provisions of State Trading Agency as enshrined in Article XVII of GATT 1994. Those who hold this view should not ignore the fact that Saudi Arabia has already become the member of the WTO and all other countries are vying to become members of the WTO (Goyal, Noor Mohd 2001). It is important to note that all members are obliged to ensure conformity of their laws, regulations and administrative procedure by virtue of Article XVI of the WTO Agreement and not on the basis of the WTO membership of any country.

Subsidies

GATT 1994, Article XVI neither defines nor prohibits a subsidy as such. It only says that if any member grants a subsidy to promote exports or reduce imports, it has to notify the effect of such subsidy. And if it uses or threatens to cause serious prejudices to the interest of any other Member, it will consult, on request, with the other Members the possibility of limiting such subsidizations. Since a separate Multilateral Agreement on Subsidy (SCM) has been concluded and in case of any conflict with general agreement covered agreement shall prevail, the subsidy aspect will be examined under SCM (Annex 1A, WTO Agreement).

Agreement on Subsidies and Countervailing Measures (SCM)

The Agreement on Subsidies and Countervailing Measures (SCM) is built on the Agreement on Interpretation and Application of Articles VI, XVI and XXIII which was negotiated in the Tokyo Round (WTO analytical index: Subsidies & Countervailing Measures: www.wto.org).

For the first time, 'Subsidy' was defined as benefit conferred by the financial contribution of the government or governmental body operating within the territory of the member State conferring the benefits (Article 1 of the Agreement on SCM).

This was confirmed by the Appellate Body in the US-SCM case, when it said that "Article 1.1 sets forth the general definition of the term 'subsidy' which applies 'for the purpose of this Agreement'. It also introduces the concept of a "specific" subsidy for the most part, a subsidy available only to an enterprise or industry or group of enterprises or industries within the jurisdiction of the authority granting the subsidy (Article 1:2 and Art 2 of the Agreement on SCM). Only specific subsidies would be subject to the disciplines set out in the agreement and it will be prohibited if 'contingent on export performance'

or 'contingent upon the use of domestic over imported goods (Article.3:1 of the Agreement on SCM).

All other specific subsidy may be actionable under Article 5 of SCM if it causes adverse effects to the interests of other signatories, i.e. injury to domestic industry of another signatory, nullification or impairment of benefits accruing directly or indirectly to other signatories under the General Agreement and serious prejudice to the interests of another member. "Serious prejudice" shall be presumed to exist for certain subsidies as per Article 6 of the SCM. In such a situation, the burden of proof is on the subsidizing member to show that the subsidies in question do not cause serious prejudice to the complaining member. The agreement also recognizes that subsidies may play an important role in the economic development programme of developing countries, and in the transformation of centrally-planned economies to market economies. Least-developed countries and developing countries that have less than \$1,000 per capita GNP are thus exempted from disciplines on prohibited export subsidies (ibid, see also Article 27 of SCM Agreement).

Does the New Pricing Scheme for urea and Concession Scheme for decontrolled fertilizers confer a 'benefit' to the Indian Fertilizers Industry to constitute subsidy as per the provisions of the SCM? To analyze and comprehend it better, it will be germane to revisit the concept of fertilizers demand supply mechanism in India. The Indian fertilizer policy aims to ensure reasonable returns (12%) to fertilizer producers for encouraging fresh investment in fertilizers sector to increase fertilizer production and consumption by offering it to Indian farmers at affordable prices. So its anatomy comprises (a) reasonable return (12% on net worth), (b) affordable price (MRP), and transportation and distribution cost (Letter No. 4-20/78-FDO-1 dated 1.1.1979-E.equated Freight, Department of Agriculture and Cooperation, Government of India). To achieve this purpose, the differential in MRP of Rs 4830/- per tonne of urea fixed by the Government and cost of production (Rs. 9183/ average group price) is paid by the Fertilizers Coordination Committee (FICC), Department of the Fertilizers, Government of India, to the industry along with normative transportation and distribution cost which always lags behind the actual expenditures incurred by the industry (Ibid).

Before examining which of the component amounts to financial contribution by the government of India conferring benefit on recipient, it will be relevant to have a look what WTO jurisprudence says about subsidy as defined in SCM.

The Panel in the Canadian Aircraft case noted that the SCM Agreement Article 1 (Para.9.96) provides that a "subsidy" exists when there is a "financial contribution" by a Government or any public body within the territory of a Member that confers a "benefit." (Panel Report of Canada—Measures Affecting the Export of Civilian Aircraft (WT/DS70/R), WorldTradeLaw.net Dispute Settlement Commentary (DSC) © 2001 WorldTradeLaw.net LLC, accessed on 24.8.04). Examining the ordinary meaning of the term "benefit," the Panel stated that "benefit" refers to an "advantage" to a recipient and not to the net cost to the grantor. This advantage, the Panel said, is made in comparison to the position the recipient would have been in absence of the financial contribution. Accordingly, a financial contribution confers a "benefit" if it is provided on terms that are more advantageous than those that would have been available to the recipient in the "market." The Panel further observed that the context provided by the SCM Agreement Article 14, which sets out guidelines for calculating "the benefit to the recipient conferred pursuant to paragraph 1 of Article 1," supports this interpretation, as these guidelines rely on a commercial benchmark that examines whether the terms are more advantageous than those available on the commercial market. (paras 9.111-113). On appeal, the Appellate Body upheld the Panel's finding.

If in the light of WTO jurisprudence we analyze the aforesaid components of the Indian Fertilizers Policy, it is understood that payment of the differential amount of MRP (Rs. 4830) and cost of production (ranging from Rs. 5159 to Rs. 14686) in case of urea or higher rate of concession to domestic DAP manufacturers (Rs. 4215 compared to Rs. 3842 for imported DAP), is a financial contribution conferring benefit to industry, as it ensures a reasonable return to industry which otherwise may not necessarily accrue in the market driven economy. The fertilizers importers are subsidized on the basis of landed imported cost, which vacillates with the price fluctuation depending on international demand-supply scenario, minus MRP. So they may not necessarily get a reasonable return on their net worth as is the case with Indian fertilizers producers. Since there is a financial contribution by the Government to the domestic industry, the differential rate of subsidization amounts 'benefit' and provides the Indian Fertilizers Industry a comparative advantage. This view is also supported by the DSB Panel on US-Lead and Bismuth II when it said "The existence or non-existence of 'benefit' rests on whether the potential recipient or beneficiary, which 'logically' must be a legal or natural person, or group of persons, has received a 'financial contribution' on terms more favourable than those available to the potential recipient or beneficiary in the market..." (WTO analytical index: Subsidies &

Countervailing Measures, Agreement on Subsidies & Countervailing Measures).

Do Indian producers have more favourable terms? At the current ruling prices of urea at international prices the landed cost of urea is coming to around Rs. 131 per tonne, which is greater than the domestic cost of gas based plants (ranging from Rs. 4963 to Rs. 9674) well most of F.Oil/LSHS-based plants (Rs. 8204 to Rs. 12848). So these producers can very well argue their return will be far greater than if they were allowed to sell in the open market and thus no benefit is conferred on them. In that case Government assistance may 'benefit' those units which have a lower cost of production compared to delivered cost of imported urea, but will certainly be a 'benefit' to those naphtha-based units where the cost of production ranges from Rs. 1377 to Rs. 16866 per tonne, and which cannot survive in the market but for Government contribution. Such Government contribution will amount to an advantage and be treated as subsidy under Art.1 of the SCM.

Some may argue that urea procurement is basically a Government purchase for ensuring timely availability to farmers at an affordable price through industry, due to administrative convenience and exigencies, and the 'benefit' is conferred on the Indian fertilizer industry even if it is considered as a Government purchase. For the sake of discussion, it may amount to financial contribution as held by the Appellate Body in the US Lumber Case, while examining the scope of Article 1.1(a) (1) that there is a financial contribution where "a government provides goods or services other than general infrastructure, or purchases goods." (Paras. 50-53 Appellate Body Report, United States—Final Countervailing Duty Determination With Respect To Certain Softwood Lumber From Canada, (WT/DS257/A) WorldTradeLaw.net Dispute Settlement Commentary (DSC)© 2004 WorldTradeLaw.net LLC).

The benefit to the recipient differs from the cost to the Government, as was the view of the Panel in the Canadian Aircraft case. "The structure of Article 1.1(b) as a whole confirms our view that Article 1.1(b) is concerned with the 'benefit' to the recipient and not with the 'cost to government'..." (Panel Report of Canada - Measures Affecting the Export of Civilian Aircraft (WT/DS70/R) WorldTradeLaw.net Dispute Settlement Commentary (DSC) © 2001 WorldTradeLaw.net LLC, accessed on 24.8.04).

For the existence of the subsidy actual transfer of the fund from the Government is not necessary. This is the view of the Panel on Brazil - Aircraft case when it

[According to Article 1:1 (a)(i) a subsidy exists if a government practice involves a direct transfer of funds or a potential direct transfer of funds and not only when a government actually effectuates such a transfer or potential transfer..." (WTO analytical index: Subsidies & Countervailing Measures, Agreement on Subsidies and Countervailing Measures).

Since both NPP and the Concession Scheme do involve a direct transfer of funds from the Government to the Fertilizers industry, it constitutes a subsidy within the definition of the Art.1:1 of the SCM. But the fixation of the MRP cannot be termed as financial contribution and consequently does not confer any benefit amounting to a subsidy. Similarly, reimbursement of the transportation cost on normative basis, despite being a financial contribution, may not be construed as 'advantage' to the recipient because these terms are not more advantageous than those that would have been available to the recipient on the "market," (Panel Report of Canada - Measures Affecting the Export of Civilian Aircraft (WT/DS70/R), WorldTradeLaw.net Dispute Settlement Commentary (DSC) © 2001 WorldTradeLaw.net LLC, accessed on 24.8.04) so there is no benefit within the stipulation of the Art.1:1 of the SCM.

The implication of the subsidy is explained in Art.1:2 of the SCM, which says that a subsidy as defined in paragraph 1 shall be subject to the provisions of Part II (prohibited) or Part III/IV (actionable/non-actionable) if it is specific in accordance with the Art.2 of the SCM.

Now let us examine whether it is specific in nature as required by the Art.1:2 of the SCM. Art 2:1 of the SCM explains that in order to determine whether a subsidy, as defined in paragraph 1 of Article 1, is specific to an enterprise or industry or group of enterprises or industries within the jurisdiction of the granting authority, following principles shall apply:

(a) Where the granting authority, or the legislation pursuant to which the granting authority operates, explicitly limits access to a subsidy to certain enterprises, such subsidy shall be specific.

(b) Where the granting authority, or the legislation pursuant to which the granting authority operates, establishes objective criteria or conditions governing the eligibility for, and the amount of, a subsidy, specificity shall not exist, provided that the eligibility is automatic and that such criteria and conditions are strictly adhered to. The criteria or conditions must be clearly spelled out in law, regulation, or other official document, so as to be capable of verification.

The objective criteria or conditions, as used herein, mean criteria or conditions which are neutral, which do not favour certain enterprises over others, and which are economic in nature and horizontal in application, such as number of employees or size of enterprise.

(c) If, notwithstanding any appearance of non-specificity resulting from the application of the principles laid down in subparagraphs (a) and (b), there are reasons to believe that the subsidy may in fact be specific, other factors may be considered. Such factors are: the use of a subsidy programme by a limited number of certain enterprises, predominant use by certain enterprises, the granting of disproportionately large amounts of subsidy to certain enterprises, and the manner in which discretion has been exercised by the granting authority in the decision to grant a subsidy. In applying this subparagraph, account shall be taken of the extent of diversification of economic activities within the jurisdiction of the granting authority, as well as of the length of time during which the subsidy programme has been in operation.

In this regard, in particular, information on the frequency with which applications for a subsidy are refused or approved and the reasons for such decisions shall be considered.

A perusal of the above mentioned Article 2:1 of the SCM Agreement reveals that Paras (a-c) use the phrase 'subsidy to certain enterprises' rather the phrase 'subsidy specific to an enterprise or industry or group of enterprises or industries' as deployed in the said Article. This does not mean that the principles, as laid down in Paras (a-c) of Art.2:1 of the SCM, are not applicable to 'industry'. But in the light of Art.31 of the VCLT (The Vienna Convention on Law of Treaties), a harmonious contextual meaning of the word 'enterprise' should also encompass the phrase 'industry'. So, taking the broader meaning of 'enterprise' used in Para (a) of Art.2:1, it is inferred that financial assistance of the government of India under NPP for urea and Concession Scheme for potassic and phosphoric fertilizers is specific to fertilizers industry within the meaning of Art.2:1 of the SCM Agreement, as the same is not available to other industries.

Now it is clear that the Indian Fertilizers Policy does have a component of specific subsidy. The next question is whether subsidy, specific to the fertilizer industry, is a prohibited or actionable? Art.2:3 of the SCM Agreement explains that any subsidy falling under the provisions of Article 3 shall be deemed to be specific. Article 3:1 of the SCM says that except as provided in the Agreement on agriculture, the subsidies, within the meaning of Article 1, shall be prohibited:

- (a) If it is contingent, in law or in fact, whether solely or as one of several other, upon export-performance, or
- (b) Upon use of domestic over imported goods. Such subsidy shall neither be granted nor maintained by a Member as per the provision of the Article 3:2 of the SCM Agreement. So the determinant factor for prohibited is the contingency of the subsidy either on export performance or use of domestic goods over imported one.

The ordinary connotation of 'contingent' is 'conditional' or 'dependent for its existence on something else'. Regarding the interpretation of the term "contingent ... in fact", the Panel in *Australia—Automotive Leather II* established a standard of "close connection" between the grant or maintenance of a subsidy and export performance (Appellate Body Report of *Canada—Autos*. WTO analytical index: *Subsidies & Countervailing Measures, Agreement on Subsidies and Countervailing Measures*. www.wto.org).

The 'contingency' in Article 3:1(b) is not only confined to de-jure (law) as was the view of the Panel in *Canada—Autos* but also extend to de-facto situation as was finally held by the appellate Body. On application of this meaning of 'contingent' it is found that reimbursement of concession amount to domestic producers of phosphoric fertilizers under Concession Scheme and payment of differential cost of production and MRP to urea manufacturers under NPP is contingent upon sale of fertilizers to domestic farmers. The sale of fertilizers to domestic farmers is the eligibility conditions for payment of subsidy. Thus payment of subsidy has 'close connection' with the sale of fertilizers to domestic users and so is contingent on use of domestic goods over imported. However, it can be argued that the phrase 'domestic use over imported goods' in Article 3:1 (b) of the SCM mean subsidy is contingent on use of domestic input for the production of the goods. So to fall within the purview of prohibited subsidy, as being contingent on use of domestic goods over imported one, it has to be administered on an input basis and not output basis. Since Indian Fertilizers Subsidy is an output-based subsidy and not input-based as stipulated within the meaning of Article 3:1 (b) of the SCM, it cannot be categorized as prohibited subsidy. But this will be a narrow view of 'contingent on use of domestic over imported one'. The essence of the subsidy is to confer advantage to domestic industry to protect it from outside competition and this causes market distortion by limiting market access to competitive 'like products'. And in this sense it covers the output subsidy also if its disbursement is contingent upon do-

mestic use. In this context it would be essential to the Panel, in *Indonesia—Autos* case, which was upon to decide whether the Indonesian subsidies contingent upon the use of domestic over imported goods specific: The panel observed, "As with any analysis under the SCM Agreement, the first issue to be resolved whether the measures in question are subsidies within the meaning of Article 1 that are specific to an enterprise or industry or group of enterprises or industries within the meaning of Article 2." We have seen that subsidies available only to fertilizers producers and so it is specific within the meaning of Article 2 of the SCM. However, it is said that fertilizer subsidy is to the farmers and not to the industry and being (input-subsidy) a non-product specific within the de minimis of 10% of Agriculture value case of developing country is permitted within Article 3(b) of the Agreement on Agriculture. But as discussed earlier, domestic producers, assured of reasonable turn, are better placed compared to importers to discontinue the MRP, which induces Indian farmers to have preference for the domestically produced fertilizers over imported fertilizers. Thus de-facto implication of present subsidy regime is to encourage consumption of the domestically produced fertilizers over imported. Since Article 3.1 (b) of the SCM Agreement covers both de-jure and de-facto situations, as held in the *Canada—Auto* case, the Indian Fertilizers Subsidy falls within the category of a prohibited one and so it should not be maintained as per Article 3:2 of the SCM.

Nevertheless, still it can be argued that Article 27:3 of the SCM, developing countries are entitled to Special and Differential (S&D) treatment and the prohibition of Article 3 does not apply to them for certain time-periods from the date of entry into force of the WTO Agreement. For a period of five years from the date of entry into force of Article 3.1 (b) shall not apply to Developing country Members. As a consequence, subsidies contingent upon export performance and upon the use of domestic over imported goods are, when granted by qualifying developing country Members, merely actionable rather than prohibited subsidies. Since India is a developing country and falls in the category of the qualifying list of countries it can legitimately grant subsidy till it is proved to be prejudicial to the interest of other Members as it restricts their exports to India. But advocates of this view call that the aforesaid exception was meant for a period of five years and that the period has already expired. So this argument may not hold good.

Agreement on Agriculture

Another defence may be that the fertilizers

is basically an agro-input subsidy, which is administered through Industry. Article 3 of the Agreement on SCM is subject to Agreement on Agriculture (AA) (Agreement on Agriculture, World Trade Organisation: The legal Texts, The Results of the Uruguay Round of Multilateral Trade Negotiations), which permits conditional export subsidy and domestic supports (product specific and non-product specific) to the extent of 10% of agriculture value in case of a developing country like India. So, fertilizer subsidy, being input support, cannot be termed as a prohibited one. Since export subsidy is not our immediate concern, the discussion will be confined to domestic support only. Reference to relevant provisions of the Agreement on Agriculture will be of immense help in comprehending the issue of domestic support as enshrined in Agreement on Agriculture. Article 3 of the Agreement on Agriculture says that subject to Article 6 of this agreement, a Member shall not support to domestic producers in excess of the commitment level specified in section I of Part IV of its schedule. Article 6:2 of the AA permits, inter alia, input subsidy to low-income and resource-poor farmers. Article 6:4 (b) limits the Aggregate Measure of Supports (AMS) to 10% of annual agriculture value in case of a developing country. But perusal of Article 13 and 13(b) (i) of the AA reveals that during the implementation period, notwithstanding the provisions of the GATT 1994 and the SCM Agreement, domestic support measures that fully conform to the provisions of Art 6 of this agreement shall be exempted from the countervailing action under Article VI of the GATT 1994 and part V of the SCM Agreement. As per Article 1 (f) of the AA, the implementation period in the context of Article 13 means 9 years commencing from 1 January, 1995, which expired on 1st January 2004. It means that all subsidies are now subject to the SCM Agreement, (Article 31 of SCM Agreement says that provision of paragraph 1 of Art.6 and the provision of art.8 & 9 shall apply for the period of five years, beginning with the date of entry of WTO Agreement, i.e. 1 January 1995), categorizes subsidies either prohibited or actionable. So the defence of fertilizers subsidy, being agro-input, within permissible de minimis limits of 10% of agriculture value, may not be available. Similarly, even if it is treated as actionable under Article 5 of SCM, being specific in nature, the exemption from action permitted under Para (c) of Article 5 to subsidies related to agriculture products falling under Article. 13 of the AA will not be available due to expiry of the so-called peace clause or 'due restraint' as mentioned above. Now a fertilizers subsidy will be actionable under Article 5, read with Article 6.3 (a) of SCM for having effect of impeding the imports of a like product. However, criticism has to be evaluated in perspective of determination of urea prices by the forces of demand-supply

operating at the international market, which remains vulnerable to maneuverings of low-cost gas-based plants due to differential feed stock-pricing policy of these countries.

Agreement on Trade-Related Investment Measures (TRIM)

This agreement is basically a clarification of applicability of the principle of National Treatment & Quantitative Restrictions, enumerated in Article III & XI of the GATT 1994, to trade aspect of the investment in goods production. The agreement recognizes that certain investment measures restrict and distort trade. It provides that no contracting party shall apply any TRIM (Article 2:1) inconsistent with Articles III (national treatment) and XI (prohibition of quantitative restrictions) of the GATT 1994. For the purpose a list of such trade distorting measures, inconsistent with TRIMs, has been appended to the said Agreement. The agreement requires mandatory notification of all non-conforming TRIMs and their elimination within two years for developed countries, within five years for developing countries and within seven years for least-developed countries (Art.5:2 of the TRIM).

To examine the consistency of the Indian Fertilizers Policy with TRIM, it would be appropriate to reproduce the relevant rule of the TRIM. The Para 2 and sub-para (c) of the Annex-(Illustrative List) of the TRIM says that trade related investment measures shall be inconsistent with Article XI of GATT 1994, if they are mandatory or enforceable and which restrict the exportation or sale for export by an enterprise of products either in terms of value or volume. The NPP does not permit free exportation of urea (within 100% production) from India and so inconsistent with the TRIM obligations. The New Production Policy for the urea requires Government clearance for installation of the plant if a manufacturer wants to avail the benefit of the subsidy offered by the Government. Since no urea producer can survive without Government support it has to take clearance from the Government and as such cannot have the freedom of free import and export. This is not TRIM consistent.

Conclusion

In the background of the aforesaid discussion, the conclusion is that the Indian Fertilizers Policy is not WTO consistent. The new fertilizer policy for Urea and Concession Scheme for potassic and phosphatic fertilizers are inconsistent with the provisions of the GATT 1994, SCM and TRIM. If the Government of India decides to

bring its policy in conformity with its WTO commitment, it has to either remove the subsidy altogether or target it in consonance with the provisions of Agreement on Agriculture, which is currently being negotiated under the Doha Round of negotiations.

References

- Koul. A.K.** - The Legal Regime of Subsidies and Countervailing Measures in World Trade Organization (WTO) - Delhi Law Review-Volume XXI: 1999.
- Palmeter, David and Petros C. Mavroidis**, Dispute Settlement in the World Trade Organization – Practice and Procedure. The Hague, London, Boston: Kluwer Law International, 1999.
- Budget Estimate 2006-07, Department of Fertilizers, Ministry of Chemical and Fertilizers, Government of India, New Delhi.
- Final Act Embodying The Result of The Uruguay Round of Multilateral Trade Negotiations, The legal Texts, The Results of the Uruguay Round of Multilateral Trade Negotiations.
- Markesh Agreement Establishing the World Trade Organization. The legal Texts, The Results of the Uruguay Round of Multilateral Trade Negotiations
- Letter No.12019/5/98-FPP dated January 30, 2003, Department of Fertilizers, Ministry of Chemical & Fertilizers, Government of India.
- Retention Price-cum-Subsidy Scheme, 1977: Gazette Notification (Resolution) No.166. (24/77-FDA dated 01.11.1977.
- The 'Concession Scheme' for extending financial supports to decontrolled fertilizers P&K on sale w.e.f. 1.10.2000. -Annual Report 2003-04, GOI, DOF, Ministry of Chemical and Fertilizers.
- Agreement on Government Procurement, World Trade Organization: The legal Texts, The Results of the Uruguay Round of Multilateral Trade Negotiations.
- Fertilizers Statistics, 2004-2005, Fertilizer Association of India, 10 Saheedjit Singh Marg, New Delhi.
- Annual Report 2005-06, Department of Fertilizers, Ministry of Chemical & Fertilizers, Government of India, New Delhi.
- General Agreement on Tariff and Trade 1994, The World Trade organization. The legal Texts, The Results of the Uruguay Round of Multilateral Trade Negotiations.
- The Fertilizer (Movement control) order, 1973 Gazette Notification No. SRO 249(E) dated 25th April 1973, The Fertilizer Association of India, 10 Saheedjit Singh Marg, New Delhi.
- Notification of Public Notice No.2 (RE-2003) 2002-03 dated 31st March 2003, Ministry of Commerce & Industry, Government of India
- Circular No.2 (RE-2001) 1997-2002 dated 31st March 2001, Serial No.166 Exim Circular No. 310-210-PO, Subject to Para 4.8 of Exim Policy, Ministry of Commerce & Industry, Government of India, New Delhi.
- Fertilizer (Control) order 1985, Gazette Notification orders No. GSR 758 (E) dated 25th September 1985. The Fertilizer Association of India, 10 Saheedjit Singh Marg, New Delhi.
- Essential commodities Act, 1955, The Fertilizer Association of India, 10, Saheedjit Singh Marg, New Delhi. 27.
- Appellate Body Report of Canada –Autos. WTO analytical i
SUBSIDIES & COUNTERVAILING MEASURES, Agree
on Subsidies and Countervailing Measures.www.wto.org
- Japan Alcoholic case and EU- Asbestos case analytical index:
SIDIES & COUNTERVAILING MEASURES, Agreeeme
Subsidies and Countervailing Measures.www.wto.org
- Notification No. S-5/2004-Shiping II dated 30-8-04 issued by th
partment of Fertilizers, Ministry of Chemical and Fertil
GOI.
- U.S. Jha**, 'Future Outlook of Fertilizers Marketing In India, Fert
& Agriculture Future Direction, December 2001, New
FAI.
- Notification No.12019/11/2003-FPP dated 29-1-04, Departme
the Fertilizers, GOI.
- WTO ANALYTICAL INDEX: GATT 1994, General Agreement o
iffs and Trade 1994.www.wto.org .
- C.H. Hanumantha Rao**, Fertilizer Pricing Policy, Report of the
Powered Review Committee, April 1998, Department of
izers, Government of India.
- Arun Goyal, Noor Mohd.**-WTO in the new Millennium, 5th E
September, 2001, Academy of Business Studies, 2
Sheeltara House, Ansari Road, New Delhi.
- Report of Economic Reform Commission, Ministry of Finance
ernment of India, New Delhi.
- Gazettes Notification No. S.O.642 (E) dated 25.08.1992 reg
decontrol of potassic and phosphoric fertilizers, issued
Department of Agriculture & Cooperation, Governm
India.
- Understanding on Rules and Procedures Governing Settlem
Disputes., The legal Texts, The Results of the Uruguay
of Multilateral Trade Negotiations
- Agreement on Subsidies and Countervailing Measures, Worlc
Organization: The Legal Texts-The Results of the U
Round of Multilateral Trade Negotiations, Cambridge I
sity Press.
- Agreement on Agriculture, World Trade Organization: The lega
The Results of the Uruguay Round of Multilateral Trade
tations.
- Agreement on Trade-Related Measures, World Trade Organi
The Results of the Uruguay Round of Multilateral Trade
tations.
- Letter No. 4-20/78-FDO-1 dated 1.1.1979-E.equated Freight, I
ment of Agriculture and Cooperation, Government of Ir
- Ministry of Chemical & Fertilizers, Department of Fertilizer:
No.18-1/2000-FM dated 15.03.2000 on violation of Mo
orders.
- Notification No.30 (RE-2003/2003-2007, New Delhi dated 28'
ary, 2004, Department of the Fertilizers, Ministry of Ct
and Fertilizers, Government of India, New Delhi.
- Vijay Paul Sharma**, Domestic Support commitments Unde
and their Implications for Indian Agriculture, Paper Pre
in FAI seminar December 4-6 1999, New Delhi.
- C.H. Hanumantha Rao**, Fertilizer Pricing Policy, Report of th
Powered Review Committee, April 1998, Department c
izers, Government of India.

Report of the Fertilizers Prices Committee (Marathe Committee) (Part I & II) (1978); Ministry of Petroleum, Chemical and Fertilizers, Government of India.

Report of the Joint Committee on Pricing, Tenth Lok Shabha (1992): Government of India.

Singh Parmanand, State, Market and Economic Reforms, Delhi Law Review, Volume XVII, 1996.

Circular No. FICC/CE/72-2003/164 dated 28-5-2003. Notification issued by the FICC, Department of Fertilizers, Government of India, New Delhi.

Gazette Notification No. S.O. 477 (E), Ministry of Industry, Department of Industrial Development dated 24th July, 1991.

Prem S. Vashishtha: Prospect of Fertilizer Sector in the Next Decade, Fertilizer & Agriculture Future Direction, December 2001, New Delhi. FAI.

U.S. Awasthi: Impact of The Policy On The Health of Urea Industry, 'Fertilizers And Agriculture' F.A.I. Seminar December 2002, New Delhi.

Panel Report of Canada - Measures Affecting the Export of Civilian Aircraft (WT/DS70/R), WorldTradeLaw.net Dispute Settlement Commentary (DSC) © 2001 WorldTradeLaw.net LLC.

WTO analytical index: SUBSIDIES & COUNTERVAILING MEASURES, Agreement on Subsidies and Countervailing Measures, www.wto.org

Appellate Body Report of EC-BANANA III. WTO analytical index: SUBSIDIES & COUNTERVAILING MEASURES, Agreement on Subsidies and Countervailing Measures. www.wto.org

Appellate Body Report of Indonesia - Autos. WTO analytical index: SUBSIDIES & COUNTERVAILING MEASURES, Agreement on Subsidies and Countervailing Measures. www.wto.org

Appellate Body Report Brazil - Export Financing Programme for Aircraft (WT/DS46/AB/R) WorldTradeLaw.net Dispute Settlement Commentary (DSC) © 2001 WorldTradeLaw.net LLC. www.wto.org

Appellate Body Report, United States - Final Countervailing Duty Determination With Respect To Certain Softwood Lumber From Canada, (WT/DS257/AB/R) WorldTradeLaw.net Dispute Settlement Commentary (DSC)© 2004 WorldTradeLaw.net LLC. www.wto.org

Panel Report on Korea - Measures Affecting Government Procurement (WT/DS163/R), WorldTradeLaw.net Dispute Settlement Commentary (DSC), www.wto.org

US Lead and Bismuth II, WTO analytical index: SUBSIDIES & COUNTERVAILING MEASURES, Agreement on Subsidies and Countervailing Measures. www.wto.org

Panel Report of Australia - Subsidies Provided to Producers and Exporters of Automotive Leather, (WT/DS126/R) WorldTradeLaw.net Dispute Settlement Commentary (DSC), © 2004 WorldTradeLaw.net LLC. www.wto.org

□

Knowledge has to be improved, challenged, and increased constantly, or it vanishes.

- Peter F. Drucker

Greenhouse for Higher Productivity

J C Paul & J N Mishra

Greenhouse cultivation is a controlled environment cultivation, which has been evolved to create favourable microclimate in which crop production can be made possible all throughout the year or part of the year as required. Greenhouse crop production is considered an enterprising approach with assured input-output relationship, higher rural employment and check on migration from rural to urban areas. In India, where there are large numbers of small and marginal land holdings, this technology can give higher return with dignified self-employment opportunities for educated rural youth.

J C Paul and J N Mishra are Associate Professor and Assistant Professor respectively, College of Agricultural Engineering and Technology, Orissa University of Agriculture & Technology, Bhubaneswar.

Agriculture is as old as human civilization. Centuries ago the population was less and Mother Nature produced enough. Therefore, man only needed to gather food and eat it. As the population grew and food preferences developed, the practice of crop cultivation began which involved seeds, tillage, harvesting and storage of crops. Appropriate tools were developed and the relevant practices for irrigation, weeding and plant protection were developed.

It did not take long to realize that food for human body needed to include a variety of natural products to meet requirements for health and survival. Early human settlements were confined to those regions where year-round food availability, either from nature or from cultivation, was ensured. When man moved to harsher climates the food habits and cultivation practices became modified. Development of greenhouse technology is an example of mankind's efforts to ensure survival under natural adversities.

Greenhouses are frames of inflated structures covered with a transparent material in which crops are grown under controlled environment conditions. These are large enough to allow a person to work within the structure in order to carry out cultural and operational activities. A greenhouse generally includes the following items:

- (i) Structure
- (ii) Covering material
- (iii) Ventilation and cooling system
- (iv) Shading system, i.e. screens
- (v) Fan and air circulation
- (vi) Artificial lighting
- (vii) Controlled system for irrigation, fertigation and microclimate.

After the advent of the green revolution, more emphasis was laid on the quality of products along with

quantity of production, to meet the ever-growing food requirements. Both these demands can be met when the environment for the plant growth is suitably controlled. The need to protect the crops against unfavourable environmental conditions led to the development of protected agriculture.

Greenhouse is the most practical method of achieving the objectives of protected agriculture, where the natural environment is modified by using sound engineering principles to achieve optimum plant growth and yields.

Greenhouse technology has been in use for crop production in more than 50 countries all over the world. Japan, with about 42,000 ha under plastic and glass cover greenhouse, tops the list in the world. China is believed to have adopted the plastic greenhouse concept to a great extent to feed the huge population. The occurrence of small and marginal land holdings with a shorter growing season in Holland and Japan have been the reason behind adopting greenhouses for intensive crop production, whereas water conservation is one of the reasons for greenhouse crop production in Israel and Middle Eastern countries.

India now has about 900 ha of land under greenhouse cultivation. Ladakh region of Jammu and Kashmir has the maximum number of units (more than 14,000). The greenhouse revolution in Ladakh has permitted round the year availability of fresh vegetables, where the normal growing season is limited to only four months. Major users of greenhouses in the country are the states of Maharashtra, Karnataka, Jammu and Kashmir, Tamil Nadu and Sikkim (Table 1). There is still a large, untapped potential for greenhouse adoption in the country.

Perspective

Greenhouse technology is a proposition in controlling plant microclimate. The objective may be to either produce crops where the production is normally not possible outdoors, or to enhance the productivity by microclimate manipulation. There are many specific situations where open field agriculture becomes limiting and protected cultivation practices of greenhouses becomes useful. The following list details some of the areas of potential greenhouse applications:

- i. Food production in the regions of inclement agro climatic conditions, i.e. very hot, very cold, heavy rainfall, etc.
- ii. Intensive production of medicinal and aromatic plants.

- iii. Production of high quality flowers for export and elite domestic markets.
- iv. Off-season production of vegetables.
- v. High-grade seed production of high purity.
- vi. Efficient and high quality nursery production through seeds and vegetative means.
- vii. Bio-safe testing of transgenic and hardening of bioengineered plant material.
- viii. Year-round cultivation of certain horticultural crops to meet local and export demand.

Table 1: Area covered under greenhouse in India

States	Area covered (ha)	States	Area covered (ha)
Jammu & Kashmir	321	Tamil Nadu	50
Himachal Pradesh	8	Karnataka	260
Uttaranchal	8	Nagaland	5
Haryana	10	Sikkim	32
Punjab	5	Meghalaya	5
Rajasthan	3	Assam	2
Delhi	5	Manipur	3
Uttar Pradesh	3	Tripura	2
Maharashtra	150	Arunachal Pradesh	5
Gujarat	4	West Bengal	5
Andhra Pradesh	8		

Advantages of Greenhouse

- i. The entrapped thermal radiation in the greenhouse increases the temperature and energy availability, thereby increasing the photosynthetic efficiency of the plants grown.
- ii. The carbon dioxide level increases by 6 to 7 times and photosynthetic activity by 3 to 4 times.
- iii. The transpiration from plants and evaporation from the soil are trapped, by which the relative humidity inside the chamber increases, followed by substantial decrease in the evapotranspiration. Hence the water uptake of plants goes down, causing ultimate reduction in intake to the tune of 40-50%.
- iv. Increased temperature and relative humidity results in higher germination rates.
- v. The microclimatic condition thus created reduces the disease incidence in the crop grown.

Classification of Greenhouse

Classification According to Cost/Technology

i. *Low cost/low tech greenhouse:* This type of greenhouse is a simple framed structure made of locally available materials like bamboo, timber, etc., with ultraviolet stabilized film used as cladding material. It has no specific control device for regulating environmental parameters inside. It has got a simple technique of opening and closing the side wall for regulating temperature and humidity. This type of greenhouse is useful for high rainfall as well as for cooler regions. Such structures in high rainfall areas are called rain shelters and are useful for vegetable cultivation.

ii. *Medium cost/Medium tech greenhouse:* This type of greenhouse is operated manually or by semi-automatic control devices, leading to minimum investment. The framed structures are made of GI pipes. The structures are connected through the nut and bolt system and are fixed to the ground, so that it does not get disturbed by the force of wind. Evaporative cooling pads and the misting arrangements help in maintaining favourable humidity inside the greenhouse. These types of greenhouses are suitable for dry and composite climates.

iii. *High cost/High tech greenhouse:* This type of greenhouse is very useful with regard to overcoming the difficulties found in the medium cost greenhouse. In this case, there is a control system consisting of a sensor, a computer, an operator and signal receiver. All the control systems are aimed at satisfying the conditions provided by the sensor. It helps in sensing and measuring the variable parameters and compares the instruments against the standard values. The whole system is controlled with the help of a microprocessor.

The technology involved in both high cost as well as medium cost greenhouses are more or less similar, except that in the former, there is an automatic control system. This type of greenhouse is suitable for any climatic condition. The crops coming under the domain of floriculture are usually sensitive to temperature and humidity and hence high-tech greenhouses are more suitable for such types of crops. Apart from the above advantages of the high cost greenhouse, there are also certain disadvantages. For instance, it demands high initial cost, needs skilled and experienced operators and higher cost for maintenance, care and operation.

Classification According to Structure

- i. Quonset
- ii. Gothic

- iii. Post rafter
- iv. A-frame
- v. Rigid frame
- vi. Post-truss

Classification According to Cladding Materials Used

- i. Glasshouse
- ii. Polycarbonate house
- iii. Polyvinyl chloride house
- iv. Acrylic house
- v. Low density poly-ethylene (LDPE) house

Construction of a Greenhouse

Site Selection

A good site can make all the difference in the functional and environmental operations of a greenhouse. The ground slope for drainage is an important factor, adequate provision should be made to direct surface water away from the greenhouse. A greenhouse needs a dependable source of good quality water and electrical energy especially in medium and high-cost greenhouses, where gadgets are used to control the environmental factors. Also the greenhouses should be located away from buildings and trees to avoid obstruction of sunlight.

Orientation

There are two criteria for greenhouse orientation. One is that the light entering the greenhouse should be equate and uniform for crop growth, whereas another that prevailing wind should not adversely affect either the structure or the operation. Orientation of greenhouse may be in any direction when they are in a single span but multispan greenhouse should be oriented in the North-South direction only to avoid shading of certain portions of the greenhouse by the structural members.

Size

Most of the people prefer to start with a small type of greenhouse. The other factors which determine the size of the proposed greenhouse are availability of funds, water, crops to be grown, marketing facility and land requirement. A greenhouse of 100 m² area may be an economical unit for propagation and production of flowering materials, whereas a greenhouse of 300-500 m² would be desirable for growing commercial flowers and vegetables for the nearby cities.

Greenhouse Crops

The choice of crops grown in the greenhouse is mainly made on the basis of physical size of the structure and economic feasibility of a particular type of crop. As a result, high value horticultural crops have been more popular in greenhouse cultivation. Raising of seedlings and plant propagation material are another important commercial aspects of greenhouse technology. Yield of crops planted in greenhouse are several times more than those obtained from traditional cultivation. Yield of some commonly grown crops under greenhouse and open field condition in India are presented in Table 2.

Due to environment control any type of crop can be grown at any time of the year. Some types of crops could be grown repeatedly if the demand persists. Besides, it is also possible and practicable to utilize greenhouse facility for vertical space by adopting tier system. Thus, capacity utilization becomes more than 100 per cent. Off-season crops can be grown in the greenhouse, which can fetch good market price in the market, as there is a heavy demand for these vegetables.

The seedlings can be raised under low cost greenhouse on rain shelters and transplanting could be advanced to have a better crop stand in the field before the peak monsoon (Table 3). The crop can also be harvested early to fetch a better market price. During monsoon, flood occurs frequently in some parts of the country and wash away crops, particularly paddy crops. Paddy seedlings can be successfully grown and made available in

15 days (Table 4). It not only supplies the seedlings in time, but also saves time, makes the first crop sure and increases the possibility of double cropping in the same field.

Table 2: Yield of important vegetables and flowers under greenhouse and open field conditions in India

	Yield (t/ha)	
	Greenhouse	Open field
Vegetables		
Tomato	150	50
Capsicum	95	10
Cucumber	180	8
Summer squash	35	25
Cabbage	50	45
Cauliflower	48	30
Brocoli	15	7
Brinjal	27	20
Chinesh cabbage	42	30
Okra	7.2	1.2
Green corriander	275	210
French bean	22	18
Green onion	102	85
Flowers		
Rose	15-20	1.2
Chrysanthemum	25-40	2.8
Carnation	20-25	7.5

Table 3: Raising of vegetable seedlings

Crop	Date of sowing	Date of germination		Percentage of germination		No. of days taken for transplantation	
		Open field	Greenhouse	Open field	Greenhouse	Open field	Greenhouse
Brinjal	7, July	13, July	11, July	64	75	22	18
Chilli	9, July	15, July	12, July	70	87	23	19

Table 4: Raising of rice seedlings under low cost greenhouse

Particulars	Days after sowing					
	10		15		20	
	Height (cm)	Weight (gm)	Height (cm)	Weight (gm)	Height (cm)	Weight (gm)
Low-cost greenhouse	17.5	0.22	29.5	0.26	41.6	0.45
Open field	10.4	0.11	13.7	0.12	17.4	0.12

Land Use Efficiency

Land use efficiency is maximized in a hi-tech greenhouse except for the periods when greenhouse operation becomes prohibitively costly. Greenhouses are used year round for cultivation of either a given crop type or a variety of crops. Dutch and French growers have been reported to grow 7 to 8 crops of lettuce in a year. It is evident from table 2 that crop cultivation in greenhouse makes unit area of land yields more. Greenhouses permit very high input-use efficiencies. As a result, crop productivities are several times of those obtained in open field agriculture. The net financial returns per unit area are also 10 to 100 times higher in comparison to open field agriculture.

Cost of Greenhouse

A greenhouse requires a certain initial investment to construct and equip it. Greenhouse operation costs include expenditure on environment control and agricultural inputs. The labour requirement is higher in case of greenhouse cultivation per unit of cultivated area than the traditional cultivation. As a result the cost of production per unit area is higher as compared to traditional cultivation. Depending upon the local climatic conditions and choice of the crops, the initial investment could range from Rs 200-500 per square meter of floor area for steel frame polyhouse (Table 5). The return begins to come just after a period of 2 to 3 months. At the current bank interest rates, the payback period on the initial investment is nearly five years. The Government is also giving subsidy for constructing different types of greenhouse.

Table 5: Cost and subsidy in various types of greenhouses

Type of greenhouse	Cost/sq.m (Rs)	Subsidy (%)	Ceiling area (m ²)	Ceiling amount (Rs)
Low cost	125	50	500	31250
Medium cost	500	40	500	100000
High cost	2000	10	500	100000

Greenhouse for Higher Productivity

From the above it can be concluded that the yield of crops planted in greenhouse are several times more than those obtained from traditional cultivation. Since greenhouse technology permits more intensive cropping activities as compared to open field agriculture under inclement climatic conditions, it should lead to enhanced local employment and thereby a reduction in migration towards cities. Promotion of greenhouse crop cultivation

should also reduce transportation of horticultural produce leading to reduction in vehicular pollution and post-harvest losses. Greenhouse employs relatively higher technology for crop cultivation with reduced drudgery. This form of cultivation should therefore attract the educated youth providing a decent living with sufficient earnings. The participation of educated youth should further improve greenhouse cultivation practices in particular agriculture in general.

Strategies for Greenhouse Development

The greenhouse technology has taken off in many parts of the country. The present annual growth rate of greenhouse area in the country is 30%. Many entrepreneurs have already adopted greenhouse technology and are further in the process of expanding the area under greenhouse. Many are in the process of adopting the technology. However, awareness of greenhouse among common farmers is still very low. Farmers need to be made aware and educated on greenhouse. There is a need for faster promotion of the concept, for undertaking training of entrepreneurs and strong research efforts to reduce the cost and make these adaptable to different climatic situations. Easy access to information, infrastructure and marketing will result in large-scale utilization of this technology.

Conclusion

Land and water resources for agriculture are shrinking as the human population and industrial activities are expanding. More efficient methods of food production are called for. Greenhouse technology permits optimal utilization of resources and therefore maximizes the efficiency of food production. As the challenge for more and better eco-friendly, agricultural production continues, greenhouse technology promises to expand the cropping front not only horizontally but also vertically. In India about 75 m-ha of land are various types of wasteland. A small portion of this area is put under greenhouse cultivation, it can feed to some extent the ever increasing population besides giving employment to some people.

In the country where there are large numbers of small and marginal land holdings, this technology can only give higher returns with dignified self-employment opportunities for educated rural youth. It is also conceivable that people living under inhospitable conditions would be able to produce food for themselves using greenhouse technology. Their long-term extraterrestrial voyages would be made possible by greenhouse technology, in its more refined form, in

in-situ food production rather than taking large supplies from the earth stations. In the events of land surface being a constraint for expansion of cropping activities, harnessing of ocean floors for food production using greenhouse technology should become-feasible.

The overall production projection worked out for various horticultural produce is to the tune of 300 million tones, which is targeted to be achieved through the implementation of the National Horticultural Mission by the end of 2011-12. This calls for hi-tech interventions in horticulture in which greenhouse technology is a component, to improve production, productivity and reduce cost of cultivation of horticultural crops. Constraints, particularly during the initial phase of development are common for any industry and this industry has been no exception. The constraints in adoption of greenhouses are high investments and non-availability of cost-effective technology for many crops. The package of practices for greenhouse cultivation is yet to be standardized. There is need to take up studies for perfecting the agro-techniques for inside the greenhouse.

References

- Anonymous, 2000. A manual on Plasticulture, P.D.C., OUAT, Bhubaneswar.
- Chandra, P. (Eds), (2002), "Short course on Greenhouse cooling in tropical regions", IARI, New Delhi, June 11-20.
- Choudhary, M. L. and Kumar, R. (2006), "Role of Information Technology in Hi-tech Agriculture and Horticulture". Proceedings of the nineteenth national convention of Agricultural Engineers, I.E.(I), Bangalore, Jan. 27-28, p-1-8.
- Mishra, J. N. and Paul, J.C. (2003), "Greenhouse for Rural Development". Kurukshestra. Vol. 51(9),p-34-36.
- Nayak, S.C., Uttaray, S.K., Dash, A.N. and Lenka, D. (1990), "Use of plastic tunnels for paddy straw mushroom cultivation and raising seedlings". Proceedings of the International Congress on the use of plastics in agriculture. P-E-135-140.
- Singh, H.P., Singh, G, Samuel, J.C. and Pathak, R.K. (Eds), (2003), "Precision Farming in Horticulture", NCPAH, DAC, MOA, PFDC, CISH, pp. 1-354.
- Radha Manohar, K. and Igathinathane, K. (2000), "Greenhouse technology and management", B.S. Publication, Hyderabad.
- Tiwari, G.N. and Goyal, R.K., (1998), "Greenhouse technology", Narosa Publishing House, New Delhi.

□

The productivity of work is not the responsibility of the worker but of the manager.

– Peter Drucker

Economic Analysis of Milk Production in Tamil Nadu

V Saravanakumar & D K Jain

This paper presents a study to estimate the costs and returns of milk production for different types of milch animals in Trichy and Erode districts of Tamil Nadu. The study aims at working out the cost and returns from milk of different species of dairy animals and examines the input-output relationship in milk production.

V Saravanakumar is Assistant Professor, Directorate of Agri-business Development, TNAU, Coimbatore, Tamil Nadu; and D K Jain is Principal Scientist, Dairy Economics, Statistics & Management Division, National Dairy Research Institute, Karnal, Haryana.

Cattle rearing in India is as ancient as the civilization and symbolises a long tradition of keeping milch animals as part of the farm household. At present the livestock sector is emerging as an engine of growth as well as economic symbiosis of the agricultural sector in India. The importance of livestock in India's economy can be gauged from the fact that 90 million farming families, cultivating an area of 140 million hectares, rear 100 million milch animals (Dastagiri, 2004).

Livestock production is an important source of income and employment in the rural sector. The sector employs eight per cent of the country's labour force including small and marginal farmers, women and less agricultural workers. It acts as a supplementary and complementary enterprise. Livestock is also important as a part of agriculture diversification and income enhancement and is crucial for nutritional security.

Livestock plays a vital role in the economic development. In India, 27 per cent of the GDP from agriculture and the allied sector was contributed by this sector (Economic Survey, 2005-06). Milk production alone involves more than 30 million small producers, each raising one or two cows or buffaloes. With 97.1 million tons of milk output, India is sustaining the status of a global leader in milk production (Economic Survey, 2005-06). It accounts for more than 65 per cent of the total value of livestock output. The prosperity of India as a nation undoubtedly depends on the advancement and success achieved in the agriculture sector, of which dairying constitutes an important component.

In any business enterprise, profit is the motive force for the entrepreneur. He tries to optimize his profit using his resources. Thus, the success of any enterprise is dependent on the extent of its profitability and milk production is no exception. Animal husbandry and dairying is an important component of the farming system. Adoption

farming on commercial lines is, therefore, influenced by its relative profitability with that of crop cultivation. At present, farmers feel a great need for diversification of farming enterprises to achieve greater profits. The information on costs and returns from milk production is important for policy makers to ensure that producers get a remunerative price for their milk and also that consumers get milk and milk products at a reasonable price. Due to wide variation in resource endowments, the cost and returns from milk production vary to a great extent across states in India. Therefore, it becomes imperative to conduct studies on economics of milk production across different states in India. Several studies have been carried out in various states on economics of milk production.

With this view, an effort was made to estimate the costs and returns of milk production for different types of milch animals in Trichy and Erode districts of Tamil Nadu.

Methodology

Sampling Technique

In order to achieve the objectives of the present study, a multi-stage stratified random sampling technique was adopted to select the sample households. Considering the variations in agro-climatic features, cropping pattern, dairy and other livestock enterprises, socio-economic characteristics and milk production, the Erode and Trichy districts of Tamil Nadu were purposively selected for the study. Two blocks were selected randomly from each of the two districts. In order to select the sample households, a complete enumeration of all the households in the selected villages was carried out. Two herd size categories, namely, small (≤ 2 milch animals) and large (> 2 milch animals) were formed on the basis of the number of milch animals by employing the cumulative square root frequency method of stratification. A sample of 20 households from each village were randomly selected on the basis of probability proportional to the number of the households in each category subject to a minimum of five households from each category.

Data Collection

The data for the investigation consisted of both primary and secondary data. Secondary data regarding agro-climatic features, cropping pattern, bovine population and infrastructural facilities for dairy enterprises were collected from various published sources. The primary data were collected for two seasons, namely, flush (August to February) and lean (March to July) for the year 2002-03 through a well structured, pre-tested proforma

by the personal interview method. The primary data pertaining to milk production, and quantity and price of feed and fodder fed to individual animals, labour utilization pattern, miscellaneous expenses, quantity of milk produced and price realized were collected.

Economic Analysis

In order to draw a comparative picture of the economic aspects of milk production for different species of milch animals based on per day milk production, cost and returns were worked out for various herd size categories for flush and lean seasons respectively. The total cost was divided into two major groups, viz., fixed and variable costs. Fixed costs included depreciation and interest on cattle shed and stores, dairy equipment and milch animals. Variable costs included expenditure on green fodder, dry fodder, concentrates, human labour, veterinary and miscellaneous items.

Production Function Analysis

To ascertain the input-output relationship in milk production, the multiple regression analysis was employed. In the present study, the Cobb-Douglas functional form was estimated.

Model Specification and Description:

$$\text{Log } Y_{kl} = \alpha + \sum_{i=1}^6 \beta_{il} \text{Log } X_{ikl} + u_{jkl} \quad \dots(1)$$

Where,

- i* = Independent input variables used in the model (1, 2, .., 6),
- k* = Number of dairy farms in the study area (1, 2, ..., 135 for crossbred cows; 1, 2, ..., 59 for buffaloes),
- l* = Number of milch animal species used in the study (1, 2) namely crossbred cow and buffalo,

The description of various variables in the equation 1 is given as under:

- Y_{kl} = Total milk produced on *k*th farm per 1th milch animal species per annum (litres),
- X_{1kl} = Total value of green fodder used on *k*th farm per 1th milch animal species per annum (Rs.),
- X_{2kl} = Total value of dry fodder used on *k*th farm per 1th milch animal species per annum (Rs.),
- X_{3kl} = Total value of concentrate feed used on *k*th farm per 1th milch animal species per annum (Rs.),

Table 1: Cost of maintenance and milk production and income measures for crossbred cows across different herd size categories for different seasons. (Rs./day/milch animal)

Sl. No.	Particulars	Flush Season			Lean Season		
		LS	SS	Overall	LS	SS	Overall
I. Total Fixed Cost		6.63 (10.29)	4.99 (9.39)	5.85 (9.87)	6.63 (15.61)	4.99 (13.06)	5.85 (14.45)
II. Variable Costs:							
1. Green fodder cost		11.98 (18.60)	9.50 (17.87)	10.86 (18.31)	5.41 (12.74)	5.20 (13.61)	5.32 (13.14)
2. Dry fodder cost		7.06 (10.96)	5.87 (11.04)	6.53 (11.01)	7.54 (17.75)	7.35 (19.24)	7.47 (18.45)
3. Concentrate cost		25.70 (39.89)	21.76 (40.93)	23.92 (40.34)	16.65 (39.19)	14.58 (38.16)	15.66 (38.69)
Total feed cost		44.74 (69.45)	37.13 (69.85)	41.31 (69.66)	29.60 (69.68)	27.13 (71.00)	28.45 (70.29)
4. Total labour cost		10.86 (16.86)	9.19 (17.29)	10.11 (17.05)	5.23 (12.31)	5.10 (13.35)	5.17 (12.77)
5. Veterinary and Miscellaneous cost		2.19 (3.40)	1.85 (3.48)	2.03 (3.42)	1.02 (2.40)	0.99 (2.59)	1.01 (2.50)
6. Total Variable Cost		57.79 (89.71)	48.17 (90.61)	53.45 (90.61)	35.85 (84.39)	33.22 (86.94)	34.66 (85.55)
7. Gross cost (Cost C)		64.42 (100.00)	53.16 (100.00)	59.30 (100.00)	42.48 (100.00)	38.21 (100.00)	40.48 (100.00)
8. Value of dung		1.59	1.48	1.46	1.52	1.28	1.46
9. Net cost		62.83	51.68	57.84	40.96	36.93	39.02
10. Milk production (litres/day)		7.99	7.21	7.62	5.01	4.68	4.86
11. Per litre cost of milk production		7.86	7.17	7.59	8.18	7.89	8.03
III. Measures of Income							
12. Gross income		67.92	61.07	64.62	43.33	40.58	42.09
13. Net income = 12 - 7		3.50	7.91	5.32	0.85	2.37	1.61

(Figures in parenthesis indicate the percentages to gross cost or cost C).

X_{4ki} = Total wages paid by k^{th} farm per l^{th} milch animal species per annum (Rs.),

X_{5ki} = Total veterinary cost and services, and miscellaneous cost incurred on k^{th} farm per l^{th} milch species per annum (Rs.),

X_{6ki} = Total value of interest and depreciation on k^{th} farm per l^{th} milch species per annum (Rs.), and

β_{il} = Parameters of regression coefficients of the i^{th} variable for the l^{th} species.

u_{ikl} = Random error term assumed to follow normal distribution with Zero mean and Constant Variance.

Results and Discussion

The income flowing from the dairy enterprise is well spread over the entire year. There is a desirability as well

as scope for developing dairy enterprise, both as a specialized or a supplementary enterprise. Individual holds in rural areas most often do maintain different types of milch animals for milk production. With this view effort was made to estimate the costs and return on milk production for different types of milch animals. The same are presented in this section.

Crossbred Cows

Table 1 gives the cost of maintenance and production for crossbred cows for different seasons. A perusal of the table reveals that the gross maintenance cost per milch animal per day was observed to be Rs.64.42, Rs.53.16 and Rs.59.30, respectively, for large, small and overall herd size categories in the flush season. The total fixed cost was Rs.6.63, Rs.4.99 and Rs.5.85, respectively, for the corresponding categories

Table 2: Cost of maintenance and milk production and income measures for buffaloes across different herd size categories for different seasons.

(Rs./day/milch animal)

Sl.No.	Particulars	Flush Season			Lean Season		
		LS	SS	Overall	LS	SS	Overall
I.	Total Fixed Cost	4.99 (11.00)	4.28 (12.63)	4.71 (11.73)	4.99 (19.97)	4.28 (19.89)	4.71 (20.07)
II.	Variable Costs						
1.	Green fodder cost	8.02 (17.67)	5.39 (15.90)	6.78 (16.88)	3.38 (13.53)	3.07 (14.27)	3.25 (13.85)
2.	Dry fodder cost	5.42 (11.94)	4.58 (13.51)	5.11 (12.72)	6.48 (25.93)	6.22 (28.90)	6.37 (27.14)
3.	Concentrate cost	18.59 (40.97)	13.13 (38.74)	16.04 (39.93)	5.83 (23.33)	4.98 (23.14)	5.46 (23.26)
	Total feed cost	32.03 (70.58)	23.10 (68.16)	27.93 (69.53)	15.69 (62.79)	14.27 (66.31)	15.08 (64.25)
4.	Total labour cost	6.48 (14.28)	5.79 (17.08)	6.21 (15.46)	3.53 (14.13)	2.23 (10.36)	2.92 (12.44)
5.	Veterinary and Miscellaneous cost	1.88 (4.14)	0.72 (2.12)	1.32 (3.29)	0.78 (3.12)	0.74 (3.44)	0.76 (3.24)
6.	Total Variable Cost	40.39 (89.00)	29.61 (87.37)	35.46 (88.27)	20.00 (80.03)	17.24 (80.11)	18.76 (79.93)
7.	Gross cost (Cost C)	45.38 (100.00)	33.89 (100.00)	40.17 (100.00)	24.99 (100.00)	21.52 (100.00)	23.47 (100.00)
8.	Value of dung	1.82	1.29	1.61	1.76	1.28	1.58
9.	Net cost	43.56	32.60	38.56	23.23	20.24	21.89
10.	Milk production (litres/day)	4.33	3.45	3.97	2.10	1.98	2.05
11.	Per litre cost of milk production	10.06	9.45	9.71	11.06	10.22	
III.	Measures of Income						
12.	Gross income	50.57	40.54	46.49	25.52	24.16	24.97
13.	Net income = 12 - 7	5.19	6.65	6.32	0.52	2.64	1.50

Figures in parenthesis indicate the percentages to gross cost or cost C).

accounted for 10.29, 9.39 and 9.87 per cent of gross maintenance cost respectively. The total variable cost for the overall category was Rs.53.45 with Rs.57.79 and Rs.48.17 for large and small size categories, respectively. Among the variable costs, the overall average feed cost accounted for 69.66 per cent of gross maintenance cost. Within the feed cost, the average share of concentrate feed was 40.34 per cent of gross cost, followed by green fodder (18.31%) and dry fodder (11.01%). The overall average labour cost was Rs.10.11, accounting for 17.05 per cent of gross maintenance cost. The veterinary cost and miscellaneous cost accounted for only 3 per cent of gross cost. The net cost (value of dung subtracted from gross cost) was found to be Rs.62.83, Rs.51.68 and

Rs.57.84, respectively, for the corresponding categories. The per litre cost of milk production in the flush season was found to be highest at Rs.7.86 for large herd size category followed by Rs.7.17 for small herd size category, with an overall average of Rs.7.59.

In the lean season, the gross maintenance cost per milch animal per day varied between Rs.38.21 for small and Rs.42.48 for large herd size categories with an overall average cost of Rs.40.48. The share of total fixed cost in gross maintenance cost varied between 13.06 and 15.61 per cent. Among the variable costs, the overall average feed cost accounted for 70.29 per cent of gross cost for both the herd size categories out of which, 38.69

per cent of the feed cost was accounted for by the concentrate feed alone followed by dry fodder (18.45%) and green fodder (13.14%). The overall average labour cost was Rs. 5.17 accounting for 12.77 per cent of gross cost. On an average, the share of veterinary and miscellaneous cost was 2.50 per cent of gross cost. The net cost was found to be Rs. 40.96, Rs. 36.93 and Rs. 39.02, respectively. The per litre cost of milk production per milch animal per day was worked out to be Rs. 8.18, Rs. 7.89 and Rs. 8.03, respectively, for large, small and overall herd size categories. It can be seen that the cost of maintenance of milch animals increased with the herd size.

Likewise, the gross income (which includes the value of dung) was also directly related to herd size categories, which varied from Rs. 61.07 for small category to Rs. 67.92 for large category with an overall average of Rs. 64.62 during the flush season and Rs. 40.58 for small and Rs. 43.33 for large category during the lean season, with an overall average of Rs. 42.09. The average net income during the flush and lean seasons was Rs. 7.91 and Rs. 2.37 for small herd size category, respectively, which were relatively higher than Rs. 3.50 and Rs. 0.85 for the large herd size category. It showed that the small herd size milk producers derived more profit than the large herd size milk producers.

Buffaloes

The cost of maintenance and milk production for buffaloes has been summarized in Table 2. In the flush season, it was observed that the gross cost of maintenance per buffalo per day varied between Rs. 33.89 (small) and Rs. 45.38 (large), with an overall average of Rs. 40.17. The fixed cost ranged from Rs. 4.28 for small herd size to Rs. 4.99 for large herd size category with an overall average of Rs. 4.71 accounting for nearly 15 per cent of the gross cost. The total variable cost accounted for more than 85 per cent of the gross cost in both the herd size categories. Within the variable cost, the feed cost accounted for 69.53 per cent of the gross cost. Within the feed cost, the concentrate feed accounted for 39.93 per cent of gross cost and followed by green fodder cost (16.88%) and dry fodder cost (12.72%). The average labour cost ranged from Rs. 5.79 for small category to Rs. 6.48 for large category with an overall average of Rs. 6.21 accounting for 15.46 per cent of the gross cost. The veterinary and miscellaneous cost accounted for more than 3 per cent of the gross cost in both the categories. The net cost during flush season was found to be Rs. 43.56 for large herd size category as compared to Rs. 32.60 for small herd size category with an overall average cost of Rs. 38.56. The per litre cost of milk production varied between Rs. 10.06 for large herd size

category to Rs. 9.45 for small herd size category the overall average cost being Rs. 9.71.

In the lean season, the gross maintenance per buffalo per day was found to be Rs. 24.99, Rs. 23.47, respectively, for large, small and overall herd size categories. The cost analysis further revealed that the total fixed cost and total variable cost accounted for 20.07 and 79.93 per cent of the gross cost, respectively. Among the variable cost components, the feed cost accounted for 64.25 per cent of gross cost, followed by labour cost (12.44%) and veterinary and miscellaneous cost (3.24%). The value of dung per buffalo per day ranged from Rs. 1.29 to Rs. 1.76 with an overall average of Rs. 1.58. The net cost ranged from Rs. 20.24 for small herd size category to Rs. 23.23 for large herd size category, with an overall average of Rs. 21.89. The cost of milk production per buffalo per day was found to be Rs. 10.22 and Rs. 10.68 for large, small and overall herd size categories.

The gross income from the buffalo was found to be Rs. 40.54 and Rs. 24.16 for small herd size category and Rs. 50.57 and Rs. 25.52 for large herd size category with an overall average of Rs. 46.49 and Rs. 24.97 for small and large herd size categories, respectively, during flush and lean seasons respectively. The net income accrued during flush and lean seasons for small herd size category was Rs. 6.65 and Rs. 0.52, respectively, which was relatively higher than Rs. 0.52 for large herd size category.

Production Function Analysis

Estimates of parameters of Cobb-Douglas production function for the crossbred cow and buffalo in the study area are presented in Table 3. As shown in the table, the coefficient of multiple determination (R^2) was 0.8805 and 0.8665 indicating that 88.05 and 86.65 per cent of the total variation respectively in crossbred cow and buffalo milk production was explained by the explanatory variables namely, value of dry fodder, concentrate, wage rate of labour and miscellaneous cost and fixed expense in the model.

In case of crossbred cow dairy farms, the elasticity of output with respect to the explanatory variables green fodder and concentrate showed that one per cent increase in the value of these inputs would raise the milk production by 0.2458 per cent, respectively. On the other hand, one per cent increase in value of dry fodder, wage rate of labour and miscellaneous costs and fixed cost would decrease the milk output by less than one per cent. The regression coefficients in the Cobb-Douglas

function are the production elasticities, and their sum indicated the returns to scale. The estimates of returns to scale were less than unity (0.7531), indicating decreasing returns to scale. This showed that an increase in the quantities of the selected inputs would result in less than proportionate increase in milk production.

Table 3: Estimates of OLS parameters of Cobb-Douglas production frontier for Crossbred cow and Buffalo milk production.

Variables	Crossbred Cows		Buffaloes	
	Coefficients	Standard Error	Coefficients	Standard Error
Constant term	-0.3379*	0.1666	-0.4121	0.3342
Value of green fodder	0.1403**	0.0301	0.0767	0.0807
Value of dry fodder	0.0949**	0.0234	0.1564**	0.0696
Value of concentrates	0.2458**	0.1092	0.2014***	0.0539
Wage rate	0.0998**	0.0334	0.1009**	0.0506
Veterinary and Miscellaneous cost	0.0811**	0.0244	0.0956	0.0743
Fixed expenses	0.0912**	0.0256	-0.0265	0.0454
Coefficient of multiple determination	0.8805	-	0.8665	-
No. of observations	135	-	59	-

* Significant ($P < 0.05$)

** Significant ($P < 0.01$)

A close perusal of Table 3 revealed that with respect to buffalo milk production the coefficients of all the variables were positive and statistically significant, except the fixed expenditure whose coefficient was not statistically significant. The value of concentrate was found to be the most important determinant followed by value of dry fodder whose coefficients were found to be 0.2458 and 0.0949, respectively. It was observed that a 10 per cent increase in the value of dry fodder, concentrate and wage rate would raise the milk production by more than one per cent, and the remaining inputs like green fodder, veterinary and miscellaneous expenses and fixed expenses would raise the milk production by less than one per cent. The returns to scale obtained as sum of elasticity estimates were found to be less than unity i.e., 0.6045, indicating decreasing returns to scale for buffalo milk production in the study area. It implied that with one per cent increase in intensity of input used, milk production would increase at a decreasing rate of 0.6045 per cent.

Summary and Conclusions

It can be concluded from the above findings that the percentage of fixed and variable cost to gross cost and the per litre cost of milk production per milch animal per day increased with increase in herd size both for crossbred cows and buffaloes. Further, the per litre cost of milk production was more in lean season as compared to flush season for both types of milch animals. The cost measures were directly related with the herd size but the income measures were inversely related with the herd size for both the species in the two seasons. The perceptible differences were observed in income measures for both the seasons. The small farmers were found to earn more profit as compared to large farmers for both the species in both the seasons. The net income for both the species was found to be relatively higher in flush season as compared to lean season. The results obtained in the present study are in conformity with the findings of Rajadurai (2002), Gandhi (2002) and Kumaravel (1998) who obtained similar results for crossbred cow and buffalo milk production in Tamil Nadu. They also concluded that there exists negative relationship between the herd size and profitability.

The value of concentrate and value of dry fodder were found to be the most important determinants for both crossbred cow and buffalo dairy farms. The diminishing return to scale was found in milk production of both cross bred cow and buffalo farms in the study area. Gupta and Devraj (1993), Rao and Jyothi (2005) and Kumaravel (1998) also obtained positively significant coefficient for green fodder and concentrates in both crossbred cow and buffalo milk production respectively, in Rajasthan, Andhra Pradesh and Tamil Nadu.

Policy Implications

The findings of the present study has several implications for the development of study area and similar agro-climatic regions, which is that the buffaloes were found to be relatively better milch animal as compared to crossbred cow, as revealed from the net return to milk producers. Therefore, more attention should be paid to facilitate the buffalo upgradation programme.

References

- Agarwal, S.B., Patel, R.K. and Sharma, K.N.S. (1989), "Milk production function and resource productivity in bovine". *J. Indian Soc. Agri. Stat.*, 42(2): 218-225.
- Chand, K. (1998), "Economic analysis of commercial dairy herds in Bikaner (Rajasthan)". Unpublished Ph.D. Thesis, National Dairy Research Institute (Deemed University), Karnal, India.

-
- Dastagiri, M.B.** (2004) "Demand and supply projections for livestock products in India". Policy Paper 21, National Centre for Agricultural Economics and Policy Research (ICAR), New Delhi, India.
- Economic Survey (2005-06). "Economics Division", Ministry of Finance, Government of India, New Delhi.
- Gandhi, P.M.K.C.** (2002), "Pricing policy and cost of production of milk in Coimbatore dairy cooperatives". Unpublished M.Sc. Thesis, National Dairy Research Institute (Deemed University), Karnal, India.
- Ganeshkumar, B.** (1997), "Economic efficiency of cow milk production in Villupuram district of Tamil Nadu". Unpublished M.Sc. Thesis, National Dairy Research Institute (Deemed University), Karnal, India.
- Gupta, J. N. and Devraj.** (1993), "Allocative efficiency of milk production in Churu district (Rajasthan)" Agric. Econ. Res. Rev. 6(3):103-109.
- Kumar, V.** (2002), "Milk production function and factor den dairy farming: Evidence from Meerut villages of Uttar Pr. Indian J. Agril. Mktg., 16(1): 32-36.
- Kumaravel, K.S.** (1998), "An economic analysis of milk pro and its disposal in Virudhunagar district of Tamil Nad published M.Sc. Thesis, National Dairy Research Ii (Deemed University), Karnal, India.
- Pandey, A.K.** (1996), "A comparative study of livestock reari tern among tribals and non-tribals in Chotanagpur re Bihar". Unpublished Ph.D. Thesis, National Dairy Re Institute (Deemed University), Karnal, India.
- Rao, B.D. and Jyothi. S.H.** (2005), "Comparative economics production in Guntur district of Andhra Pradesh". Agri Situation in India. LXII (7): 459-461.

Productivity and the growth of productivity must be the first economic consideration at all times, not the last. That is the source of technological innovation, jobs, and wealth.

- William E. Simon

Supply Chain Management in the Indian Meat Industry

Gyan Prakash

With the opening up of the Indian economy, the meat sector offers vast opportunities for export and revenue generation, but the Indian meat industry suffers from certain inefficiencies. The supply chain perspective of the meat industry can provide benefits such as an enhanced level of delivery performance, elimination of waste during processing of meat, reduction in lead time in meat supply, improved flexibility in serving markets, enhanced level of farm and livestock capacity utilization, and higher returns on investment. This study concludes that a supply chain perspective and use of information and communication technologies can transform the Indian meat industry.

India has a livestock population of 470 million and occupies the eighth position in meat production in the world, annually producing an estimated 5 million tonnes (KPMG, 2006). Liberalisation and globalisation present new opportunities and challenges for the Indian meat industry. With the opening up of the economy, meat from India is gaining access to new destinations in many Asian, African and European countries due its inherent organic nature, as our animals rely mainly on agricultural by-products and natural pastures. With the increase in the purchasing capacity of the Indian consumers and almost 70% of the population being non-vegetarian, a very strong internal market also exists. India also has a large livestock population, accounting for 16% of cattle, 57% of buffalo, 17% of goats and 5% of sheep population of the world. Presently India possesses 96.9 million buffaloes, 226.1 million cattle, 124.5 million goats, 59 million sheep, 18.5 million pigs, 842 million chicken and 107 million ducks (FAO, 2003). Despite its huge potential, the Indian meat industry has not claimed its due. In dairying, although India has acquired number one status in the world contributing 13% of the world milk production, the meat production, which goes hand in hand with dairying, is very low. During the last 25 years, it has only increased from 764,000 tonnes in 1970-71 to 5.9 million tonnes valued at INR 24,876 crores (FAO, 2003). The compound average growth rate during the last two decades works out to 4.6% as against 21% during the last five years and this is now the fastest growing segment of the livestock sector. Livestock production is a vital activity in rural areas and has helped to provide employment and income generation for farmers, rural poor and weaker sections. India possesses large livestock resources but their production and utilization is not optimum or at comparable levels of developed countries.

The production and market for meat and meat products in India is comparatively small compared to that of most developed nations. The per capita consumption of

Gyan Prakash is a research scholar at the Department of Industrial and Management Engineering, IIT Kanpur, and a faculty member at School of Management Sciences, Tezpur University, Tezpur.

meat is 5.2 kilograms per year (FAO, 2004). There are many reasons for the slow growth of the meat industry, including the negative attitude of public towards meat on account of misinformation campaigns, and socio-cultural and religious considerations that encourage traditional vegetarian diets. Moreover, the Indian meat industry still remains unorganized and unscientific. Most meat is sold in the domestic market without proper sanitary inspection by veterinarians. Small animals such as sheep, goats and pigs are slaughtered in small numbers ranging from 2 to 10 by individual butchers in unregistered slaughter houses, and meat is sold fresh on the same day. There are few modern state-of-the-art abattoirs following world class sanitary and phytosanitary measures.

The single-most important constraint that the Indian livestock sector is facing is the highly inefficient supply chain. Lack of infrastructure like cold chain and efficient processing systems is the chief cause of wastage and low level of productivity. The central argument of this paper is that a supply chain-based perspective can help in managing the supply of livestock, processing of meat, and distribution of products to markets. The supply chain perspective of the meat industry can provide benefits such as enhanced level of delivery performance, elimination of waste during processing of meat, reduction in lead time in meat supply, improved flexibility in serving markets, enhanced level of farm and livestock capacity utilization, and higher returns on investment.

The supply chain is defined as the network of interconnected and interdependent organizations that work mutually and co-operatively to manage, control and improve the flow of materials and information from suppliers to end users (Christopher 1998). Supply Chain Management (SCM) is a management process that comprises the stages involved in fulfilling a customer order (Chopra, 2006) – i.e., integrated and synchronized operational efforts to improve the flow of material and product. Ayers (2001) has defined SCM as a value chain that involves flow of physical, financial, information/knowledge resources and spans procurement, manufacturing and distribution (Lee and Billington, 1995). SCM is an approach for organizations to control and integrate the business functions related to the manufacturing of products, including procurement and distribution, with the dual objectives of attaining higher levels of customer satisfaction and reducing inventory risk (Das and Abdel-Malek, 2003).

SCM helps organizations achieve multi-criteria objectives such as serving the right customers, identifying the right suppliers and fostering trust with partners. In recent years, SCM has assumed greater significance as

it can help organizations eliminate non-value added activities, reduce production cost, improve their market position, and enhance competitiveness. SCM provides uniqueness to the organization's capabilities, makes the difficult to replicate, and is thus a source of competitive advantage.

The Indian Meat Market

Agriculture comprises 24.2% of India's GDP, 15.2% of total exports, and employs 58.4% of the workforce. The livestock sector is one of the most important components of Indian agriculture. Livestock products in India include milk, egg, wool, meat, hide and skins and are obtained by rearing species such as cattle, buffalo, poultry, ducks, sheep, goats, pigs, yaks, mithuns, ostrich etc. The value of the output from livestock is INR.156,000 crores. The share of milk group is INR.107,544 crore, meat INR.24,876 and egg group INR 5,238 (DAH&D, G 2004). In India buffalo contributes 30% of the total meat production, while the contribution by cattle, sheep, goats and poultry is 30%, 5%, 10%, 10.2% and 11.5%, respectively. India is a net exporter of meat and meat products, with a trade balance of \$431 million in 2003. In 2008 India's cattle population is estimated to reach 300 million heads, half of which are buffaloes.

Table 1: Current and projected meat demand in India for 2010 and 2020

Livestock	Current Production ('000 Tones)	Projected Demand (Year)			
		2010	Increment in %	2020	Increment in %
Goat	470	850	81	935	99
Sheep	232	600	159	687	196
Poultry	1401	2930	109	3162	126
Buffalo	1443	3250	125	3552	211
Beef	1462	Almost same			
Pig	612	770	26	840	37

Source: Food and Agriculture Organization, 2002

The market environment presents opportunities as well as challenges for the Indian meat industry. Even with the human population crossing the billion mark, increasing urbanisation, changes in lifestyle, and shift in eating habits (with non-vegetarianism becoming popular), the Indian meat and meat products market is expected to experience growth. As a result of rising consumer incomes and increased awareness of the healthiness of meat, both the production and consumption of meat are on the rise. During the period 1995-2001, meat consumption in India has grown at about 4.8% per year. Poultry meat has

grown the fastest at 20%, growth of mutton was almost the same, whereas growth for pork was slower, and the bovine meat segment was virtually stagnant. High-priced meat products include mutton and goat meat and pork, all of which have per capita consumption rates that are less than half that of buffalo meat and poultry meat. Table 1 depicts current meat production and projected demand in near future.

Meat Supply Chains: Issues and Challenges

Product Characteristics

Meat is a perishable product, therefore it cannot be inventoried like other non-perishable products nor be made to order because of the varying levels of lead time for the development of livestock (8 to 10 weeks for poultry, 4 to 6 months for goat and sheep, and year(s) for buffalo). In this lead time constrained scenario, optimum capacity utilization becomes a critical issue. The seasonal nature of demand, and preference for specific body parts of livestock further add to the complexity of capacity utilization. Therefore, the challenge is to create a lean, agile and flexible supply chain that not only leverages scale efficiencies, but also provides reliable delivery. The supply chain perspective provides market-oriented differentiation in processing of livestock and helps in assigning boundaries of push/pull processes. Vertical integration of standalone supply chains and transforming them into cold chains is the need of the hour. The Indian meat industry has a huge opportunity to become a leading global meat supplier. Thus, it is imperative to have market-driven strategies and agile, adaptive and efficient supply chains.

Stakeholders in the Supply Chain

In addition to the perishable nature of meat, complexity in the meat supply chain arises from the involvement of various types of stakeholders down the stream, ranging from farmers to butchers to slaughter houses to processing units and retailers. Most stakeholders along the value chain are not integrated, operate mostly on a standalone basis and lack market orientation. Demand forecasting is almost absent, data/information sharing is weak, and most producers try to push their product in the market on their own. Supply chain concepts like data/information sharing, data integration and consolidation, flow of funds, matching of demand with supply, collaborative planning forecasting and replenishment, synchronization of various activities involved in meat processing and logistics, which are well established in business markets, can be effectively applied in the meat market.

Infrastructure

Poor road conditions not only delay the transit time for processed meat, thus severely affecting its quality, but also reduce the weight of livestock before it reaches the markets. Existing infrastructure such as roads and power conditions should be improved and new infrastructure such as warehouses, refrigerated transportation and cold storage facilities should be created with adequate capacity. Chilled and frozen meat also needs a steady power supply to maintain the chilling and freezing temperature, respectively.

Regulation Related to Meat Processes

Regulation dealing with processing of meat and its impact on the environment is another important challenge for the meat industry. The increase in world food trade and the conceptualization of the Sanitary and Phyto-Sanitary (SPS) agreement under the World Trade Organization (WTO) have led to increasing recognition and adoption of food safety measures. At present different systems are in operation for production of safe meat and meat products for the domestic market. Table 2 describes select list of regulations for the meat industry. Involvement of different agencies demonstrates the need for streamlining of control measures and implementation by a single authority. This will lead to effective control and would help the industry follow the quality criteria of meat and meat products for both domestic and international markets.

Conformance to regulatory specifications requires strict quality control measures for meat processing and meat products. Quality control systems for meat processing deal with processing under hygienic conditions and mechanisms for handling of by-products. The essence of quality control for meat involves carrying operations as per specifications of Codex principles of food hygiene, HACCP, which involve process control system and addresses risks from physical, chemical, microbial contamination and toxic residues, and basing operations on the total quality management philosophy.

Due to the growing awareness towards protection of the environment, meat processing units are required to adhere to the environmental regulations as stipulated by the governments, particularly with regard to water purity, manure removal and dead carcass disposal.

Globalization

In today's global marketplace the challenge is in concomitantly maintaining the domestic market share and

Table 2: Select list of regulations applicable to meat industry

Regulation	Description
Meat Food Products Order 1973, 1994	The Directorate of Marketing and Inspection (Ministry of Agriculture, GoI) administers order for safety and quality of meat and meat products during production, processing and distribution. A license is required under this order to set up a factory for producing/processing meat products. Export of meat is subject to pre-shipment inspection and a certificate required from State Animal Husbandry Department/Directorate of Marketing and Inspection. Slaughter of cows is banned in most of the States. Export of beef is prohibited. Objection Certificate (NOC) has to be obtained from the District administration for the slaughter of cattle, buffaloes etc. Permission from the civic bodies/State Government (Department of Animal Husbandry) is also required before setting up a meat processing unit integrated with a slaughter house.
Raw Meat (Chilled and Frozen)	Regulates the hygienic production of meat and meat products.
Grading and Marketing Rules 1991	Advisory Committee formed under this order advises the Government on matters relating to meat and meat products.
Export Quality Control and Inspection Act 1963	Deals with the promotion of export of safe food products to global markets. The Inspection Council has been established to ensure compulsory quality control and inspection of various commodities.
Agriculture and Processed Food Products Exports Development Authority (APEDA)	Operates under Ministry of Commerce, GoI, covering the export of agro and processed food products including meat and meat products. It looks after the development of export of food products and strengthens the capabilities related to quality control systems.
Bureau of Indian Standards	Sets standards for a variety of foods including meat and meat products. It operates a certification system in India.
Ministry of Food Processing Industries (MFPI), GoI	Deals with the development of food industries including meat, extends financial support, strengthening and upgrading infrastructure facilities in the meat industry, and supports programmes in improving the quality of meat and meat products.
Prevention of Food Adulteration Act 1954	Provisions for prevention of adulteration of food.
Livestock Importation Order and Meat Food Products Order. Sanitary and Phyto-Sanitary measures (SPS)	WTO regime stipulates quality assurance such as Hazard Analysis Critical Control Point (HACCP), Good Animal Feed Practices (GFPs), Good Hygiene Practices (GHPs), Good Manufacturing Practices (GMPs) and Cold Chain System.
Article 48 of the Constitution of India	Slaughtering of animals and related activities are governed as State subjects.
Environment (Protection) Act 1986,	Standards for discharge of effluents.
Nutrition labeling and Education Act 1990	Products are labelled on the basis of levels of various contents.

increasing export. Global players are consolidating and scaling up either by vertical or horizontal integration. Global meat supply chains enjoy the benefits in terms of economies of scale, sourcing options, technological know-how and economic resources. The outcomes of global supply chain operations are lower prices, effective product differentiation, enhanced level of quality, and the value added meat products. The globalization of meat supply chains is influenced by several environmental factors such as purchasing power, import duty, regulation, national culture and traditions, food safety and hygiene standards, bio-security protocols, cost of capital and labour, availability of land and related infrastructure. With globalization, the risk of spreading of diseases across geographical boundaries has increased, thus, emphasising the need to maintain stringent control over quality and adherence to regulation in the meat supply chain.

A Conceptual Framework for SCM in Meat Industry

The supply chain of the meat industry comprises several entities such as animal farms, meat processing units, distributors, retailers, and end customer. A typical meat supply chain is depicted in Fig. 1.

Animal Farms

Live animals serve as raw material for the meat industry. Sheep and goat are reared in large numbers by migratory nomads on available grazing and forest lands. The raising of pigs is meant exclusively for slaughter. Most of the animals are raised in an unorganized manner by grazing with little or no supplementation. Rearing in organized farms is negligible and limited due to the financial resources available with the farmers. Slaughtering of animals and related activities are governed as State subjects.

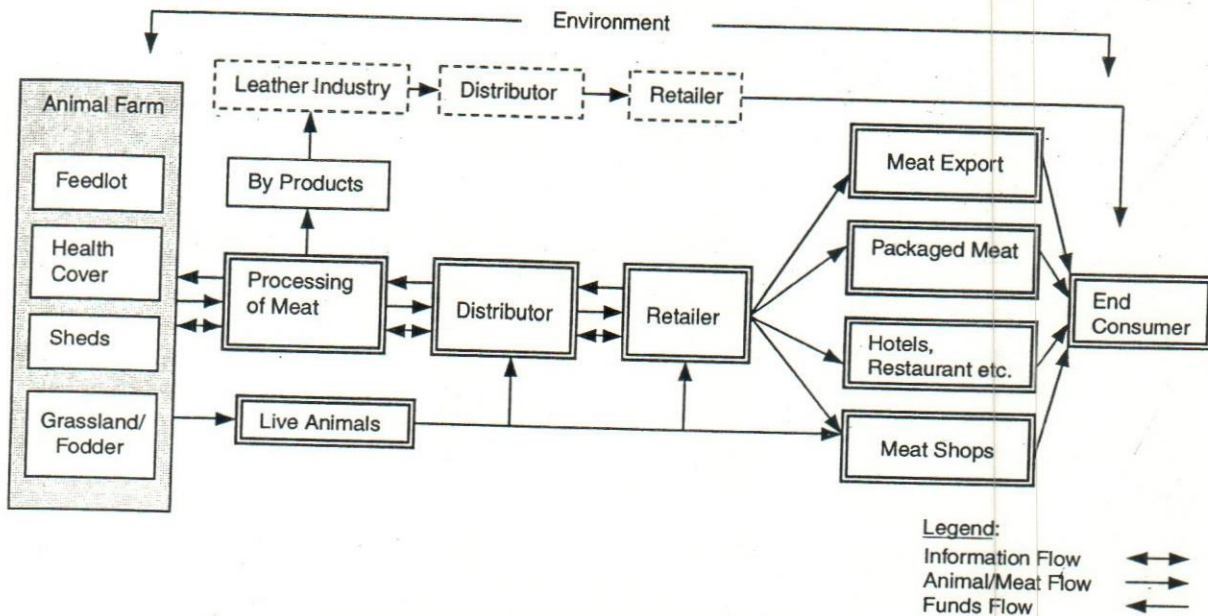


Fig. 1. The supply chain of the meat industry

animals such as spent females, surplus males, surplus buffalo calves, lambs and kids, find their way to slaughter houses. Livestock is transacted in more than 2000 upcountry livestock markets of the country. The quality control over this raw material is lacking and is not standardized. The meat produced for the domestic market is sold as hot meat. Traditionally livestock is sold in terminal livestock markets to meat traders who get them processed in slaughterhouses.

Slaughter Facilities

Adequate slaughter facilities are not available to produce meat under sanitary conditions. 2702 authorized and more than 12,000 unauthorized places are functional as slaughter houses in the country. Floor slaughter under poor hygienic conditions is practiced for large animals. Overcrowded slaughters in unaesthetic premises are quite common and are regulated by local bodies. Effective meat inspection has not been feasible. A good number of attempts to relocate the existing slaughterhouses, improve the existing slaughterhouses and establish new abattoirs have met with resistance from the local residents, meat industry personnel and people staunchly opposing animal slaughter and meat consumption. Increased demand for meat is being met through the existing slaughterhouses and unauthorized slaughter, compromising hygiene and posing possible public health risks.

Processing and Distribution

At each stage of processing some amount of value

is added to the meat. In general the meat products reach the end customer directly from animal farms, local meat shops or meat retailers. About 1.7% of the total meat is processed into meat products and sold through a retail network comprising company outlets, supermarkets and high-end grocery shops located in big cities and metropolises. The movement of meat products along the supply chain is facilitated by in-house or third-party logistics service providers. Information and Communication Technology (ICT) applications offer ample scope for application in the meat supply chain in the organised sector, and the potential to transform the meat supply chain into demand-driven just-in-time production systems. Raw hides and skins are the most valuable slaughter by-products which become input raw material for the leather industry.

Export of Meat

Export of Indian meat, especially buffalo meat, to Gulf countries has proven to be a thriving business over the last several years. At present, more than 60 countries import meat from India. The meat meant for export passes through inspection and the approved dressed carcass is chilled for 24 hours to bring its pH to a level below 6. Thereafter it is deboned and deglaned and then packed into different cuts and frozen at -40° celsius. The frozen meat is stored in cold storage for export. Many corporate organizations have set up modern integrated meat complexes having state-of-the-art facilities for livestock holding, slaughter, carcass deboning, packing, chiller and frozen storages, by-products processing, effluent treatment, etc.

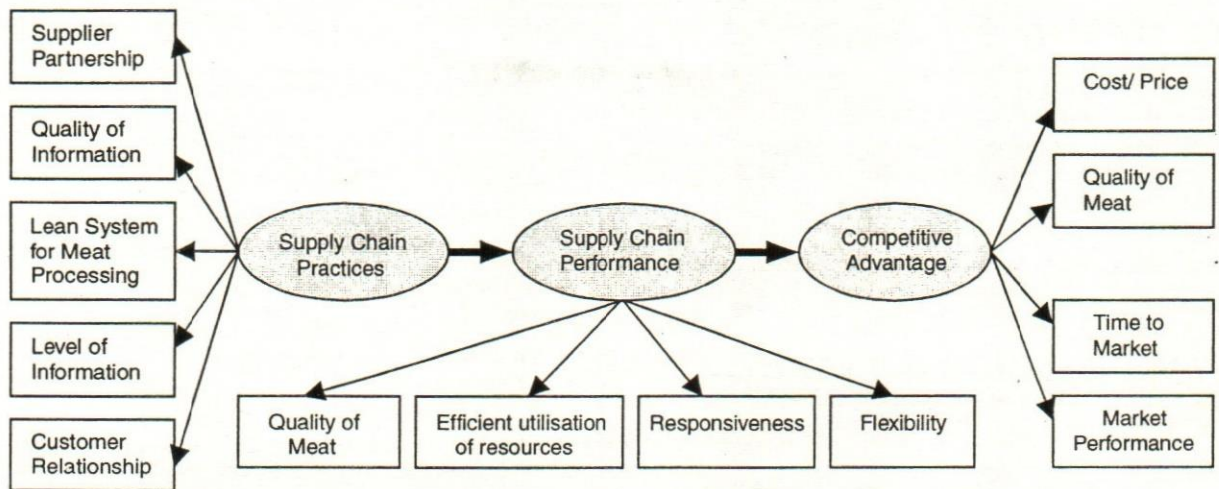


Fig. 2. Conceptual Framework for SCM in Meat Industry

On the basis of the above discussion, we have conceptualised a framework for SCM in meat industry. The constructs of this framework include supply chain practices relevant to the meat industry, performance criteria for meat supply chains and competitive advantage for the meat industry. The relationships among these constructs are depicted in Figure 2. In this figure, latent constructs, namely, supply chain practices, performance criteria and competitive advantage, are represented by an ellipse, and their corresponding manifest variables are depicted as rectangles. SCM practices include a set of activities that organizations carry out for managing their meat supply chains efficiently and effectively. These include strategic supplier, customer relationships, information sharing, information quality and a lean production system. Performance measurement criteria include quality of meat, efficient utilization of resources, responsiveness, and flexibility. Competitive advantage includes price, quality, time to market and market performance.

Supplier partnership deals with the long-term relationship between the focal organization and its suppliers. These partnerships yield increased market share, reduced lead time, improved service delivery, improved quality, shorter product life cycles of meat products, free exchange of information and coordinated decision making (Corbett et. al., 1999).

Customer relationship involves the practices for managing downstream supply chain partners (distributors, retailers and end customers), and maintaining lasting and profitable relationships (Jackson, 1985). SCM relationships are symbiotic though complex and often involve customization of products/services, pricing, procurement

and distribution methods (Cardozo et. al., 1987; McDonough et. al., 1997). Such relationships involve costs such as investing in customization and risks such as customer and/or supplier power or dependence.

Level of information sharing refers to the extent which critical and proprietary information is communicated to one's supply chain partner (Monczka et. al., 1998). In addition to level (completeness) of information sharing, quality (relevance, timeliness, accuracy, use form, etc.) is recognized as an independent dimension of information sharing in the supply chain. Development of a lean system for meat processing aims to eliminate all type of waste and develop a sequence of operations that produces higher quality products with reduction associated cost.

Organizational performance refers to the extent which an organization achieves its goals – which may be market-oriented as well as financial (Gunasekaran et al., 1999; Stock 2000), only financial (Holmberg, 2000), or operational, or both financial and operational (Kaplan and Norton, 1992).

Competitive advantage refers to capabilities that differentiate an organization from its competitors, and enable it to create a defensible position over its competitors (McGinnis and Vallopra, 1993; Porter, 1985). Competitive capabilities comprise price/cost, quality, delivery, flexibility (Tracey, 1999), and time-based competitiveness (Handfield and Pannesi, 1995; Kessler and Chakrabarti 1996; Stalk, 1988; Vesey, 1991). Table 3 depicts the elements of a supply chain framework and describes the role in managing a meat supply chain.

Table 3: SCM framework for the indian meat industry

Constructs of Framework	Description
A. Supply Chain Practices for Meat Industries	
Supplier partnership	Partnerships with livestock as well as fodder suppliers.
Quality of Information	Timely sharing of information with all members of meat supply chain
Lean System for Meat Processing	Meat processing system which eliminate all kinds of waste
Level of Information	Sharing critical and proprietary information with all stakeholders
Customer relationship	Designing systems so as to fulfil customer demand
B. Supply Chain Performance for Meat Industries	
Efficient utilization of resources	Optimum utilization of farm resources, optimum number of livestock, just-in-time processing of meat, logistics cost, labour cost, other variable costs.
<ul style="list-style-type: none"> • Cost <ul style="list-style-type: none"> <i>Farm Cost</i> <i>Administrative cost</i> <i>Processing cost</i> <i>Other Costs</i> • Capacity 	<p>Equipment cost, seed and chemicals, fertilizers, fodder, electricity, land cost, livestock cost, drenches, dips, shearing and crutching, labour, etc.</p> <p>Banking, postage, telephone, other subscription charges, etc.</p> <p>Machines repair and maintenance, labour</p> <p>Marketing and distribution cost, overheads</p> <p>Capacity of sheds and processing unit, fodder supply, land for grazing</p>
<p>Quality</p> <ul style="list-style-type: none"> • <i>Animals</i> • <i>Specification</i> • <i>Regulatory requirement</i> 	<p>Quality refers to weight, fat cover and its distribution, muscling and bruising, meat colour, intermuscular fat colour, marbling, cut shape, size, weight, tenderness and visual attribute of meat.</p> <p>Health-related requirements for animals,</p> <p>Conformance to specifications, meat delivery as per schedule</p> <p>As prescribed by appropriate law, livestock health specifications and vaccination, occupational health and safety for worker.</p>
<p>Responsiveness of supply chain</p> <ul style="list-style-type: none"> • <i>Delivery</i> <ul style="list-style-type: none"> <i>Production Lead time</i> <i>Speed</i> <i>Reliability</i> • <i>Lead time</i> • <i>Customer service level</i> • <i>Information and material flow</i> • <i>Risk</i> 	<p>Time taken to fulfil an order, lead time and order fill rate</p> <p>Time related with growth of animals.</p> <p>How swiftly customer demand is fulfilled.</p> <p>Fulfilling demand with right product and as per agreed schedule.</p> <p>Time taken in fulfillment of customer order.</p> <p>Customers should be satisfied with the meat received and the way demand was fulfilled.</p> <p>Sharing of information by all stakeholders involved in meat supply chain</p> <p>How stakeholders of meat supply chain adapts to environmental changes and changes in end customers' preferences, etc.</p>
<p>Flexibility</p> <ul style="list-style-type: none"> • <i>Service flexibility</i> • <i>Order flexibility</i> • <i>Location flexibility</i> • <i>Time flexibility</i> 	<p>Ability to meet special/sudden demand</p> <p>Ability to adjust order during transportation part of delivery</p> <p>Meeting demand from alternative sources.</p> <p>Ability to meet time-based demand</p>
C. Competitive Advantage for Meat Industries	
Cost and price of meat	Reduction in cost incurred, and increase in profit margin
Quality of meat	Quality of meat as per national/international specification
Time to market	Ability to introduce meat products to create demand
Market performance	Increase in profit margin and increase in market share

Operational Excellence

Operational excellence means conducting business in a manner that improves quality, obtains higher yields, faster throughput, and provides customers with reliable products/services at competitive prices and delivery with minimal difficulty. A supply chain that builds around operational excellence organises itself to provide market offerings that delight a defined set of customers. The various methods and processes to achieve operational excellence in the meat supply chain are illustrated in Table 4.

The meat supply chain needs to apply operational excellence through a continuous improvement process, whether on a day-to-day basis or by re-engineering the solution to meet the challenges imposed by the perishable nature of meat, floating demand, and low yield of meat processing technologies. The meat supply chain needs to define key performance indicators (KPIs) that measure performance of each stakeholder across the supply chain and end customer expectations.

Key Aspects of Meat Supply Chain Operations

- **Speed:** Ability to move meat in the fastest possible way safely and securely, while minimizing damage.

sible way safely and securely, while minimizing damage.

- **Reliability:** Ability to deliver meat with speed and efficiency consistently.
- **Visibility:** Ability to track the movement of meat through the supply chain.
- **Partnership:** Collaborative partnerships to leverage each others' competencies and to increase global reach.
- **Network:** Extensive network to supply meat to geographically dispersed locations.
- **Trust:** Long-term relationships between supply chain partners rooted in trust.

The Way Ahead

India currently processes a very small percentage of its total meat production. The meat supply chain is characterized by inefficiencies, diseconomies of scale, lack of investments and inadequate infrastructure, resulting in high prices, poor yields (of crops for feed and manure) and inadequate preservation of processed meat. More processing and value-added products are likely to yield higher returns for the farmers. The wealth of lives

Table 4: Achieving operational excellence in meat supply chain

Attributes of Operational Excellence	Methods and Processes to Achieve Operational Excellence
<i>Timely, accurate, and complete visibility to orders, shipments, and perishable inventory.</i>	<p>Visibility has to extend across multiple parties and nodes from animal farms to customers. Tools and process that facilitate visibility include:-</p> <ul style="list-style-type: none"> • Bar Code or RFID to capture point of sale data, and track and trace meat production. Capture of data enables analysis of losses and costs over multiple production stages involved in meat processing and process improvement. • The use of ICT tools like Geo-Positioning Systems (GPS), Electronic Data Interchange (EDI), mobile devices etc. for data communication. • Scalable IT architecture: Off-the-shelf application packages, Enterprise Resource Planning (ERP). • Order Management Gateway, Asset Management for enhanced return on investment on animal farms.
<i>Meat processing systems</i>	<p>Meat processing system designed around lean thinking and practices of :</p> <ul style="list-style-type: none"> • Six Sigma (Define, Measure, Control, Improve) • Kaizen (continuous improvement) • Total Quality Management
<i>International trade management</i>	<p>Comply with trade, animal welfare, meat processing and quality and environment regulations, including license determination and quotas.</p>
<i>Design, plan/optimize, and execute multiple distribution strategies</i>	<p>Leveraging different modes of transportation and services in order to supply the perishable meat product to the right location, at the right time in the most efficient and cost-effective manner. This includes:-</p> <ul style="list-style-type: none"> • Cold chain infrastructure <ul style="list-style-type: none"> • Coolers, refrigerated trucks, carriers etc. • Transportation management system • Warehouse management system
<i>Collaborative relationships</i>	<p>Partners must share a similar commitment towards continuous improvement.</p>

resources available in the country has immense potential and opportunities that need to be exploited. Several initiatives are underway in this direction. These include research for implementing international quality standards, adoption of value-added technologies and export-oriented slaughterhouse-meat processing plants. It is also planned to establish disease-free zones in areas where processing facilities are located. Given these improvements, there is high growth potential in India's processed meat market.

The government plays a key role in formulating and implementing policies that promote the growth of the meat processing industry, increase consumption by the population, facilitate export, substitute imports, and encourage entrepreneurship and employment in the meat sector. This includes concessions, investment subsidy and tax incentives for contract farming, setting up animal farms and meat processing units. Meat exports can be increased by simplifying customs procedures and providing infrastructure such as cold storage and warehousing facilities at ports and airports. The government needs to direct more funds for research on areas such as development of high meat yielding animals through genetics and breeding, nutrition, and meat processing technology, through research institutes under Indian Council of Agricultural Research (ICAR), agricultural universities, and private sector research laboratories. There is a need for a tripartite partnership of research institutes, farmers and industrialists so as to enable technology development and transfer. The possibilities of public-private partnerships – collaborative relationships between the public and private sectors based on clearly identified partnership structures, shared objectives and specified performance indicators for carrying out specific activities – can be explored in this sector. The success of the meat industry would depend on how well the farms, the industry, and the researchers join hands for meaningful partnerships and achieve synergies.

In India bulk of the meat is sold in fresh form and is a commodity product. There is a need to stimulate demand for processed meat. Recently the Union Ministry of Food Processing Industry launched a campaign for promoting consumption of processed food. Meat processors need to develop innovative products, which facilitate the use of specific animal parts, have different flavours, and have longer shelf life. They also need to develop value-added products, which are products processed to a higher degree, with a view to increase convenience to the consumer, improve nutritive value, hygiene, and ease of handling, preservation, transportation and distribution and marketing. Another policy option could be to reduce the value-added tax (VAT) on

processed meat to make its price at par with the price of fresh meat. There is a need to strengthen infrastructure in terms of improvement of roads, development of cold chains and ensuring steady power supply.

With the phasing out of subsidies on agricultural products under WTO agreements, the global market is likely to throw open new markets such as Russia and Eastern Europe. In order to compete globally, the Indian meat industry needs to consolidate itself through mergers, acquisitions and strategic alliances and create vertically-integrated supply chains. Vertical integration not only allows a farm to have complete control over all the elements of the supply chain, but also enables it to be lean, efficient and price-competitive, and achieve economies of scale. The AMUL model of cooperative dairying, processing of milk, manufacture of value-added products, and their distribution and marketing, can serve as a model for integrating animal farm owners and feed growers who at present, operate in the unorganized sector.

Thus, to summarise, pragmatic approaches for efficient livestock production and utilization are important to sustain livestock production activities. Sustainable animal production depends on feed supplies and costs, production efficiency and optimum utilization of produce, hygienic production, value addition and diversification, better utilization of by-products, cost efficient processing technology, creating sustained demand for the product, building a positive image and innovative marketing approach.

References

- APEDA. (2007), Agriculture Product Export Development Authority.
- Ayers, J.B. (ed.) (2001), "Handbook of Supply Chain Management", CRC Press, Boca Raton.
- Cardozo, R.N., Shipp, S.H., Roering, K. J. (1987), "Implementing new business-to-business selling methods", *Journal of Personal Selling & Sales Management*, Vol.7 No. 2, pp. 17-26.
- Chopra, S. and Meindl, P., (2006) "Supply Chain Management", Pearson Education, New Delhi.
- Christopher, M. (1998), "Logistics and Supply Chain Management: Strategies for Reducing Cost and Improving Service", *Financial Times*, Pitman Publishing, London, p. 19.
- Corbett, C.J., Blackburn, J.D., and Van Wassenhove, L.N. (1999), "Partnerships to improve supply chains", *Sloan Management Review*, Vol. 40 No. 4, pp. 71-82.
- DAH&D. (2004), Department of Animal Husbandry and Dairying, Government of India.
- Das, S. and Abdel-Malek, L. (2003), "Modeling the flexibilities of model quantities and lead-times in supply chains", *International Journal of Production Economics*, Vol. 85 No. 2, pp. 171-181.
- FAO. (2003), Food and Agriculture Organization.

- Food and Agriculture Organization of the United Nations (FAO), FAOSTAT on-line statistical service (FAO, Rome, 2004). Available at: <http://apps.fao.org>.
- Handfield, R.B. and Pannesi, R.T.**, (1995), "Antecedents of lead-time competitiveness in make-to-order manufacturing firms", *International Journal of Production Research*, Vol. 33 No. 2, pp. 511-537.
- Gunasekaran, Yamin S. and Mavondo F.T** (1999), "Relationship between generic strategy, competitive advantage and firm performance: An empirical analysis" *Technovation*, Vol.19 No. 8, pp. 507-518.
- Holmberg, S.A.** (2000), "A systems perspective on supply chain measurements" *International Journal of Physical Distribution and Logistics Management*, Vol. 30 No. 10, pp. 847-868.
- Jackson, B.B.** (1985), "Build customer relationships that last", *Harvard Business Review*, Vol. 63 No.3, pp.120-128.
- Kaplan, R.S. and Norton, D.P.** (1992), "The balanced scorecard-measures that drive performance", *Harvard Business Review*, Vol. 70 No. 1, pp. 71-85.
- Kessler E. and Chakraborty, A.** (1996), "Innovation speed: a conceptual model of context, antecedents, and outcomes", *The Academy of Management Review*, Vol. 21 No. 4, pp. 1143-1191.
- KPMG. (2006), "Food processing: India", India Brand Equity Foundation.
- Lee, H.L. and Billington, C.** (1995), "The evolution of supply chain management models and practices at Hewlett Packard", *Interface*, Vol. 25 No. 5, pp. 42-63.
- McDonald, M., Millman, T., Rogers, B.** (1997), "Key account management: theory, practice and challenges", *Journal of Marketing Management*, Vol.13 No. 8, pp. 737-757.
- McGinnis, M.A. and Vallopra, R.M.** (1999), "Purchasing and supplier involvement in process improvement: a source of competitive advantage" *Journal of Supply Chain Management*, Vol. 3: 4, pp. 42-50.
- Monczka, R.M., Peterson, K.J., Handfield, R.B. and Ragatz,** (1998), "Success factors in strategic supplier alliances buying company perspective", *Decision Science*, Vol. 29: 1 pp. 5553-5577.
- Porter, M.E. and Millar, V.E.** (1985), "How information gives competitive advantage", *Harvard Business Review*, Vol. 64, pp. 149-160.
- Stalk, G.** (1988), "Time the new source of competitive advantage" *Harvard Business Review*, Vol. 66 No. 4, pp. 41-51.
- Stock, G.N., Greis, N.P. and Kasarda, J.D.** (2000), "Enterprise architecture and supply chain structure: the role of fit" *Journal of Operations Management*, Vol. 18 No. 5, pp. 531-547.
- Tracey, M., Vonderembse, M.A. and Lim J.S.** (1999), "Manufacturing technology and strategy formulation: keys to enhancing competitiveness and improving performance" *Journal of Operations Management*, Vol. 17 No. 4, pp. 411-428.
- Vesey, J.T.** (1991), "The new competitors: they think in terms of speed-to-market", *Academy of Management Executive*, No. 2, pp. 23-33.

The simple act of paying positive attention to people has a great deal to do with productivity.

– Tom Peters

Dynamics and Prospects of the Indian Logistics Industry

Subrata Mitra

Though Supply Chain Management (SCM) has been the buzzword for some time now, logistics per se has not been able to attract the same attention so far. What is the difference between SCM and logistics anyway? Though in literature, SCM and logistics are interchangeably used, there is a subtle difference between the two. While SCM is more strategic in nature, logistics is more operations-oriented. While SCM deals more with the linkages in the chain, contracts and relationships, supplier selection, information and financial flows besides materials flows, creating new facilities such as plants, warehouses and distribution centres, and broader issues such as society, economy, government and environment, the scope of logistics is more or less confined to the routine job of transportation and storage of goods.

If SCM is a white-collar job, logistics is perceived to be a blue-collar job. Hence, as far as interests, citations and job markets are concerned, SCM has scored over logistics so far. However, if one deeply ponders, one may realize that logistics is the core of SCM, and if logistics fails, the whole chain snaps. Though logistics deals with mundane vehicles, warehouses, layouts, material handling equipment, Motor Vehicles Act, toll tax, sales tax, octroi, documentation, etc., efficient management of it has the potential to make the chain taut and agile. Therefore, there is growing interest in logistics throughout the whole world. India, of course, has been slow to react; however, of late a concerted effort is being put in by shippers, service providers and the government to jack up the industry.

The growing interest in logistics in the world in general, and in India in particular, makes it an important area for research. A lot of research papers and articles on different issues related to logistics have appeared, and are still appearing, in academic and trade journals. The author of this paper too, conducted a survey of Indian logistics service providers (Mitra, 2006), taking inputs from

Logistics as a research area is increasingly getting attention throughout the world since only efficient management of this can reduce costs and also improve delivery performance, thereby enhancing marketability of a product or service. The Indian logistics industry is currently plagued by low demand, poor infrastructure, high costs, government regulations, etc. However, it is going to turn around on the back of robust GDP growth, globalization, FDI in logistics and increasing government support. This paper highlights the current state of the industry, including the dynamics, opportunities and prospects for growth, while putting forth recommendations for the government to facilitate a sustained growth of the industry.

Subrata Mitra is Associate Professor, Operations Management Group, Indian Institute of Management, Kolkata.

primary sources such as meetings, interviews, conferences, seminars, etc. and secondary sources such as articles appearing in newspapers, trade journals, magazines and the Internet. The note provides an overview of the Indian logistics industry. It starts with an estimate of the size of the global logistics industry, followed by the dynamics prevailing in the industry. In the backdrop of the global logistics industry, an estimate of the size of the Indian logistics industry is given, followed by the players, competitive dynamics and other related issues in the industry. Subsequently, the opportunities and prospects of the industry, and implications for the Indian economy are highlighted. The note ends with recommendations for the government to facilitate growth of the industry. It has been prepared keeping in mind the interests of shippers, service providers and the government and it is expected that this will serve the purpose of educating people about the current state of the industry and steps to be taken to boost its growth.

Global Logistics Industry

The world logistics cost is about USD 3.5 trillion, out of which the logistics industry accounts for USD 300 billion or about 10%. The logistics cost in the US is about USD 1 trillion, out of which the US logistics industry accounts for more than USD 100 billion or roughly 10%. Though the largest logistics service providers are headquartered in Europe, the US still remains the largest market, accounting for 33% of the world market.

Dynamics

Following are the dynamics prevailing in the global logistics industry:

- Continuous downward pressure on pricing, high costs of operations and low returns on investments in technology.
- Demand for one-stop, customized solutions and value-added services, support for global operations, adoption of new technologies such as RFID.
- Hiring and retaining talents, port congestion, capacity constraints in all modes of transport, rising fuel prices and government regulations.
- Long-term contracts, customer and industry focus, aggressive selling to clients' customers and vendors, leading to complete supply chain integration.
- Consolidation in the global logistics industry through acquisitions, mergers and alliances.

Indian Logistics Industry

The logistics cost in India is estimated to be about 14% of the GDP (worldwide, the logistics cost in a country is pegged between 9% and 20% of the GDP), which turns out to be approximately USD 140 billion assuming the GDP of India to be slightly over USD 1 trillion (than to the appreciation of Indian Rupee against USD). Out of this USD 140 billion logistics cost, almost 99% is accounted for by the unorganized sector (such as owners of less than 5 trucks, affiliated to a broker or transport company, small warehouse operators, customs broker, freight forwarders, etc.), and slightly more than 1%, approximately USD 1.5 billion, is contributed by the organized sector (asset-based and asset-free integrated logistics service providers, also known as 3PL and 4PL providers).

Suppliers of Service

- Transportation service providers (through road, air, waterways—sea, coastal and inland ropeways, pipeline, etc.)—FTL/LTL, FCL/LCL single- and multi-modal
- Warehouse, ICD and CFS operators
- Customs House Agents (CHA)
- Freight forwarders, NVOCC, etc.
- Asset-based and asset-free 3PL and 4PL providers
- Port/Airport and Customs authorities, and Central and State Government departments related to logistics activities (Though they do not directly provide logistics service, they definitely affect quality of service)

Buyers of Service

- Major buyers belong to the following industries: pharmaceuticals, auto, engineering/industry, textiles/apparels, computer/electronics, telecommunications, FMCG and durables.

Competitive Dynamics and other Issues

Mentioned below are the problems faced by the Indian logistics industry. They also make the sector unattractive for investments and create entry barriers.

- Logistics is a high-cost, low-margin business. The problem of organized players is compounded by the unfair competition with unorganized players who can get away without paying taxes and following operating norms stipulated in the M

Vehicles Act such as quality of drivers and vehicles, volume and weight restrictions, etc.

- Economies of scale are absent in the Indian logistics industry. Even the organized sector that contributes slightly more than 1% of the logistics cost, is highly fragmented. Existence of the differential sales tax structure also brought in diseconomies of scale. Though VAT has been implemented since April 1, 2005, failure in implementation of a uniform VAT structure across different states has let the problem persist even today.
- Apart from the non-uniform tax structure, 3PL providers have to pay numerous other taxes, octrois and bribes, and face multiple check posts and police harassment. Bribes paid to police, check posts and other interested parties may constitute well over 20% of the freight cost. High costs of operation and delays involved in compliance with varying documentation requirements of different states make the business unattractive. On an average, a vehicle on Indian roads loses 24-48 hours in complying with paperwork and formalities at different check posts en route to a destination. Fuel worth Rs. 10,000 crore is spent on waiting at check posts annually. A vehicle that costs Rs. 12 lakh pays Rs. 3 lakh per annum in the form of various taxes, which include the excise duty on fuel. This is why freight cost is a major component of the cost of a product in India.
- There is lack of trust and awareness among Indian shippers as regards to outsourcing logistics. The volume of outsourcing by Indian shippers is presently very low (~ 10%) compared to the same for the developed countries (> 50%, sometimes as high as 80%). The unwillingness to outsource logistics on part of Indian shippers may be attributed to skepticism about the possible benefits, perceived risk, and losing control, of sensitive organizational information, and vested interests in keeping logistics activities in-house.
- Indian shippers expect 3PL providers to own quality assets, provide more value-added services and act as an integrated service provider, and institute world-class information systems for more visibility and real-time tracking of shipments. However, they are unwilling to match the same with increased billings; even pay little attention to timely payments that leave 3PL providers short of adequate working capital.
- Indian freight forwarders face stiff competition from multi-national freight forwarders for international freight movement. MNCs, because of their size and operations in many countries, are able to offer low freight rates and extend credit for long periods. Indian freight forwarders, on the other hand, because of their smaller size and lack of access to cheap capital, are not able to match the same. Moreover, clients of MNCs often want to deal with a single service provider and especially for FOB shipments specify the freight forwarders, which most of the time happen to be the multi-national freight forwarders. This is sort of a non-tariff barrier imposed on Indian freight forwarders.
- Poor physical and communications infrastructure is another deterrent to attracting investments in the logistics sector. Road transportation accounts for more than 60% of inland transportation of goods, and highways that constitute 1.4% of the total road network, carry 40% of the freight movement by roadways. Slow movement of cargo due to bad road conditions, multiple check posts and documentation requirements, congestion at sea-ports due to inadequate infrastructure, bureaucracy, red-tapeism and delay in government clearances, coupled with unreliable power supply and slow banking transactions, make it difficult for exporters to meet the deadlines for their international customers. To expedite shipments, they have to book as airfreight, rather than seafreight, which adds to the costs of shipments making them uncompetitive in international markets. Moreover, many large shipping liners avoid Indian ports for long turnaround times due to delays in loading/unloading and hence Indian exporters have to resort to transshipments at ports such as Singapore, Dubai and Colombo, which adds to the costs of shipments and also delays delivery.
- Low penetration of IT and lack of proper communications infrastructure also result in delays, and lack of visibility and real-time tracking ability. Unavailability and absence of a seamless flow of information among the constituents of logistics service providers creates a lot of uncertainty, unnecessary paperwork and delays, and lack of transparency in terms of cost structures and service delivery. For example, a shipper has to pay a higher freight rate if it cannot ensure return load. At present, there is no real-time process by which a shipper may know about the availability of trucks and going rates at the destination

market. Therefore, it has to pay more. Had the market information been available to both the shipper and the service provider, the service provider's cost structure would have been transparent to the shipper and it would have ended paying the actual market rate. Another example would be that LTL shipments cost more than FTL shipments. Now, when a shipper books a LTL shipment, it has no idea about the status of its shipment after it leaves the warehouse at the origin and before it reaches the warehouse at the destination. The service provider may still convert this LTL shipment into a FTL shipment at its own warehouse before delivering at the destination. So, the shipper ends up paying LTL rates for a FTL shipment. Had there been visibility during delivery, this problem would not have occurred.

- Since most of the 3PL providers are of relatively small size, they cannot provide the entire range of services. However, shippers would like service providers to offer more value-added services and a single-stop solution to all their logistical problems. The inability of service providers to go beyond basic services and provide value-added services such as small repair work, kitting/dekitting, packaging/labeling, order processing, distribution, customer support, etc. has not been able to motivate shippers to go for outsourcing in a big way.
- Service tax levied on 3PL service fees (currently 12.36% with educational cess) may make outsourcing costly and outweigh the possible benefits.
- There is a dearth of skilled and knowledgeable manpower in the logistics sector. Management graduates do not consider logistics as a prime job. To improve the status of the industry, service providers have to move beyond the level of brokers and truckers.

Future Prospects

- Despite the problems mentioned above, the Indian logistics industry is forecasted to grow at 20% compared to the average world growth rate of 10%. As mentioned before, the organized sector accounts for slightly more than 1% of the country's logistics cost, which highlights the potential of this sector.
- Many large Indian corporates have been attracted by the potential of this sector and have estab-

lished logistics divisions. They started providing in-house logistics services, and soon sensing the growth of the market, have started providing services to other corporates as well. Examples include Tata, Reliance, M&M, TVS and Essel Shipping.

- Large express cargo and courier companies such as TCI, Blue Dart, Gati and Safexpress have also started logistics operations. These companies enjoy the advantage of already having a large asset base and an all-India distribution network. Some large distributors have also forayed in the logistics business for their clients.
- Since logistics service can be provided without assets, there is growing interest among entrepreneurs to venture into this business.
- Indian shippers are gradually becoming more aware of the benefits of logistics outsourcing. They are now realizing that customer service and delivery performance are equally important to cost to remain competitive in this global economy.
- The Indian economy is growing at over 9% the last few years (compared to the world GDP growth rate of 3%), which implies more output and more demand for specialized logistics services.
- The Indian government has focused on infrastructure development. Examples include the golden quadrilateral project, East-West and North-South corridors, FTWZ in line with the 100% FDI limit, private-public partnerships in infrastructure development (The monopoly of CONCOR in containerized inland transportation has been done away with). It is expected that infrastructure development would boost investments in the logistics sector.
- In India, 100% FDI is allowed in logistics whereas in China, until recently, foreign investment was not allowed in domestic logistics. Almost all the global logistics companies have their presence in India, mainly involved in freight forwarding, domestic transportation and warehousing, and have tie-ups with Indian companies. As the Indian logistics scenario looks promising, the MNCs are expected to play a bigger role, probably forming wholly-owned subsidiaries or using the acquisition route. As an example, Danzas, the biggest logistics company in the world, has taken over Blue Dart.

Implications for the Indian economy

- If India can bring down the logistics cost from 14% to 9% of the GDP (level in the US), savings to the extent of USD 50 billion will be realized at the current GDP level, making Indian goods more competitive in the international market. Moreover, improved service delivery and customer satisfaction would boost export of Indian goods.
- Growth in the logistics sector has the potential for more job creation.

What Government needs to do

The Indian government cannot change the mindsets of shippers and service providers overnight; nor can it alleviate the problems faced by the organized sector with direct intervention, but it can, of course, create an environment conducive for growth of this sector, remove hurdles for the organized players and facilitate generation of awareness towards the benefits of 3PL/4PL. Following are some of the recommendations:

- There is an urgent need to bring all 3PL/4PL providers under one umbrella. At present, there is little or no information available about service providers and their capabilities. Neither there is any government-published directory or database of service providers. A committee comprising of representatives from concerned ministries, industry and academia may be formed, which would look into the registration process of prospective service providers. A set of criteria should be set that would dictate qualifications of a service provider to be categorized as a 3PL/4PL. Once registered, service providers would be issued licenses to operate as 3PL/4PL providers, and the same information may be published as a directory and made available on a government website. This should be the first step to bring service providers under one umbrella so that some grading mechanism, if required, can be introduced at an appropriate time.
- As mentioned before, low penetration of IT has created lack of visibility, delays and corruption in transportation and storage of goods. Besides facilitating creation of an all-India IT and telecommunications backbone, automated transportation and warehousing facilities, Government can boost the use of RFID and GPS that have become global standards for real-time tracking facility by providing financial assistance for initial years until the prices of these technologies fall below a threshold level.

- Policies and procedures may be simplified. The need for documentation/paperwork at multiple check posts and in different states, customs formalities, and bureaucracy and red-tapeism in various government departments should be reduced as far as possible. With spreading of IT and automation, and introduction of a uniform VAT structure or GST across all states, this situation is expected to improve in the near future.
- Government can create logistics SEZs/logistics hubs/logistics parks with concessions in tax and land rates. The same incentives may also be extended for construction of modern automated warehouses and cold chains. Duties and cross-subsidies on ATF may be reduced to international levels (or at least to the level of diesel) so that more materials, particularly perishable items and emergency orders, can move by air within the country.
- Government may also facilitate formation of transport cooperatives to get rid of industry fragmentation and diseconomies of scale. Cheap capital may be made available to service providers for investments in infrastructure, enabling them to extend longer credit periods to their clients and supplementing their working capital.

The above-mentioned economic sops/incentives/subsidies extended to the organized sector would make a level playing field for it to compete with the unorganized sector and MNCs. The issue of poor quality and low reliability of service providers is linked with price-sensitivity of the market that operates at a low-cost, low-quality level. It is not feasible for any outside agency to enforce rules for improving the quality of service and this can only be done by the buyer of service. With increased competition, quality of service is bound to improve.

- Government undertakings such as Railways and Shipping Corporation of India may forward- and backward-integrate to provide multi-modal and 3PL services, both domestically and worldwide. With a vast experience and a large asset base, it is a logical extension of services already provided by these carriers.
- Feasibility of movement of cargo by rail and road to bordering states such as Pakistan, Bangladesh, Nepal and China may be explored, which might open gateways to Europe, Middle East, Far East and South-East Asia for trade. Models of trading blocs such as NAFTA and EU may be followed.

-
- Government may organize seminars/workshops/conferences/exhibitions cum meetings (like at Pragati Maidan in Delhi or at Netaji Indoor Stadium/Salt Lake Stadium in Kolkata) to bring in representatives from shippers, service providers and government under one roof (For example, CII organizes Logistics East Meet every year in Kolkata). Frequent interactions would help generate more awareness of this sector, and also attract better quality of human resources.
 - Government may facilitate conducting certificate/diploma courses in logistics to attract and retain talents, jointly with, say, IIMs, XLRI and other leading business schools.
 - Besides taking the above-mentioned initiatives specific to the logistics sector, Government must also continue to boost the economic growth and allow more FDIs, both in quantum and spread,

which would indirectly fuel the growth of the logistics sector. For example, globally retailing accounts for 70% of the logistics cost. However, in India organized retailing constitutes less than 5% of the total retail pie. As organized retail grows and FDI restrictions in retail are lifted, retail logistics will get a boost. Government must also persistently strive to curb unrest and improve infrastructure in terror-prone border states such as J&K and North-East. Because of security concerns and ill-developed infrastructure, organized players are not willing to extend operations to these states.

Reference

Mitra, S. (2006), "A Survey of Third-party Logistics (3PL) Service Providers in India", IIMB Management Review, 18(2), 159-177.

[

Even if you are on the right track, you'll get run over if you just sit there.

– Will Rogers

Lean manufacturing – Hurdles and Solutions

Krishna Murari & K S Gupta

In the present business scenario, to survive in the market and be profitable, the goal of any manufacturing system is to produce the highest quality products in the shortest lead time possible at the lowest possible cost. Lean manufacturing is a total business approach designed to identify and eliminate all forms of waste in the process of producing goods. This paper highlights that the major hurdles in implementation of lean concept include resistance to change, lack of awareness, clash of priorities between production schedule and the lean implementation programme, lack of facilities and training and non-involvement of employees at each level. It suggests that Kaizen event and lean activity can be linked to incentives or reward to generate interest among the people for participating in the lean journey.

In the last two decades, there was a revolutionary change in the business scenario worldwide. The whole world has become a small village as far as business is concerned. With this change, competition has gone up. There is cut throat competition among different companies in the same business. There are various strategies adopted by the companies to overcome the competition and survive in the market. Lean manufacturing is one of the reliable and proven concepts to succeed.

Lean manufacturing is an operational strategy oriented towards achieving the shortest possible cycle time by eliminating waste. It is derived from the Toyota Production system and its key thrust is to increase the value added work by eliminating waste and reducing incidental work. The technique often decreases the time between a customer order and shipment, and it is designed to radically improve profitability, customer satisfaction, throughput time and employee morale.

The basic objective of the lean is to minimize the *muda* (a Japanese word which means waste), and continuous improvement in every stage of product by utilizing minimum time and cost. *Muda* is any activity which absorbs resources but ends up creating waste. These activities add no value to the product, service or the customer. Lean manufacturing focuses on reduction of all kind of waste to make continuous flow of the work, reduce the cycle time, reduce the transportation, eliminate the non-value added process, reduce the motion of workers by providing proper location of tools and parts, minimize the transportation, maximize the utilization of machines and reduce the inventory in the production space. The benefits generally are lower costs, higher quality and shorter lead time.

The term lean manufacturing is coined to represent half the human effort in the company, half the manufacturing space, half the investment in tools and half the engineering hours to develop a new product in half the time. These benefits can be achieved only if the concept is religiously followed in the organization.

Krishna Murari is Senior Manager (Production), ARDC, Bangalore; and K S Gupta is Associate Dean, ICFAI Business School (IBS), Bangalore.

All these objectives can be met only when there is a conducive environment; and when the concept is understood properly by all employees from top to bottom. And when everyone is committed to bringing about change.

It is observed that many companies have tried to utilize the lean manufacturing concept to sustain themselves in the market. But only a few are successful. Other companies are either using a few tools, like kaizen or have left the journey in the middle. Literature survey reveals that a few studies have been done in the west to find out the hurdles, but that no such study has been found in Indian business organizations. It emphasizes a need for a study to find out the reason for failure in implementation of the lean concept and identify the hurdles to overcome these and succeed.

The present study was carried out in a medium size manufacturing industry where the lean programme was started about two years back. It highlights the hurdles in the implementation of lean in a manufacturing organization. It also suggests the solution to the hurdles.

Lean Manufacturing Concept

Lean manufacturing is in direct opposition to traditional manufacturing approaches characterized by the use of economic order quantities, high capacity utilization and high inventory. In changing from a traditional environment to one of lean production, cultural issues will emerge quickly and so will a resistance to change. A managing change programme is needed to accompany the effort. However, just like anything else, lean manufacturing is no panacea, nor should it be embraced as a religion. It is an operational strategy that, if implemented properly, will provide a new dimension to competing, quickly introducing new customized high quality products and delivering them with unprecedented lead times, swift decisions and manufacturing with high velocity.

Lean manufacturing is a total business approach designed to identify and eliminate forms of waste in the process of producing goods, services, or combinations of both. Lean means "manufacturing without waste." It is a team-based approach to identify and eliminate waste (non-value adding activities) through continuous improvement.

Any activity that adds cost/time without value to the service we offer to our customers is called waste. Waste is any resource, which does not add value to the product being manufactured. There are seven kinds of waste:

- i) Motion, i.e. moving without working.
- ii) Delays, i.e. waiting for anything.
- iii) Transporting, i.e. moving products between work centres.
- iv) Defects, i.e. not working right the first time.
- v) Over-working, i.e. doing work that beyond what is needed.
- vi) Materials, i.e. more than normal consumption of materials.
- vii) Storing, i.e. keeping products waiting.

Basic Elements of Lean Manufacturing

There are five basic elements to define the philosophy and to implement lean management:

- a) Specify value
- b) Identify the value stream
- c) Flow
- d) Pull
- e) Perfection.

Value defines how the customer determines whether or not the service provided satisfies their need. Value stream consists of all actions required to produce the product and it consists of all the activities including problem solving, information management and physical transformation tasks required to produce value and operational modifications. Flow means creating a new value stream without any waste to enhance the efficient addition of value, eliminating all actions that may not create value for the customer. Pull emphasizes that production and delivery instructions are implemented at supplier locations only when signalled by the customer. And finally perfection is brought through radical and continuous improvement efforts in the generation and delivery of the product or service to the customer.

Benefits of Lean

Major benefits of lean manufacturing are lead time reduction, inventory reduction, cost reduction, floor space reduction, new product development in the least possible time and time reduction in production of existing products. Other benefits include on time delivery, improved response to market, accountability, better use of equipment and manpower, improved quality, improved workflow, job satisfaction, flexibility, predictability, team work and less conflicts.

Important Tools and Techniques

5S housekeeping is the first step of any lean implementation programme. This is the first step towards continuous improvement. The aim of 5S is to create an atmosphere to keep a clean, organized, safe and efficient workplace for everyone. The foundation for the practice of 5S comes from a Japanese programme derived from these words: *seiri* means shorting, i.e. removing unneeded items; *seiton* means storage, i.e. identifying home for everything; *seiso* means sweeping i.e. cleanliness; *seiketsu* means standardizing, i.e. adherence to the standard procedures developed during the 5S programme; and *shitsuke* means sustain which needs self discipline, support and rewards.

There are four important concepts namely one piece flow, workable work, takt time and visual control. One Piece Flow refers to the concept of moving one work piece at a time between operations within a work cell. Takt time is how many minutes or seconds are needed to make one part when considering the daily volumes to be produced in that work cell and the total time available to perform the job. Visual controls enable the work place to be self-explaining, self-regulating and self-controlling.

Goal setting and review of lean implementation is done through Policy Deployment Matrix and Policy Deployment Progress Review. In policy deployment matrix, goals are identified and measures are decided to judge the degree to what the goals are met, targets are fixed against these measures and actions are finalized. These are generally tabulated in a chart with the location, i.e. responsible agencies for action and resources. It is used to provide action areas to ensure that actions are focused on activities that will impact overall goals.

Core Techniques of lean manufacturing are:

- i) Lean daily management system (LDMS).
- ii) Cellular manufacturing.
- iii) Kanban (pull scheduling).
- iv) Total productive maintenance.
- v) Set up reduction (SMED).
- vi) Team development.
- vii) Poka yoke.
- viii) Value stream mapping.
- ix) Standard work sheet.
- x) Spaghetti diagram.
- xi) Kaizen Event.

These techniques are used for identification of non-value added activity and eliminating or minimizing the non-value added activity or waste. Usually, lean resource teams are set up in the organization to facilitate lean implementation.

Methodology

Literature survey was carried out to collect secondary data on hurdles faced during the implementation of lean in various organisations. A questionnaire method has been utilized to collect the primary data.

A lean questionnaire has been prepared for workmen and executives to know the hurdles and solutions for implementing lean in shop floor in an effective manner. This questionnaire is based following parameters:

- a) Basic knowledge of lean.
- b) Interest in lean.
- c) Resistance to change.
- d) Awareness about lean.
- e) Working environment.
- f) Level of communication.
- g) Level of satisfaction.
- h) Level of appreciation for innovation.
- i) Level of implementation – i) Kaizen event, ii) House keeping.
- j) Training of lean.
- k) Benefit from lean.
- l) Inclination for growth of company.

There are about 500 regular workmen and 100 executives in the company. The questionnaire was circulated among the workmen and executives in lower and middle management level. Follow-up was done and 220 responses were received from the workmen and 48 responses from the executives.

Findings from Secondary Data

Literature survey reveals the following:

- i) Lean manufacturing's focus is eliminating waste. The practice has accumulated many excellent concepts, methods and techniques that are well documented.

- ii) Masaaki Imai, father of continuous improvement and founder of the Kaizen Institute, says that once lean has been successfully introduced, one will find that he can build products in 10 per cent of the lead time, with 20 [per cent] to 30 per cent fewer workers, with 10 per cent of work-in-processes, using one-third or one-quarter of the space utilized in the traditional environment, and realizing one-tenth the mistakes or rejects of the previous level to improve quality.
- iii) Masaaki Imai, cites the three big hurdles to implementing lean manufacturing:
 - a) Lack of interest in manufacturing from top management
 - b) Lack of commitment from employees
 - c) Difficulty in developing a useful roadmap for process without outside help.
- iv) In a recent survey conducted by the lean enterprise institute (LEI), a non-profit training and publishing company, 46% of respondents said their lean implementation efforts were "early" consisting of pilot projects, but had produced positive results. Twenty-eight per cent characterized their efforts as "extensive" with many areas applying lean concepts successfully. Despite the strong positive records, 36% of respondents reported that "backsliding to the old ways of working" was a major obstacle to the effort to their facility.
- v) *Lean Enterprise Institute* survey conducted recently identified the following hurdles to lean transformations, based on 999 responses to a questionnaire distributed earlier this year to managers and executives:
 - Backsliding to the old ways of working—36% of respondents
 - Lack of implementation know-how—25%
 - Lack of a crisis to create a sense of urgency—24%
 - A traditional cost accounting system that doesn't recognize the financial value of shop-floor improvements—22%
 - Resistance by middle management—21%
 - Lean is regarded as the "flavour-of-the-month"—19%
 - Failing to remove "anchor draggers" who oppose change—18%
 - Resistance by hourly employees—11%
 - Resistance by supervisors—10%
 - Failure of past lean projects—6%
- vi) It is observed that often the superficial act continue and one never gets to the activities provide a positive business impact.
- vii) Zomax Canada faced two specific challenges while implementing lean, according to Cugham, director of operations. The first challenge was dedicating enough people powered to the project of the ground. The challenge overcome by top management's commitment to lean, and the realization that the company must have to free of production staff to work on it in order to make it work [ref 3]. Zomax Canada confirms the importance of proper training in implementation of lean manufacturing.
- viii) Paul Manfold identified following hurdles for smaller companies:
 - a) Lack of understanding of lean
 - b) Not willing to change
 - c) 'cherry-picking' mentality, where companies take lean thinking for lean tools and techniques
 - d) Lack of focus and commitment
- ix) Companies can overcome many obstacles avoid them altogether—by following a five transformation process that applies lean production techniques strategically as part of creating lean value streams (Jim Womack & Dan J 2003)
 - a) **Finding a Change Agent:** This leader of transformation must have the will power and to initiate fundamental change and make it :
 - b) **Getting the Knowledge:** A company needs a lean expert, someone who has mastered thinking and techniques as a result of years experience in actually transforming value streams.
 - c) **Finding a Lever by Seizing a Crisis or by Creating One:** Tough times are valuable because they create urgency for change that doesn't exist during good times.
 - d) **Mapping Value Streams:** LEI has found many companies skip this step and charge ahead to step five, rushing into well-intentioned—ultimately under performing—kaizen offenses

improve a small part of a value stream instead of the whole chain of activities. The bottom line on these isolated activities is that little cost savings reach the bottom line and the improvements are difficult to sustain.

- e) Picking something important and getting it started, removing waste quickly to show how much can be accomplished in a very short period.
- x) An analysis of lean methodologies and the experiences of successful lean practitioners provide best practices for launching a lean programme. Rapidly execute the lean methodologies in this sequence: 5S, Value stream mapping, setup reduction, cellular manufacturing and kanban. In the sequence each lean methodology builds on previous accomplishments. There is a strong tendency on the part of most organization that implement lean to do the easy stuff fast to show some accomplishment and gain acceptance.

Findings from Primary Data

The responses are summarized and given at Table 1 for the response by workmen and at Table 2 for the response by the executives.

Table 1: Workmen survey result

Category	Agree (%)	Disagree (%)	Neutral (%)
Level of awareness	46.47	17.64	35.89
Level of basic knowledge	56.06	40.03	3.91
Interest	50.88	20.77	28.35
Resistance to change	38.97	16.17	44.86
Inclination towards growth of company	07.84	09.31	82.85
Level of communication	40.44	24.70	34.86
Level of training on lean	26.47	50.00	23.53
Level of implementation	29.40	20.58	50.02
Benefit of lean	22.05	25.73	52.22
Participation in Kaizen event	32.35	14.70	52.95
Housekeeping	66.17	23.52	10.31
Conducive environment	29.40	24.26	46.34

Response from Workmen

On analyzing the responses from employees the following observations are made:

Table 2: Executives survey result

Category	Agree (%)	Disagree (%)	Neutral (%)
Level of awareness	77.3	12.6	10.10
Level of basic knowledge	79.16	10.41	10.43
Interest	29.6	15.2	55.2
Resistance to change	20.80	02.08	77.12
Inclination towards growth of company	6.15	22.90	70.95
Level of communication	08.33	06.25	85.42
Level of training on lean	80.20	10.80	09.00
Level of implementation	18.05	18.05	63.90
Benefit of lean	23.61	33.33	43.06
Participation in Kaizen event	22.34	11.11	66.55
Housekeeping	29.16	10.42	60.42

- 50 per cent workmen are aware of lean.
- 58 per cent workmen have basic knowledge about lean.
- Most of them (70%) are interested in lean implementation.
- 55% workmen are more comfortable in old ways of working.
- Most of them (80%) are indifferent about the growth of company.
- Level of communication about lean is not satisfactory.
- Most of the workmen (70%) are interested in training on lean.
- 60% workmen are not satisfied with the existing level of implementation of lean.
- Most of them want to participate in kaizen event.
- 70% workmen are interested in house keeping.
- Most of them find the environment is not suitable for lean implementation.

Response from the Executives

On analyzing the responses the following observations are made:-

- 80 per cent executives are aware of lean.
- 80 per cent executives have a basic knowledge about lean.

- Most of them are interested in lean implementation.
- 80% executives want change in the way of working.
- Most of them (70%) are indifferent about the growth of company.
- Level of communication about lean is not satisfactory among officers.
- Most of the executives (80%) are interested in training on lean.
- Most of them want to participate in kaizen event.

Suggestions made by Employees and Executives

The following suggestions have been noted down during the survey among workmen and officers:

- The organization must be ready to bear the teething troubles in transition from one system to another. Awareness and interest must be developed at all levels. Kaizen event and lean activity can be linked with incentive or reward to generate interest among the people.
- Safety precautions should be improved on the shop floor.
- Precision instruments required by facilities to carry out day-to-day activities should be available at work place.
- Safety consumables like masks, gloves, cloth should be available all the time.
- Material should be available all the time.
- For the movement heavy tools a movable trolley should be there always.
- There should be one lean lecture in every month.
- Proper working area should be maintained for different type of work like sanding, trimming, finishing and cutting.
- Latest documents should be providing to avoid rejection and reworks.
- Regular discussions should be held with the employees about implementing lean.
- Basic knowledge to be given to newly appointed employees.
- Sufficient space for individual work should be provided.

- First implement lean outside the shop floor rather than inside.
- Groups or teams should be made and training to be given to them about lean.
- Handbooks on lean should be given to employees.
- Lean should be implemented from down below, i.e. from operator level to supervisor.
- Working areas for each group should be specific; this should not happen that some other person is working on somebody's table.
- Those who are really working well, higher management should appreciate them from time-to-time to increase their morale.

Hurdles for Lean Implementation

Based on the above data, the following hurdles have been identified in the present study:

- Lack of awareness.
- Lack of interest.
- Shortage of basic infrastructure
- Wasteful movement due to a larger distance between supporting departments like personnel payrolls, canteen, etc.
- No regular and proper training to workmen and officers.
- While implementing lean in initial stage, some production will be disturbed.
- More work in progress waiting for availability of next facility to carry out next operation.
- Time wasting during shifting tools from one place to another.
- Wrong concept about lean among employees
- Lack of group inspiration.
- At times, priority clash arises between meeting production schedule of critical parts and activities pertaining to lean.
- Facilities required for implementing lean not provided.
- Not involving members from respective departments to carry out kaizen events and make them responsible for implementation.

Conclusion

According to the survey result most of the workmen and executives put more emphasis on training than on lean. Workmen want to work according to their own old ways but the executives are more interested to work according to new ways like lean. The workmen are not that aware about lean tools. Some workmen have the wrong concept in their mind about lean. By proper training and providing required facilities at the work level the workmen can be encouraged to participate in lean implementation. Resistance to change is to be dealt by proper training, counselling and advertising the results of achievements on implementing lean in some identified areas.

Organizations must be ready to bear with the teething troubles in the transition from one system to another. Awareness and interest must be developed at all levels. Kaizen event and lean activity can be linked with incentive or reward to generate interest among the people.

References

Implementing a Lean Strategy features on ReedLink.htm,
www.reedlink.com

www.arcweb.com

www.leanadvisors.com

Kaizen Teian2 by Japan Human Relations Association

Beau, Keite and Drew, Locher (2004), "The Complete Lean Enterprise: Value Stream Mapping for Administrative and Office Processes", Productivity Press New York

Charles, J. Corbett (2003), Environmental Aspects of Lean Operations Environmental Management And Operations Management: Introduction To The Third Special Issue

Dennis, P. Hobbs (2003), Lean Manufacturing Implementation APICS, The Association of Operations management, Santa Clara.

William, M. Feld (2001), "Lean Manufacturing" ; The St Lucie Press

Jeffrey, P. Wincel (2003), "Lean Supply Chain Management"; Productivity Press New York

Jim, Smith (2004), "Lean Cuisine for Manufacturing", Avnet Advantage Magazine December, Avnet Executive Comment.htm

Paul, Manfold (2005), "Lean for all - lean applications for SMEs", Paul Manfold info@qmsolutions.com.au

Jim, Womack and Dan, Jones (2003), "Lean Thinking", Second Edition, The Free Press

Jeffrey, K. Liker (2004), "The Toyota Way", Tata McGraw-Hill Edition

John, M. Nicholas (2001), "Competitive Manufacturing Management", Tata McGraw-Hill Edition

□

If time be of all things most precious, wasting time must be the greatest prodigality, since lost time is never found again; and what we call time enough always proves little enough.

– Benjamin Franklin

Human Resource Practices in the Indian Financial Sector

Kshitiz Garg, Rakesh Kumar Agrawal & Archana Tyagi

The Indian financial sector is currently witnessing rapid growth and expansion. However, it is not possible to sustain the growth in qualitative terms unless the human resource systems and processes of these organizations are geared to meet the inherent challenges of expansion. In this paper, the authors carry out an exploratory study to investigate the nature of human resource practices in twenty companies, both multinational and Indian, operating in India and dealing with mutual funds, banking and life insurance. The findings are discussed with respect to seven HR practices – recruitment, manpower planning, training and development, performance management system, talent management, employee engagement and exit process. The results reveal some lacunae in the HR policies and practices of these firms.

Kshitiz Garg is currently pursuing his PGDBM (HR) from IMT, Ghaziabad; Rakesh Kumar Agrawal is Asst. Professor (OB & HR) at IMT, Ghaziabad; and Archana Tyagi is former Professor of OB & HR at IMT Ghaziabad.

With intense competition in the financial sector from both domestic and international players, the way in which a banking or finance firm conducts business and reaches out to its customers has changed significantly. The financial sector has witnessed rapid innovation and introduction of new financial instruments, changing customer demands, and explosive growth in the use of information technology. In order to survive and adapt to a changing environment, many banks and finance companies are putting greater stress on understanding the drivers of success – better utilization of resources such as technology, infrastructure and employees, improving the process of delivering quality service to customers, and benchmarking performance (Mukherjee et. al., 2002). And with Sensex crossing the 15000 mark (Times of India, 2007) India's financial industry is only expected to witness greater activity.

As an industry grows, so do the organizations, and the competition between them. In the service sector, apart from technology, which is crucial but easily available, human capital and intellectual assets become important sources of competitive advantage. Today, human resources have become a key concern for banks and financial institutions as the sector depends heavily on people for its daily operations as well as for future growth and expansion. Banks are silently fighting a battle on the people front even as they grapple with other frontline issues like liability management, margin pressures and rising rates.

Mr. Anil Khandelwal, chairman and managing director, Bank of Baroda, lists HR as amongst his foremost concerns (ET Intelligence, 2007). Most corporate officers agree that the biggest constraint to pursuing growth opportunities is the availability of talent. According to Mr. Sanjay Nayar, CEO of Citigroup, "Retaining and finding people to feed the growth needs of business is at the epicenter of our strategy." As banks move into newer business lines and evolve new skill sets, they will need

o constantly re-evaluate their acumen requirements and identify resource pools to complement the same (ET Intelligence, 2007).

As such, a company's strategic objectives cannot be met without having a comprehensive human resource strategy in place—an HR strategy that can provide a competitive edge by hiring the right candidates, create a competitive and innovative culture, nurture and develop employees, keep motivation levels high and make the whole organization flexible enough to absorb any changes that are necessitated due to external and internal forces. In order to explore and understand the different HR practices prevalent in various companies in the financial sector in India, an exploratory study was undertaken from April to July 2007 which focused on seven important functions/areas of concern of the human resource function in an organization, viz., recruitment, manpower planning, training and development, performance management system, talent management, employee engagement and the exit process. It can provide insights into the various practices being adopted by organizations in the financial sector, and the gaps and areas for improvement, which can help an organization properly orient and transform HR to benefit itself and the financial industry as a whole.

Methodology

This study is primarily explorative in nature. A convenient sample was used and 34 companies in the financial sector were contacted to participate, out of which 10 agreed. The final sample consisted of 20 companies and included prominent names in the Indian financial industry. They were a healthy mix of Indian, multinational and joint venture companies and dealt in mutual funds, banking and life insurance. The companies agreed only on the condition that their names should not be disclosed.

Both qualitative and quantitative information about HR practices were collected for each company in various stages. First, secondary information about the company was collected over the internet. This helped in getting an overall idea about the background and history and culture of the company, as well as about the various products and services on offer. Then a basic semi-structured questionnaire to collect data about the various HR policies and practices was prepared. Next, telephonic interviews were conducted with HR executives/managers/heads to get a general impression about the openness and willingness of the managers to share information as well as to fix appointments. This was followed by a formal face-to-face interview with each manager, who was also requested to fill up the questionnaire. Wherever

possible, the comments and responses were complemented by observational methods.

Findings

The findings of the study are discussed under various heads below:

Recruitment

With increasing manpower shortages and high rates of attrition, India Inc is facing a tough task in its growth path. High attrition rates drive up training costs, increase HR and recruiting costs, increase the prospect of customer service complaints or penalties and create substantial continuity problems for longer-lived projects. The ASSOCHAM Business Barometer Survey on 'Attrition Problem in a Growing Economy,' covering 160 HR heads, reveals that maximum attrition is taking place among employees in the age group of 26 to 30 years, while those with an experience of 2 to 4 years were job hopping the most (Anonymous, 2007). The costs of replacing an employee can be as high as 120 per cent of the employee's annual salary (Crane, 2001; Cooshalle, 2007). According to the PwC report of attrition, the attrition rate in business and finance is 25 %, which is the second highest after the retail sector where the attrition rate is 50 % (PwC, 2006).

To meet the challenges of staffing, it was found during the survey that companies adopt various recruitment strategies and mechanisms such as advertisements, employee referrals, etc. simultaneously. However, the study reveals that taking the help of recruitment agencies is the most preferred channel of recruitment (75% of the companies surveyed). Figure 1 shows the two channels most preferred for recruitment. Employee referrals emerge as the second most preferred channel. Employment exchange is preferred only by one company in our sample. Campus recruitment and web portals are the other channels that can be given some importance; while advertising has very few takers (only one company cited this as the most preferred channel, and a second as the second most preferred channel).

This pattern can be justified on the grounds that in a competitive business environment where talent has to be acquired quickly, recruitment agencies and employee referrals can tap a large source of a trustworthy database quickly through recruitment agencies and employee referrals. As one HR manager put it, "It is easy to get the frontline staff from the various recruitment agencies. They are also cost effective. We hire normally around 15% of

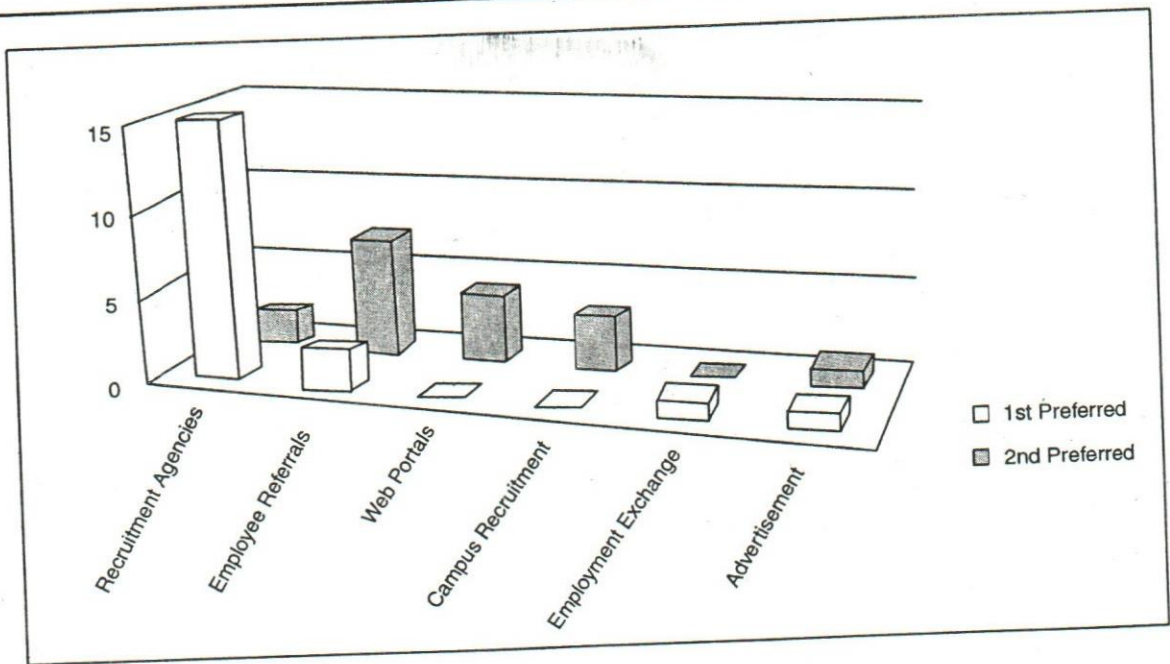


Fig. 1. Preferred channels of recruitment

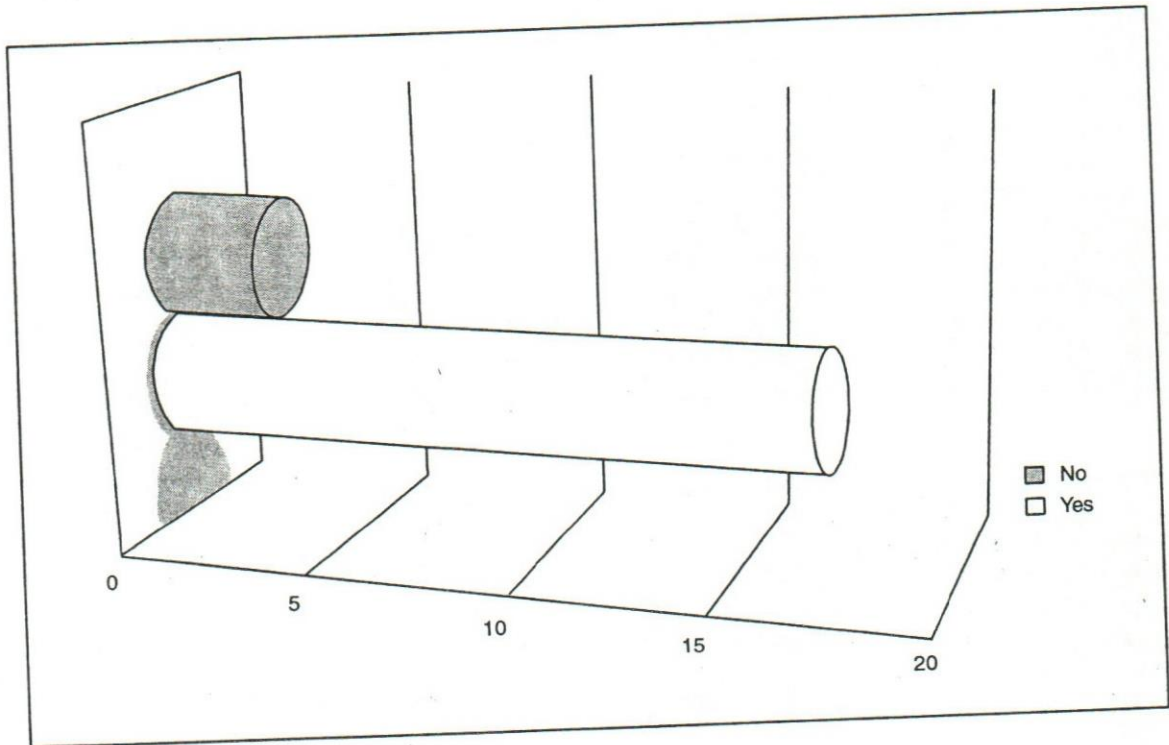


Fig. 2. Employee referral policy

our workforce from this channel." These various recruitment agencies offer candidates on a temporary basis for a tenure of normally six months. This can be extended by the company, and if the company finds the individual suitable, it can absorb him/her on a permanent basis. Some companies have gone a step ahead by forming

their own channel for such purposes. Examples include Pinnacle in ICICI Prudential Life Insurance that recruits around 15% of the employees.

As Figure 2 shows, 85% of the companies studied have employee referral schemes in place for their employees.

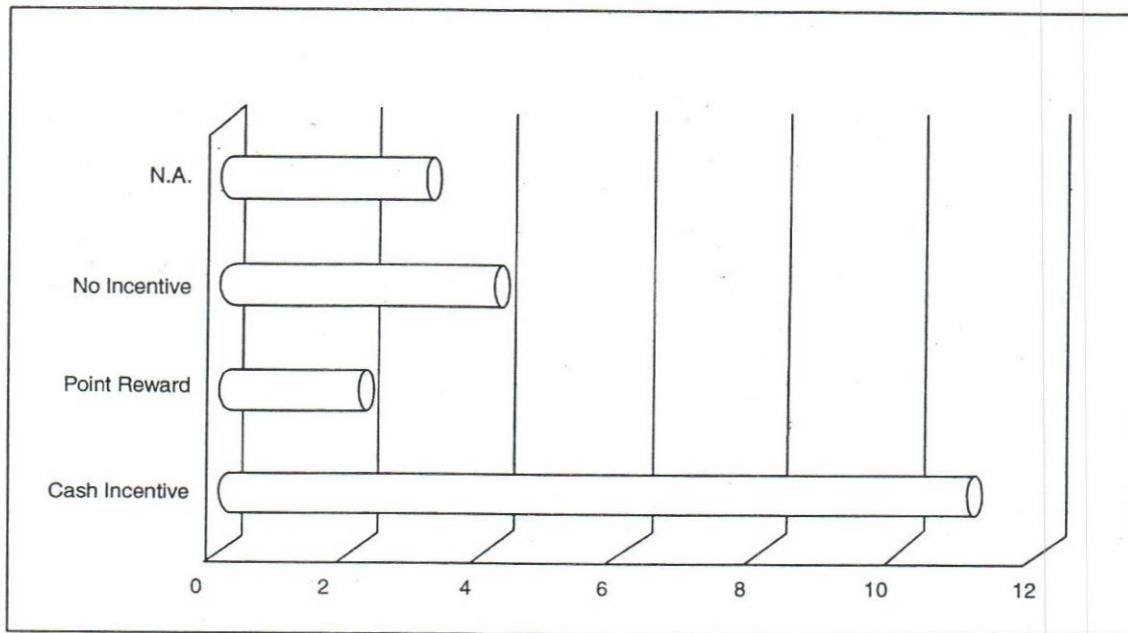


Fig. 3. Incentives for employee referrals

ees. Of the remaining 15%, some are government companies while others refused to share any information about employee referrals. Out of the 17 companies who have employee referral policies, six companies have a mandatory condition to be fulfilled before an employee becomes eligible for the reward linked to employee referral. Mostly, this mandatory condition is that the referred and hired employee has to stay with the company for at least six months after joining. As another HR manager opines, "Having an employee referral policy in place helps us in getting good employees using the network of employees. However, our biggest challenge is to prevent employee referral policy becoming a money earning exercise."

The incentives given for referrals vary from company to company. As Figure 3 shows, most companies give cash incentive for referrals, which is based on the grade or level for which the employee is referred. Others have a point reward system, wherein the number of points awarded to the employee varies, again according to the grade at which the referral is made. These points are accumulated to redeem a gift based on the total points obtained annually.

Basically, employee referrals are applicable at all levels of the organization. If any vacancy arises, the information is communicated through the intranet. In urgent cases, printed advertisements are also pasted. The CVs of the referrals are received by the HR Department via e-mail. If the referral is found suitable for the job and he/

she joins the job, then the employee who had referred the new recruit becomes eligible for fixed cash or point based incentive, according to the grade or level of the employee being referred.

Another important channel for sourcing CVs is the job web portals. The recruiters are able to get access to a large database of CVs through this source. However, due to low effectiveness of the portals, this channel is not amongst the two most preferred. Yet all companies go to these job portals for recruiting purposes. Some of the companies have gone a step ahead by introducing their own online recruiting website, where a prospective employee can post his/her CV. Companies like Monster.com, Naukri.com, Timesjobs.com also provide their services to these organizations for online recruitment. Amongst these, it was found in our study that 50% of the companies prefer Monster.com, and 25% of the companies prefer Naukri.com.

Campus recruitment is not neglected by the companies, especially for lower managerial positions. Only six of the twenty companies did not go for campus hiring. 50% of the companies have a grading system of the colleges and institutes, which is based on the company's own philosophy and criteria. These grades form the basis for the salary package and the grade at which a particular employee from a particular institute will be selected. Overall, the basic rule for campus recruitment is that a company goes for campus recruitments only if the company has a good requirement of employees.

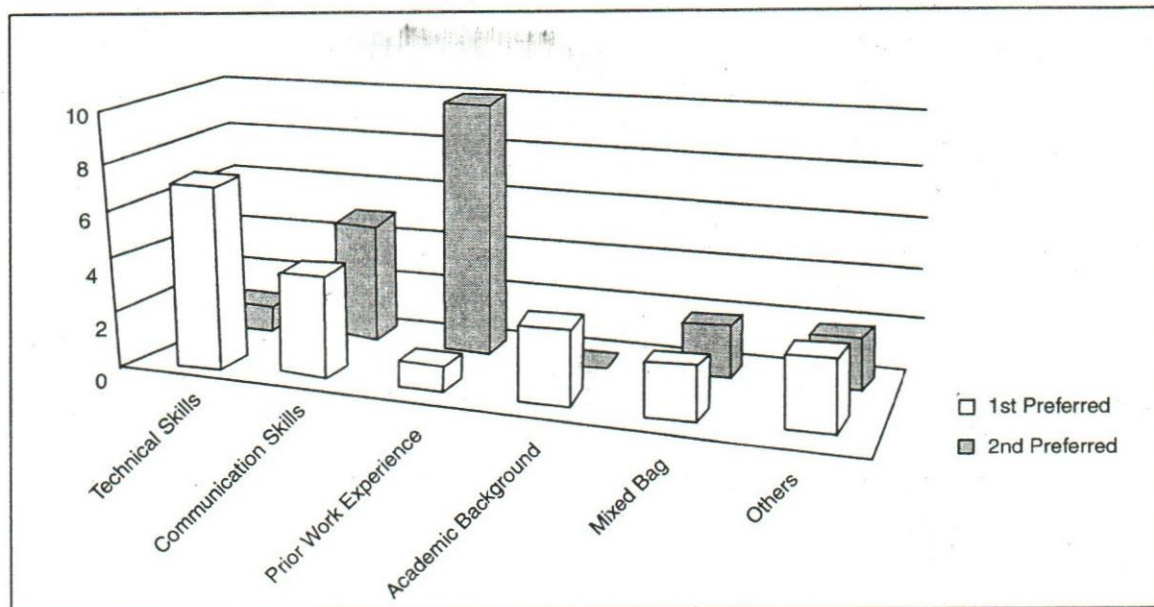


Fig. 4. Preferred elements for recruitment

The companies look for technical skills, communication skills, academic background, etc. while selecting the candidates. Figure 4 shows the elements preferred in a candidate by the companies. As is clear from the figure, technical skills (knowledge) are considered most important. It is important that the candidate has knowledge of the industry. To illustrate, for mutual funds, each candidate must possess a certificate of the Association of Mutual Funds in India (AMFI) before joining any Asset Management Company (AMC). In the insurance sector, companies prefer to recruit someone who knows the ins and outs of the industry and how the sector functions. Communication skills are also important, as more than 70% of the company employee strength in the financial sector is represented by the sales people. Although prior work experience is not the most preferred attribute, every company believes that it is a major element. Almost 50% of the companies prefer prior work experience as the second way of filtering the candidates. However, it was revealed during our interviews, in the case of senior management or middle management, work experience becomes the most important criteria for selection.

Manpower Planning

Our survey discloses that manpower planning is carried out generally on an annual basis in the last quarter of the financial year. Senior management is responsible for manpower planning, and the requirement is then transmitted to the human resource department for further processing. The HR department then plans according to the figures provided. It was also found that many HR

personnel had no clarity on any manpower planning done in the organization, although some had a idea—that the business heads look at the market and somehow formulate the requirements. In almost every organization, the method used is inventory based—which calculates the attrition rate, employees during the previous year, current employee base requirement of the employees in the current year hence calculates the number of employees to be recruited during the current year. Market signaling method is followed in some of the companies. This is based on market watch—how the industry is growing and the recruitments of competitors (Figure 5). Weighted API, is a modified version of market signaling, in which company's growth rate followed by employee requirements is identified, is also adopted by some of the companies is identified first and then the requirements of employees is identified.

Training and Development

To continuously improve and maintain the quality of human capital, it is essential to invest in human capital through education and training (Lucas, 1988; Eicher, 1993). Effective employee training is not only critical for enhancing long term employment and economic growth which can add to a country's competitive advantage, it also provides firms with a unique and differentiated position that can improve the standard and quality of services and products, resulting in continual innovation and increased productivity and profitability (Maiti

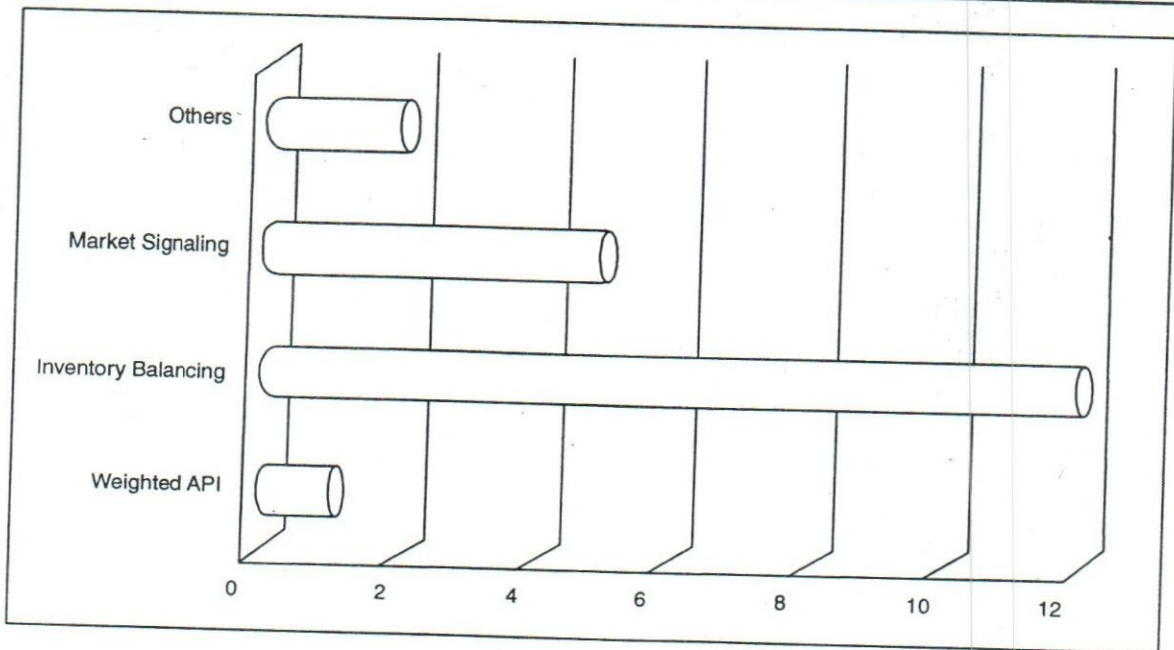


Fig. 5. Methods of manpower planning

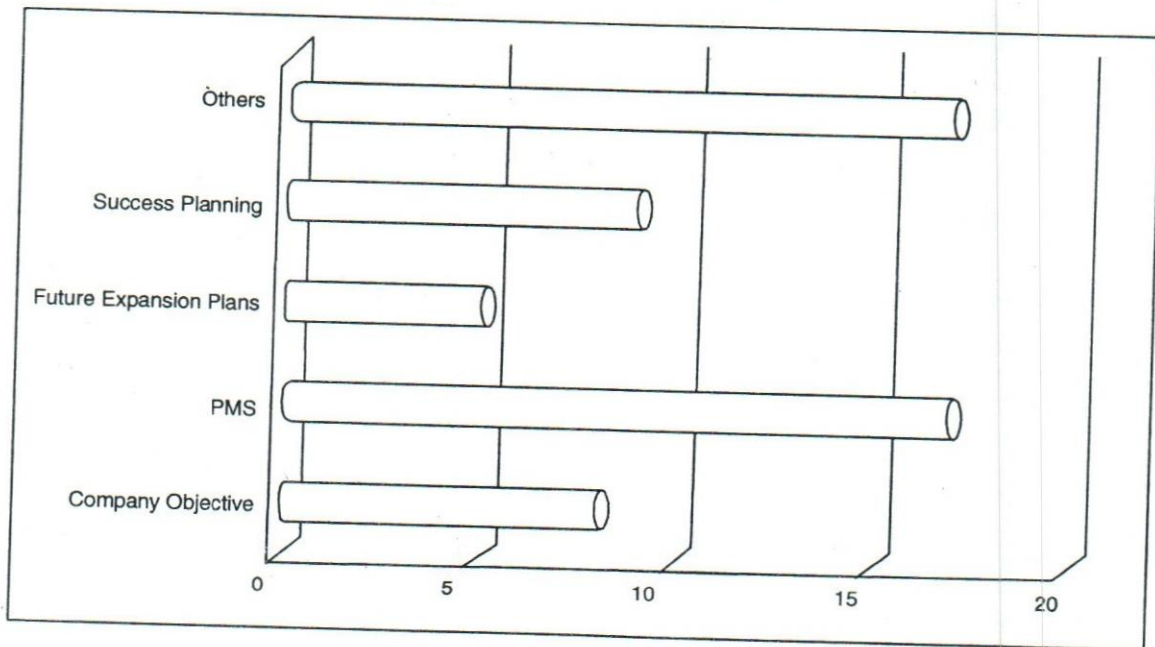


Fig. 6. Training needs identification

2002; Taylor and Davies, 2004). Financial industry is not an exception; however the functional training requirements in financial sector are high due to high volatility. Some of the companies (around 30%) have a fixed percentage of HR budget for training purpose, while one company spent a fixed percentage of revenue on training. Others do not have any pre-set basis for allocating expenditure on training.

Some companies have a provision of imparting at least some mandatory hours of training to all its employees. Almost every company conducts training for its distributors. As stated earlier, for mutual funds, distributors starting their relationship with a company have to be AMFI certified. Some of the companies have gone a step further, wherein the prospective employees are required to pass a certification course indigenously developed by the

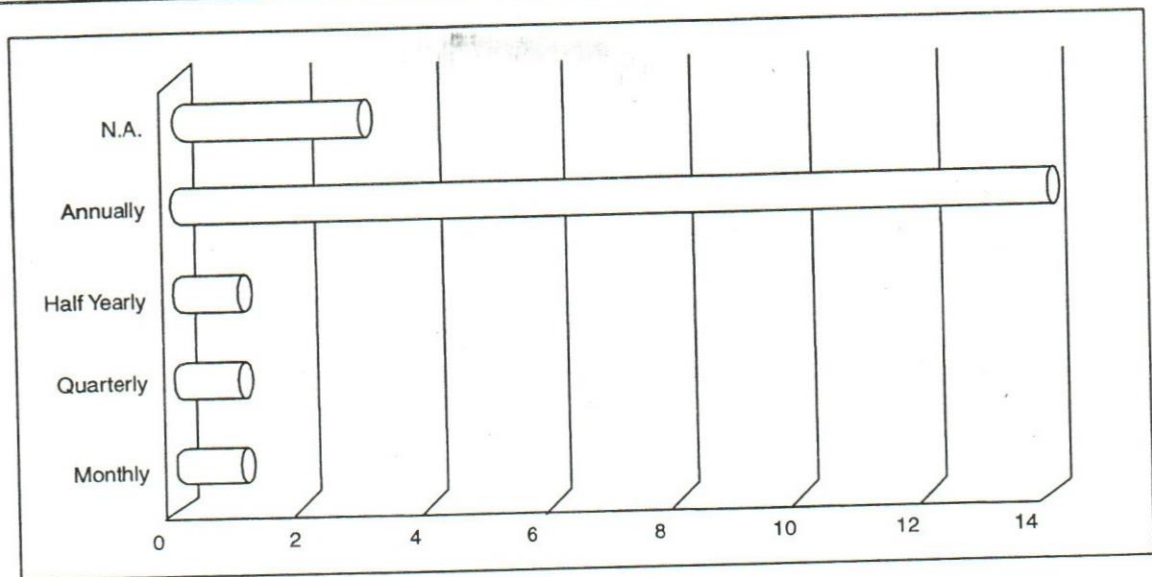


Fig. 7. Review of training calendar

company. "We make sure that anybody we are hiring is AMFI certified and has some theoretical knowledge of mutual fund sector," according to an HR manager of a mutual fund company. In the insurance sector, a rigorous training is given to the sales people during their induction program, which may extend up to 18 days. In addition, the sales departments of the companies train the distributors from time to time, in subjects related to IRDA and product training.

Different strategies are adopted by companies to identify the employees' training needs. These include company objectives, expansion plans, performance management, etc (Figure 6). 40% of the companies refer to the company's objectives while identifying the training needs. In almost every company (85%), the training needs are identified through performance gaps that appear during the performance appraisal of the employee. The performance appraisal reveals the gaps between the desired and expected levels of performance, as well deficiencies in both behavioral and technical skills. Training needs are also identified by the business heads or the functional heads. Senior management gives their suggestions to employees and the HR department for training purposes. However, it was also found that future expansion plans are not considered in most companies for identifying the training needs.

After identification of training needs, most companies studied appear to follow the same pattern for implementation of training. 17 companies have a training calendar, which is executed on an annual basis, while the remaining companies inform the employees about

training as soon as the need crops up. Out of these a majority (14) review their training calendars on an annual basis, while others review their calendars on monthly (1), quarterly (1) or half yearly (1) basis (Figure 7).

Four of the companies surveyed had their own training center(s). In general, external agencies are hired for training purposes by most companies; however some companies use the services of internal faculty. The internal faculty may comprise of senior management personnel or even the members of the HR department. External agencies are mainly hired for soft skills training, while internal faculty is used for functional training. On whole, companies in the industry give a fair chance employees to nominate themselves for a particular training. Employees can also participate in a training which is not on the list. However, it was found that in more than 40% companies, employees cannot nominate themselves for a particular training. It is the line managers or senior management that ask them to attend a particular training programme.

Evaluation of the training is one of the most important parts of the training, which lets the company know whether the training is making any sense to the company or not. The results of any training pertaining to functional or technical skills are easily seen within a period of a few months. Line managers keep track of the progress of the subordinates and the impact of the training on their performance. However, evaluation of soft skills training is done through subjective analysis. Companies take feedback from the customers, subordinates and line managers about the impact of the training on the behaviour

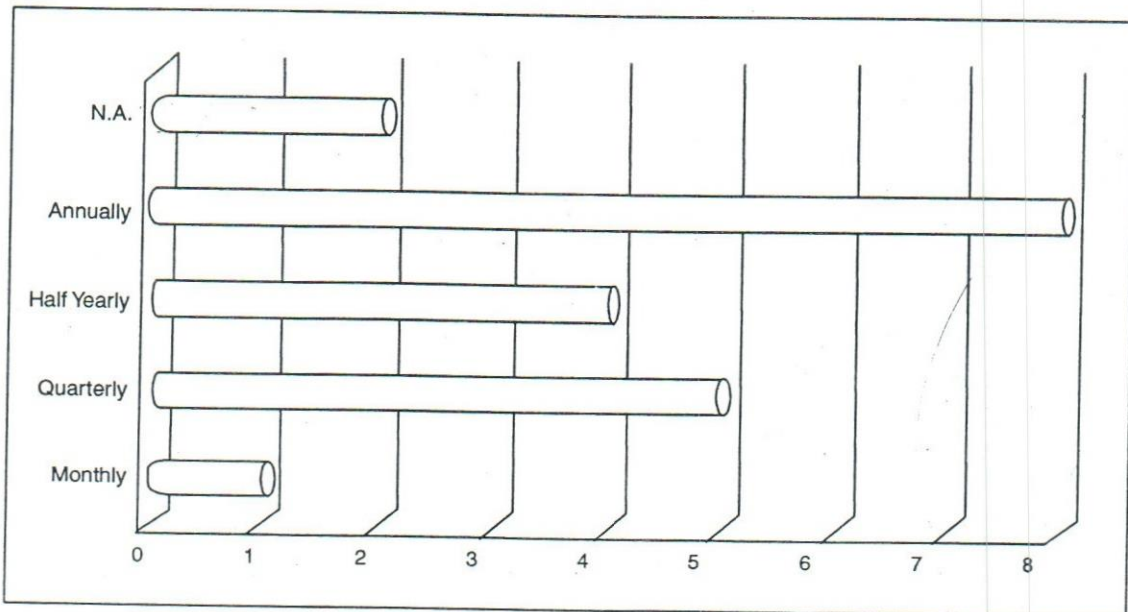


Fig. 8. Goal sheet review period

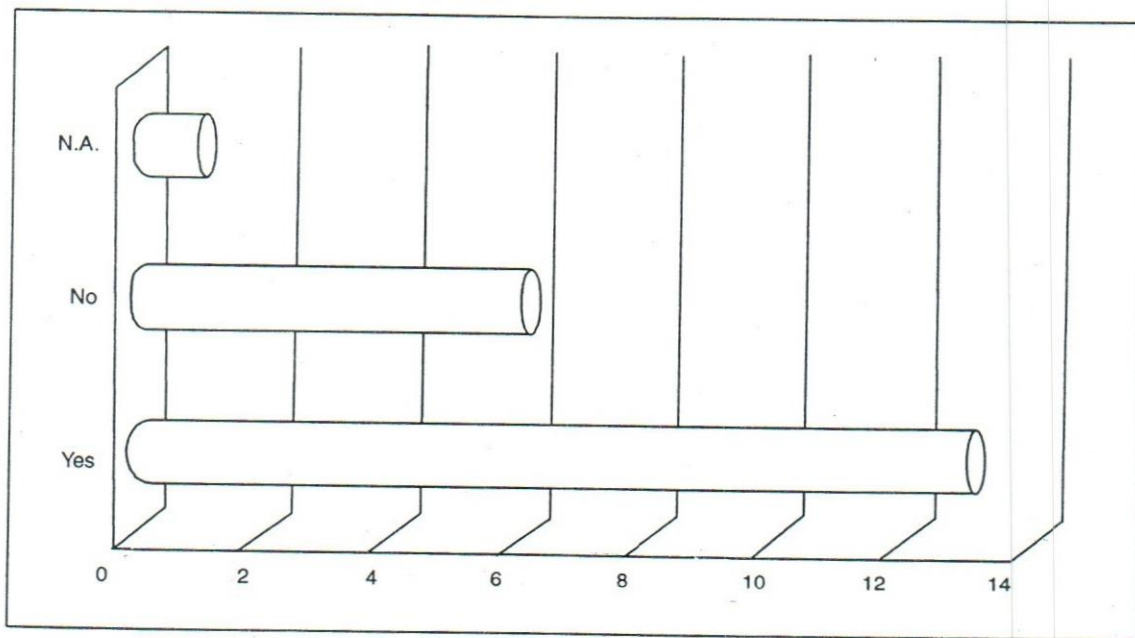


Fig. 9. Online PMS

soft skills of the employee. For overall evaluation, the companies normally take feedback from the trainers, trainees and the HR department. This feedback provides insights on improvement required. It was also found that 35% of the companies follow the Kirkpatrick model for evaluation the training programme. This model is used only for the first two levels of the Kirkpatrick model, i.e., reaction and learning, out of the four levels—reaction, learning, behaviour and results.

Performance Appraisal

Performance appraisal in most of the companies studied is conducted annually in the final quarter of the financial year. The performance appraisal process was found to be quite systematic. Based on future growth and the previous targets achieved, senior management set the goals for the company. These objectives and goals are then shared with the departments and conveyed to

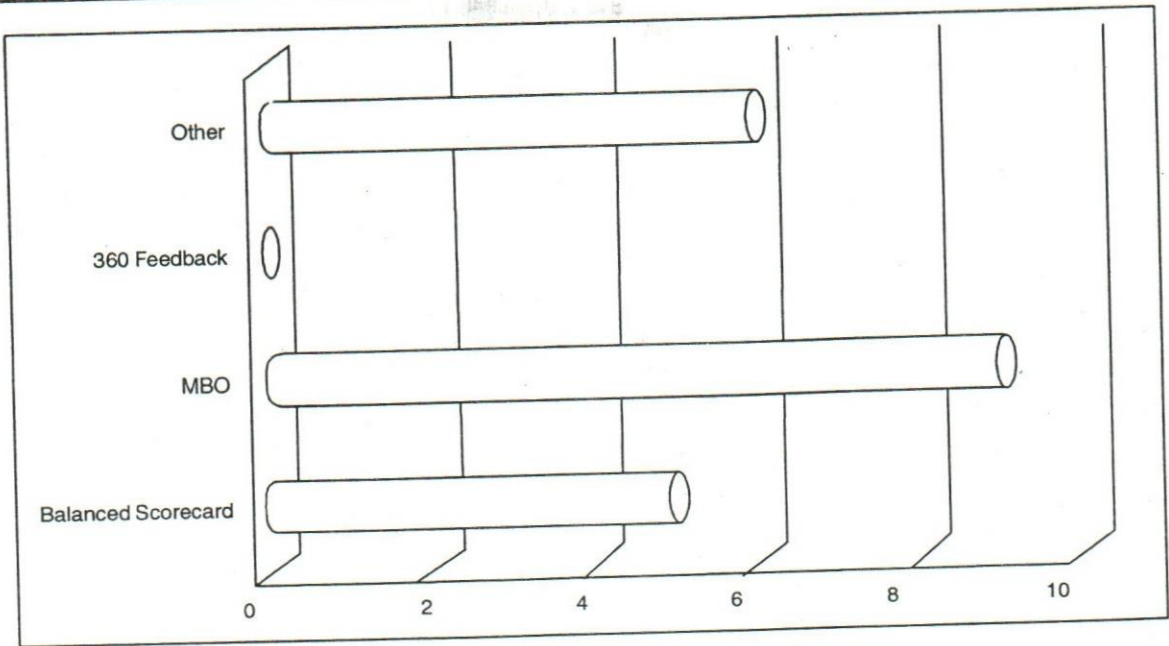


Fig. 10. Methods of performance appraisal

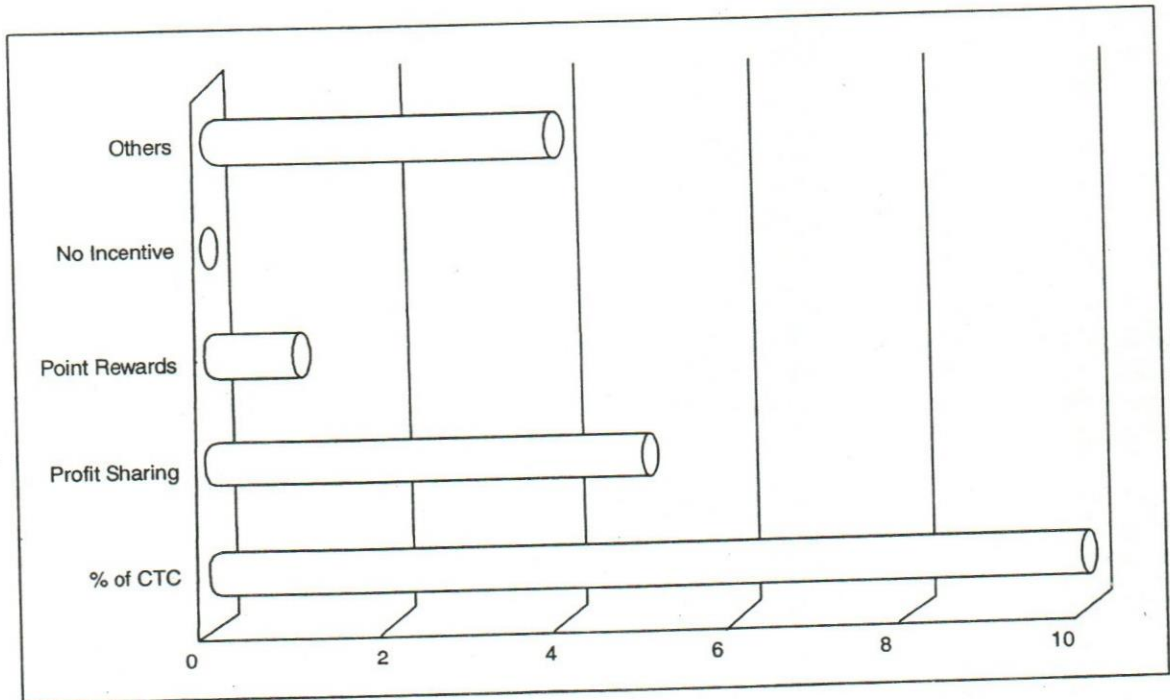


Fig. 11. Performance rewards

the lowest levels. The individual goals are set by the line manager, in accordance with target achieved previously and the market conditions, in consultation with the individual employee. The employee fills a goal sheet and is rated later on based on performance against the pre-set goals. The goals are reviewed on an annual basis in most companies; however some companies review them on a half yearly basis, others every quarter or even on a

monthly basis (Figure 8). As one HR manager says, "It is the prerogative of the line manager. The relationship between the junior and senior also matters." The performance appraisal process period also varies from department to department. For example, in one of the companies, performance appraisal for the sales department was conducted on a quarterly basis, while other departments appraised performance annually.

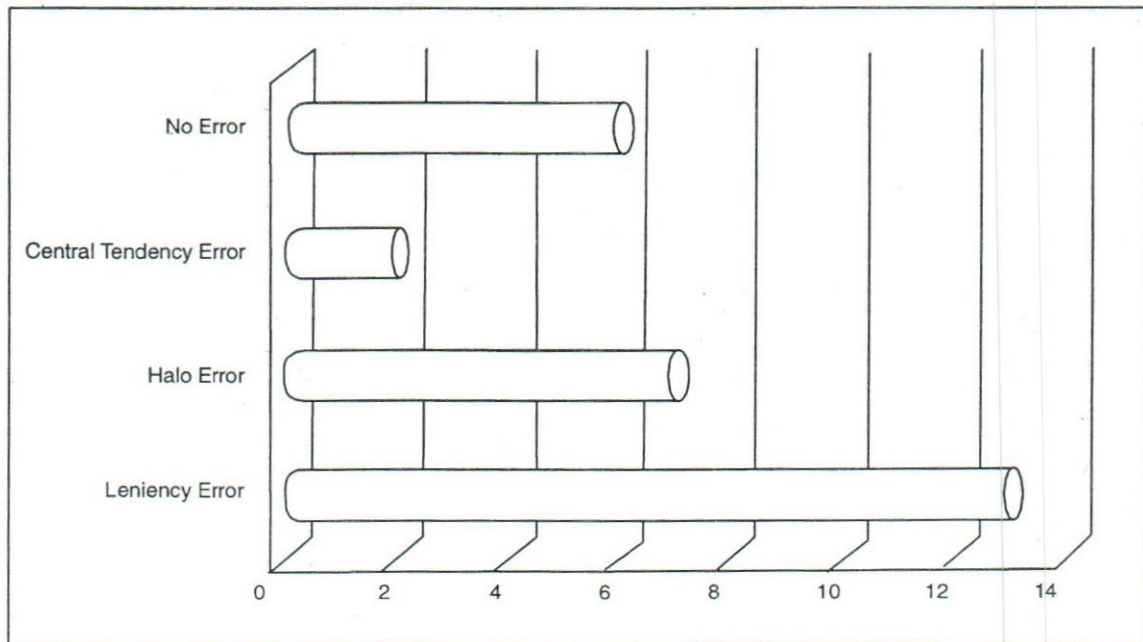


Fig. 12. Errors identified during performance appraisal

70% of the companies surveyed have an online performance management system (Figure 9). However, the methods of performance appraisal are not the same across companies. As Figure 10 shows, different companies use different methods of performance appraisal. Management by Objective (MBO) method is relied upon by the some companies (45%), while 25% of the companies follow the Balanced Scorecard approach. 360 degree feedback is not used in any company's PMS process. For rating employees, three of the 20 companies do not adopt comparative methods for ranking, 55% use bell curve, while the remaining utilize ranking method or alternate ranking method.

Based on the performance, around 50% of the companies provide fixed percentage of CTC to their employees as performance incentives to high performers, while 25% share profits either in the form of employee stock options or cash based on profit (Figure 11). The companies arrange training for the underperformers. Some companies also have a system of coaching or mentoring. 70% of the companies give their underperformer a time limit to adhere, and if the employee does not show improvement, the individual may be asked to leave the organization. The companies also give a fair chance to employees to appeal, and all the companies have an appeal mechanism in place. If any employee is not happy with the feedback given by the line manager, the individual can report it to the HR department. The HR department in consultation with the senior management

probes the situation and takes appropriate action as required.

One of the major tasks during performance appraisal is to minimize the risk of errors. As one of the HR managers cautioned, "These errors can affect the decision relating to incentives and promotion. If there is bias in the feedback, a deserving employee may not get the appropriate bonus." Figure 12 shows that most of the companies sampled frequently encounter leniency error. This is followed by halo error. However, 7 companies did not identify any error encountered during the performance appraisal. This is likely because they have a small employee base; hence any error that surfaces is taken care of then and there, and is not allowed to go into next step. As one HR Manager comments "We are small company of around 300, and I know most of the employees and how they are performing, and the same applies to the other employees in the department. Hence the chance of error is minimal. Even if we come across such an error, we are able to rectify it then and there."

Talent Management

Talent management ensures that the right people, with the right skills, are in the right place, and are engaged and focused on the right activities to achieve targeted business results. It is the complete set of processes an organization employs to identify, acquire, deploy, develop and manage the people it needs to successfully

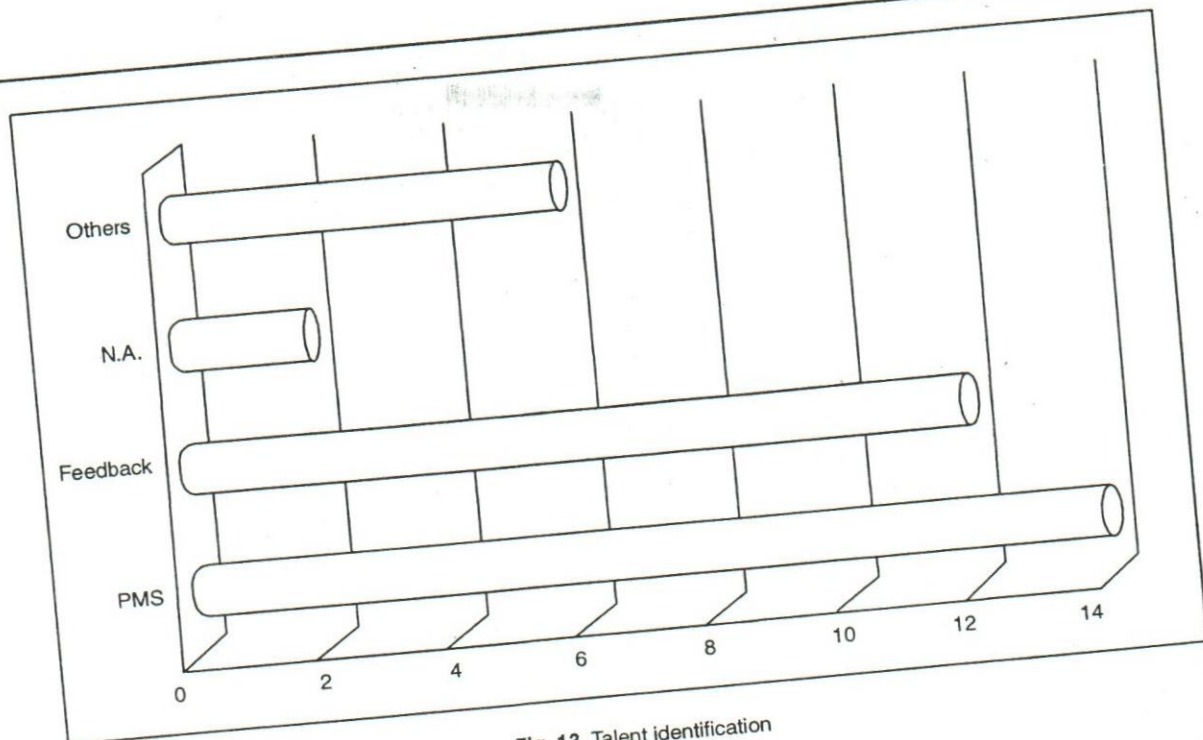


Fig. 13. Talent identification

execute its business strategy. This set of processes is the global integration of HR functions, grouped into three primary areas which impact the employee lifecycle - attracting talent, alignment and maintenance (appropriate skill sets need to be aligned with job functions) and continuous learning and development of talent (Workforce Management, 2007).

The HR department in the financial industry is currently in the evolving stage. Hence most of the companies in the industry do not have a formal process of talent management—the talent management in the organization is identified through the performance grade or the subjective feedback given by the senior management or the line managers of the company (Figure 13). Each company tries its level best to retain the talent in the organization. As shown in Figure 14, about 60% companies of the companies surveyed give their talent overseas exposure, while 30% companies give them educational incentives.

However, some companies do have a formal talent management process in place. They have a system of talent rating which is carried out through a comprehensive process of talent identification. It is a three stage process where the engagement level and the motivation level are judged through different psychological surveys. Some of the companies give best employee of the month awards while others make their succession plans keeping the talent in focus.

Employee Engagement

Organizations have traditionally relied upon financial measures or hard numbers to evaluate their performance and health (Luthans and Peterson, 2001). A meta-analysis of financial metrics such as profitability, revenue, and cash flow, the so-called important financial indicators, the so-called human oriented measures such as employee engagement and perceptions are also now being recognized as important predictors of employee behaviour and performance (Pfeffer, 1998). A meta-analysis conducted by the Gallup Organization concluded that the most successful work units of companies have people doing what they like best, with people they like, and with a strong sense of psychological ownership for the outcomes of their work (Harter, 1999). Within over 2,500 business, health and education units, Gallup has empirically demonstrated what it calls "employee engagement" to be a strong predictor of desirable organizational outcomes such as customer satisfaction, retention, productivity and profitability (Buckingham and Coffman, 1999). A meta-analysis by Kahn (1990), engagement is a multidimensional construct—employees can be emotionally, cognitively and physically engaged. Engagement occurs when one is fully present, vigilant and/or emotionally connected to the work. In the present survey, it was found that organizations use various kinds of contests to keep employees engaged. For example, ICICI Bank holds Namaste tests, while ING Vysya Mutual Fund conducts Cricket Championship. The contests are all

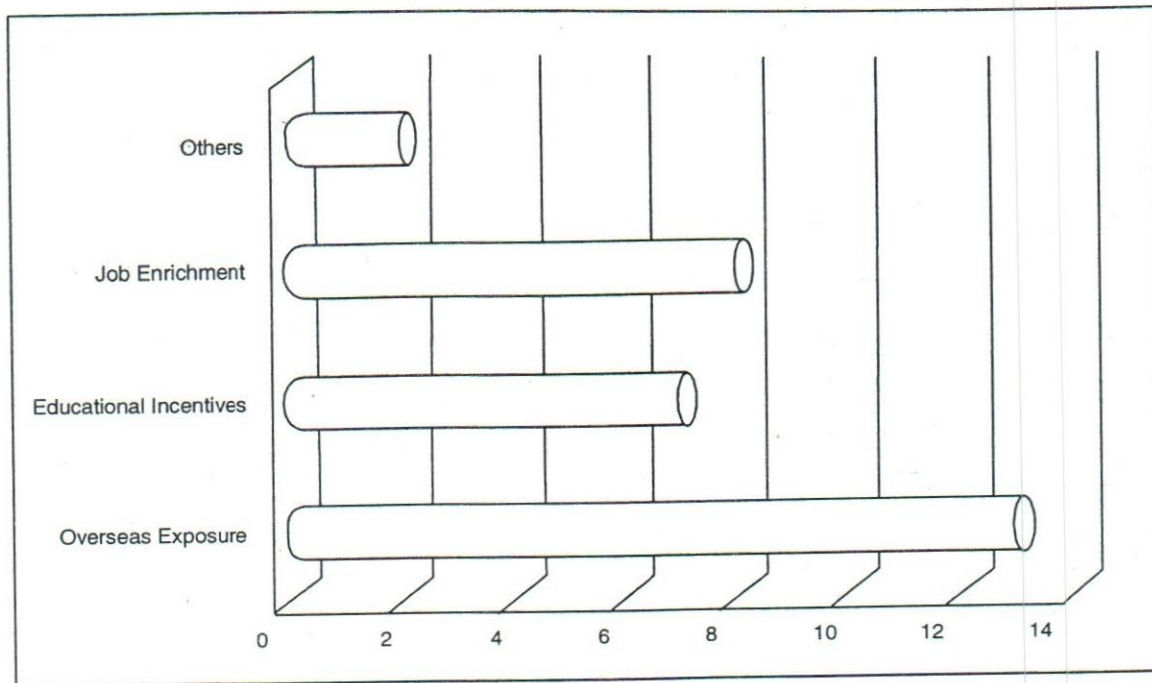


Fig. 14. Talent retention techniques

at the departmental and branch levels. Many companies also conduct festive celebrations and off-site picnics to nearby hill station or other picnic spots. Most of the organizations also have a reward and recognition system in place. ICICI Prudential Life Insurance has a separate department called RnR specifically for this purpose. Every company calls these programs by different names: Champions in CRISIL, Star of the month in ICICI Prudential, Star Performer in Standard Chartered MF, etc.

Exit Process

An exiting individual is a teeming repository of all the experiences acquired over his/her period in the organization. Passing on these experiences in a way that illustrates how a company does its business provides a powerful management tool to induct a successor quickly, efficiently and cost effectively into the new job and the new company (Kransdroff, 1995). In the present survey, we found that every company has an employee exit form for the exit interview. 85% of the companies have made it compulsory to give an exit interview. Each company maintains a checklist for the formalities to be completed when an employee leaves the organization. Most of the companies observe that they have never encountered a situation when the company is at fault. However, if they do encounter such a situation, senior management has the discretionary right to correct it.

Implications and Suggestions

The financial industry is in the service sector where knowledge is the main competitive advantage. Knowledge resides with the employees; hence to manage the manpower effectively, companies must have strong HR practices to support the predicted growth. However, it was observed in our study that some companies have newly created HR departments while others have HR departments which still need to evolve and grow. Many gaps in the HR processes and practices followed in the industry are quite evident. If the lacunae are not corrected, the growth of the financial sector, and consequently the Indian industry, will be affected.

One of the lacunas identified during study is that in most companies, HR itself is treated more as a 'hygiene' factor than a 'motivator.' Consequently, HR policies were geared more towards preventing dissatisfaction rather than increasing motivation. There were very few companies who actually gave HR the place it deserves, especially allowing it to perform a strategic role.

Job description is a very crucial part of the organization. In most organizations, either the job description is not reviewed at all or if it is reviewed, the process is done by the business heads or the team leaders of the organization with the HR department as a consultant. The person on the job is not involved in preparing or

reviewing the job description. As an individual working on the job, he might have a better knowledge of the changes required, if any; hence his/her feedback is very valuable. Hence, involving the employee in the process not only will make the job description more comprehensive, it will also increase the involvement level of the employee and his sense of ownership.

Most of the companies identify their training needs through the performance grades. Although it is a good source of training needs identification, it should not be the only important source of training needs identification. Training needs can be identified from many sources like company objectives, succession planning, etc. In addition, a company does not attempt to align its training needs with the overall vision and mission of the company. A company's long-term plan and objectives are extracted from its vision and mission; hence they become the obvious source of identifying training needs for long term success. However, the surveys reveals that companies generally follow a short-term approach—as the requirement creeps in due to various forces, the companies send their employees for training to address the immediate concerns.

In addition, many companies do not have a process in place to identify the errors that occur during performance appraisal, neither do they have a formal control to prevent biases from creeping in. This is an important area which needs to be looked into; else a company may lose its most talented people due to inequities in the organization. Unfortunately, most of the companies feel that compensation is the best way to retain people, ignoring other factors as superficial. The financial sector being very volatile, the performance review process should be improved and made more authentic wherever required. In addition, companies need to work further and put a formal talent management process in place. Lastly, employee engagement should not simply be treated as a fun culture creating activity; it is a much more complex process and should be treated as one.

Conclusion

Our study has revealed that the human resource policies, systems and processes are not fully geared towards meeting the challenges of expansion taking place in the Indian financial sector. With human capital being a key driver of organizational success in the service industry, this needs to be seriously looked into. Rather than enabling HR to be a source of competitive advantage for firms, an unplanned and ad hoc approach towards HR can become a barrier for success in the future. As a

function, organizations should empower HR to become a 'motivating' arm rather than just a 'hygiene' arm. Or then will human resources be able to play a strategic role in the future.

References

- Anonymous (2007). Attrition rate touches 20 per cent at India II (<http://www.domain-b.com/management/hrd/2007061attrition.htm>, 15 June 2007)
- Booth, A. (1993). "Private sector trainings and graduate earning" *The Review of Economics and Statistics*, Vol.75 (1): 164-17
- Buckingham, M. and Coffman, C. (1999), *First, Break all the rules* Simon and Schuster, New York, NY.
- Cooshalle, S. (2007). "Rewriting HR policies to retain talent", *Hindustan Times*, Aug 20, 2007, p12.
- Crane, S. (2001). India's most wanted. CFO Asia.com (www.cfoas.com/archives/200012-38.htm, 5th Sep 2007)
- ET Intelligence (2007). www.etintelligence.com, 6th May 2007.
- Harter, J.K. (1999). "Appendix E: the meta analysis" in Buckingham M. and Coffman, C.(Eds), *First Break All the Rules*, Simon and Schuster, New York, NY.
- Kahn, W.A. (1990), "Psychological conditions of personal engagement and disengagement at work, *Academy of Management Journal*, Vol. 33, pp.692-724.
- Kransdorff, A (1995). Exit interviews as an induction tool, *Management Development Review*, Vol-8(2): 37-40.
- Lucas, R. (1988), "On the mechanics of economic development" *Journal of Monetary Economics*, Vol.32: 3-42.
- Luthans, F. & Peterson, S.J. (2001). "Employee engagement a manager self efficacy", *Journal of Management Development* Vol 21: 376-387.
- Mathews, J. (2002), "Innovation in Australian small and medium enterprises: contributions from strategic human resource management," *Asia Pacific Journal of Human Resources*, Vol. 40(193-204).
- Mukherjee, A., Nath, P. and Pal, M.N. (2002). "Performance benchmarking and strategic homogeneity of Indian bank" *International Journal of Bank Marketing*, Vol. 20(3): 122-135
- Pfeffer, J. (1988). *The Human Equation :Building Profits by Putting People First*, Harvard Business School Press, Boston , MA
- PwC (2006). Report on Rates of Attrition, PricewaterhouseCoopers (www.pwc.com)
- Taylor, R. and Davies, D. (2004). "Aspects of training and remuneration in the accommodation industry: a comparison between Australian and Singaporean providers," *Journal of European Industrial Training*, Vol.28 (6): 466-73.
- Times of India (2007). Sensex crosses 15,000 for the first time, 6 July, 2007, (http://timesofindia.indiatimes.com/Sensex_touches_15K_ends_a_tad_lower/articleshow/2182491.cms downloaded on 5th Sep 2007)
- Workforce Management (2007). *A Framework for Talent Management*. Vol. 86 (12).

Book Review

Green Productivity In Small and Medium Enterprises, (Volume-1: Industry and Agriculture; Volume-II: Environment, Health and Waste Management), Edited by: M. Soundarapandian, Concept Publishing Company, 2007, pp 335 (vol. 1) pp 294 (vol. 2), price Rs 1500.

The book titled "Green Productivity in Small and Medium Enterprises" is an edited volume in two parts based on 53 articles presented in the national seminar organized by Gandhigram Rural Institute, Gandhigram, in association with AICTE, New Delhi.

Volume I: Industry and Agriculture

Green productivity is not a new concept, but has emerged gradually. Because it concentrates upon the preventive approach, it assumes the utmost importance as far as small-scale industries are concerned. This book explains the impact of green productivity in the fields of agriculture and industry. The volume comprises of 25 articles by various authors.

Green productivity can be explained as adoption and implementation of environmentally sound processes and procedures to optimize the utilization of resources to enhance production. In other words, this concept focuses upon enhancing, producing without rating adverse impacts on the environment. Seen from a different perspective, improvement of the environment should have beneficial rather than deleterious effects on the quantity and quality of production. Thus green productivity stresses optimum utilization of space, manpower, energy and raw materials, i.e., all the factors of production.

The principles of green productivity and problems in application of green productivity industrial estate management has been explained with pollution prevention and energy conservation processes. The approach and methodology of green productivity like getting started, planning, generation and evaluation of GP options, implementation of GP options and monitoring and review are explained with various GP tools and techniques like

Benchmarking, Brainstorming and Concentration, Eco-mapping, Pareto analysis and control charts, etc.

The book also dealt with environment guidelines for industries particularly textile industry, Indian packed drinking water industry and dyeing units giving details about environment impact assessment and measures to improve in case of packed drinking water industry. The techniques of solid waste management in rural industrial units has been analyzed using three R's", i.e. Reduce, Reuse and Recycle. Similarly waste minimization techniques and strategies for waste management in small-scale industries are explained giving benefits rendered by a business corporation to environment and key factors in the success of a cleaner production programme.

Green productivity in the agriculture sector has been explained on the basis of gross sown area, gross irrigated area, consumption of fertilizers and consumption of pesticides using regression on time series data from 1991-2001. It is highly imperative to promote organizational link-up system to encourage growth and development of Green Marketing Cooperative Organizations and Enterprises in the New Millennium. Particularity for the promotion and encouragement of adoption of Green Marketing Practices by cooperative marketing and processing organizations for doing business and transactions to face cut-throat competition in the open market.

Society as a whole has become sensitive to the natural environmental and depletion of natural resources. Thus the cooperative Marketing and Processing Organization in the new millennium must adopt the approach to marketing of green products.

Environmental management and implementation issues are directly and indirectly affecting and influencing all human and business organizational activities. Various link-up system like (i) Linking Green Marketing Cooperative Enterprises with credit (financial) organizations (ii) Linking Green Marketing Cooperative Enterprises with processing organizations (iii) Linking Green Marketing

Cooperative Enterprises with processing and Export-oriented organizations (iv) Linking Green Marketing Cooperative Organizations with Trading and Production System (v) Linking Green Marketing Cooperative Enterprises with inter-Cooperative Organizations (within and outside India) can be encouraged.

Green marketing refers to the marketing of products, commodities and services considered. It refers to the need for being environmentally friendly and by doing so, it places the onus on marketeers to be environmentally responsible directly and accountable in the long run. The demand for the green marketing of products and services has been necessitated by the increasing demand of the consumers (both in developed and developing countries). Even many Governments across the developed and developing countries are increasingly becoming more concerned about the promotion of "Green Marketing System and Business Activities". A large number of rules, procedures, acts, laws, guidelines, controls and regulations have been framed and instituted by various Governments to promote Green Marketing.

The approach to human resource development for agriculture productivity and economic, technological and institutional issues of watershed management have been explained with case studies. The impact of bio-energy on rice production in agriculture has been discussed giving energy use patterns, influence of different energy sources on productivity of rice, and problems and prospects of energy use in the agricultural sector.

Typology of groundwater socio-ecologies, groundwater and poverty in Asia has highlighted the implications of runaway growth of groundwater irrigation, especially in some Asian countries and the tremendous contribution groundwater has made to human welfare globally. The depletion of groundwater will make our country more prone to earthquakes. Therefore an appropriate mix of legislation, pricing policy and enforcement measures are essential to optimize water conservation and protection.

Green productivity thus forms an integral part of the broader sustainable development agenda and moves society towards sustainable production and consumption. This book is useful for the students of industrial and agriculture economics, strategic management and business policy in general.

Volume-II: Environment, Health and Waste Management

It will be difficult for small and medium enterprises to

continue to operate in view of strict implementation of existing environment regulations and more regulation to be promulgated in the future. For example, in India many small-scale units have been forced to close down or change location for environmental reasons. Secondly if SMEs invest in waste (end of pipe) treatment, production costs may not remain competitive. Now SMEs are finding themselves in a dilemma, and the way out appears to be the green productivity approach, because results in a clearer environment and higher production at less cost.

Green productivity can resolve a number of major problems of SMEs pertaining to the environment. It can enable them to sustain today's cutthroat competition and survive against giant multinational companies. On the other hand, it will help industries to create a positive image as an environmentally responsible company in the market, while at the same time helping the company confirm to regulatory requirements.

Solid waste management in small towns has been explained in terms of better utilization, and aspects like health hazards due to handling of solid waste have been highlighted and so too has the role of different agencies in the management of solid wastes. This is an important problem faced by the local governments, like Panchayat Municipalities and Corporations. Every day large quantities of waste are being generated by the different economic sectors. This waste could be effectively managed and in some cases effectively conserved. Effective management and conservation of waste generally conserve the natural as well as environmental resources.

Furthermore, conservation of natural resources and effective management of waste can reduce the problem of pollution and thus save man and nature. Natural environment can be protected by adopting appropriate waste management policies, which should be effectively implemented by the authorities. The success of waste management schemes and programmes depends upon the coordination of the different government machineries, with the support of effective people's participation.

Environmental reporting is at its infancy in India. However, even this type of brief statement in the directors report is also absent in most of the annual reports. In its environment statement the concerned industry is required to provide information on (a) Water and material consumption (b) Pollution generated (c) Nature of hazardous and solid wastes and disposal practices (d) Impact of pollution control measures on conservation of natural resources. Considering the poor level of environmental disclosure in the corporate environment

ports, the possibility of constraints of inclusion of the environmental statement in the director's report should be judged. Thus the Environmental Reporting will fulfill the social responsibility of corporate.

Environment issues in product development like social accountability 8000 (SA 8000), ISO 9000 and ISO 14001 etc. are explained with benefits to workers, trade unions, NGOs, organizations, consumers and investors. The aspects of eco-efficiency, environmental responsibility, greenwash, stakeholder accountability etc. for corporate responsibility are put in plain words in detail elaborating the environment issues in corporate business.

The pollution of various resources has gone on to such an extent that we are unable to breathe fresh air and drink fresh water. Pollution does not have to cause physical harm, but may merely interfere with human activities. Chemical spewed into the air or water from an industrial plant may be harmful to humans and other organisms living near the plant. If expensive pollution controls are required, the plant may be forced to shut down. On one hand the advancements of science and technology have added to human comforts by providing us with automobiles, electrical appliances, supersonic jets, space crafts, better medicines, better chemicals to control harmful insects and other pests, etc., but on the other hand, these have given us a very serious problem to face, that is, pollution.

The book also analyzes the reasons for health hazards due to conventional energy and environment suited rural energy systems. Environmental and health impacts against using conventional (or) traditional biomass fuels

and striking with force on other alternatives available for meeting the energy requirements. The awareness regarding health impacts against conventional sources and collision with force on the other alternative renewable energy sources will reach the people's mind, only if the Government takes proper steps to spread this awareness by conducting many development programmes about renewable energy sources. They must try to increase the subsidy on the installation cost of renewable energy devices. Only then the middle income and high-income group will come forward to adopt these renewable energy sources, which lead to sustainable economic development of our country. Adopting a proper renewable energy source is an important way of reducing health-related problems and keeping the environment clean and safe.

Environment has emerged as a major worldwide concern. Pollution in particular is perceived as a serious threat in industrialized nations, while natural resource degradation due to pollution and population explosion is becoming a serious impediment to the economic development in developing countries. This book is very useful to young researchers and academicians working on different environmental issues. It is also useful for the students of industrial economics, corporate executives and prospective entrepreneurs.

Reviewer: Rajesh Sund
Dy. Director
National Productivity Council
New Delhi

□

Oil is seldom found where it is most needed, and seldom most needed where it is found.

– L.E.J. Brouwer

Productivity

Announces

a

Special Issue
(April–June, 2008)

on

'Knowledge Management'

Place your orders with

Editor, Productivity Journal

National Productivity Council

Lodhi Road, New Delhi-110003

Telephone: 91-11-24607371 or 24690331

Fax: 91-11-24615002

Email: npcres@rediffmail.com

