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Bridging Digital Divide: Special Emphasis on Rural India

Management of Poultry Production in Rural Areas

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Strawberry Cultivation in Hilly Tracts of India

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Soy-Millet Extruded Snacks-based Enterprises—A Contributor to Livelihood and Rural Development

L. K. SINHA AND S. D. KULKARNI*

Soybean and millets being the nutritious food raw materials, snacks with millets and soybean were attempted to help improve nutritional profile of the product. To examine the potential of enterprises, a techno-economic feasibility analysis was done for production of soy-millet-maize-based extruded snacks in cottage-scale (10 kg/h) plant, which revealed a payback period of 11 months at 25 per cent profit margin. Thus, establishment of small enterprise of only about 70 kg finished product per day with a moderate investment of Rs 3.3 lakh can be a livelihood opportunity and source of income for unemployed in the rural areas and small town(s). The paper discusses various aspects of processing of soy millet for production of value-added extruded snacks suitable for livelihood opportunity leading to rural development.

Introduction

At the time of Independence agriculture occupied the most dominant place in the Indian economy by providing livelihood to about 70 per cent of population and contributing about 48.6 per cent of GDP. The growth rate of agriculture production is generally judged by the performance of food grains and non-food grains production. However, agricultural production of food grain is more significant as it provides the base for subsistence by supplying basic food items and, therefore, is the only group of agricultural produce where Green Revolution was introduced firstly and more successfully. After the Green Revolution, the Indian agriculture moved from food shortage to self-sufficiency and from these to a food surplus country. It could be possible due to technological developments as well as government initiatives in the form of various programmes. The new method of agricultural practice brought a drastic change in the productivity and production. More and more agricultural land was brought under cultivation with the help of improved irrigation facilities with assured means of irrigation, cheaply available chemical fertilizers and supply of seeds of high-yield varieties. Farm mechanization has also helped shorten the total duration of farm operations like ploughing, sowing and harvesting process of agriculture. The period of 1980s witnessed a higher increment in food grain production in comparison to increase in the population resulting in increased supply of food grains in the economy over the demand. Consequently, the items of food grains failed in attracting the appropriate prices in the market and therefore, India was in a great need of new market for the food grains. The opening up of the economy in 1991 and the establishment of WTO in

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1995 once again changed the life of Indian farmers. The era of 1990s can be marked as a decade of complete departure from the restriction and controlled economic system with the Government of India introducing a number of new economic policies. This accelerated the high growth of the Indian economy. Since agriculture continues to be the largest sector of the economy in terms of employment, the deceleration of growth of this sector has serious implications for the living standard of both farmers and agricultural labourers.

Advancement in science and technology has made India self-sufficient in food production. However, the basic problem of the nutritional gap still exists in India. Though India has achieved food security on account of food availability, it is yet to achieve nutritional security. Nutrition for the rapidly growing population has been the focus of all plans and yet the problem continued and became more acute with the time. To find additional food with better nutrition is, therefore, the prime need of the nation. Food consumption of people world over is related to agro-ecological condition, socio-cultural factors and the need of proper nutrition.

Millets

The 'millets' is a generic term referring collectively to a number of heterogeneous groups of several types of small-seeded annual crop belonging to the grass family, Graminae (FAO and ICRISAT, 1996) belonging to species under the five genera in the tribe *Paniceae*, namely *Panicum*, *Setaria*, *Echinochloa*, *Pennisetum* and *Paspalum* and one genus, *Eleusine*, in the tribe *Chlorideae* (FAO, 1972). Most of the genera are widely distributed throughout the tropics and subtropics of the world (de Wet, 1987). The term 'Millets' also refers to any of the small-seeded cereal and forage grasses used for food, feed or forage. In earlier times sorghum and even maize were included in this category. Synonyms like 'miscellaneous cereals' or 'coarse grains' are also used to describe the millets. However, with the increased use and advances in improvement, first maize and later sorghums received separate status; although in many regions of the world, crop production statistics are still reported as a total for the millets and sorghum. It is likely that other millet species will gain separate status as they begin receiving increased attention in improvement and are more extensively used. Millets are the staple food of the millions inhabiting the arid and semi-arid tropics of the world, and distributed in most of the Asian countries including India, African countries and parts of Europe.

These are cultivated primarily on marginal lands in dry areas of temperate, subtropical and tropical regions and generally regarded as a subsistence product and generally looked upon as a famine crop for the poor. Millets have a capacity for wide adaptation as poor man's crop capable of withstanding both drought and water logging and a certain degree of soil acidity and alkalinity, stress due to moisture and temperature and variation in soils from heavy to sandy infertile. These can be grown generally on hills under shifting cultivation in *Kharif* season. Millets assume significance for food and nutritional security in most of the Asian and African countries because of their hard nature and ability to grow in rain-fed lands with very little agricultural inputs as compared to most of the cereals. Coarse cereals in India occupy 4–5 per cent of the cultivated area and are confined to vast stretches of dry land and hill areas. Besides being staple foods, these grains are also raw materials in the production of various products both for food and industrial uses. Millets constitute a little less than 25 per cent of the total food grain production in India and are grouped along with maize and sorghum as 'coarse cereals' perhaps because of their typical grain texture which makes them difficult to process as well as cook in convenience form similar to rice and wheat. The annual production of the millets worldwide is about 32 million tonnes, of which a little more than half the quantity is produced in India. Millets are cultivated in India in almost all the states and the major millet-producing states are Karnataka, Rajasthan, Gujarat, Haryana and Maharashtra. These are predominantly used for food purposes in rural India as well as in other major developing countries but in a limited way. Millets in India include sorghum (*Sorghum bicolor*), pearl millet (*Pennisetum glaucum*), finger millet (*Eleusine coracana*) and other millets such as *kodo* (*Paspalum scrobiculatum*), *litle* (*Panicum sumatrense*), *barnyard* millets (*Echinochloa crus-galli* var. *Fruentacea* or *E. colona* (Sawa), *proso* millet (*Panicum miliaceum*) and *foxtail* millet (*Setaria italica*), etc. Though these 'coarse' grains have potential for augmenting the grain supplies and also bridging the protein gap considerably, the production of new generation food products based on these grains are yet to be realized.

Factors Responsible Limiting Productivity of Millets

The millet production varied with the time and showed fluctuating trend (Figure 1). Excepting sorghum, pearl millet and finger millet, no other millet has showed any improvement in their cultivable area. The major constraints are as follows:

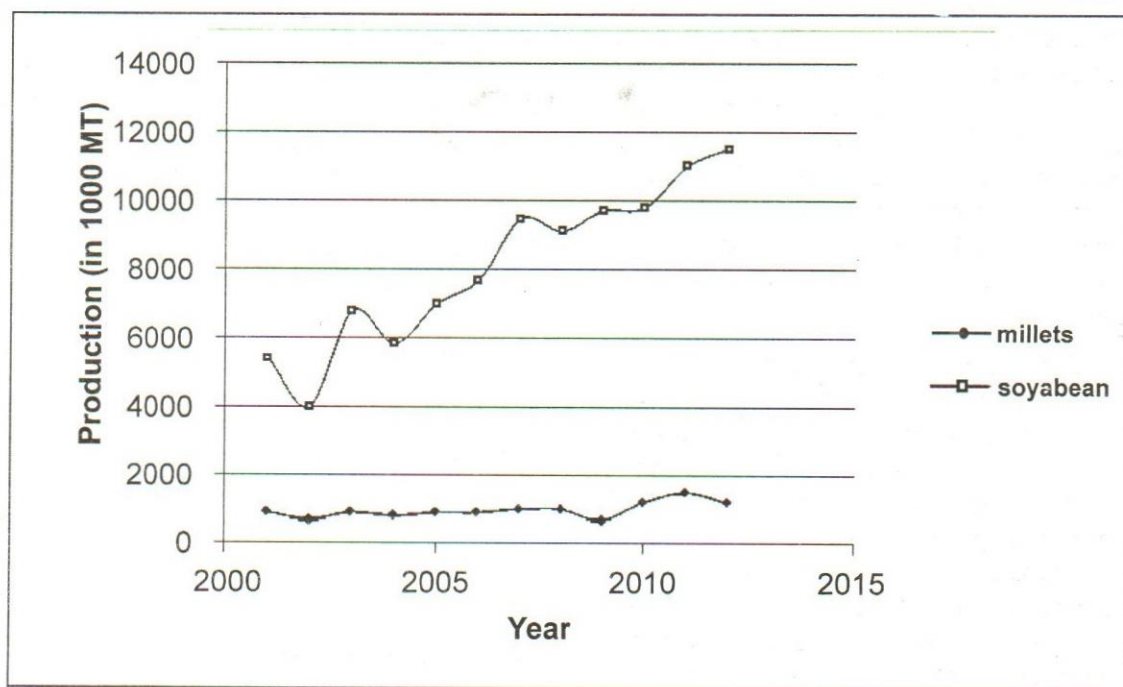


Figure 1: Trend of production of millets and soybean in India

Source: Data from [http:// www.agricoop.nic.in/](http://www.agricoop.nic.in/) for soybean and <http://www.agrochart.com/en/statistic/products/product/132/section/56> (last accessed on 1 August 2014) for millets.

- Millets are grown on poor shallow and marginal soils under rain-fed conditions. Some of these are still grown in the hilly areas under shifting cultivation, which is one of the most primitive ways of crop production. The soils on which these crops are cultivated have low moisture retention capacity.
- Seeds are often broadcast. This is a major bottleneck in taking inter-cultivation operation and effective weed control. The mixed cropping practices adopted by the farmers are mostly suited to sustenance agriculture and many of them are not remunerative.
- They are often cultivated under unmanured and unfertilized conditions. Non-adoption of improved varieties and timely agricultural operations, such as tillage, sowing, weeding and inter-culturing has resulted in reduced returns. Improved crop management practices are not adopted by the farmers due to socio-economic constraints.
- Research on crop improvement and agro-techniques was neglected till recently. There is no organized programme for production and supply of seeds of improved varieties. There is no ready market for the

disposal of surplus produce at a remunerative price. There is a need to intensify to increase the area and production of millets.

So, developmental efforts need to be made through mini kit demonstrations and state-level training programmes for popularization of newly released varieties among the farmers in replacing the low-yielding local varieties. Increased use of small millets in various ready-to-eat (RTE) food products should be encouraged as it enhances their value and market price. The Government of India should allocate at least 40 per cent of its food security budget to millet-based farming and food systems that will use millets as their major food component. Millets need to be integrated into the existing public distribution system (PDS) of India and their cultivation and consumption be promoted recognizing these as climate change compliant crops. Several kinds of millets are grown in the world. Pearl millet, finger millet and proso millet account for a large proportion of the world production. The major producers of millets are India, China, Nigeria and the Soviet Union.

Several kinds of millets are grown in the world (Table 1) in different countries. Pearl millet, finger millet and proso millet account for a large proportion of the world

Table 1: Major producers of millets in the world (Production in '000 metric tonnes)

Country	2010/11	2011/12	2012/13	2013/14	2014/15
India	13,290.00	12,800.00	10,760.00	11,520.00	12,000.00
Nigeria	5,170.00	1,271.00	5,000.00	5,000.00	5,000.00
Niger	3,843.00	2,926.00	3,862.00	2,995.00	3,400.00
China	1,573.00	1,567.00	1,796.00	1,800.00	1,800.00
Mali	1,373.00	1,462.00	1,772.00	1,237.00	1,450.00
Burkina Faso	1,148.00	829.00	1,078.00	1,100.00	1,100.00
Uganda	903.00	984.00	820.00	820.00	820.00
Ethiopia	635.00	652.00	742.00	750.00	750.00
Senegal	813.00	481.00	663.00	572.00	650.00
Chad	600.00	319.00	847.00	582.00	650.00
Sudan	471.00	634.00	378.00	625.00	625.00
Russia	131.00	878.00	334.00	419.00	500.00
Tanzania	351.00	312.00	214.00	350.00	350.00
Nepal	250.00	250.00	250.00	250.00	250.00
Pakistan	230.00	230.00	230.00	230.00	230.00
Total	32,519.00	27,427.00	30,427.00	30,004.00	31,362.00
Total selected	30,781.00	25,595.00	28,746.00	28,250.00	29,575.00
Others	1,738.00	1,832.00	1,681.00	1,754.00	1,787.00

Source: <http://www.agrochart.com/en/statistic/products/product/132/section/56> (last accessed on 1 August 2014).

production. Millet production ranged from 32.52 million tonnes in 2010–11 to 31.36 million tonnes in 2014–15. Asia, Africa and the former Soviet Union produce almost all the world millets and the major producers of millets are India, China, Nigeria and the Soviet Union (Table 1).

Millets as Food Raw Material

Millets are easy to digest, contain a high amount of antioxidant activity and are excellent for strengthening the nervous system. They have niacin, B6 and folic acid, and calcium, iron, potassium, magnesium and zinc. Millets are good for people who are gluten-intolerant. Their fiber content also helps prevent constipation and may reduce the risk of developing bowel disorders including bowel colon. Most executives work long hours with almost no exercise. Restaurants serve rich food with butter, oil and cheese, which has led to various health ailments. However, awareness about the inclusion of millets in our daily meals for healthy living to combat the effects of a more westernized, sedentary lifestyle is needed. Thus in many sorghum- and millet-producing countries, vegetable products, especially cereals, provide the bulk of energy and protein.

In India, millets formed the core of the everyday diet for millennia much before Green Revolution. Earlier, millet cultivation minimized the risks and uncertainty as these were cultivated in dry lands under rain-fed and toughest conditions, which dealt with recurring droughts easily and were a blessing for the poor, especially women and children from nutrition point of view. Be it poor soil conditions or underdeveloped areas in India where agriculture solely depended on the mercy of rain, millet cultivation was going on unhindered. The Green Revolution did serve its purpose—it ensured self-sufficiency in food, reduced hunger and introduced hybrids (especially wheat and rice) into Indian agriculture but as a bargain the Indian diet lost its nutritional diversity through millet cultivation. Besides Green Revolution, the disappearance of millet cultivation can also be attributed to certain lopsided policy decisions. The government-run PDS gave out rice and wheat at subsidized rates to the poor. The dependence of farming communities on these staple crops grew, as they did not have to toil hard in their fields to grow millets and millets are slowly dying out due to changing eating habits. India is still the largest producer of millets—there are about eight different kinds of millet varieties that are still grown and consumed but not to the extent that they were

previously. These include sorghum, pearl millet, finger millet, kodo millet, little millet, barnyard millet, proso millet and foxtail millet. Of these the first three are more widely consumed. The cultivation of millets has less impact on the environment as well making them ideal for organic cultivation. In a warming world, where wheat and rice cultivation are pesticide and water intensive, millets are the ideal alternative; 5,000 liters of water are required for 1 kilo of paddy (rice) whereas millets require less than one fifth of that. Their extensive root system they improve soil fertility and thrive in stressful conditions. Cultivating 1 kilo of rice, for instance, requires 1,300 mm of rain. Millets on the other hand, can survive with just 400 mm. In fact, pearl millet grows even on sandy soil, finger millet in saline soil and barnyard millet in poor problematic soil that cannot support rice or other crops.

Among rain-fed crops, millets as a group figure prominently. India is the largest producer of many kinds of millets, which are often referred to as coarse cereals. However, realizing the nutrient composition of these grains they are now considered as nutri-cereals (nutritious grains). Millets grown in India are sorghum (Jowar), pearl millet (Bajra), finger millet (Ragi) and many other small millets, viz. kodo millet, foxtail millet, little millet, proso millet and barnyard millet. Of the total area of 23–24 million ha under millets, ragi and other small millets account for about 2.7 million; the cultivation extending from sea level in Coastal Andhra Pradesh to 2439 m (8,000 feet) above sea level in hills of Uttarakhand and Northeastern states. The major

ragi growing states are Karnataka, Tamil Nadu, Andhra Pradesh, Orissa, Jharkhand, Maharashtra and Uttarakhand. Karnataka state has the largest area of around 1 million hectares (60 per cent of the total area) followed by Maharashtra, Orissa, Tamil Nadu, Andhra Pradesh and Uttarakhand each having 10–12 per cent of the area. The cultivation of kodo millet, little millet and foxtail millet is more seen in Madhya Pradesh, Chhattisgarh, Orissa, Tamil Nadu, Jharkhand, Karnataka, Andhra Pradesh and Maharashtra. Madhya Pradesh with around 1-million hectares is the most important state for small millets production and kodo millet and little millet are the important crops. Barnyard millet and proso millet are largely grown in Uttarakhand, northeastern regions, north Bihar, western Uttar Pradesh and Maharashtra. Foxtail millet is grown in Andhra Pradesh, Karnataka, Chhattisgarh and concentrated pockets in Tamil Nadu. (<http://smallmillets.res.in/html/millets.html>).

Millets and Health

Millets are known for their health benefits from time immemorial. Millets are a storehouse of nutrients and recognized as nutri-cereals. They have much higher contents of calcium, iron, phosphorus, etc. (Table 2). They are also higher in fibre, lower in fat and gluten-free. They make an ideal source of nutrition for diabetics due to their low glycaemic index. With the advent of sedentary lifestyles with diets rich in simple carbohydrates, such as rice and wheat, India is becoming the diabetic capital of the world with one in four Indians having diabetes. Utilization of these

Table 2: Nutrient composition of sorghum, millets and other cereals (per 100 g edible portion; 12 per cent moisture)

Food	Protein (g)	Fat (g)	Ash (g)	Crude fibre (g)	Carbohydrate (g)	Energy (kcal)	Ca (mg)	Fe (mg)	Thiamin (mg)	Riboflavin (mg)	Niacin (mg)
Rice (brown)	7.9	2.7	1.3	1.0	76.0	362	33	1.8	0.41	0.04	4.3
Wheat	11.6	2.0	1.6	2.0	71.0	348	30	3.5	0.41	0.10	5.1
Maize	9.2	4.6	1.2	2.8	73.0	358	26	2.7	0.38	0.20	3.6
Soybean	43	19	5	4	21	430	240	10	1	1	3
Sorghum	10.4	3.1	1.6	2.0	70.7	329	25	5.4	0.38	0.15	4.3
Pearl millet	11.8	4.8	2.2	2.3	67.0	363	42	11.0	0.38	0.21	2.8
Finger millet	7.7	1.5	2.6	3.6	72.6	336	350	3.9	0.42	0.19	1.1
Kodo millet	9.8	3.6	3.3	5.2	66.6	353	35	1.7	0.15	0.09	2.0
Little millet	9.7	5.2	5.4	7.6	60.9	329	17	9.3	0.30	0.09	3.2
Barnyard millet	11.0	3.9	4.5	13.6	55.0	300	22	18.6	0.33	0.10	4.2
Foxtail millet	11.2	4.0	3.3	6.7	63.2	351	31	2.8	0.59	0.11	3.2
Common millet	12.5	3.5	3.1	5.2	63.8	364	8	2.9	0.41	0.28	4.5

Sources: Hulse, Laing and Pearson. 1980: United States National Research Council/National Academy of Sciences. 1982. USDA/HNIS. 1984.

crops is mainly as food for human consumption. The grain is consumed in traditional way and almost the entire produce is utilized at the farm/village level. In spite of superior nutritive value of grains their use is largely confined to rural areas and very little finds its way to urban markets. The promotion of these crops can lead to efficient natural resource management and holistic approach in sustaining precious agro biodiversity. Each of the millets has its nutritional and nutraceutical specialities and probably because of this, traditionally, different millets are consumed specifically in different seasons of the year. Since, the dietary fibre component of the food offers several physiological benefits including the health of gastrointestinal tract, the millets could be gainfully utilized in the preparation of functional and health foods for target population. Millets are the basic cereals in India and consumed by large section of the population belonging to lower income strata. Millets, rich source of minerals, vitamins and dietary fibre, have been earlier considered as the basic food raw material for poor and tribal in India. However, now they are in very good demand from different economic segments of the society. Millets provide complementarity with soybean, a rich source of quality protein with 40 per cent protein, around 20 per cent oil, some important minerals like calcium, phosphorus, magnesium and health promoting phytochemicals. Non-availability of nutritious millet-based food product variety in past is the primary reason for confinement of their consumption to the traditional consumer.

The essential amino acid profiles of the millet proteins is better than maize. They are rich source of vitamins and minerals. Millets are especially rich in calcium. The dietary carbohydrates content of millets is also relatively high. Starch is the main carbohydrate component and they also contain a higher proportion of non-starchy polysaccharides (dietary fibre). Prolamins and glutelins form the major portion of their proteins. The fats from millets though in small quantity (1.5–5 per cent) contain a higher portion of unsaturated fatty acids and supply essential fatty acids. Although, a considerable portion of nutrients is concentrated in the seed coat, the bioavailability of the nutrients present in the endosperm is higher than the seed coat nutrients (Hulse, Laing and Pearson, 1980; United States National Research Council/National Academy of Sciences, 1982 and USDA/HNIS, 1984). Antinutritional factors such as phytate and polyphenols are also present in millets but they are mostly confined to the seed coat and the milled millets are generally free from the antinutritional factors. Millets have certain specialities,

which, if exploited, may yield products of superior nutritional and technological characteristics than the major cereals. But their utilization is limited. They have remained as the food for the people of the lower socio-economic strata and traditional consumers, because of their coarse texture, characteristic flavour, intense coloured seed coat and cultural attachments. With constantly increasing awareness of good nutrition for healthy living, the consumption of millets is increasing as they are considered poor man's diet. Very little work has been done till recently on development of value-added products to increase their utilization. Out of total area under millets, ragi accounts for 50 per cent area and gives 60 per cent of total production. The productivity of ragi is around 1,500 kg/ha and those of minor millets 500 kg/ha. Finger millet is the richest source of calcium (300–350 mg/100g) and other small millets are good source of phosphorus and iron too. The protein content of the millets ranges from 7–12 per cent and fat content from 1.12–5 per cent. The millet protein has well-balanced amino acid profile and good source of methionine, cystine and lysine. These grain contain 65 per cent of carbohydrates, high proportion of both soluble and insoluble dietary fibres, which helps in prevention of constipation, lowering blood cholesterol and slow release of glucose during digestion. They are rich sources of thiamine, riboflavin, folic acid and niacin.

There are no reports in the Indian subcontinent of any adverse effects on regular consumption of the millets. On the other hand, incidence of diabetes mellitus and gastro-intestinal tract-related disorders are minimal among the population using these grains as staple. Even then, the millets, although nutritious, still form staple only for the under-privileged section of the society. Low incidence of cardiovascular disease, duodenal ulcer and hyperglycemia is reported among the regular users of millet. Millets are not only comparable to major cereals with respect to their nutritional features but are very good sources of carbohydrates, micronutrients and phytochemicals with nutraceutical properties.

Present Status

Absence of appropriate processing technologies to prepare ready-to-use value-added products have been the major limiting factors for their diversified food uses and better economic status. However, studies towards processing of millets have demonstrated their successful utilization for various newer convenient health-oriented extruded products for diversified utilization and popularization of these for wider adoption among rural as well as non-

traditional urban population. Extruded snacks offer increased scope of utilization in rural as well as urban areas, which will support increase in area and productivity under these crops, which in turn improve the standard of living of rural/urban population and farmers.

The Soybean

Soybean [*Glycine max* (L.) Merrill] referred as the 'golden bean' belongs to the family Leguminaceae. It is one of the very few plants that provide a high-quality protein with minimum saturated fat. The soybean originated in China has been cultivated there for over 13,000 years. It was first introduced into Japan before becoming popular in other Asian countries. Now soybean cultivation in the world is mainly confined to USA, Brazil, China, Argentina and India. The production level differs in different countries. An average yield of 1,046 kg/ha of soybean is recorded in India against the world average of 2,270 kg/ha. Madhya Pradesh and its adjoining area of Maharashtra and Rajasthan constitute predominant soybean belt. These three states account for nearly 96 per cent of soybean area of the country. Madhya Pradesh tops, with its share of 56 per cent of the total area under soybean followed by Maharashtra (32 per cent) and Rajasthan (8 per cent) in the country. The trend of soybean production is of increasing nature (Figure 1).

Soybean and Health

A number of health benefits are associated with soybean. Soybean contains complete protein, carbohydrate, polyunsaturated and monounsaturated fats, and has an abundance of omega-3 fatty acids. It is also an excellent source of iron, calcium, folic acid, zinc, vitamin E, several B-vitamins, fiber, calcium, iron and rich in isoflavones. Soybeans are best known as a source of high-quality protein. Soybean protein provides almost all the essential amino acids in the amount needed for human health. Soy products are nutrient-rich foods that can promote good health. Soy products are a high-quality protein like meats and milk, also cholesterol-free and low in saturated fat. The protein content of the full fat soy flour is of high quality and is about 40 per cent, much higher than the flour from other grains. Nutritionally, soy flour is an excellent complement to lysine limited cereal protein with other essential minerals and vitamins. Soybean, the first vegetable proteinaceous raw material was used for making protein rich extruded food (Harper, 1981). The health benefits of soybeans and soy foods include reduced LDL cholesterol, cancer prevention and reduced risk of heart/coronary artery disease, lower cholesterol levels, reduced risk of prostate cancer, fewer menopause symptoms and

decreased risk of osteoporosis. The U.S. Food and Drug Administration approved health claims that soy protein may lower the risk of heart disease if at least 25 grams of soy protein are consumed daily.

The Extrusion Cooking

Extrusion cooking is an efficient manufacturing processes and have an important role in the food industry as their main role was developed for conveying and shaping fluid forms of processed raw materials, such as dough and pastes. Extrusion cooking technologies are used for cereal and protein processing in the food and, closely related, pet foods and feeds sectors. The processing units have evolved from simple conveying devices to become very sophisticated in the last decade. Today, their processing functions may include conveying, mixing, shearing, separation, heating or cooling, shaping, co-extrusion, venting volatiles and moisture, flavour generation, encapsulation and sterilization. They can be used for processing at relatively low temperatures, as with pasta and half-product pellet dough, or at very high ones with flat breads and extruded snacks. The pressures used in extruders to control shaping, to keep water in a superheated liquid state and to increase shearing forces in certain screw types, may vary from around 15 to over 200 atmospheres. The most important feature of an extrusion process is its continuous nature. It operates in dynamic steady-state equilibrium, where the input variables are balanced with the outputs. Therefore, in order to obtain the required characteristics in an extrudate, the multivariate inputs must be set at the correct levels to give the dependent physical conditions and chemical process changes within the barrel of the machine. These dependent system variables determine the extrudate variables, which are reflected in the product variables. Once the relationships between the independent variables and the dependent variables within the processor are established for an individual product type, they must be maintained close to their optimum levels, in a small processing window, to ensure that the extrudate variables are also kept at the required levels.

Food Extrusion

Food extrusion is one of the very popular contemporary processing technologies and largely followed for corn and rice but the millets could also be extruded to prepare ready-to-eat (RTE) products. Food extrusion is a versatile high temperature, short time (HTST) process established for the continuous manufacture of new and traditional type products. Extrusion cooking has the capacity to produce a large variety of food products from numerous food raw

ingredients. Applications of extrusion cooking in the food industry today cover a wide range of food products based on starches, cereals, proteins and sugars. It is often characterized by low production costs, relatively reduced energy consumption and in many cases, the amount of added water to extrusion cooking. It has become very popular to produce expanded, fully cooked RTE snacks and or partially cooked products (Sinha and Kulkarni, 2008; Sinha et al., 2008; Patil et al., 1990, 2001 and 2005; Patel et al., 2004, Bargale and Kulkarni, 2010a&b). The extrusion process facilitates use of different ingredients in the feed to prepare the RTE crispy and acceptable-in-taste product, and also permits the product design to provide the nutrition in the required quantity. Since, the seed coat or the bran affects the expansion ratio and also the eating quality of the extrudates, it is desirable to use refined grits and flour, preferably of less than sieve size ISS No. 40. Equilibrating the flour to about 18 per cent moisture content and extruding in a single- or twin-screw extruder at about 150°C and 200 rpm, gives extrudates of highly desirable food qualities with an expansion of 1.5–2 times. The products have a crunchy texture and can be coated with traditional ingredients to prepare sweet or savory snacks. Alternately, the grits could be mixed with spices and condiments prior to extrusion to obtain RTE snacks of desirable taste. Millets and soy-based extruded foods would be a very good source of protein, micronutrients and phytochemicals. The gelatinization temperature of the millet starch is slightly higher compared to rice and wheat.

Millets in Extrusion

Of late, there has been a growing interest in using the millets as a source of therapeutic or nutritional diet due to presence of high dietary fiber and micronutrients like essential minerals and vitamins and help manage diabetes, blood pressure, constipation and obesity. Hence they are also termed as Nutri-cereals. The bioavailability of micronutrients in properly processed millets and also true digestibility of millet proteins has been reported to be much higher (Geervani and Eggum, 1989). Since millets are generally neither grown with application of any chemical fertilizers nor do they require any chemical to protect them from insects and pests during crop growth, thus, most of the millets are organically produced food raw materials. The use of these crops is, therefore, growing in the food chain as well as health drinks using roasted flours. Extruders provide the most efficient means of converting electrical and mechanical energy into thermal energy for cooking feed and food formulations. The use of extrusion technology, therefore, offers scope for processing of these, specific group of food raw materials—the millets—and soybean for their value-added formulated nutritious low moisture extruded RTE crisp snacks for all age groups under controlled gelatinization with long shelf life.

Materials and Methods

The Extruder

The Wenger X-5 laboratory single screw extruder (Figure 2) used (Wenger Mfg., Sabetha, KS, USA) was equipped

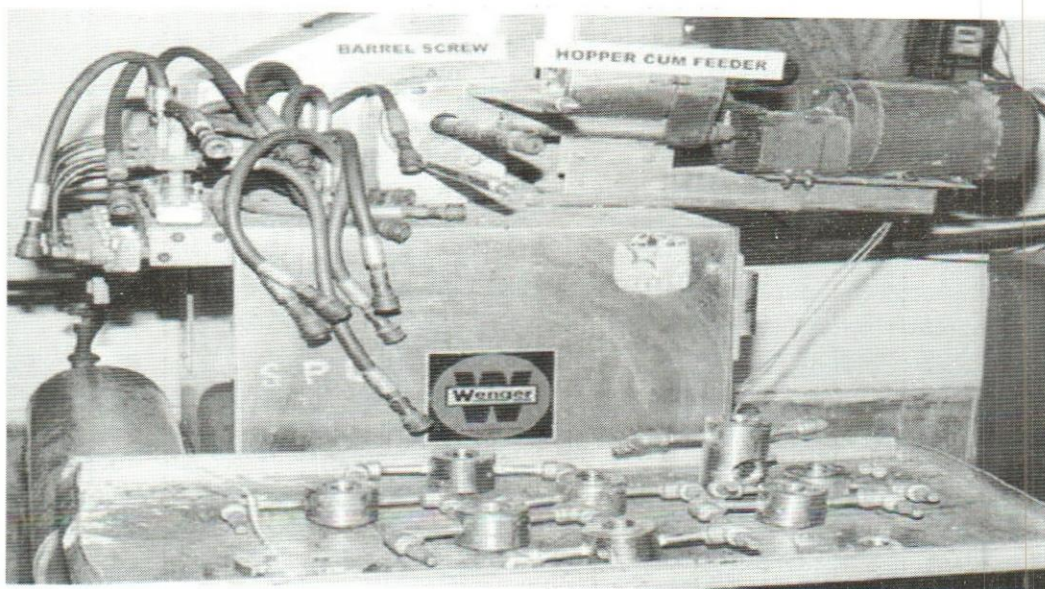


Figure 2: Details of Wenger X-5 laboratory single screw extruder

Source: Authors.

with eight stainless steel barrel segments—the cylindrical members fitted tightly around the rotating extruder screw. The interior surface of the barrels of food extruder had small grooves to prevent slippage of food material at the walls. The presence of grooves also increased the ability of the extruder to pump food material against high backpressures. The grooves could be straight and spiral. The temperature of the extrusion ranged from 80°C to 100°C. For each test run, the samples were collected after the stabilization of extrusion process and extrudates of visibly same quality obtained.

The Material

Soybean, maize and millets were taken as raw materials. The samples were cleaned, graded, de-husked, milled and sifted to get grits. The extruded products were prepared following the uniform process (Figure 3). Extrusion cooking of raw material mix (soybean 10–20 per cent, millets 60–75 per cent and maize 15–20 per cent) was tried and optimized combinations were identified based on acceptable organoleptic quality of the product.

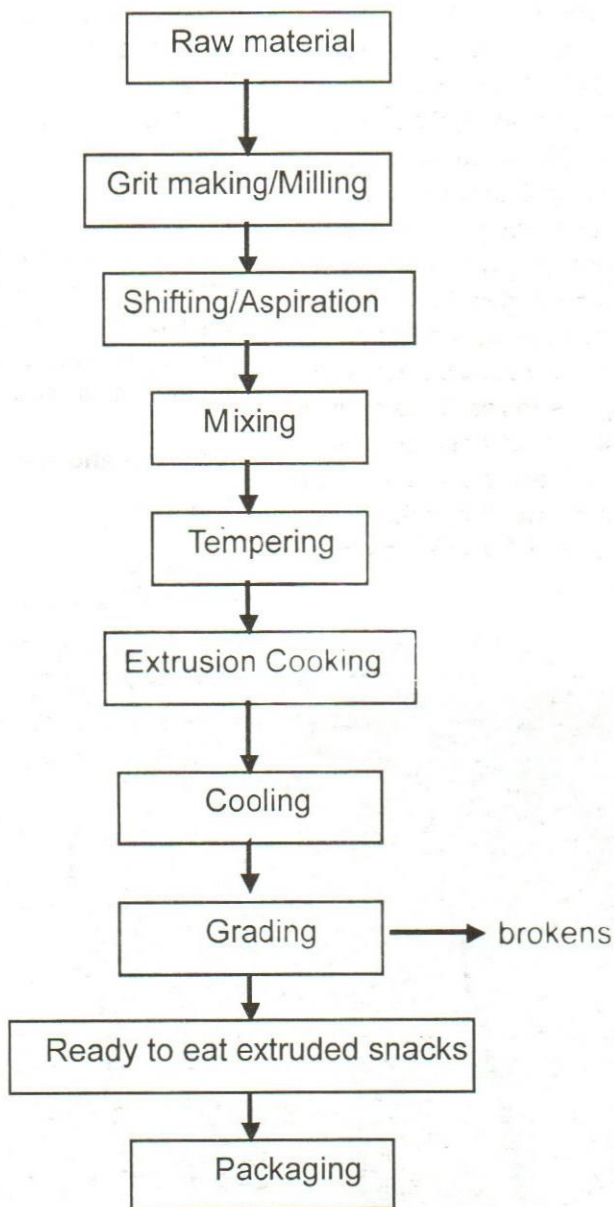


Figure 3: Process Flow Chart for Preparation of Extruded Snacks

Source: Authors.

Results and Discussion

Acceptable Products

The extrusion parameters and combinations of food raw materials used, e.g., Soybean, one cereal and one millet, and end product quality decided the product acceptability on the basis of sensory evaluation of extrudates on account of taste, flavour, colour and appearance. The acceptable quality puffed expanded extruded snack products could be prepared using extrusion cooking process and 10 per cent soy, 65 per cent millets and 25 per cent maize and thus these raw material combinations used were optimized (Table 3).

All the products obtained with different soy-millet-maize combinations were highly acceptable on sensory quality attributes and nutrition (Table 3). Soybean

Table 3: Nutrition value of soy-millet-maize based ready-to-eat extruded snacks at optimized combinations

Sl. No.	Food raw material	Optimized ingredient proportion	Protein, %	Fat, %
1.	Soy:Little millet : Maize	10 : 65 : 25	12.93	6.48
2.	Soy:Kodo millet : Maize	10 : 65 : 25	13.00	5.44
3.	Soy:Finger millet : Maize	10 : 65 : 25	11.63	4.01
4.	Soy:Sorghum : Maize	10 : 65 : 25	13.38	5.12
5.	Soy:Pearl millet : Maize	10 : 65 : 25	14.29	6.22

Source: Author's estimates based on biochemical analysis in the laboratory.

incorporation in the recipe enhanced the protein content by 30–40 per cent and oil content by 15–20 per cent making the products more nutritious and demanding.

Techno-economic Feasibility

The production of extruded snacks was carried out in a commercial plant (Figure 4) of 10 kg/h capacity located at Bhopal using the optimized combinations of food raw materials and the process parameters. Techno-economic feasibility study was conducted (Table 4) for the product output of cottage scale plant engaged in commercial production of cereal-based extruded snacks (Figure 4). The product (Figure 5) of very good quality could be prepared on commercial unit. Economic analysis done for commercial production in cottage-scale plant is presented (Table 4) as a pointer for upcoming entrepreneurs to explore the potential of establishment of soy-millet-maize-based enterprise for earning their livelihood and creating employment opportunities to the needy.

The cost of the extruded snacks would be about Rs 68.00 per kg assuming 20 per cent profit margin. The cost of the extruded snacks would increase to Rs 70 and Rs 73 per kg assuming 25 per cent and 30 per cent profit margin respectively. Break-even Point (BEP) in terms of production could be 17,860 kg assuming 25 per cent profit margin. It can be seen (Table 5) that the pay-back-period comes to be 11 months at full capacity utilization indicating that the total investment could be recovered in just 11 months after establishment of the enterprise.

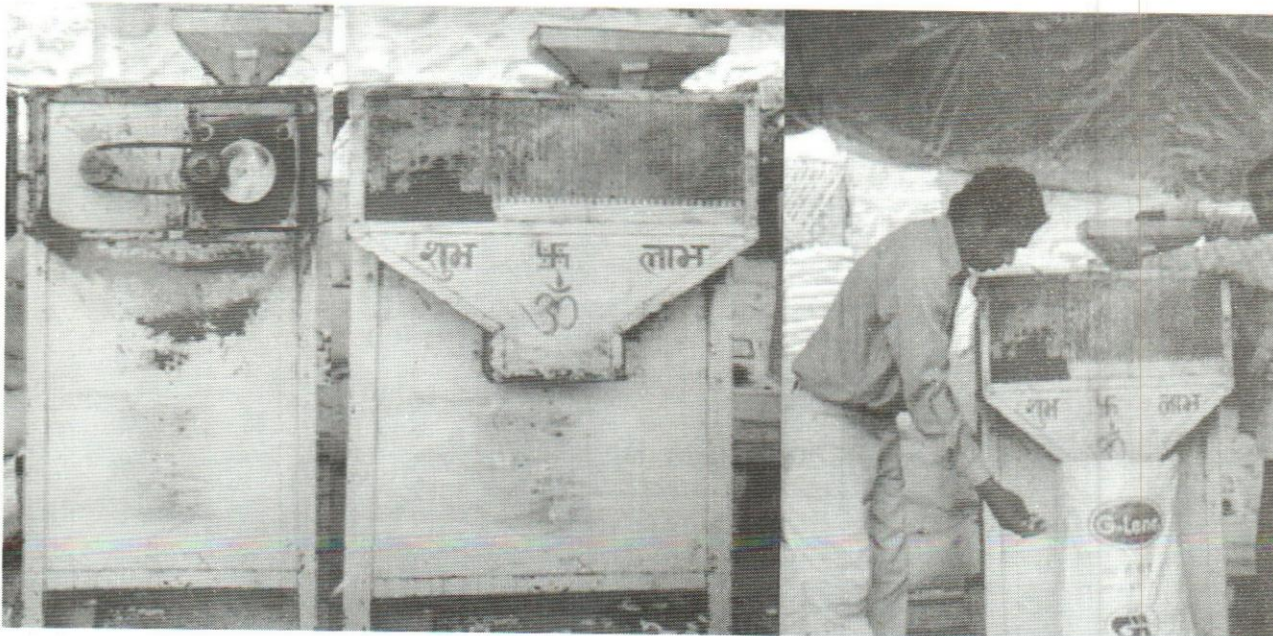


Figure 4: Small capacity commercial extruder plants

Source: Authors.

Table 4: Economic Analysis of Commercial Extrusion Unit with 70 Kg per Day Capacity

I. Assumptions

1. Capacity of the unit: 10 kg/h
2. Power requirement: 10 HP electric motor
3. Operation: 8 h per day (1 h for pre extrusion and 1 h for post extrusion operation)
4. Number of working days: 300 in a year
5. Production of snacks: 70 kg per day

Fixed cost

II. Machinery	Quantity	Rate	Rs.
Cleaner-cum-grader: (50 kg/h capacity)	1	15,000	15,000
Hammer mill: (50 kg/h capacity)	1	25,000	25,000
Soybean dehuller with 1 HP motor: 80kg/h capacity	1	20,000	20,000
Extruder with 10 HP motor: 10 kg/h capacity	1	150,000	150,000
Oil spray unit	1	10,000	10,000
Blender	1	5,000	5,000
Weighing scale: 50 kg capacity	1	10,000	10,000
packaging machine- heat sealing	1	15,000	15,000
Total			250,000

III. Variable cost (one month basis)

(Salary of Employees, hiring of shed, utilities and contingencies)

Supervisor/Skilled operator	1	6,000	6,000
Worker	1	4,000	4,000
Shed 3 × 8 m (on rent)			5,000
Electricity including lighting - @ 60 kwh day			9,000
Other contingencies at the rate 1% of fixed cost per year			2,500
Total			26,500

IV. Working capital per month

Raw material (Average cost of soy, cereals and millets including packaging @ 75 kg/day	1,750	26 (Rs 48,750)	49,000
Salaries, utilities and other contingencies			26,500
Total			75,500

V. Capital Investment

Machinery			250,000
Working capital			75,500
Total			325,500

VI. Analysis

Cost of production per year

Working capital per year (75500 x 12)			906,000
Depreciation on machineries and equipments @ 10%			25,000
Interest on total capital investment @10%			32,550
Total			963,550

Total production per year = 70 x 300= **21,000 kg**

Fixed cost, Rs. per kg		11.90 Say	12.00
Variable cost, Rs. per kg		43.14 Say	44.00
Cost of production, Rs. per kg			56.00
Net profit = Gross profit – (Depreciation + Interest + Taxes)			
Break Even point (BEP) in product units = Fixed cost (per year) / (Selling price per unit – Variable cost per unit)	8,374 kg		
Payback period in days per year = Capital investment / Net profit	1.09 y		
Return on Investment % = (Net profit x 100) / Total capital investment	92.00		

Source: Author's estimates and analysis.

Table 5: Economic analysis details at different profit margins of product with sale price at different profit margins

Parameter	Profit margin, %					
	5	10	15	20	25	30
Sale price per kg, Rs.	58.80	61.60	64.40	67.20	70.00	72.80
Total revenue per year, Rs.	1,234,800	1,293,600	1,352,400	1,411,200	1,470,000	1,528,800
Net Profit per year, Rs.	58,800	117,600	176,400	235,200	294,000	352,800
Return on investment, %	0.18	0.36	0.54	0.72	0.90	1.08
Break Even Point in terms of kg/year	89,285.71	44,642.86	29,761.90	22,321.43	17,857.14	14,880.95
Pay Back Period, year	5.54	2.77	1.85	1.38	1.11	0.92

Source: Author's estimates based on the analysis presented in Table 4.

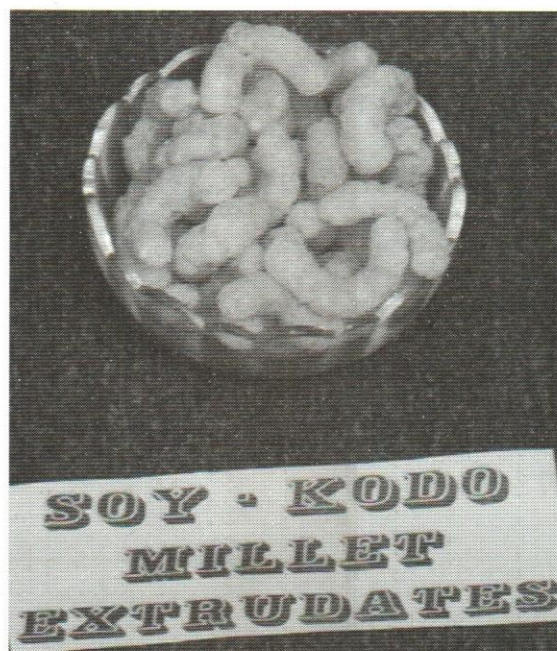


Figure 5: Extruded soy-millet snack

Conclusion

The soy-millet-based RTE extruded snacks were found to have more protein (30–40 per cent) and 15–20 per cent fat compared to non-soy products, highly acceptable and remunerative. Assuming 25 per cent profit margin and full capacity utilization, a cottage scale unit of 70 kg finished product per day capacity can give a net income of about Rs 25,000 (twenty-five thousand only) per month to the entrepreneur, direct employment for at least two persons, indirect employment to two persons and total recovery of investment in 11 months. The upcoming entrepreneurs should come forward to avail the economic advantage of the soy-millet-based snack food enterprise and thereby also contribute in nutrition enhancement for needy population at low cost.

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Almost half of the population of the world lives in rural regions and mostly in a state of poverty. Such inequalities in human development have been one of the primary reasons for unrest and, in some parts of the world, even violence.

— **A.P.J. Abdul Kalam**

MGNREGA as a Tool for Rural Development

DR NARENDRA SINGH BOHRA

National Rural Employment Guarantee Act (NREGA), now Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) is one of the largest rural development programmes, aimed enhancing the livelihood security of people in rural areas by guaranteeing 100 days of wage employment in a financial year to households whose adult members volunteer to do unskilled manual work. It is a direct poverty reduction pathway through boosting employment and income for the poor. The basic economic logic of self-targeting employment guarantee scheme is that the households whose members are most likely to seek (MGNREGA) employment are those that are otherwise unemployed or whose self-employment or market wages option would yield less than the programme's minimum wages.

In the recent past (MGNREGA) is losing momentum, from a peak level of 54 person-days of employment per rural household in 2009–10, this scheme generated 47 person-days in 2010–11, 43 person-days in 2011–12 and 35 person-days in 2012–13 (till early February). Massive amount of funds in this remained unspent in 2010–11 and 2011–12. After the initial success until FY-10 when jobs went up to Rs 283.6 crore person-days, it fell to Rs 257.15 crore in FY-11 and stood at Rs 228.54 crore in FY-13. In the recent past scholars find that MGNREGA performance is disappointing due to certain reasons such as shift of labour from rural to urban areas, absence of transaction-based management information system and

delayed payment of rural workers. In this present study, the scholar is focused to find out the application aspects of this scheme in such a place where control and communication system for supervision of this programme is very poor.

This research study is aimed to highlight the ill effects of (MGNREGA) in Gangolihat Block in Pithoragarh district of Uttarakhand. This research is divided in three major segments, first part of the research focuses on the budget amount spent in the last five years under the ambit of (MGNREGA), and the nature of work done under this scheme, second part is a study of the poor process by which the remuneration of rural workers is distributed in this scheme and last part of this research highlights how this can be improved by suggesting an alternative model of work and remuneration distribution. This study will help not only in finding the execution error of this scheme but also will suggest the alternative model of effective implementation of such schemes.

Introduction

Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) was launched in 2005. It aims at enhancing the livelihood security of people in rural areas by legally guaranteeing at least 100 days of paid employment in every financial year to adult members of any household willing to do unskilled manual work related to public work. Covering all the 626 districts of the entire country, benefiting 41 million households, it is the largest social welfare programme anywhere in the world.

(MGNREGA) is the most significant act in the history of Indian polity in many ways like grass-roots level participation of every citizen and beneficiary through democratic process, multilayered social audit and transparency mechanism by involvement of civil society,

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Table 1: Work under MGNREGA

Name of Gram panchayat	Work Name (Work Code)	Executing Level	Work Start Date	Est. labour component (in Rupees)	Est. material component (in Rupees)	Actual exp. on labour (in Rupees)	Actual exp. on material (in Rupees)
NAKOTE	PALLA DUBARIYA JAL SANGRAHAD/ CHECK WALL (3511006057/FP/1177)	GP	17/05/2011	325,200	216,800	314,660	231,124
	CHECK WALL DUBARIYA DAYRANI (3511006057/FP/138916)	GP	5/2/2013	60,300	36,000	52,488	31,160
	DUBARI JAL SANGARHAD SICHAI HAZ NAKOT (3511006057/WC/1675)	GP	11/8/2012	54,600	36,400	55,250	24,750
		GP	1/2/2013	70,000	6,000	15,000	21,900
	NOLA GHARTERA ME (3511006057/WH/3719)						
	CHECK WALL NAKOT (3511006057/LD/1504)	GP	1/2/2012	209,400	139,600	204,020	127,950
	CHECK WALL KHIRMANDE (3511006057/LD/357563)	GP	8/8/2012	257,400	171,600	70,500	148,780
	CHECK WALL MALLA DUBARIYA NAKOT (3511006057/LD/358008)	GP	1/4/2012	57,300	38,200	40,500	35,050
	MALLA TUPARIYA KUNGARI MAI CHECK WALL (3511006057/LD/361420)	GP	1/4/2013	57,300	38,200	54,528	33,140
SUNDER RAM KE GHAR KE PICHHE CHECK WALL (3511006057/LD/363349)	GP	17/11/2013	59,400	35,200	42,600	21,846	
ELC: Estimated Labor Cost, EMC: Estimated Materail Cost, ALC: Actutal Labor Cost, AMC: Actual Material Cost				1,150,900 (ELC)	718,000 (EMC)	849,546 (ALC)	675,700 (AMC)
Total Estimated Cost (TEC) and Total Actual Cost (TAC)				1,868,900 (TEC)		1,525,246 (TAC)	
	CHECK DAM GHERAN NANOLI (3511006055/FP/135767)	GP	1/1/2013	60,000	40,000	7,500	29,440
	CHECK DAM KALAGAD NANOLI (3511006055/FP/1680)	GP	8/8/2012	57,840	38,560	39,000	20,547
	CHECK WALL GHERAN NANOLI (3511006055/LD/1482)	GP	18/01/2012	58,800	39,200	48,180	32,150
	LALIT KE GHAR KE AAGE CHECK WALL (3511006055/LD/1677)	GP	31/07/2012	57,900	38,600	58,500	35,273
	KHANIMUL MAI CHEK WALL (3511006055/LD/357987)	GP	29/12/2012	60,000	40,000	50,244	55,060
	PANNYAR MAI CHECK WALL (3511006055/LD/357997)	GP	1/1/2013	36,000	24,000	37,500	0
	CHECK WALL GHERAN NANOLI (3511006055/LD/358003)	GP	1/1/2013	52,800	35,200	54,000	32,390
	KAFALI TOK MAI CHECK WALL (3511006055/LD/358342)	GP	22/01/2013	49,200	32,800	47,886	30,030
	DUGARI MAI SURAKHYA DIWAL (3511006055/LD/358347)	GP	1/10/2012	49,200	32,800	47,000	17,360
	PRIMARAY SCHOOL KE PASS CHECKWALL(3511006055/LD/361514)	GP	27/06/2013	117,000	78,000	40,896	29,540
	BAKARI SET JOGA RAM S/O DHANK RAM (3511006055/OP/3643)	GP	18/01/2013	70,000	6,000	15,000	4,947
	GOPAL SINGH KE GHAR SE SAME MANDIR TAK KHARANJ a/c. (3511006055/RC/13639)	GP	25/08/2013	58,800	39,200	0	0

ELC: Estimated Labor Cost, EMC: Estimated Materail Cost, ALC: Actual Labor Cost, AMC: Actual Material Cost				727,540 ELC	444,360 EMC	445,706 ALC	286,737 (AMC)
Total Estimated Cost (TEC) and Total Actual Cost (TAC)				1,171,900 (TEC)		732,443,(TAC)	
PILKHEE	KANALCHHINA GAUR MAI JALMOD (3511006066/FP/144323)	GP	1/2/2013	57,000	38,000	0	0
	CHECK WALL PILKHI (3511006066/LD/1448)	GP	1/9/2011	106,200	70,800	81,960	65,300
	CHECK DAM (3511006066/LD/1551)	GP	1/3/2012	85,500	57,000	89,136	52,533.34
	CHECK WAL GADHERA (3511006066/LD/358316)	GP	19/01/2013	34,200	22,800	32,040	15,880
	BADIDYA ME CHECKWALL (3511006066/LD/361552)	GP	9/7/2013	257,400	171,600	28,968	29,700
	CHURAGAD ME CHECK WALL 2 (3511006066/LD/361554)	GP	9/7/2013	90,000	60,000	17,040	30,840
	TALDHAR CHECKWALL (3511006066/LD/361555)	GP	9/7/2013	90,000	60,000	40,896	15,880
	PILKHI MAI JAL SANRAKHSAN KARYA (3511006066/WC/2008004723)	GP	1/1/2013	59,940	39,960	41,580	27,150
	DRAMATA MAI HUAZ NIRMAN KARYA (3511006066/WC/2008004724)	GP	1/1/2013	59,940	39,960	41,580	33,840
ELC: Estimated Labor Cost, EMC: Estimated Materail Cost, ALC: Actual Labor Cost, AMC: Actual Material Cost				840,180 ELC	560,120 EMC	37,3200 ALC	271,123.34 (AMC)
Total Estimated Cost (TEC) and Total Actual Cost (TAC)				1,400,300 (TEC)		644,323.3 (TAC)	
RITHAYAT	BHUSAKHALAN ROKNE HETU CHECK WALL (3511006103/LD/1317)	GP	26/09/2011	190,080	126,720	16,8456	104,469
	MALADHURA MAI CHECK WALL (3511006103/LD/1447)	GP	1/4/2011	270,000	180,000	91,200	166,030
	TALLA CHHANA MAI CHECK WALL (3511006103/LD/358006)	GP	26/12/2012	57,900	38,600	51,636	34,460
	MALAGU MAI CHECK WALL (3511006103/LD/363273)	GP	1/9/2013	56,400	37,600	17,040	0
	NAUKHUNA MAI CHECK WALL (3511006103/LD/363276)	GP	11/7/2013	49,200	32,800	34,080	0
ELC: Estimated Labor Cost, EMC: Estimated Materail Cost, ALC: Actual Labor Cost, AMC: Actual Material Cost				623580 (ELC)	415720 EMC	362,412 ALC	304,959 (AMC)
Total Estimated Cost (TEC) and Total Actual Cost (TAC)				1039300(TEC)		667,371 (TAC)	
MATOLI	MATOLI MAI CHECK WALL BHUSAKHANLAN ROKNE HETU (3511006099/LD/1499)	GP	20/01/2012	228,600	152,400	99,000	170,800
Total Estimated Cost (TEC) and Total Actual Cost (TAC)				381,000 (TEC)		269,800	
	CHECK WALL NIRMAN 2 (3511006046/LD/361425)	GP	6/4/2013	36,000	24,000	8,520	14,750
TUNDACH AURA	PRAMPARAGT NAULA SUDHAR KARYA (3511006046/WH/3371)	GP	1/1/2013	45,600	30,400	7,500	14,850
	KANDARA MAI NAULA SUDHAR KARYA (3511006046/WH/3378)	GP	1/1/2013	45,600	30,400	7,500	26,850
ELC: Estimated Labor Cost, EMC: Estimated Materail Cost, ALC: Actual Labor Cost, AMC: Actual Material Cost				127,200 (ELC)	84,800 (EMC)	23,520 (ALC)	56,450 (AMC)
Total Estimated Cost (TEC) and Total Actual Cost (TAC)				212,000 (TEC)		79,970 (TAC)	

Source: nrega.nic.in (compiled by author).

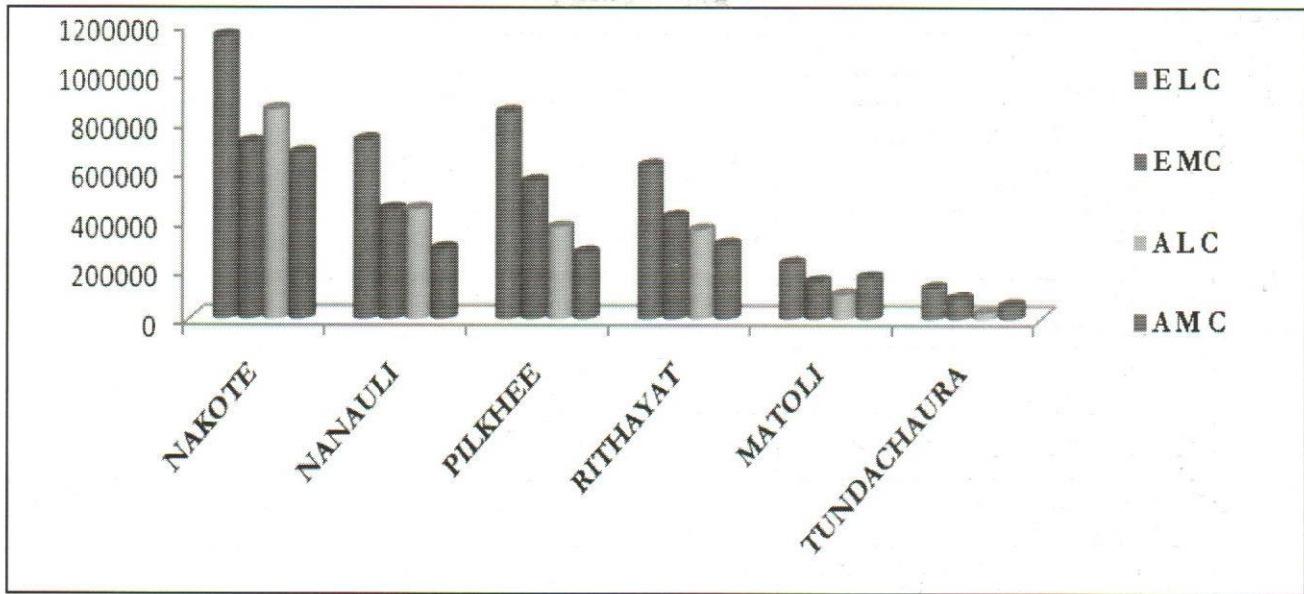


Figure 1. (Based on Table 1)

ELC: Estimated Labor Cost, EMC: Estimated Material Cost, ALC: Actual Labor Cost, AMC: Actual Material Cost

comprehensive planning at village level towards sustainable and equitable development, etc. An important salient feature of the Act is to improve the quality of life of rural households who are vulnerable to out-migration in search of daily wage employment by channelising the wage workforce towards developmental activities at the village level itself.

The Study Area

The study is based on primary and secondary data collected from official website of MGNREGA and the selected Grampanchayat (06) of Gangolihat block in Pithoragarh District of Uttarakhand (India). Pithoragarh District, having its entire northern and eastern boundaries being international assumes a great strategic significance and, is a politically sensitive district along the northern frontier of India. The district has been divided into six tehsils, viz. Munsyari, Dharchula, Didihat, Gangolihat, Berinag, Pithoragarh and two sub-tehsils, Dewalthal and Kanalichhina, having its headquarters at Pithoragarh and the Commissionery headquarter at Nainital.

Objectives of the Study

The present study on evaluation of the MGNREG Scheme is intended to assess the actual status of work done under MGNREGA in the various places of selected Grampanchayats in Gangolihat block of Pithoragarh District in Uttarakhand and the operational bottlenecks, and at last to assess the impact of the scheme on the targeted beneficiaries.

Data Analysis

In the last two years, the state government has spent over Rs 3,919,153 against the estimation of Rs 6,073,400 in two years on the scheme in selected Grampanchayats in Gangolihat block of district Pithoragarh in Uttarakhand. The preferred choices of the work in studied areas are check wall, check dam and *khdanja* (footpath of small pieces of stone or cement). The estimated labour and material cost in each Grampanchayat is more than the actual. Rithayat is the Grampanchayat which has the most populated and geographical area but lesser number of works because of the conflicts between two villages of the Grampanchayat (Table 1).

MGNREGA and Rural Development: Facts on Ground

The implementation of the scheme under the MGNREGA might not be as great a success here as the government and social auditors have claimed it to be across the country. If statements of rural people of selected Grampanchayat in Gangolihat of Pithoragarh District in Uttarakhand are to be believed, it has failed in either providing employment, curbing migration or creating viable community assets. In the last two years, the state government has spent over Rs 3,919,153 against the estimation of Rs 6,073,400 in two years on the scheme in selected Grampanchayats in Gangolihat block of district Pithoragarh in Uttarakhand. However, results remain unsatisfactory. Corruption and delayed payment of wages plague the MGNREGA apparatus in all selected areas. The major finding under

this research is categorized in three major segment preferred work choice, asset creation and satisfaction of people regarding MGNREGA. Firstly, preferred work under this scheme in the selected Grampanchayat consists of the construction of check wall (Grampanchayat Nokote 6 check wall out of total 9 works in last two and half year, in Nanauli 9 out of 12, in Pilkhee 6 out of 9, in Rithayat 5 out of 5, in Matoli 1 out of 1, in Tundachura 1 out of 3 [Table 1]). In case of further studies the reason behind

the proffered check wall construction is availability of stone; it saves transportation cost of stones. Secondly, the majority under this scheme is poor in quality, in case of Jalsangralaya again source of available material is the main factor of construction, and some of the Jalsangralaya are constructed at a place where flow of water is not possible. The third major finding of the research is the people satisfaction regarding the MGNREGA work and the way it is distributed (Box 1).

Box 1: MGNREGA; Execution Satisfaction on Ground

To understand the satisfaction level of people regarding MGNREGA a general visit was made in the selected Grampanchayats. It was asked why people did not want to work under the scheme; a Block Development Officer of Gagolihat block said: 'The NREGA is a demand driven scheme. We can provide work only if it is demanded. Still, we are working towards generating demand by spreading awareness of the Act.' But the other side of the mirror picture is something different.

Rozgaar guarantee mein ko kaam karol [why should we work under the scheme], asks Debu Bohra, a farmer from Nakot in the Gangolihat Block. 'We have to pay bribes, face intimidation and still wages are never paid on time. Private employers pay less, but at least we get paid at the end of the day.' Add to this the high-handedness of panchayat officials. Villagers from Nakot, Nanauli, Matoli, Rithayat in Gagolihat Block of Pithoragarh District complained that their job cards were being withheld by the *Sabhapati*.

Manuli Devi, a schedule cast poor women from Grampanchayat Pilkhee replied when asked why she is not getting work under MGNREGA '*Mer crad pchhel dew sal be sabhapati pas chhoo, jab mail apan crad wepar pucchu wel ko ki mer leji koi kam nahti*' [My job card has been with the *Sabhapati* for the past two years. Whenever I ask for it, he threatens me and says there is no work for me]. In further study it has been found that the attendance role of Manuli Devi job is filled with work days attendance and on ground same women (Manuli Devi) is not getting work, it means there is a mismatch between labor on record and labor on real ground.

MGNREGA: Route—Causes of Poor Execution

This study analyses executional irregularities in three different phases, work planning, work execution and wages disbursement phases (Figure 2). The major irregularities that have been found in work planning phase are work estimations process (as per the philosophy of MGNREGA work demand will be created by the job card holders or households but in actual ground the work under

MGNREGA are estimated at the offices of block panchayat y their representatives, due to this a scope is created for irregularities). In work execution phases lack of supervision creat a scope for assymetry between actual workers and job cardholders. This resulted in surrender of job cards for Rs 50 to Rs 100 per month. To receive the wages against jobs done in MGNREGA is very important for the labourers, but certain irregularities like attendance role

Table 2: Available Banking Channel

S. N.	Name of Grampanchayat	Job Card Holder (2013-14)	Number of Bank	Bank Account	Remark
1	NAKOTE	134	1	3	
2	NANAULI	122	NIL	NIL	Money withdrawn by post office
3	PILKHEE	86	NIL	NIL	Money withdrawn by post office
4	RITHAYAT	127	1	1	
5	MATOLI	51	1	14	
6	TUNDACHAURA	59	NIL	NIL	Money withdrawn by post office

Source: nrega.nic.in (compiled by author).

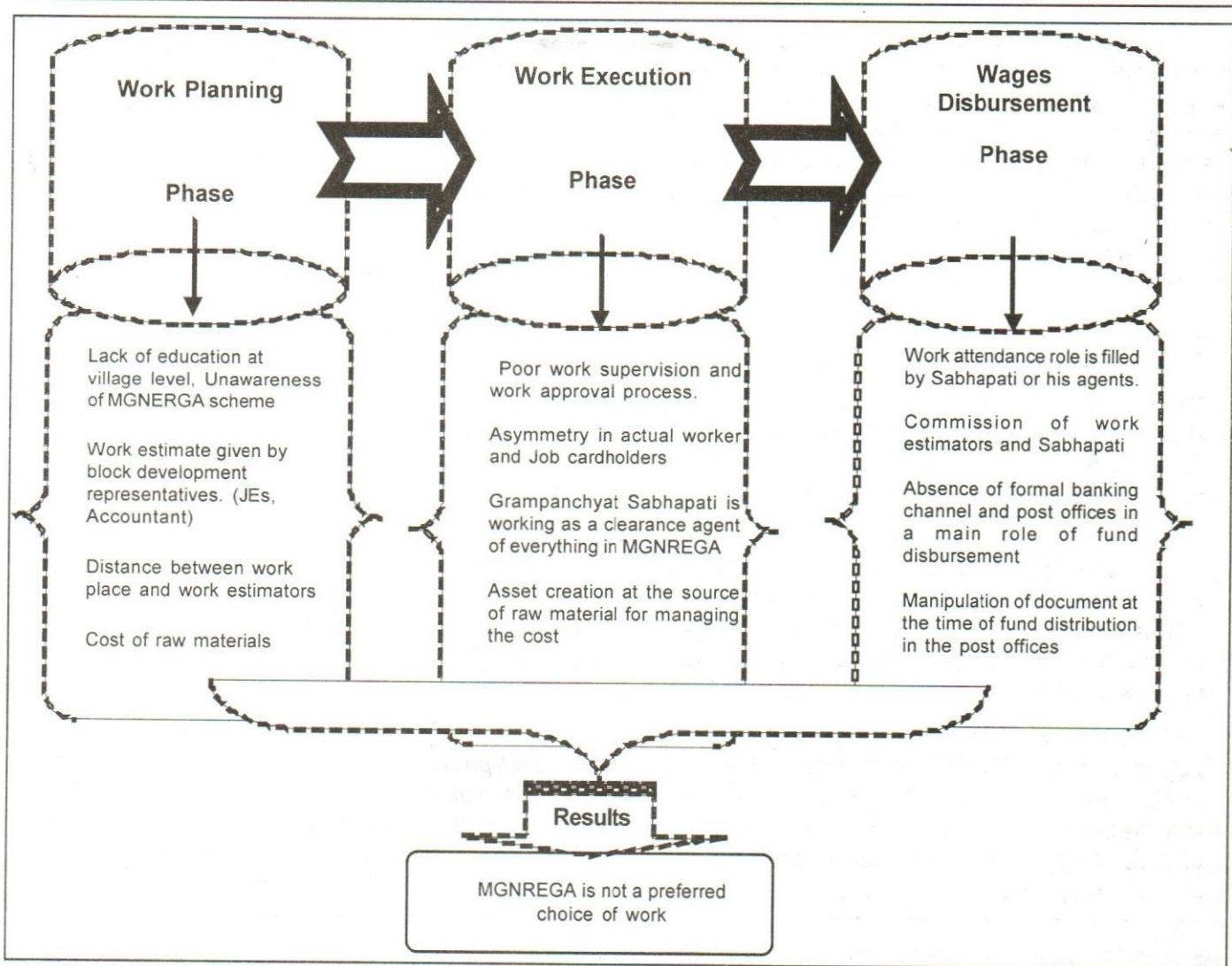


Figure 2: MGNREGA: Route—Causes Matrix

filling by the Sabhapati, absence of formal banking channels (Table 2), manipulation of attendance role in block offices and managing post offices are the prime reasons for the delay of wages payments.

This has resulted in poor perception of rural people for work under MGNREGA schemes, so they would like to work under private contractor instead of MGNREGA or would like to migrate from those places for their economic survival.

Reviving Execution of MGNREGA for Rural Development

Recent result of MGNREGA is not satisfactory; the governments of India also accept it but claim the decline in MGNREGA work could be an indication of the success of various poverty alleviation schemes and dynamism in rural economy. Activists partly agree with this, but also

accuse the government of not generating enough work under the scheme even in places where demand exists.

This study suggests some modifications in the execution of this scheme which can improve the overall efficiency of this programme in terms of employment generation, asset creation and labour satisfaction towards this programme. In the work-planning phase regular advertisement for awareness can be communicated through rural communication channel. Work can be estimated with consultation of educated people having rural background of respective areas. Help of NGOs and SHG can be taken for work supervision in the work execution phases; phase wise approval of work may a mechanism for assuring quality asset creation. Wages disbursement can channelise through the link of MGNREGA remuneration with the future saving like RD and FD of concern labour.

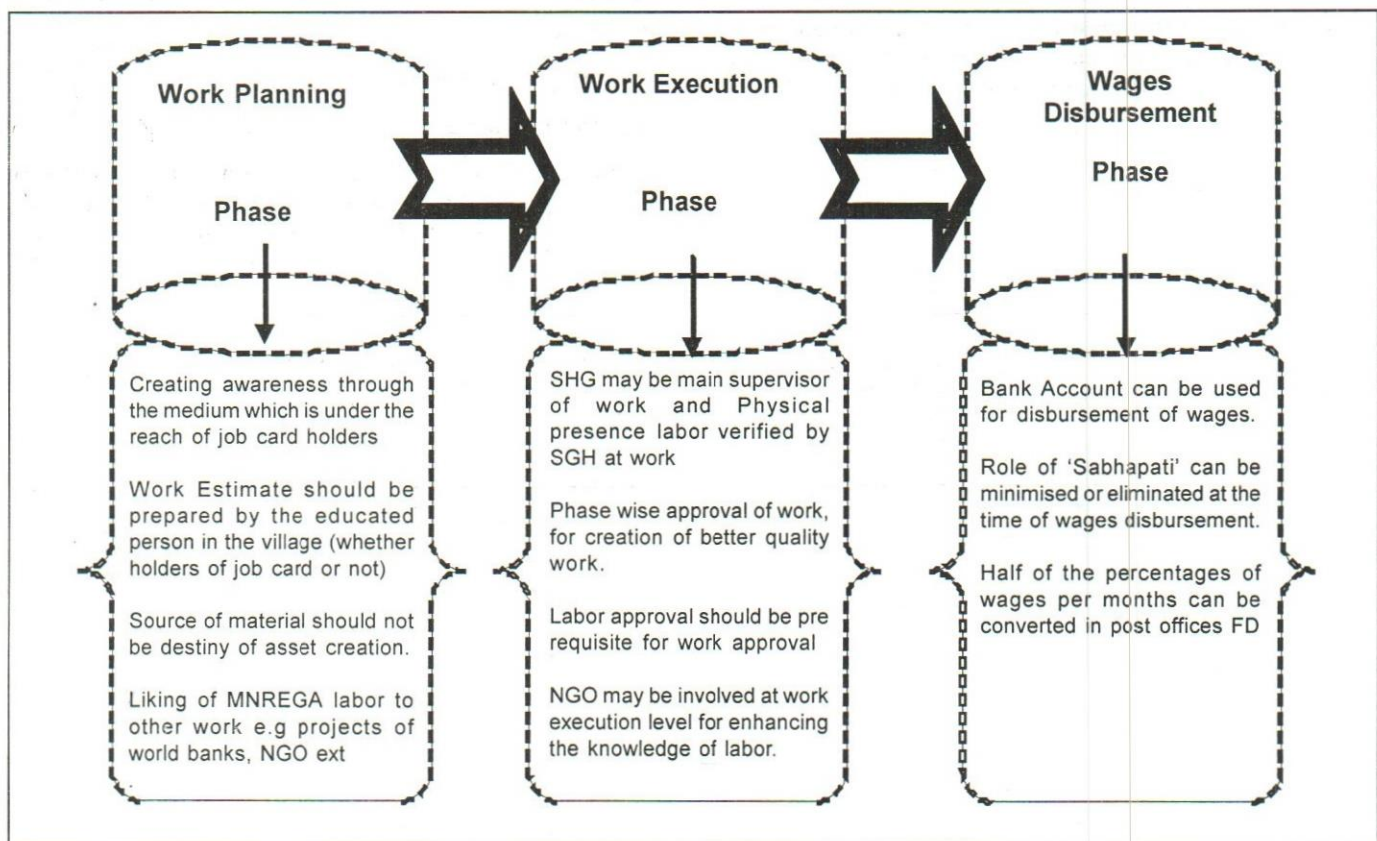


Figure 3: MGNREGA: Reviving Execution

Conclusion

It must be stated that MNREGA has immense potential to provide social security to the masses only if its implementation efficiently, in fact, this scheme ensures the economic security of the rural poor by providing guaranteed wage employment. Performance across the some of the criteria such as work estimation process, work approval process and wages fund disbursement process has been disappointing and has deteriorated over time. Percentage of expenditure against total available funds has risen sharply. Finally, it is difficult to escape the conclusion that the NREGS has not performed well; it can produce good result with modification in execution level.

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The village is the cell of the national body and the cell life must be healthy and developed for the national body to be healthy and developed.

— **Sri Aurobindo**

Socio-Economic Survey on Management of Poultry Production in Rural Areas

S.C. VETRIVEL

Poultry egg and meat is an important source of high-quality proteins, minerals and vitamins required to balance the human diet, specially developed varieties of chicken are now available with the trait of quick growth and high feed conversion efficiency. A majority of the poultry products available for consumption in Tamil Nadu come from rural poultry production in spite of the dearth of knowledge on their statistics, production, management practices, disease control methods and level of government intervention in the business. The need to obtain baseline information on the availability of rural poultry under the village conditions in Namakkal area formed the basis of the study. The study investigated production systems and reproductive performance of village chicken in rural areas surrounding Namakkal town, Tamil Nadu state. Data used were collected from rural poultry farmers in the Namakkal district using structured questionnaires and were analysed by means of simple average and percentages.

The study revealed that men dominated (93.3 per cent) rural poultry production. Middle-age persons dominated the study area compared to other age groups (45.9 vs 25.8 and 28.3 per cent). Married people were engaged in rural poultry production (87.8 per cent). Majority of the poultry farmers in rural areas had school-level education (51.3 per cent). Likewise, farm ownership of the rural areas was by sole proprietors (78.6 per cent) and partnership (21.4 per cent). Relevant solutions centring on dedicated support from government are suggested.

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Introduction

Animal husbandry occupies an important place in the Indian economy and livestock plays a vital role in the life of rural people. With the improved production potentials of our livestock and poultry, livestock farming has become economically viable and remunerative. Due to this, animal husbandry, which was all along a subsidiary occupation, has now become a main source of income for many rural poor farmers. The Department of Animal Husbandry is carrying out various programmes for livestock development, such as genetic improvement through well-defined breeding policies, supply of improved and nutritive fodder and health care both preventive as well as for treatment of diseases.

Chicken production systems are characteristically an indigenous part of farming systems with short life cycles, quick turnover and low inputs. Animal agriculture in India revolves largely around poultry, fish, cattle, sheep and goats. These livestock contribute a substantial proportion of internal supply of animal protein. Among these livestock, poultry is the most numerous and most widely spread in both urban and rural areas in India. Chickens raised for eggs are usually called layers while chickens raised for meat are often called broilers. The egg-laying birds are categorised into three stages; namely, chicks, grower, layer. At each stage the birds are grown separately in different sheds.

Poultry farming has undergone a transformation from being a mere backyard unit to the present vibrant and dynamic commercial enterprise. Poultry farming took a step ahead with the introduction of deep litter system during the late 1960s. The introduction of new scientific techniques, new strains of poultry and California cage system have revolutionised the industry.

Various nationally coordinated animal improvement programmes and policies on poultry are focused on exotic breeds, while little attention is paid to rural poultry in spite of their significant contribution to animal protein supply. It is noteworthy that rural poultry in spite of their poor genetic potential for meat and egg production compared to exotic breeds are of invaluable contribution to nutritional intake of rural dwellers by affording them access to cheap but nutritionally balanced animal protein. Village poultry makes the greatest contribution to the supply of meat and eggs for the average Indians, contributing annually 21 per cent of overall meat products basket—providing an affordable alternative for meeting protein requirements in the Indian diet with per capita consumption of meat up to 2.8 kg pa and 55 eggs during the period 2012 (ICRA, 2012).

Baba (2007) studied the financial feasibility of investments in contract poultry farming in Tamil Nadu region. Fifty integrated poultry were selected randomly in Coimbatore district. He concluded that on an average, farmers received a growing coat at Rs 2.36 per kg of the bird. The study also calculated the profitability per chick, which was found to be Rs 1.50 in the beginning. The study also estimated the returns on investment that was found to be 11.5 per cent in the beginning and increased up to 20 per cent.

According to Gausi et al. (2004), smallholder village chicken producers tend to ignore new technology even when it appears to be better than their current practices due to market limitations. This implies that apart from meeting subsistence needs, engagement and level of investment of smallholder farmers in agricultural enterprises responds to existing market opportunities.

Putting into cognizance the significant contribution of rural poultry and the organised systematic management of these village birds is long overdue. Appreciation of the importance of rural poultry could be of immense contribution to stemming the tide of rural–urban migration of youths and enhancement of food security of rural dwellers. Besides, promotion of indigenous chicken production could also economically empower rural youths and women (Miah et al., 1992) who are mostly economically disadvantaged compared to men, in our male-dominated society.

It is difficult to design and implement poultry egg production programmes that benefit rural people without understanding village poultry production and marketing systems (Pedersen, 2002).

Meganathan et al. (2010) in their study identified the constraints in tribal livestock farming by collecting data from 900 sample tribal farmers in 6 hilly areas of Tamil Nadu, viz. Kolli Hill in Namakkal district, Yercaud Hill in Salem district, Ooty Hill in The Nilgiris district, Kodaikanal in Dindigul district, Yelagiri Hill in Vellore district and Sitheri Hill in Dharmapuri district. The data were analysed by Garrett's ranking technique. Lack of sufficient pasture land, lack of marketing facilities, lack of adequate credit facilities, unremunerative price for the livestock products and lack of scientific knowledge on livestock farming were observed to be the major constraints perceived by the tribal farmers. Establishment of more milk co-operative societies, enhancing fodder cultivation, provision of loans to needy tribal livestock farmers at reasonable interest rate and conducting awareness programmes among tribal farmers on various scientific livestock management practices will lessen the prevailing constraints in tribal livestock farming, which in turn improve the tribal livestock production.

In view of the foregoing, the present study was initiated to obtain some baseline information on the management, disease control methods and level of government intervention on the productivity of the indigenous chicken under village conditions in Namakkal district of Tamil Nadu state, India.

Backyard Poultry Development

In Tamil Nadu, poultry rearing is practiced since time immemorial as a profitable traditional backyard enterprise. It still continues to be the livelihood preposition of several poor farmers in the rural areas and contributes to 5 per cent of the total egg production in the state. Backyard poultry rearing has distinct advantages over other vocations, as the land requirement is small; returns are faster with little initial capital investment. Though the initial investment is minimum, the landless agricultural labourers find it very difficult even to invest this little amount. Hence, for the economic upliftment of this category of people and to improve the household nutrition, Giriraja birds were provided to be reared as backyard units under Western Ghat and Hill Area Development Programme (HADP). This backyard poultry development is being taken up in the districts where poultry rearing is not practiced on a commercial basis.

Materials and Methods

The socio-economic survey for this study was carried out in the surrounding rural towns and villages of Namakkal

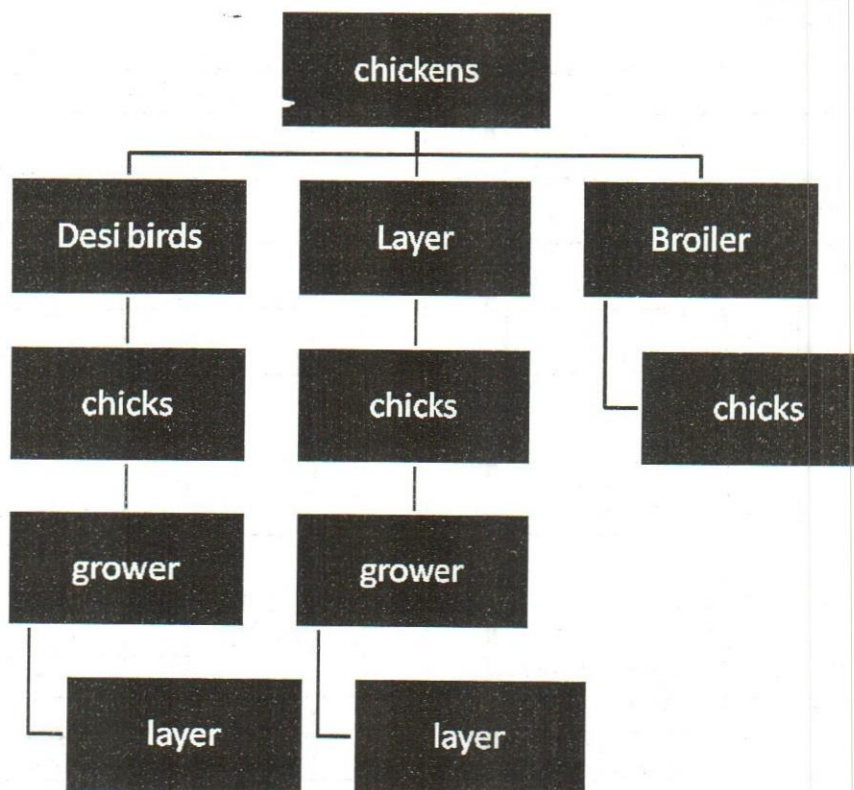


Figure 1: Classification of Chickens

Source : Field survey.

District in Tamil Nadu state of India. The primary data were collected from three taluks (Tiruchengode, Namakkal and Rasipuram) of Namakkal district, which includes 10 villages.

The Villages Involved in the Study

Vaiyappamalai, Periyamanali, Velagoundanpatti, Puduchatram, Buthansanthai, Munjanur, Minnampalli, Kattipalayam, Elachipalayam and Morangam.

From the selected rural areas, data collected from poultry farmers and the respondents for this study were randomly selected. A total of 523 fully completed questionnaires by respondents were used for this study.

Structured questionnaires were used for the survey. Various questions relating to the different aspects of poultry production practices and marketing in the rural areas were asked. In order to obtain accurate information, check questions and cross fertilization of ideas were introduced to control earlier information given. All information was obtained in confidence and questionnaires were pretested few days before the interview with necessary modifications made to suit the purpose of this survey and adapt to the conditions of the rural farmer respondents.

Data were analysed by means of simple averages and percentages. Some qualitative information was recorded and obtained, especially when such information was given by a simple majority.

Socio-economic Factors which Affect the Poultry Business

The impact of society and economical environment in any business is inevitable. In poultry business, the socio-economic factors were studied under the following six headings: government support/subsidies, education to the poultry farmers, proper training to poultry labour, consultancy support to farms by government agencies, geographical segmentation of poultry industry will boost export business and government support/subsidies.

It is observed from Table 1 that among socio-economic factors which affect the poultry business, 41.1 per cent of the farm respondents agree and 9.9 per cent neither agree nor disagree to the government support/subsidies factor. Education to the poultry farmers factor is agreed by 59.7 per cent and disagreed by 2.3 per cent; 64.6 per cent respondents agree the proper training to

Table.1: Socio-Economic Factors

S. No.	Statement	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
1	Government support/subsidies	185 (35.4)	215 (41.1)	66 (12.6)	52 (9.9)	5 (1.0)
2	Education to the poultry farmers	123 (23.5)	312 (59.7)	73 (14.0)	12 (2.3)	3 (0.6)
3	Proper training to poultry labour	101 (19.3)	338 (64.6)	76 (14.5)	6 (1.1)	2 (0.4)
4	Consultancy support to farms by government agencies	111 (21.2)	310 (59.3)	92 (17.6)	8 (1.5)	2 (0.4)
5	Geographical segmentation of poultry industry will boost export business	106 (20.3)	274 (52.4)	130 (24.9)	11 (2.1)	2 (0.4)
6	Government support/subsidies	105 (20.1)	243 (46.5)	149 (28.5)	22 (4.2)	4 (0.8)

Source: Field survey.

poultry labour and 1.1 per cent disagree. Further, consultancy support to farms by government agencies is agreed by 59.3 per cent respondents and disagreed by 1.5 per cent. The factor of geographical segmentation of poultry industry boosting export business is agreed by 52.4 per cent respondents and 2.1 per cent respondent disagree with the statement; 46.5 per cent agree and 4.2 per cent respondent disagree with the statement government support/subsidies in socio-economic factors which affect the poultry business.

Results and Discussion

Socio-economic Characteristics of Rural Poultry Farmers

The results of preliminary investigations on socio-economic characteristics of rural poultry farmers in Namakkal district are presented in Tables 2 through 7.

Sex of Respondents

A further probe into the sex of respondents who were actively involved showed that men overwhelmingly (93.3 per cent) took the lead in all the villages considered. Women have been reported to be the minor producer of rural poultry in the study area.

Table 2 shows that the sample consists of 488 (93.3 per cent) respondents belongs to the male category and 35 (6.7 per cent) respondents were female poultry farm entrepreneurs. Greater involvement of men in village poultry production might not be unconnected with its easier management and relative low cost of procurement of foundation and replacement stocks.

Table 2: Gender of Respondents

S. No.	Gender	No. of Respondents	Percentage
1.	Male	488	93.3
2.	Female	35	6.7
	Total	523	100.0

Source: Field survey.

Another possible explanation for higher proportion of men in rural poultry production could be attributed to the fact that most women play complementary roles in villages, occupying themselves with household chores, looking after the children and livestock and assisting their husbands in harvesting, processing and sale of farm produce.

Though men dominate village chicken production; nevertheless, it is worth emphasising that decisions made by them are largely discussed with the consultation made with women or in some cases, with the family.

From Table 3, we see that 25.8 per cent of respondents were young below the age of 40 years,

Table 3: Age of Respondents

S. No.	Age	No. of Respondents	Percentage
1.	Young (Below 40 yrs)	135	25.8
2.	Middle (41-50 yrs)	240	45.9
3.	Old (Above 50 yrs)	148	28.3
	Total	523	100.0

Source: Field survey.

45.9 per cent were between 41 and 50 years, while 28.3 per cent were above 60 years. It is evident that the majority of rural poultry keepers in the study area were in their middle age. Most of the fowls owned by youngsters were given as gift by parents, grandparents and relatives.

Marital Status of Respondents

Marital status is playing a vital role in poultry business. Poultry business is mostly carried along with agriculture, and marriage gives an added advantage to the poultry entrepreneur in supporting the business. At times, during shortage of manpower family members' support becomes vital. The married personnel are normally supported by their in-laws in all aspects including timely financial support, moral support and emergency supply of manpower from their villages. Hence, the married poultry farm owners manage all kind of crises much more easily than the unmarried poultry farm owners. In this study, an attempt was made to analyse the relationship between marital status of the poultry farm entrepreneurs and their successful operation in their business. For this purpose, the marital status of the respondents was classified into two categories: married and unmarried.

Information on marital status revealed that 87.8 per cent of the rural poultry farmers were married. The remaining (12.2 per cent) were unmarried rural farmers. They were single parents and young children who still stayed with their parents and a few poultry were tagged

Table 4: Marital status of Respondents

S. No.	Marital status	No. of Respondents	Percentage
1.	Married	459	87.8
2.	Unmarried	64	12.2
	Total	523	100.0

Source: Field survey.

as belonging to them. This implies that poultry keeping is done by married farmers in the study area.

Educational Qualification of Respondents

Education makes a man complete. Even though man learns from his experience, it might become too late in business to be a successful entrepreneur. Education along with business knowledge and experience is an added advantage in carrying out business successfully. An

attempt was made to analyse the relationship between educational qualification of the poultry farm entrepreneurs and their successful operation in their business. For this purpose, the educational qualification of the respondents was classified into four categories: Illiterate, School level, Collegiate and Professional.

Table 5 reveals that 74 (14.1 per cent) are illiterate, 268 (51.3 per cent) are at school level, 104 (19.9 per cent) are collegiate and 77 (14.7 per cent) are professional poultry farm entrepreneurs.

Table 5: Educational Qualification of Respondents

S. No.	Educational qualification	No. of Respondents	Percentage
1.	Illiterate	74	14.1
2.	School level	268	51.3
3.	Collegiate	104	19.9
4.	Professional	77	14.7
	Total	523	100.0

Source: Field survey.

Management Practices, Farm Ownership, Source of Feed

Teamwork is considered as a successful concept in modern days. Poultry business is also not exempted from this concept. Entrepreneurs, who have interest and idea to do poultry business, join with the like-minded people and start their business. The advantage in partnership farm is that initial investment is shared with the partners, and experience and skills of other partners can be utilised for the development of the business. The farm ownership of the respondents was classified into two categories, viz. sole proprietors and partnership.

Table 6 states that 411 (78.6 per cent) respondents were sole proprietors and 112 (21.4 per cent) respondents were partnership poultry farm entrepreneurs.

Table 6: Type of Farm Ownership

S. No.	Farm Ownership	No. of Respondents	Percentage
1.	Sole Proprietors	411	78.6
2.	Partnership	112	21.4
	Total	523	100.0

Source: Field survey.

Source of Feed

Source of getting poultry feed has direct influence in managing the poultry business effectively. It affects the business in the initial investment; that is, feed nutrition, manpower to work in the feed mill, raw material procurement, transportation, overall co-ordination and management, infrastructure facilities for the feed mill activities etc.

The sample in Table 7 consists of 62 (11.9 per cent) respondents getting the feeds directly from the companies; 368 (70.3 per cent) of them obtained from the dealers and 93 (17.8 per cent) respondents producing themselves.

Table 7: Source of Feed

S. No.	Getting the feed from	No. of Respondents	Percentage
1.	Companies	62	11.9
2.	Dealers	368	70.3
3.	Self made	93	17.8
	Total	523	100.0

Source: Field survey.

The major item of feed given to poultry in the study area was maize. This was supplemented occasionally with corn. However, the choice between these cereals depended largely on their availability and season of the year. Occasionally, farmers gave the chickens supplements comprising of kitchen wastes and agricultural by-products.

Special attention is commonly given to the feed of chicks. Broken maize/corns are commonly fed to them. This is one of the reasons why most farmers prefer feeding corn to brooding hens as it makes it easier for chicks to pick.

Respondents also commented that hatching rate also depended on season. Most of them asserted that chicks' production was low in dry season in contrast to wet season.

Conclusion

- Since men constitute the larger proportion of rural poultry keepers, it is advisable that all forms of

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

— Peter Ducker

assistance in form of input and training should be focused on them.

Farmers need to be enlightened on the need to adopt improvised management methods.

Agriculture, the largest backbone of India, has been shrinking day by day due to lack of interest and attention to it. Similarly, allied profession in India (poultry industry) is also dwindling day by day. A proper rejuvenating measure should be initiated to safeguard the poultry industry. The state government has to take meticulous care and should analyse the problems in poultry industry and create awareness among the poultry entrepreneurs to manage the industry efficiently by analysing new trends in the study area. All these policies are however feasible and could accomplish the desired goal of raising rural poultry, if there is a dedicated intervention and willingness by the various governments.

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Strawberry Cultivation in Hilly Tracts of India Profitability and Sustainability Issues

DEEPAK SHAH

Strawberry has significant demand from urban consumers due to its high source of vitamin, significant levels of mineral contents, ellagic acid, rich aroma, fabulous flavour, important dietary components etc. Though strawberry requires a significantly high cost of cultivation, the returns are equally high and one can expect as much as Rs 4.00 lakhs of net profit margin from one hectare of strawberry orchard under suitable climate and well-managed efficient cultivation practices. However, adverse climatic conditions and some emerging threats to its cultivation, viz. threats caused by diseases like mildew, leaf spot, leaf blight and other fungal attacks on leaf of strawberry plants—white spots on the leaves, and important pests of strawberry such as spider mites and cutworms, etc.—might adversely affect the cultivation of strawberry. One of the major weaknesses of strawberry is the shorter shelf life and higher rate of perishability. Lack of money management, plan for the future growth and realistic view followed by processing units with respect to the production of products are some of the causes of concerns raised by the farmers in the cultivation of strawberry. The study, nonetheless, reveals that by using plasticultural techniques like plastic mulching, plastic punnets etc., there is significant scope to revolutionize high-density strawberry cultivation.

Introduction

Strawberry (*Fragaria x ananassa Dutch.*), a rich source of vitamin C and containing numerous important dietary components with significant levels of ellagic acid, is a temperate fruit crop and can be cultivated in sub-tropical as well as tropical regions. It is considered as one of the most fascinating fruits of the world since it not only possesses a fabulous flavour with tantalizing aroma but also contains minerals. The cultivation of strawberry fruits is seen throughout Europe, United States, Canada and South America. These regions of the world have significant variations in climate, which is conducive to the cultivation of strawberry. Since strawberry plants adapt well with varying climatic conditions, these regions with wide variations in climate help in harvesting and marketing of the fruit during most parts of the year. The cultivation of strawberry in India is noticed in those regions that have sub-tropical climate, such as Nainital (district) and Dehradun in Uttar Pradesh, Mahabaleshwar and Panchgani in Maharashtra, Kashmir Valley, Bangalore and Kalimpong (West Bengal). Although cultivation practices of strawberry are noticed in 4–5 states of India, the major bulk of about 85 per cent of India's total production of strawberry comes from the Western hilly tracts of Maharashtra. In fact, Panchgani and Mahabaleshwar¹ of Maharashtra are the strawberry capitals of India. Strawberry is generally cultivated in the hills. However, in recent years, its successful cultivation is also noticed in plains, viz. around towns like Pune, Nasik and Sangli of Maharashtra. There are more than 20 varieties of strawberry cultivated in India.² The delicacy of strawberry makes it possible to consume it fresh as well as in different forms like in ice cream, jams and jellies, biscuits, wafers, etc. It is a very soft and highly perishable fruit and often shipped in frozen conditions to Western countries. Since strawberry has a significant demand throughout the country from urban consumers due

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to its high source of vitamin, significant levels of mineral contents, ellagic acid, rich aroma, fabulous flavour etc., it was thought prudent to address various issues relating to strawberry with specific reference to its cultivation technique, economics of cultivation, strengths, weaknesses, opportunities and threats to its cultivation and several other related issues.

Cultivation Technique

Strawberry is the only high value fruit crop that starts paying back within 100 days of its plantation. Since strawberry plants are susceptible to frost and low temperature, they require protection from frost and cold winds during winter season. The high temperature during summer also affects the growth of the plants. In order to offset extreme climatic conditions, plasticultural techniques are used, which include mulching, use of plastic tunnels and micro-irrigation systems (MIS). While low plastic tunnels and mulching during winter help in reducing the influence of cold, the micro-sprinklers maintain proper micro-climatic conditions in summer (Singh, 2008). Although strawberry grows well under temperate climate, some cultivars can also be grown in sub-tropical climate. The flower-bed formation requires daylight period of 12 hours or less and moderate temperature. However, it is to be noted that each cultivar has a different requirement of daylight and temperature and sandy loam to loamy soil with pH 5.7–6.5 is ideal for the cultivation of strawberry.

In order to have proper drainage and intercultural operations, strawberry plants are required to be raised on beds having height of 25 cm and width of 1 m. Generally, the distance of one bed from the other stands at 50 cm and runners are planted in the second fortnight of September at a spacing of 25 × 25 cm with four rows of plants per bed (Singh, 2008). One acre strawberry farm normally accommodates 35,000–40,000 runners. Although the early stage of growth of the plant requires irrigation through micro-sprinklers, this system is replaced by drip irrigation during the reproductive phase, which not only facilitates fertigation but also helps in uniform and timely watering of the plants. Since the growth of strawberry requires adequate nutrients, drip system is used to apply water-soluble fertilizers at an interval of 15–20 days, which facilitates to have better fruit size and higher nutrient use.

In the cultivation of strawberry, mulching is one of the most important operations, which needs to be done before the stage of flowering. Black plastic mulching is the most preferred one. It not only keeps the fruit clean but also prevents its rotting owing to soil contamination.

The process of mulching includes making of holes in the plastic sheets to keep the plants above the sheets with drip irrigation system being followed below the sheet. Plastic tunnels are made over the bed through wires in order to protect the plants from cold winds during winter nights. The plants come into bearing stage within 3–4 months of their plantation. Generally, one acre strawberry orchard yields 8–10 tonnes of fruits if proper cultural practices are followed. Since fruits are very delicate, they are placed in shallow plastic trays at the time of harvesting. Mulching is removed from the beds after the reproductive phase. The plants are allowed to produce runners on the beds and the surplus of this can be sold to generate additional income, apart from income from fruits.

Planting and Water Management

The land preparation for the plantation of strawberry requires repeated ploughing, which helps in making soil friable, remove weeds and stubbles. On the other hand, soil fumigation with a mixture of methyl bromide and chloropicrin helps in increasing root system, reduce fertilizer requirement and control the weeds. Since strawberry happens to be commercially propagated by runner plants, tissue culture is being widely used in order to have large-scale propagation of virus-free plants. In fact, in the cultivation of strawberry, the time of plantation is one of the most important factors. One can expect early establishment of runners and resultant early and higher yield of quality fruits if plantation of strawberry is undertaken in the mid-September to October through MIS instead of traditional method of plantation being carried out in north-India in the second fortnight of October, which restricts the availability of fruits to one and a half months only during March–April, resulting in lower profit margins too farmers. The longer period of availability of fruits from January to April can be expected if staggered plantation is undertaken from mid-September to mid-October at weekly intervals, which turns out to be a more profitable proposition to the farmers. Therefore, the ideal time of planting runners or crowns in hilly areas is September–October. Very early plantation leads the plants to lack vigour and result in low yield and lack of quality of fruits, whereas very late plantation leads the runners³ to develop in March with lack of quality of fruit, i.e., crops are light.

In the cultivation of strawberry, water management is the most crucial factor in semi-arid regions mainly owing to the fact that strawberry happens to be a low surface creeping herb having shallow root system, which grows well with MIS (drip + sprinklers). The MIS helps in supplying

Table 1: Time and Stages of Micro-irrigation System for Strawberry Cultivation

System	Phase of Growth	Irrigation Duration	Benefits
Micro-sprinkler system	Vegetative phase (Early growth)	Daily 2–3 hours during noon at interval of 1–2 hours	Early and easy plant establishment; Vigorous growth of plant; Creation of better micro-climate
Drip system	Reproductive phase (Flowering and fruiting)	Twice or thrice a week for 1–2 hours depending on weather conditions	Easy and timely irrigation; Facilitates fertigation; Uniform application of water and fertilizers
Micro-sprinkler	Runner development	Daily for 2–3 hours	Creation of better microclimate; Healthy runner development; Vigorous runners

Source: Singh and Asrey (2005).

precise water to the crop as per the stage of growth (Singh and Asrey, 2005). Micro-sprinkler system (69 lph), installed at a distance of 3 meters for uniform 2–3 hours daily application of water, is used during early stage of plantation for early vegetative growth. On the other hand, drip system is used by replacing micro-sprinkler system during the reproductive, i.e., flowering and fruiting phase, which provides timely irrigation as well as facilitates fertigation (Table 1).

The drippers (41 ph) are installed on two lines of laterals (16 mm) placed on each bed at a space of 50 cm. While expected usage of drip system happens to be 2–3 times a week as per the water requirement of the plants, the application of water soluble fertilizers (fertigation) is being carried out fortnightly in order to have proper growth and development of the plant. For better fertilizer use efficiency, water-soluble fertilizers like poly feed, multi-k etc. are used.

Interculture and Plant Protection Measures

The strawberry field is required to be kept weed-free during the first season by applying herbicides or plastic sheets, harrowing and ploughing etc. and intercultural practices need to be continued until the application of straw mulch.⁴ It is to be noted that the application of GA₃ sprayed for four days after flowering and spray of maleic hydrazide raise the yield of strawberry by 30–40 per cent, whereas application of morphactin improves the fruit size (as per National Horticulture Board report). Further, since prevailing low temperature during winter hampers proper growth of strawberry plants, there is need to install low tunnels (50 cm height) for transparent polyethylene film with the help of GI wire over the raised beds in order to protect plants from frost and cold winds (Singh and Asrey, 2005). The tunnels need to be opened during daytime with their closure being done during night in order to facilitate higher

soil-temperature, resulting in early flowering and higher yield of strawberry fruit.

It has been found that white grubs, cutworms and hairy caterpillars affect the strawberry plants. Therefore, endosulfan or malathian should be applied to counter their attacks. The main diseases affecting the strawberry are leaf spot and grey mould and to counter these diseases chemicals like carbendazim or thiophanate methyl need to be applied. In certain climatic conditions, a physiological disorder, known as Albinism, is found in strawberry, which leads to lack of fruit colour during ripening. Under such conditions, fruits remain either completely white or irregularly pink and sometimes swollen having acid taste and less-firm. These fruits are often damaged during harvesting and decay during storage. This kind of disorder adversely affects cultivation of this high-value fruit crop.

Harvesting and Yield

Although plants start fruiting after 3–4 months of planting, harvesting is done when half to three fourth of skin of strawberry develops colour, which is generally natural crimson colour. Picking is done on every second or third day usually in the morning hours depending on the weather conditions and harvested fruits need to be placed in shallow plastic trays due to their highly perishable nature, which get damaged when bulky containers are used. Further, fruits need to be kept in a shady place to avoid damage being done owing to excessive heat in the open field. Picking of fruits is done in small plastic punnets and placed in CFB boxes for marketing. Since fruits are highly perishable and delicate, refrigerated vans are used for transportation. By following adequate cultural practices, one hectare strawberry farm yields 15–20 tonnes of fruits. However, well-managed strawberry orchards can even produce 20–30 tonnes of fruits per hectare under standard climatic conditions.

Profitability Analysis

The farmers belonging to the twin hill towns of Panchgani and Mahabaleshwar generally have brisk business through the sales of the crimson-hued fruit during the period between December and March, where strawberries typically thrive when temperature is around 13–14 degree Celsius. The prices of strawberry range between Rs 80–120 per kg in mid-January to Rs 250 per kg in early December when the first crop comes in the market. The strawberry is being sold at Rs 60 per kg in the retail market towards the end of January and the bulk sales to processing firms stand at even as low as Rs 25 per kg. The strawberry cultivation in the hilly tracts of Western Maharashtra is a lucrative proposition due to significantly high element of profit involved in its cultivation. The economics involved in the cultivation of strawberry on a one-hectare farm is brought out in Table 2.

Table 2: Economics of Strawberry Cultivation on Per Hectare Basis Per Year

Sr. No.	Description of Materials	Approximate Cost/Income (Lakh/Ha)
Costs		
1.	Planting material (100,000 plants/Ha) @ Re 1/plant	1.00
2.	Micro-Irrigation System (MIS)	1.50
3.	Land preparation, planting and intercultural operations	0.20
4.	Plastic film for mulching and low tunnel	0.30
5.	Manure, fertilizers and pesticides	0.25
6.	Labour charges	0.50
7.	Packing materials and transportation	0.50
8.	Miscellaneous charges	0.25
	Total cost	4.50
Income		
1.	Sales of fruits (15 tonnes/Ha) @ Rs 50/kg	7.50
2.	Sales of runners (1 lakh @Re 1/plant)	1.00
	Total Income	8.50
	Net Profit	4.00

Source: Singh and Asrey (2005).

As per the estimates reported by Singh and Asrey (2005), the total annual expenditure on a one hectare strawberry farm without using discounting procedure works out to Rs 4.50 lakhs under standard package of practices, which include 33 per cent expenses on MIS, 21 per cent on planting material, about 16 per cent on land preparation,

planting and intercultural operations, plastic films for mulching and low tunnels, manure, fertilizers and pesticides, 21 per cent towards labour charges, packing materials and transportation, and about 3 per cent on other miscellaneous operations. The income is generated not only from the sales of fruits but also from runners. The gross return from a one hectare strawberry orchard works out to Rs 8.50 lakhs, which include returns to the tune of Rs 7.50 lakhs from the sale of fruits and Rs 1.00 lakh from the sale of runners, assuming yield levels of fruit at 15 tonnes/ha with sale price at Rs 50/kg and production of 1 lakh runners with a sale price of Re 1/plant. Thus, a farmer can expect a profit margin as much as Rs 4.00 lakhs from a one hectare strawberry orchard.

It is to be noted that high-quality commercial cultivation of strawberry crop by using high quality planting material and drip system of irrigation leads to three-pronged major benefits, viz. (a) synchronized growth, flowering and harvesting, (b) reduction in variation in off-type and non-fruit plants and (c) improved fruit quality. The time of plantation, water management and proper intercultural operations further improve yield levels of crop and thereby higher net returns to the farmers. As for profitability in the cultivation of strawberry, there are some

Table 3: Cost of Production and Profitability in Strawberry Cultivation

(Rs in Thousand)

Particulars	Year I	Year II	Year III
Income	320.00	320.00	320.00
Sales Value	320.00	320.00	320.00
Cost	135.30	135.10	135.10
a. Manure/ Fertilizers/ Chemicals	6.00	6.00	6.00
b. Direct Labour Cost	8.30	8.10	8.10
c. Other Cost	3.60	3.60	3.60
d. Harvesting and Transportation Cost	112.40	112.40	112.40
e. General Expenses	5.00	5.00	5.00
Gross Profit	184.70	184.90	184.90
Depreciation	19.20	19.20	19.20
Interest-term Loan	14.40	12.40	9.80
Profit Before and After Tax	151.10	153.30	155.90
Retained Profit	151.10	153.30	155.90
Net Cash Accrual	170.30	172.50	175.10

Source: Based on NHB estimates.

costs and return differences with respect to the estimates reported by the NHB and Singh and Asrey (2005). The estimates relating to costs and returns with respect to strawberry cultivation as provided by the NHB for all the three years are presented in Table 3.

Since strawberry is a short duration crop, one can expect yield within 3–4 months of its plantation in September-October. The returns from strawberry orchards are available up to three years and thereafter replantation needs to be done. With efficient management practices, the strawberry orchards yield 8 tonnes of fruits per acre, and an average sale rate of Rs 40,000 per tonne, one can expect an annual gross return to the tune of Rs 3.20 lakhs per acre. The major components of costs encompass expenses on planting material, land preparation, input applications (FYM, fertilizers, micro-nutrients limiting material, plant protection chemicals etc.), power and labour on application of inputs, inter-cultural and other farm operations. The fixed cost for a one acre strawberry orchard remains by and large same and hovers at around Rs 1.35 lakhs per annum from first year to the third year. Similarly, expenses towards depreciation also remain same at Rs 0.19 lakh per annum during all the three years. However, interest-term loan keep decreasing from first year to the third year, whereas profit before tax is found to increase during this period. The net retained profit from one acre strawberry farm works out to Rs 1.51 lakhs in the first year, Rs 1.53 lakhs in the second year and Rs 1.56 lakhs in the third year. These costs and return estimates with respect to strawberry cultivation are not too much different than the estimates in this respect reported by Singh and Asrey (2005). The returns with respect to two different estimates are very close mainly due to the fact that the NHB estimates are based on higher yield levels but lower valuation of the crop.

PHI Management and Strategy

Post-harvest infrastructure (PHI) management is another important aspect in the cultivation practices of strawberry. The major operations after harvesting include grading, storage, packing, transportation and marketing of produce. The grading of strawberry fruits is done based on their weight, size and colour. The storage operation includes storing of fruits in cold storage at about 32°C up to 10 days, and for the marketing of fruits at distant locations, they are pre-cooled at 4°C within two hours of harvesting and kept at the same

temperature until their final disposal in the domestic market. In the export market, they are shipped in refrigerated vans after pre-cooling. As for packing, it is done according to grades for long-distance markets. Although fruits of lower grades are packed in baskets, the high-quality produce needs to be packed in perforated cardboard cartoons with proper paper cuttings as material for cushioning. Generally, trucks or lorries are considered as the most convenient mode of transportation of produce due to their easy access to orchard as well as markets. The marketing of produce by majority of growers is done through trading agents at village level or commission agents at the market.

It is to be noted that the major sources of technology with respect to cultivation technique of strawberry, post-harvest management and domestic as well as offshore marketing are available with Dr YS Parmar University of Horticulture Forestry, Nauni, Solan, Himachal Pradesh and Directorate of Horticulture, Shivajinagar, Pune, Maharashtra. Further, since among various high value fruit crops strawberry has advantages of easy propagation, early maturity and high yield with 5–9 per cent sugar content, there is need to develop adequate infrastructure facilities for the transportation of produce to primary markets due to their highly perishable nature. Creation of proper infrastructure facilities will certainly augment production of this valued fruit crop. For value addition, processing facilities in the major producing states also need to be developed.

SWOT Analysis

The major strength of strawberry cultivation is the economic viability. An element of high profit can be expected from its cultivation if proper planting technique is used coupled with efficient water management, runner production, intercultural operations, harvesting and marketing of produce. Although major producing areas are confined to hills, strawberry can also be cultivated in plains in Maharashtra. The products of strawberry mainly encompass jams, jellies, syrups and squash and are also used as flavour in various other products like ice cream, biscuits, custard powder etc. As a result, income from the fruits and fruit products is consistent throughout the year. Since there are numerous strawberry-based products, large number of manufacturing and processing units for the same have come up in India in recent times. In fact, strawberries are high in nutrients and contribute valuable phytonutrients to a healthy diet and could be served fresh or processed

Table 4: Important Features of Strawberry Cultivation

Features	Status	Description
Strengths	Economically viable and profitable	Product used in jams, jellies, syrups, squash and as flavour in various other products. Consistent income from fruit and fruit products throughout the year. Rich source of vitamin C. Exported to Western countries in frozen form.
Weaknesses	Short shelf life and highly perishable	Proper climatic conditions needed for cultivation. Major weaknesses encompass lack of money management, plan for the future and realistic view in processing units with respect to products.
Opportunities	Development of new varieties with high consumer acceptance	More efficient breeding processes. Harvesting and marketing of fruits during most part of the year through wide adaptation of strawberry plants with a normal yield of 20–25 tonnes per hectare and 50 tonnes/hectare under ideal conditions. Off-season availability of crop through preservation techniques.
Threats	Strawberry Allergy—anaphylactoid may sometime cause breathing problems to consumers	Mildew, leaf spot and leaf blight—the most troublesome fungoid attacks. Fungal attack on leaf of strawberry plants. Pests of strawberry.

into a variety of forms such as freeze-dried, sugar-infused and drum-dried (Sharma and Jain, 2006). Although it is a soft and highly perishable fruit, it has very wide urban consuming population due to its rich source of vitamin. The highly perishable nature of strawberry makes its export difficult and therefore shipped in frozen condition. The wide adaptation of the strawberry plant permit its harvesting and marketing during most part of the year.

Short duration of shelf life happens to be one of the weaknesses of strawberry as they are highly perishable fruits. However, an increase in shelf life can be expected if packing is done using sheets of polypropylene. Further, since cultivation of fruits requires proper climatic conditions, they are not cultivated in all the regions of the country. The strawberry suffer from three major weaknesses, viz. the lack of money management, the lack of plan for the future production and the lack of realistic view in terms of their processing in manufacturing units for the production of products (Table 4).

Since strawberries are seasonal in nature, efforts are made to develop new varieties of strawberries with high consumer acceptance and more efficient breeding processes. Although a yield of 20–25 tonnes per hectare is reasonable, one can even expect yield up to 50 tonnes per hectare under ideal conditions. Generally, strawberry fruits are perishable and available only during 4–5 months

in a year. Efforts, therefore, need to be made to make them available even during off-season through better preservation techniques. Strawberries also have significant *opportunities* to generate income and employment throughout the year by processing them into products.

Strawberries sometime pose *threat* to consumers due to allergy—anaphylactoid, which may cause breathing problems in response to their consumption by specific consumers. The other threats include diseases⁵ in strawberry like mildew, leaf spot and leaf blight, which are most troublesome fungoid attacks affecting the strawberry cultivation. Another threat to strawberry cultivation is the fungal attack on the leaf of the plants known as *Sphaerella fragariae*, and symptoms of this attack include white spots on the leaves. The important pests of strawberry are red spider mites and cutworms.

Conclusion

In conclusion, a few major observations emerge with respect to the cultivation of strawberry. Although strawberry, a major fruit of temperate region and also grown profitably well in the sub-tropical regions, has several important characteristics, viz. rich source of vitamins and minerals, fabulous flavour and tantalizing aroma, important dietary components, significant levels of ellagic acid, etc., it is yet to attract significant consumer demand in India as

only 8 per cent of the households consume strawberry either fresh or in processed form or as flavour as compared to 94 per cent of the households in California. The restricted production of strawberry is mainly due to its dependence on specific climatic conditions, soil type and technique of production. The extreme climatic conditions like cold wind during winter and high temperature during summer hamper the production of fruits and runners. However, extreme climatic conditions can be countered by plasticultural techniques like mulching, use of low plastic tunnels and MISs. The use of plasticultural techniques in strawberry can accentuate its commercial cultivation for higher profitability in semi-arid regions. Though strawberry requires significantly high cost of cultivation, the returns are equally high and one can expect as much as Rs 4.00 lakhs of net profit margin from one hectare of strawberry orchards under suitable climate and well-managed efficient cultivation practices. However, adverse climatic conditions and some emerging threats to its cultivation, viz. threats caused by diseases like mildew, leaf spot, leaf blight and other fungal attacks on leaf of strawberry plants—white spots on the leaves, and important pests of strawberry such as spider mites and cutworms etc. might adversely affect the cultivation of this high-value crop. Further, since strawberry is relatively shallow-rooted, it has susceptibility to conditions of draught. One of the major weaknesses of strawberry is noticed to be shorter shelf life coupled with higher rate of perishability. Lack of money management, lack of plan for the future growth and lack of realistic view followed by processing units with respect to the production of products are some other weaknesses encountered by the farmers in the cultivation of strawberry. The findings of this investigation clearly underscore the fact that by using plasticultural techniques like micro-irrigation, plastic mulching and tunnel, plastic punnets as packing material for proper marketing etc., there is significant scope to revolutionize high-density strawberry cultivation.

Endnotes

1. Mahabaleshwar, located 120 km from Pune and 250 km from Mumbai, was the perfect summer getaway for the Bombay province during the British Raj. A good-looking red fruit called strawberry took Mahabaleshwar by storm about 90 years ago. The farmers now grow this fruit crop every year. It was way back in 1920s when the

British first introduced strawberries in India. It was then grown in the kitchen gardens and called Australian Strawberry. Though strawberry cultivation continued by farmers of this area from the 1960s onwards, the strawberry revolution came into being in 1992 when the Maharashtra chief minister, Shri Sharad Pawar, ordered 25,000 saplings of the plant from California and consequently strawberry cultivation picked up from 600 acres then to 2,000 acres now in Mahabaleshwar alone under its cultivation.

2. The important varieties of strawberry cultivated in India encompass Chandler, Tioga, Torrey, Selva, Belrubi, Fern and Pajaro. Other varieties include Premier, Red Cost, Local Jeolikot, Dilpasand, Bangalore, Florida 90, Katrin Sweet, Pusa Early Dwarf and Blackmore.
3. Runners are uprooted from the Nursery, made into bundles and planted into the field, which can be kept in cold storage before transplanting. Frequent irrigation of soil is necessary to reduce water stress on the leaf. In fact, defoliation not only suppresses the growth of the plant but also delays fruiting and reduces yield as well as quality of fruits.
4. The mulch keeps the fruits free from soil, reduces decay of fruits, conserves soil moisture, lowers soil temperature in hot weather, protects flowers from frost in mild climates and protects plants from freezing injury in cold climates. Several kinds of mulches are used, but the commonest one is straw mulch. Though several kinds of mulches are used, the preferred one happens to be straw mulch. Sometimes black alkaline mulch is used to cover the soil, which saves irrigation water, prevents the growth of weeds and keep the soil temperature high.
5. The most common diseases of strawberry are red stele, caused by the fungus *Phytophthora fragariae* and black root rot. The red stele can be countered by growing resistant varieties like stelemaster. The other disease can be taken care of by rotating strawberry with other crops like legume vegetables (beans, peas, etc.). Some virus diseases like yellow edge, crinkle and dwarf also affect strawberry.

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*The strawberry grows underneath the nettle
And wholesome berries thrive and ripen best
Neighbour'd by fruit of baser quality*

—William Shakespeare, Henry V

Inclusive Rural Development through Green Jobs: The NREGA Example

SAMIK SHOME

The paper presents a decision-making model to show how National Rural Employment Guarantee Act (NREGA) not only addresses the most significant social and economic ills such as poverty, unemployment, rural-urban migration, etc. in India but also fits well into the green jobs initiative of UNEP as majority of its work helps in eco-restoration and regeneration of natural resource base for sustainable rural livelihood, though it is not one of the stated objectives of this programme. To illustrate the application of the model, the study assesses the environmental dimensions of the existing projects generated under NREGA in one particular district of Karnataka as case study. The result of this study clearly indicates that NREGA, by providing employment and income to rural communities, has helped to address the issue of inclusive rural development through multiple environmental services and reduced vulnerability, apart from reducing rural poverty, rural-urban migration and child labour, among others.

Introduction

There is growing recognition worldwide that the modern economies are built on an unsustainable foundation which in turn results in a severe environmental crisis for human civilization (Attfield, 2006; Yang, 2006; Hongying and Wei, 2011). Activities ranging from agriculture and mining to manufacturing and services rely heavily on fossil fuels and generate copious amounts of pollution and waste which undermine the critical eco-systems, eco-services, and life-support. Air and water pollution, hazardous wastes, deforestation and desertification are among the key environmental challenges globally in recent years (ADB, 2009; Kemeny, 2009; Seagle, 2010; De Gobbi, 2011). On the other hand, there are longstanding social and economic problems like, poverty, unemployment and rural-urban migration, among others which are increasingly compounding and getting aggravated by the spectre of underdevelopment. Therefore, the core challenge of UNEP¹ is directed towards solving the most significant social and economic ills in the world through a substantial reduction in environmental risks and ecological scarcities (UNEP, 2011). In other words, growth in income and employment should be driven by investments that reduce carbon emissions and pollution, increase energy and resource efficiency, and prevent the loss of biodiversity and ecosystem services. These investments need to be catalyzed and supported by targeted public expenditures, policy reforms and regulating changes. Most of the economies are working toward its full implementation. However, there exists a long and difficult journey ahead because the nature of issues is complex and enormous.

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¹The United Nations Environment Programme (UNEP), established in 1972, coordinates United Nation's environmental activities in implementing environmentally sound policies and practices. Its activities cover a wide range of issues regarding the atmosphere, marine and terrestrial ecosystems, environmental governance and green economy.

In this backdrop, the paper review show National Rural Employment Guarantee Act² (NREGA) imbibean innovative policy and addresses issue of inclusive rural development³ in India, by denting social and economic ills, through green jobs or green employment, interchangeably used in literature. The paper presents an extended version of a decision-making model as proposed by Shome (2011) to show how NREGA not only addresses the issues of poverty, unemployment and accelerating pace of rural-urban migration in India, but also fits well into the Green Jobs initiative of UNEP as majority of its work contributes to environmental sustainability. To substantiate the application of the model, the study assesses the environmental dimensions of the existing jobs created under NREGA in one particular district of Karnataka as a case study.

The organization of the paper is as follows. A brief idea about how green jobs initiative can be linked to NREGA is given in Section 2. Section 3 deals with the process of decision-making and it is divided into two parts. The first part provides a summary of the decision-

making model as proposed by Shome (2011). In the second part, the viability of the model is examined through NREGA. Section 4 discusses about the primary survey conducted in Karnataka. The findings and analysis of the survey is illustrated in Section 5, followed by conclusion in Section 6.

Green Jobs Initiative and NREGA

The Green Jobs Initiative was formulated in 2007. It is a joint initiative of the United Nations Environment Programme (UNEP), the International Labour Organisation⁴ (ILO), the International Organisation of Employers⁵(IOE) and the International Trade Union Confederation⁶ (ITUC). The main idea behind this initiative was to mobilize governments, employers and workers to engage in a dialogue on coherent policies and effective programmes, leading to a green economy⁷ with green jobs and decent work⁸ for all.

Green jobs are defined as the direct employment created in various economic sectors and activities, which reduce adverse environmental impact and ultimately bring it down to a sustainable level. Green jobs are also decent

²National Rural Employment Guarantee Act, 2005 (NREGA) is a guaranteed wage employment programme in India that enhances the livelihood security of marginalized households in rural areas. It was enacted on August 25, 2005 and is renamed as the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) on October 2, 2009. Though the primary objective of NREGA is poverty alleviation through generation of new employment opportunities for rural unskilled workers, but as an auxiliary objective, it also helps in eco-restoration and regeneration of natural resource base for sustainable rural livelihood. Therefore, NREGA directly touches the lives of millions of unskilled poor, promotes inclusive growth, and also contributes to the restoration and maintenance of ecological infrastructure. The programme is implemented by the Ministry of Rural Development (MORD) in all 625 rural districts of the country, with women representing roughly half the employed workforce. The emphasis is placed on labour-intensive work, prohibiting the use of contractors and machinery. Total number of households and persons who got themselves registered by 2010–2011 at the national level are 11.62 crore and 25.38 crore respectively. Total number of job cards issued by 2010–2011 at the national level is 11.53 crore (as on February 1, 2011). These figures definitely show the vastness of the programme and also the issue of mass public involvement.

³Inclusive rural development is a more specific concept than the concept of rural development. In broad terms, inclusive rural development is about improving the quality of life of all members of rural society. More specifically, inclusive rural development covers three different but interrelated dimensions. The first is the economic dimension that encompasses providing both capacity and opportunities for the poor and low-income rural households, in particular, to benefit from the economic growth process in such a way that their average incomes grow at a higher rate than the growth of average incomes in the sector as a whole. The economic dimension also includes measures to reduce intra- and inter-sectoral income inequalities to reasonable levels. Second is the social dimension of supporting social development of poor and low-income households and disadvantaged groups, eliminating inequalities in social indicators, promoting gender equality and women's empowerment, and providing social safety nets for vulnerable groups. Third is the environmental dimension of improving the quality of life through improvement in health and nutrition, education and environmentally safe living condition.

⁴The International Labour Organization (ILO), with its headquarter in Geneva (Switzerland), is a specialized agency of the United Nations that deals with labour issues pertaining to international labour standards.

⁵Since its creation in 1920, the International Organisation of Employers (IOE) has been recognised as the only organisation at the international level that represents the interests of business in the labour and social policy fields. Till March 2011, it consists of 150 national employer organisations from 143 countries all over the world.

⁶The International Trade Union Confederation (ITUC) is the world's largest trade union federation. It was formed on November 1, 2006 out of the merger of the International Confederation of Free Trade Unions (ICFTU) and the World Confederation of Labour (WCL).

⁷UNEP defines a green economy as one that results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities. In its simplest expression, a green economy can be thought of as one which is low carbon, resource efficient and socially inclusive (UNEP, 2011).

⁸Decent Work involves opportunities for work that is productive and delivers a fair income, security in the workplace and social protection for families, better prospects for personal development and social integration. It also aims at freedom for people to express their concerns, organize and participate in the decisions that affect their lives and equality of opportunity and treatment for all men and women. (Accessed from <http://www.ilo.org/global/topics/decent-work/lang-en/index.htm> on October 30, 2011).

jobs because it contributes to environmental sustainability. These jobs can be found in all economic sectors and helps to protect the ecosystems and biodiversity. It reduces the need for energy and natural resources, such as, materials and water. It also de-carbonise the economy and minimise all forms of waste and pollution. Green jobs are, therefore, directly related to climate change⁹ mitigation and adaptation activities and also to other environmental issues, such as, natural risk management, biodiversity conservation, prevention of desertification, pollution control and prevention, etc. (Renner et al., 2008). Again, climate change and climate variability have a major socio-economic impact in India because it rely largely on environment-based income and livelihood.¹⁰ Therefore, responses to climate change needs to be mainstreamed into national-level, state-level and local development strategies of India.

On the other hand, the jobs created under the employment intensive environmentally sustainable public programme like, NREGA, would in principle fall under the definition of green jobs. Because works executed under the Act fits well into the green jobs initiative as majority of its work contributes to development of natural resources. The focus on Natural Resource Management is already built into the programme, through the high priority on work related to rural connectivity, land development, water conservation and harvesting and microirrigation. The new ILO initiative on green jobs would further support the national effort towards promoting sustainable developmental practices and livelihood opportunities in natural resource

management, while leading to a more apposite environment at the local level through the NREGA (Kumar et al., 2010).

The next section initially discusses about the science of decision-making, followed by an illustration of the proposed model and its applicability in NREGA.

The Decision-Making Process

The process of decision-making has been well studied in the fields of management and social sciences. Decision-making simply involves making choices that attempt to address problems. Simon (1994) and subsequent scholars have further developed the science of decision-making as it normally occurs in organizational, social and public policy contexts.¹¹ A special form of decision-making called 'strategic decision-making' involves finding ways and means of reaching the goals of the organization and responding to the environment. Given the inherent nature of problems addressed, strategy-making is more complex and involves higher analytical and reasoning skills.

Innovative strategy-making involves the use of novel and creative methods to address organizational challenges. Such models have recently become well known as the complexity and nature of change experienced by organizations has accelerated. One such decision-making model proposed by Shome (2011) is briefly explained below.

The Model

A general model of problem-solving is built on the rationale of decision-making (Figure 1). For the sake of simplicity,

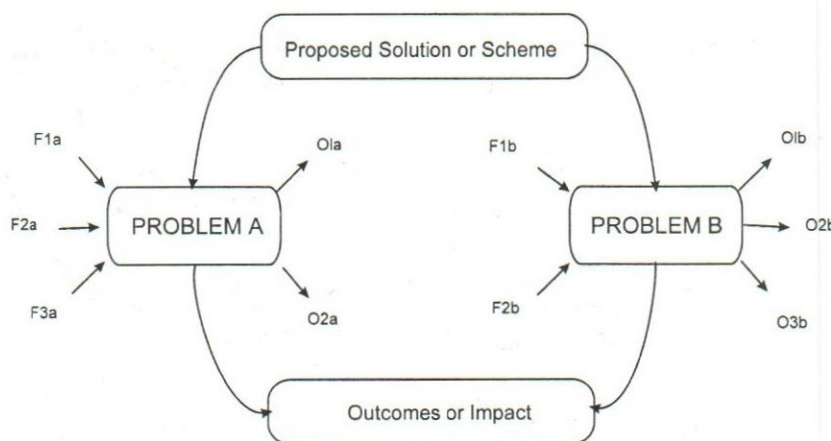


Figure 1

⁹Climate change is a significant and lasting change in the statistical distribution of weather patterns over periods ranging from decades to millions of years. It may be a change in average weather conditions or the distribution of events around that average. Climate change may be limited to a specific region or may occur across the whole Earth.

¹⁰In India, still about 55 per cent of the people depend on agriculture and mining activities for their livelihood, and both agriculture and mining are environment-based employment.

two set of problems have been considered here: Problem A and Problem B. The two problems are individually analyzed. This yields the antecedent factors. These factors are identified for each problem; i.e., F1, F2, F3, etc. The subsequent outcomes are also identified; i.e., O1, O2, O3, etc. The factors and outcomes are appropriately connected with the relevant problems; i.e., F1a and O1a for problem A and so on. Traditionally, countries pass legislation aimed at addressing each problem separately with varying results.¹² However, this proposed model prescribes tackling the two problems simultaneously.

In order to solve the two problems, each problem is analyzed separately. The positive and negative characteristics of each problem are identified and assessed. Now the proposed solutions are taken up in such a way that the positive characteristics of one problem balance themselves off against the negative characteristics of another. The same approach can be extended to three or more problems—Problem A, Problem B, and Problem C. The analytical steps remain the same. However, now the characteristics of each problem are pitted against each other. A creative scheme or solution then needs to be

identified that balances off the characteristics of one problem against another. Now, to show how this model will actually work in reality, a specific example of NREGA is taken up in the next part.

Application of the Model in NREGA

The application of the model is illustrated by reviewing an innovative programme in Indian context. NREGA was a creative programme implemented by the Indian Government in 2006. Here, the model is extended to three problems. The three major problems which the rural India is facing for decades are poverty, environmental degradation and out migration to urban areas (Figure 2). Unemployment is considered as a basic factor underlying the three problems. Now, the antecedents and consequences for each of the above-mentioned problems are discussed.

Poverty

The antecedents to poverty are many but some are presented here, among others. There are certain districts in India where conditions are not favourable for agriculture

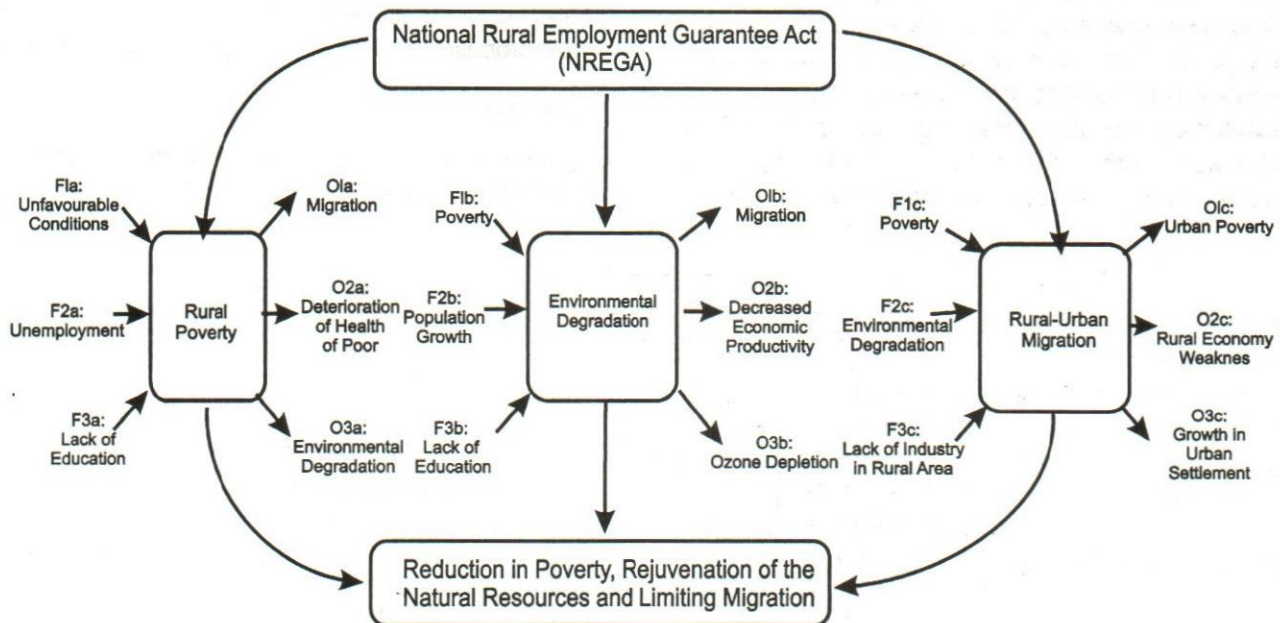


Figure 2: Application of the model in NREGA Context

¹¹ For more details, please see Allison and Zelikow (1999), Cohen et al. (1972), George (1972), Janis (1982), March and Simon (1958), and Mintzberg et al. (1976).

¹² The traditional model of decision-making provides a simplistic solution to any problem by enacting legislation. For example, in India, government programme, such as, Jawahar Gram Samridhi Yojana (JGSY), aimed at reducing poverty or alleviating poverty have had less than satisfactory results. Simplistic and populist measures ignore associated and consequent factor dynamics that diminish the overall effectiveness of such schemes.

and poverty has been endemic in these areas (F1a). Chronic unemployment has been a cause of deep poverty as the poor do not have any income (F2a). Similarly, it is generally believed that lack of education contributes to poverty (F3a).

The consequences of poverty are also many, however, a few major consequences are listed here. Poverty is responsible for migration to cities (O1a) and in the progressive deterioration in the health of the poor further contributing to their poor conditions (O2a). Again, poverty is considered as a great influence of environmental degradation¹³ (O3a). There could be other factors that are antecedent or consequent to poverty, such as, child labour. The next problem considered here is the issue of environmental degradation.

Environmental Degradation

As discussed earlier, poverty is an antecedent to ecological crisis (F1b). Similarly, it is normally believed that population growth (F2b) contributes to depletion of natural resources. Rapid population growth plays an important role in environmental problems of India, from deforestation to land degradation, air and water pollution to the spread of disease (Nagdeve, 2002). The lack of education (F3b) also prohibits them from practicing environmentally sustainable agriculture, protect natural resources against degradation or rehabilitate degraded resources.

The effects of environmental degradation are also many. However, a few of them are discussed here. Environmental factors have an impact on global migration flows, as people have historically left places with harsh or deteriorating conditions (O1b). The scale of such flows is expected to rise as a result of accelerated climate change, with unprecedented impacts on lives and livelihoods which in turn has a negative effect on the economic productivity (O2b). It is well established by now that the occurrence of environmental degradation through human processes has resulted in ozone layer depletion, global warming and the loss of biodiversity¹⁴ (O3b). The third major problem considered in Indian context, which is already high on the agenda of policy makers and urban planners, is rural-urban migration.

Urban Migration

The selected antecedents are described next. Migration to urban centres is caused by poverty (F1c). Similarly, decline in environment quality has a positive significant impact on the migration flows across nations (F2c) (Afifi and Warner, 2008). Lack of adequate investment in rural areas by the government, and other public or private sector companies has been a cause for migration (F3c).

Rapid and uncontrolled migration to urban centres has led to the growth of urban settlements (O3c), the urbanization of poverty (O1c) (Harris and Todaro, 1970), and the consequent weakening of rural economy (O2c). Now, to have an impact on all the three above-mentioned problems, the Indian government came up with NREGA.

Through its design and implementation, NREGA has linked three of the most critical problems of recent times, namely, extreme poverty, migration and environmental degradation. By providing employment opportunities within the rural areas itself, all these problems are simultaneously attacked. Through employment, rural poverty is reduced, and this leads to a reduction in rural-urban migration which in turn curbs urbanization of poverty. Again, the jobs which are provided to the rural households when they are engaged in works under NREGA are directly associated to the environmental services. For example, water conservation, land development and afforestation through NREGA has provided local services, such as, ground-water recharge, enhanced soil fertility and increased biomass. This, in turn, generates global benefits, such as, adaptation and mitigation of climate change and biodiversity conservation. Therefore, the works have significantly changed the environment through rejuvenation of the natural resource base.

So, what has NREGA done? In simple words, it has directly addressed the issues of rural livelihood security by mitigating both rural poverty and rural-urban migration and also improving the quality of environment simultaneously. The focus on water conservation and harvesting, drought-proofing, afforestation, tree plantation, minor irrigation works, renovation of traditional water bodies, desilting of tanks, land development, flood control and protection, drainage in water-logged areas and rural connectivity, has not only

¹³ In many regions of the world, regional overgrazing has resulted in destruction of grazing lands, forest and soil. Air and water have been degraded. The carrying capacity of the natural environment has been reduced. As the people become poorer, they destroy the resources faster. They tend to overuse the natural resources because they do not have anything to eat or any means of getting money except through the natural resources, and therefore, they start to depend more on natural resources (Nangammbi, 2007).

¹⁴ For more details, please see WHO (1992, 1997), UNDP (1998, 2000), Luthra (1999) and Mallik (2000).

improved the local environmental services, but they also have the potential to yield co-benefits of adaptation and mitigation to global climate change. This is done through rejuvenation of the livelihood base and thereby strengthening resilience of rural communities, and also by enhancing carbon sequestration in agricultural soils, pasture lands and woody perennials¹⁵ (Reddy, 2011).

Now, to have an essence of the impact of NREGA on the aforesaid social, economic and environmental issues at the grassroots level, a small field survey was conducted in Bangalore district in the state of Karnataka in India which is discussed in the next section.

The Survey

A primary survey was conducted in Anekal block in Bangalore district in the Indian state of Karnataka. The block was selected for the study because of its geographical location. It is in close proximity to the industrial town of Hosur¹⁶ across the border on the one side and the Jigani Industrial Area¹⁷ and the Electronic City¹⁸ in Bangalore on the other side. The data was collected in October 2011¹⁹ from two hundred households who worked in different NREGA projects in four panchayats of Anekal block. In each of these panchayats, five villages were randomly selected; and in each village, ten households who were beneficiaries of NREGA were again randomly selected for the study. Official records from each panchayat were analyzed and informal discussions with the elected representatives and officials involved in NREGA

were conducted. Conclusions have been drawn based on observations, discussions with representatives and officials, and personal interviews of the beneficiaries.

Profile of Anekal Block

Anekal, a block in Bangalore district, is located between 12°42' N and 77°42' E latitudes and 12.7°N / 12.7°N and 77.7°E longitudes. It has an average elevation of 915 meters (3,001 feet). It lies in the southern part of the Bangalore metropolitan area which is around 40 km. from main Bangalore city. Anekal is famous for the cereal *Ragi* which is being grown in the area and is also the staple food supporting the agricultural fraternity. Anekal is also called as *Ragiya Kanaja* which means Ragi Depot of Karnataka state.

As of 2001 India census, Anekal block had a population of 299,428 individuals. Males constitute 53 per cent of the population and females 47 per cent. It has an average literacy rate of 70.4 per cent which is higher than the national average of 59.5 per cent. The male literacy rate is 79 per cent and for the female it is 60.5 per cent. The sex ratio in this block is 883. The block has work participation rate²⁰ (WPR) of 43.6 per cent with male WPR at 61.9 per cent, and female WPR at 23 per cent.

Status of NREGA in Anekal Block

The total number of rural households (HHs) in Anekal block, as per 2001 census, was 67,450 and average household

¹⁵ In this connection, the review of some of the success stories of NREGA will be worth mentioning. Water conservation accounts for about half of the total projects supported under NREGA, with 850,000 water conservation works funded and completed from 2006 to 2008. For example, in the District of Jalaun (Uttar Pradesh), NREGA provided training and jobs for villagers to develop solutions to their heavily silted water harvesting infrastructure, alleviating their water shortage. In 2007–2008, more than 3,000 new soak pits, together with hand pumps were constructed. This has helped to conserve an estimated 5 million litres of water. Similarly, in Andhra Pradesh, NREGA supported the restoration of a network of water storage tanks dating back over 500 years in the principal arid zone. Repairs to the gates of the tanks, as well as works to desilt the channels feeding them, has restored to full capacity. This has not only boost crop and livestock production, but has also contributed to groundwater replenishment (Sharma, 2009).

¹⁶ Hosur is a town and a municipality in Krishnagiri district in the Indian state of Tamil Nadu. It is a block of Krishnagiri district. It is located about 40 km. south-east of Bangalore city. Hosur is an industrial hub for several areas such as abrasives, automobiles, welding and wire mesh industries. TVS Motor Company, Ashok Leyland, Hindustan Motors, Titan Industries, AV Tech, Hindustan Unilever, Premier Mills, Luk India, Granite companies like ARO, Madhucon, Pelican, Ankit, Gem, are among several companies which have their manufacturing units in Hosur.

¹⁷ Jigani is located in Anekal block in South Bangalore and is situated at a distance of 20 km from Bangalore city. It has a well established industrial area and also very near to Electronics City in Bangalore. Tata Advanced Materials Ltd., Delphi Automotive Systems Pvt. Ltd., Otis Elevator Company (India) Ltd., HCL Technologies Ltd., Crompton Greaves Ltd., Kirloskar Toyoda Textile Machinery Pvt. Ltd. and Syngene International Ltd. are among several companies which have their manufacturing units in Jigani Industrial Area.

¹⁸ Electronics City is one of India's largest electronic industrial park, spread over 332 acres (1.3 sq. Km.) in Konappana Agrahara and Doddathogur villages, just outside Bangalore city. It has three phases—Phase I, Phase II and Phase III. Electronics City was established by Keonics, Karnataka Electronics, a pioneer in information technology infrastructure development. Electronics City has a world class infrastructure which housed major IT/ITES companies like, Wipro, Tata Consultancy Services (TCS), Hewlett-Packard, Infosys, HCL Technologies, Patni Computer Systems, CGI, Siemens, Yokogawa Electric etc.

¹⁹ The study considers the NREGA projects till October 2011.

²⁰ According to the Census of India (2001) definition, work participation rate (WPR) is the proportion of total workers (main + marginal) to total population. In other words, it is the workers-population ratio.

size was 4.4. There are 27,360 job card holders in Anekal block as on October 2011. However, out of them only 16,957 job card holders also have bank accounts. Interesting, till the end of October 2011, only 184 HHs have demanded jobs and 6054 person-days were generated in the block in which the share of women was 42.9 per cent. Cumulative number of households that completed 100 days of employment during the running financial year as of now is only one.²¹ Therefore, it can be inferred that Anekal is yet to achieve significant milestones as far as participation in NREGA is concerned. The outreach of NREGA is limited to almost 40 per cent of the total rural households in the block. One major reason for less involvement of the rural households in this block is its close proximity to the nearby towns which gives better casual employment opportunities (in terms of wages) to the workers. However, this study was more focused on how NREGA addresses the issues of poverty, rural-urban migration and sustainable development by enumerating nature of projects undertaken under each one of the panchayats and villages. Therefore, in the next section, a summary of findings from an analysis of the information thrown up by the survey are highlighted.

Findings and Analysis

The nature of projects undertaken in different panchayats in the study area is almost similar, with some minor variations. However, there are some differences in the number of projects undertaken in different villages in each of the panchayats. The total number of projects undertaken in the panchayats and their respective villages under study in all the phases of NREGA implementation is presented in Table 1.

There were in total 397 projects taken up under NREGA in the four panchayats selected for this study. Panchayat-wise analysis reveals that Karpuru Panchayat (187) has undertaken the highest number of projects followed by Samanduru (96), Marasuru (89) and Byagadadenahalli (25).

Project-wise analysis shows that rural connectivity, i.e. developing roadways within the village, was the most frequent venture that has been carried out. It was also observed that one-third of all the projects (i.e., 134 out of 397) undertaken were related to rural connectivity followed

by micro irrigation (43), drought proofing (29) and land development (23).

The panchayat-wise analysis reveals that in Byagadadenahalli panchayat, out of 25 projects undertaken, there were 15 projects based on rural connectivity followed by six projects on land development. Samanduru panchayat also confirms the same pattern. Out of total number of 96 projects undertaken in the programme, 54 projects were anchored in rural connectivity followed by 10 each in land development and renovation of traditional water bodies. Similarly, Marasuru panchayat had 29 rural connectivity projects followed by 25 projects based on drought proofing. However, in case of Karpuru panchayat, other activities had 114 projects followed by rural connectivity (36) and minor irrigation (26).

The village-wise analysis reveals that among all the 20 villages considered for study, Bidaragere of Karpuru panchayat had the highest number of projects (56) undertaken, followed by Haradenahalli (49), Karpuru (42), both in Karpuru panchayat, and Samanduru (32) of Samanduru panchayat. Surprisingly, Avadadenahalli and Kaval Hosahalli villages of Byagadadenahalli panchayat had undertaken only one project each in the entire period. A major reason for the low performance of these two villages that has been observed during the survey was the lack of interest among local functionaries.

There are a number of possible reasons for the observed differences between the panchayats and villages with respect to the projects taken under NREGA, including: institutional constraints (the implementing agency, panchayats versus block-level bureaucracy), ability to chart out a functional strategy for implementation, societal constraints, and, practical difficulties, among others.

The discussions with the workers at site and perusal of the data and documents reveal some important tendencies:

- (a) In terms of rural-urban migration, there has been a substantial decline in the distress migration. However, a significant number of unskilled workers still migrate to nearby towns for casual work (mainly, construction) because the wage rate is almost twice than that of the wage paid under NREGA.²²

²¹ Retrieved on October 31, 2011 from <http://www.nrega.nic.in>.

²² Till September 2011, the wage rate paid under NREGA was Rs 132 per day if a person works from 8 am to 5 pm. On the other hand, if the person goes for construction work for same hours in Hosur or Bangalore city, the wage rate paid is approximately somewhere between Rs 230 to Rs 250.

Table 1: Number of Projects* Taken in MNREGA by Selected Panchayat till October 2011

Bygadadenahalli Panchayat						
Projects/Villages	Chikkahagade	Kempavaderahalli	Avadadenahalli	Bygadadenahalli	Kaval Hosahalli	Total
Rural Connectivity	4	9	—	1	1	15
Drought Proofing	—	—	1	—	—	1
Land Development	1	3	—	2	—	6
RTWB ^b	—	2	—	—	—	2
Any Other Activity	—	1	—	—	—	1
Total Projects	5	15	1	3	1	25
Samanduru Panchayat						
Projects/Villages	Hompalaghatta	Samandura	Guddanahalli	Kuvempunagara	Maranayakanahalli	Total
Rural Connectivity	2	18	4	3	27	54
WCH ^c	3	—	1	—	4	8
Drought Proofing	—	—	1	—	—	1
Micro Irrigation	—	5	—	—	1	6
Land Development	—	6	—	2	2	10
RTWB	4	—	2	2	2	10
Any Other Activity	2	3	—	2	—	7
Total Projects	11	32	8	9	36	96
Karpuru Panchayat						
Projects/Villages	Arayantigepura	Karpuru	Haradenahalli	Bidaragere	Bestamanahalli	Total
Rural Connectivity	8	14	6	8	—	36
WCH ^c	—	2	—	—	—	2
Drought Proofing	—	—	—	—	2	2
Micro Irrigation	—	14	—	10	2	26
Land Development	—	—	2	—	2	3
RTWB	—	1	2	—	—	3
Any Other Activity	22	11	39	38	4	114
Total Projects	30	42	49	56	10	187
Marasuru Panchayat						
Projects/Villages	M. Madiwala	Marasuru	Bandapura	Shettihalli	Adesonnatti	Total
Rural Connectivity	2	13	3	9	2	29
Drought Proofing	6	5	6	8	—	25
Micro Irrigation	2	—	7	—	2	11
Land Development	2	—	—	—	1	3
RTWB	—	—	1	—	2	3
Any Other Activity	9	—	7	2	—	18
Total Projects	21	18	24	19	7	89

Source: MNREGA Section of Gram Panchayat and Block Office.

*Out of nine types projects sanctioned under MNREGA, only those projects which are taken by the respective panchayats are presented here.

^bRTWB implies Renovation of traditional water bodies.

^cWCH implies Water conservation/harvesting.

- (b) Since the projects under NREGA are not implemented well in Byagadadenahalli Panchayat, and therefore, work is not distributed properly among the villagers. As a result, the wages are not paid on time and so the workers have no incentive to stop migrating.
- (c) The income from NREGA made very significant contribution to children's well-being, such as, reducing hunger, improved health and better school attendance. For example, the survey shows that around 73 per cent of the sample workers recognized that it has actually helped them to avoid hunger, while it helped to cope with illness for 52 per cent. Around 45 per cent of the workers mentioned that the programme has helped in reduction of child labour and it made possible in sending children to school.
- (d) NREGA has also improved assets to almost all villages. Significant proportion of respondents indicated that it improved employment, connectivity, drinking water, reduction in soil erosion, etc.

Now, looking towards the environmental aspect of NREGA, the projects in Anekal block were largely concentrated on rural connectivity, micro irrigation, drought proofing, land development and water conservation and harvesting through renovation of traditional water bodies. As these works are generally termed as environmental sustainability work, therefore, it can be inferred that majority of the works undertaken under NREGA in this block would qualify as environment and eco-friendly. However, drought proofing, micro irrigation and water harvesting structures appear to be more environmentally friendly than road construction as these works have the twin advantage of strengthening both land and water as a natural resource, as well as bringing efficiency in the use of water. Therefore, the study has observed that the jobs created under NREGA in Anekal block should be considered green jobs, as these jobs are decent jobs and contribute to inclusive rural development through environmental sustainability. The employment generated to improve rural connectivity under NREGA would also be considered green employment. They should also be decent, under the assumption that the labour intensive way of constructing roads is carbon friendly, as opposed to the other methods that make an extensive use of machinery.

Conclusion

The paper presents a decision-making model to show how NREGA not only addresses social and economic ills, such as poverty, unemployment, rural-urban migration, etc. but

also fits well into the green jobs initiative of UNEP as a significant proportion of its work has not only improved the local environmental services, but they also contributed to the mitigation of global climate change. Therefore, though the issue of environmental sustainability is not one of the stated objectives of this programme, but as an auxiliary objective, it also helps in eco-restoration and regeneration of natural resource base for sustainable rural livelihood. Thus, NREGA directly touches the lives of millions of unskilled poor, promotes inclusive growth, and also contributes to the restoration and maintenance of ecological infrastructure.

To illustrate the viability of the model, the study also assesses the environmental dimensions of the nature of projects created under NREGA in Anekal block in Bangalore district of Karnataka state. The findings clearly indicate that NREGA has provided multiple environmental services and reduced vulnerability, apart from helping to reduce rural poverty, rural-urban migration and child labour, among others, by providing employment and income to rural communities. However, one of the limitations of this study was its geographical scope and the limited coverage, as well as the limited range of the types of works surveyed. It is, therefore, important to commission a study that makes comparative analogies regarding the social, economic and environmental sustainability of works undertaken under NREGA in different parts of the country.

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We need to promote development that does not destroy our environment.

—Wangari Maathai

Bridging Digital Divide : Special Emphasis on Rural India

CHARU MALHOTRA

Digital divide refers to the gap between those with regular, effective access to digital and information technology and those without this access. It encompasses both physical access to technology hardware and, more broadly, skills and resources which allow for its use. The main goal of this study is to understand the disparities faced by the rural Indian population in respect to their urban counterparts. Factors like infrastructure facilities, gender, level of education, access to the technology, language disparity and lack of ICT skills have contributed to the digital divide. In India the use of IT and computerisation began in 1978. In 1985 the Government of India decided to increase the pace of IT use at the district level. Despite of it, the benefits are yet to be reaped by the rural Indians. The genesis of digital divide is rooted in the primary concern over the rising problem of digital technologies being available to only the urban strata of the society. The study affirms that the rural Indians are far behind in terms of the infrastructure facilities to use the ICT tools. Access to information in society is not uniform and thus the society had got divided into the information 'haves' and 'have-nots', leading to a kind of digital divide which is the major concern for the government.

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¹2011 Census of India's provisional population.

Introduction

India, a union of states, is the second-most populous nation in the Asian region with a total population of 1.21 billion and rural area is home to 69 percent of India's population that accounts for 833 million.¹ The country has achieved impressive progress in the field of science and technology and is emerging as one of the strongest economies in the developing world. Information and communication technologies have brought significant changes in development of the Indian society through information dissemination. ICT is a tool for augmenting communication networking, educational prospects and livelihood opportunities for all, especially the marginalized. It has indeed, played a key role in the socioeconomic development, especially in the developing countries like India. The review of the related literature (Bellamy and Taylor, 1998; Fors and Moreno, 2002; Kuttayan and Rao, 2003) sufficiently indicates that in developing countries, ICT has tremendous potential to generate growth by bringing in efficiency in public administration, generating significant export surpluses, helping to shrink distances and also by aiding means of income and employment. Expectations of such benefits have propelled several countries including India to concentrate on the ICT sector as one that offers the greatest potential to boost growth. There are, however, some perceptible differences in the outcome of the digitization process among various Indian states and also among various social and economic strata of the country (Government of India, 2006).

The Indian Reality of Digital Divide: The Review of Literature

Several scholars have delineated the IT-related policies for understanding the growth of Internet Indian subcontinent,

(for instance, Gupta, 2010) and the core issues associated with it. This literature indicates the various reasons, specifically the poor formulation and implementation of policies, paucity of funds that perpetuates the divide. Though IT and its subsequent problems in the Indian society have started receiving some attention, concerns were echoed by some social thinkers in the 1970s. This trend was supported by technological developments over the past few decades without which it is difficult to imagine such a spurt in communication networks.

Singh (2010) clearly highlights the problems of digital divide in India and reveals that the problems of digital divide also exist within and among the various states of India. While some people being rich afford to have the necessary resources, others do not. The educational system of India also has been slow to achieve the target framed by various commissions and committees and schemes launched from time to time. The lack of sound ICT strategies and policies in India are the main causes of this. In addition, the inadequate Internet and telephone connectivity to India's rural areas, where more than 70 percent of India's population lives, is a key challenge for a number of government agencies, nongovernmental organizations (NGOs) and multilateral aid agencies. The corporate sector too is discovering that bridging this digital divide could translate into new market opportunities. Therefore, factors like illiteracy, lack of skills and infrastructures in rural areas are the main obstacles and these must be tackled if India heads to lessen the gap of digital divide. At the government front, it should put thrust towards connectivity provision, content creation, capacity augmentation, core technologies creation and exploitation, cost reduction, competence building, community participation and commitment to the deprived and disadvantaged. Rajora (2002) elucidates the author's experiences in taking ICT to the masses with specific reference to his experience of initiating and implementing a rural tele-centre cum e-governance initiative titled *Gyandoot* initiated in Dhar district of Madhya Pradesh state of India. In similar vein, Rao (2005) highlights India in the context of digital divide by discussing its infrastructural bottleneck that includes electricity, IT penetration, tele-density, and Internet industry. Within India, some states are more digital than others and within a state; there is an urban-rural digital divide. Within urban areas, there is educated-uneducated digital divide and amongst educated there is a rich-poor digital divide.

Though the developed world has been working on preparing some database for measuring the Net

penetration and usage in their countries, it's only recently that such an exercise was attempted in case of India. On the lines of the *Global Information Technology Report*, there is *India: E-readiness Assessment Report 2003*, which is the first report of its kind on India and assesses the e-readiness of different states and union territories (UTs), as also of various central ministries and departments. There are six indicators such as e-readiness index, network access, network learning, network society, network policy, e-governance, and network economy for assessing the e-readiness of states and UTs. All these indicators are further refined on the basis of related sub-indicators. The report is extremely useful for those who want to study the issue of digital divide in the country. The reports of the Ministry of Information Technology and the TRAI have also been used in this study for examining the causes of digital divide in India as well as the indicators of this divide in terms of tele-density, Internet use and mobile use. Singh (2010) too provides a perceptive understanding of the sociocultural implications of digital technologies in Indian context after analyzing the trends of IT diffusion in India propelled by globalization, modernization and privatization. More specifically, this study analyses the implications of globalization, combined with IT on local cultures and identity assertion for many communities in the country.

Ghosh (2011) attempts to provide a holistic overview on the initiatives taken by government for implementing ICT in the development of rural areas. As per this study, several projects have reduced the costs and have also increased transparency. A large number of rural e-Governance initiatives, developed as pilot projects aimed at offering easy access to citizen services and improved processing of government to citizen transactions have been examined. This paper presents a brief review of the innovative projects in Information and communication technologies for rural development and how far it has contributed to rural development. The other aim is to ponder over the achievements and the failures of ICT in the sustainable development march. The analysis also indicates communication related initiatives and projects for development before media liberalization and post media liberalization.

Tharayil and Rajeev (2005) are of the view that in a developing country like India, advances in ICTs have brought a lot of opportunities and perhaps a whole lot of challenges as well. One of the main challenges is the digital divide. The paper highlights the concept of digital divide in general and the Indian scenario in particular. Major

challenges in the path towards digital opportunity such as poverty, illiteracy, political instability and poor ICT infrastructure are highlighted. Key initiatives in bridging the digital divide in India are explored in detail.

According to Bist (2007), the direction and pace of development in ICT have led practically all world economies to recognize the improvement of ICT in catalyzing economic activity, in efficient governance, empowerment of society and bringing about major socioeconomic transformations in societies. Developing countries like India, have therefore, made significant investments in these technologies and integrated the same with the development programmes to gainfully realize the fruits of such developments to their society. However, it is realized that this development has created a divide between the 'have' and the 'have-nots' in the form of a gap between the 'technology empowered' and the 'technology excluded' communities. It is, therefore, catching the attention of governments the world over to device programmes to alleviate this divide, called the digital divide. This paper highlights the digital divide scenario in India, various ICT initiatives undertaken and the major challenges and key solutions in bridging the digital divide in the Indian context.

Chopra (2005) outlines a new approach of dealing with the digital divide problem facing India across the borders and within its own borders in his article 'Bridging India's Digital Divide: Some Policy and Technological Options'. First, it assesses the technological divide in India with respect to other countries. Second, it examines the underdevelopment of information and communication technology infrastructure that is lacking in most of rural India. The paper tests and explains two hypotheses, one stating that by removing government monopoly, liberalizing and de-licensing the telecom sector would help the brisk dissemination of ICT in rural areas and the other stating that by the coordination of stakeholders like government, industry, civil society and community in establishing Internet kiosks to villages would help the brisk dissemination of ICT in rural areas. The article also examines some low-cost technological options for infrastructure accessibility as well as for hardware and software applications in rural India. In the end the paper deals with some of the most innovative business models in India and globally so that developing countries can learn from each other's experiences.

More specifically, Gupta (2010) has traced the evolution of e-governance in India. The initial part of the article examines the historical perspective and the

evolution of e-governance in India since the formation of the Department of Electronics. The following sections give a detailed study about the initiatives taken by the Government of India over the period of five years and then missions and objectives in the creation of transparent and efficient governance ability from grass-root levels. The relative development with the induction of these technologies through various policies and reforms are mapped against projects and gauge the significant impact on the ability of the government to establish the current e-governance structure.

The term Digital Divide has several connotations and to assimilate it as part of a growth model, the indicators of the digital divide, present government policies and their implementation need to be studied. In a developing country like India, advances in ICT have brought a lot of opportunities and perhaps a whole lot of challenges as well. 'The Great Indian Digital Divide' (Das, 2000) mentioned India's latent capabilities in bridging the digital divide paradigm. The government has formulated an IT policy along with the telecom reforms in 1999 attracting greater participation from private sector. In spite of these achievements, the country faces several challenges. There is a widespread undernourishment; infant mortality rate has been deteriorating; approximately 40 percent people live without electricity, safe drinking water and sanitary facilities. Gender inequality is another area of concern (Das, 2000).

Summing up the aforementioned literature, it can be presumed that in the Indian context some researchers treat it as a problem that needs to be solved, others still believe that the existing divide will fill up on its own over the years.

India at a Glance

Fortunately, India took to IT early compared to many other developing countries. The nationwide network of computers set up by the National Informatics Centre (NIC), India took the PC to every district in the country, making government-level interaction and communication faster for planners (Srinivas et al., 2014). India's large economy, with its young and increasingly urbanizing consumer base, offers strong growth potential for Internet usage. Weak infrastructure has kept India's Internet penetration low; at 10 percent, it is much lower than the average of 40 percent across aspiring countries (McKinsey & Company, 2012). Even so, with about 120 million people online in 2011, India is the third-largest Internet user base in the world. India's

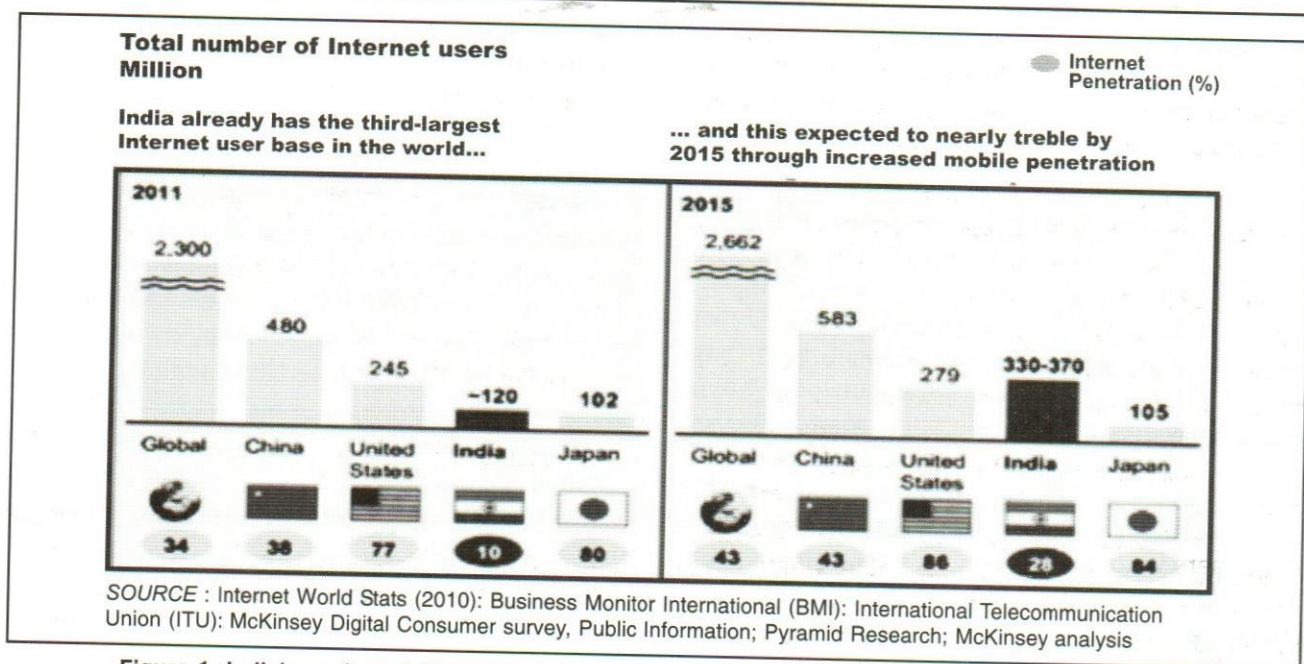


Figure 1: India's projected 330 million to 370 million Internet users will form the second-largest Internet population in the world by 2015

current Internet user base of about 120 million is likely to nearly treble by 2015, and will thereby account for approximately 12 percent of the global total.

Although India has been one of the emerging superpowers in IT, the benefits have been remarkably slow, particularly in rural and remote areas. Besides socioeconomic factors, geographic, educational and attitudinal factors have been some of the challenges for the government when introducing IT-oriented programmes. India still has a wide gap of technological access within its country, where the *rich* have more access to the best use of technology and where the *rural/poor* have little access to these same equipments, this has divided the society into the information 'haves' and 'have-nots', where the 'haves' continue to accumulate more technological advances, and widen the gap calling digital divide.

Grounds of Digital Divide

A digital divide is an economic and social inequality according to categories of persons in a given population in their access to, use of or knowledge of information and communication technologies (ICT).² Digital Divide exists due to inadequate capacities and skills to use the technologies more effectively. The major hindrance in the penetration of ICTs lies in the infrastructure and it is unlikely that the development of infrastructure here will be able to

keep pace with the ambitions, aspirations and needs of the people, especially in the rural areas. The range of criteria used to assess the ICT disparities has concluded in the following categories of digital divide.

The Technological Divide

The most common category is the technological divide that refers to the gap between people who 'have' information and communication technological (ICT) devices and those who 'do not have'. One school of thought holds that, as the Internet becomes progressively more sophisticated, the digital divide is growing, that those to whom it is least available are left behind. According to 2011 Census data for Communication in India, only 9.4 percent houses in India have computer (any of Laptop or Desktop). Chandigarh (U/T), Goa and NCT of Delhi are top three states/union territories with highest computer density also. Chhattisgarh, Odisha and Madhya Pradesh have the lowest household computer density of about 5 percent.³

Internet Access Divide

This divide can be described in terms of Internet access, but again, in the have/have-not dichotomy. The long electrical power cuts in rural areas leads to the collapse of Information Infrastructure. There could be a possibility wherein a rural person might possibly have a portable

²Digital Divide, From Wikipedia, the free encyclopedia.

³2011 Census data for Communication in India <http://updateox.com/india/state-wise-internet-users-in-india-census-2011>.

computer, but certainly not have an access to the Internet. Having the hardware is one thing, but having Internet access in addition to the hardware immensely multiplies the potentiality of the technology. According to 2011 Census data for Communication in India, only 3.1 percent of total houses have Internet access in India. According to this, the census covered 24,66,92,667 (246.7 million) houses in India and found only 76,47,473 (3.1 percent) of these houses use Internet.⁴ The Internet includes both broadband and low-speed connections. Only one state and two union territories in India have Internet density of over 10 percent. Chandigarh (U/T) has the highest 18.8 percent of total households Internet users, followed by NCT of Delhi (U/T) 17.6 percent and Goa 12.7 percent. Bihar has below 1 percent of total households Internet users which is the lowest in India. Other states like Maharashtra have 5.8 percent, Uttar Pradesh 1.9 percent and West Bengal 2.2 percent of total households Internet density only.

Mobile Access Divide

The term digital divide is used to usually refer to ICT devices and facilities such as computers and Internet, but it is important to include other technologies like mobile phones in the discussion of the digital divide. However, the digital divide of mobile phones is different from the digital divide of the Internet. The number of mobile Internet users has reached 155 million in India in March 2014, and 185 million in June 2014, maintaining a quarter on quarter (QoQ)

growth of 20 percent. The number of mobile Internet users in October 2013 was 110 million with 85 million users from Urban India and the rest 25 million from Rural India (IAMAI, 2013).

Human Resources Divide

The requisite knowledge and skills for using technology are as important as possessing the technology itself that defines a new kind of digital divide, referred to as Human resources divide. This kind of divide refers to the knowledge and skills required to operate the technology and also refer to the concerns of how to practically benefit from it. The more educated citizenry tends to use new technologies with greater frequency than those who are less educated.

As per the Census 2011, the rural literacy accounts for just 67.77 percent out of the total literacy rate of 72.99 percent, wherein the urban counterparts holds 84.41 percent share. Kaiser (2006) states that the digital divide intensifies divisions because it is even more difficult for the uneducated and those without Internet access to get certain, good paying jobs. The understanding of this kind of divide emphasises that efforts need to be channelised not only to providing physical access to those without ICT access, but also equally on access to the knowledge and skills necessary for meaningful ICT access. In general, countries where the Internet and other technologies are less/not accessible, it is usually the uneducated people

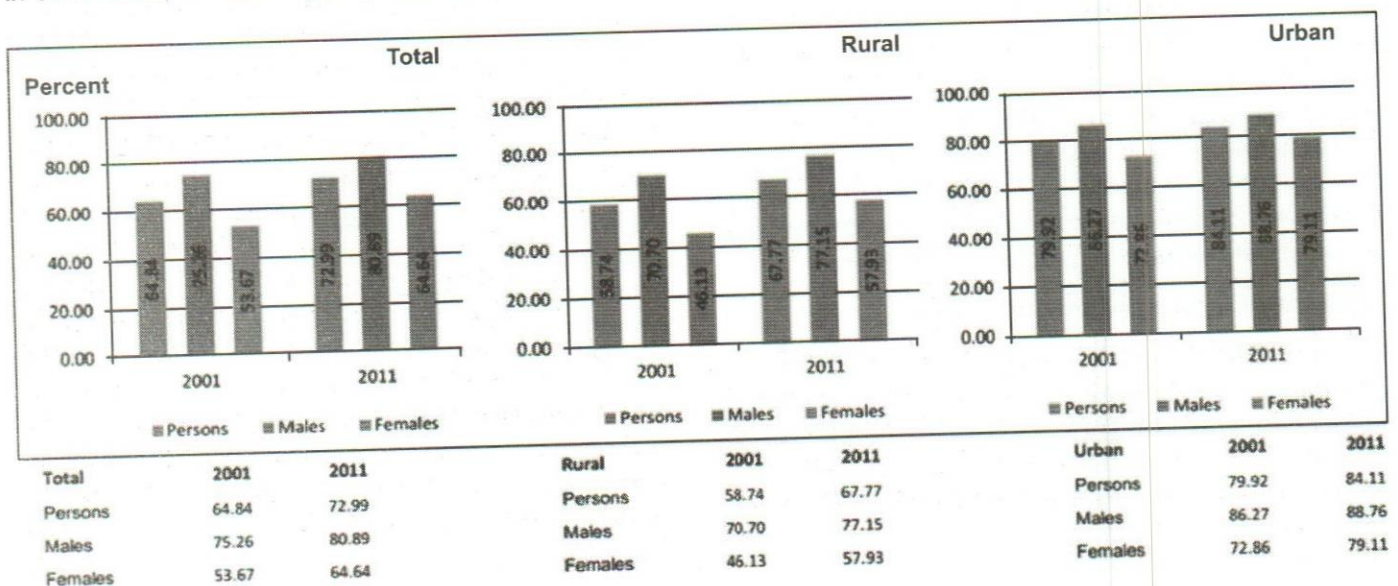


Figure 2: Literacy rate, 7 + yrs

⁴2011 Census data for Communication in India <http://updateox.com/india/state-wise-internet-users-in-india-census-2011>.

and societies that are not benefited making them the least competitive in the global economy.

The Education Divide

In continuation to the aforementioned category of digital divide, access to education at school level defines an important issue influencing digital access/skills. Broadening students' technology-related skills can serve as an important measure to resolving/mitigating the digital divide. The access to education at school level defines an important issue influencing digital access/skills. As per the literacy rate India 2011 was found to be 74.04 percent. Compared to the adult literacy rate here the youth literacy rate is about 9 percent higher.⁵ Though this seems like a very great accomplishment, it is still a matter of concern that still so many people in India cannot even read and write. The numbers of children who do not get education especially in the rural areas are still high. In India, less than 10 percent of all the schools have a computer and these are skewed in favour of urban areas (26.41 percent) while the rural areas (6.66 percent) are marginalized⁶ (Mehta, 2005a; 2005b). Even when computers are considered for study in schools, the emphasis is largely on acquiring the technology (computers) per se and there is little deliberation on what should be on what should be taught at each level.

Linguistic Divide

This divide addresses the issue of content available on internet is usually in English and for the rural Indians who speak no (or little) English, the barriers to the Information Age are almost insuperable. All widely used operating systems require some knowledge of English or one of the 'Northern' languages. Thus, in practice, unless Indians know English, which most Indians do not, no matter how wealthy, brilliant, educated, prosperous or motivated they may be, computer use and Internet access are effectively out of the question. The report also finds that nearly 42 percent of the Internet users prefer to access Internet only in Local languages.⁷ With more content becoming available in the local languages, more users will start using the Internet. The findings of the report reveal that majority of the rural Internet population is not comfortable in accessing Internet in English and this is holding them back from using Internet fully for other purposes than online entertainment.

⁵literacy rate India 2011 <http://www.census2011.co.in/literacy.php>.

⁶Computer Attitude and Fluency: A Study of Elementary School Students. <http://www.it.iitb.ac.in/~sri/papers/cm-site09.doc>.

⁷Rural India internet penetration still hovers low at 6.7 percent. http://www.business-standard.com/article/technology/rural-india-internet-penetration-still-hovers-low-at-6-7-113102200523_1.html.

The Gender Divide

Last but not the least; women have had a small role when it comes to access/application of technology. Various studies (Rao, 2005; Singh, 2010) have revealed that even when women and men have equal access to the Internet either through home, work or school, they may not have the opportunity to access the Internet or engage in a wide variety of uses. The gender issue is highly relevant in the developing countries like India. Women have less access than men in India due to various social, personal and cultural factors. Cooper (2006) states that there is a dramatic digital divide for gender such that women are not reaping the benefits of the technological revolution at par with men. As per the census of 2011, an effective literacy rate for men was 82.14 percent whereas for women it was 65.46 percent. Though there has been seen a substantial increase in the number of literate women and this gap is narrowing, it still persists.

Some Interesting Findings about Digital Divide

Small Little Innovative Steps Started

ICTs are therefore the potential instrument for addressing the unmet needs of the vast rural population. It can be of use in reducing the digital divide if only we commit to that goal with the same intelligence and imagination that has gone into creating the technologies themselves. For bridging this gap, it is necessary to cultivate skills, capabilities, interests, and motivation for using ICTs at individual, community and national level. The divide, if not addressed well, can but only make 'the digital divide' even deeper and wider, rendering large cross-sections of societies as dangerously and primitive. This ICT must not just be for the urbans but also for rural-urbans, a new breed of rural populace with talent, spirit and aspirations comparable to their urban counterparts. Enhancing infrastructure in rural areas will require a multipronged approach including some alterations in the basic policy design as well as some changes in the implementation strategies. In this regard, our Government has also recently taken certain initiatives by proposing a pan-India programme, Digital India, to provide broadband connectivity and other IT facilities at village level. This programme aimed to ensure greater transparency in government processes and increased indigenous production of IT hardware and

software for exports and improved domestic availability. A National Rural Internet and Technology Mission for services in villages and schools, training in IT skills and e-Kranti for government service delivery and governance scheme is also proposed at a cost of Rs 500 crore, in the Union budget 2014–15. The Government has also shown interest in Google Inc.'s balloon project, a network of high-altitude balloons that enable Internet access to remote areas yet to be penetrated by the global network. Project Loon, as Google calls it, will allow Internet access to remote locations with the help of specialized antennas, and could help bridge the Internet divide across the globe, and in developing countries like India where Internet access is dismal. Besides the government policies and programmes, an effort has to be made to involve the Public Private Partnership (PPP), Non-Governmental Organizations (NGO's) & youth centers in creating the facilities and sensitizing the rural people altogether. Private participation should be encouraged for developing technology which is suitable for the rural areas and requires low amounts of investment for putting in place the requisite infrastructure for people to access Internet and information. An understanding of government policies shows that a lot has been done for creating the right environment for bringing in foreign participation and private participation in the IT sector, however, most of these investments remain confined to the urban areas. Enhancing infrastructure in rural areas will require a multi-pronged approach including some alterations in the basic policy design as well as some changes in the implementation strategies. Some of the suggested measures on both these fronts are elaborated in the following paragraphs.

Improved Policy Design

The current scenario and the analytical study of telecom past demands that GOI should deregulate tariffs and the number of operators in different circles. A cohesive national strategy for telecommunications reforms is being drawn out; for example, a unified licensing regime that will do away with the necessity of multiple licenses for different services is being debated to be introduced. It is also being suggested at appropriate forums that the license should be technology neutral (e.g., not dependent on CDMA *versus* GSM) as well as should be product neutral (e.g., basic services *versus* cellular services). It has been realized that the empowerment of the TRAI, privatization of DoT, equalization of BSNL with other service operators is also essential to encourage healthy competition and a free environment sans the hold of bureaucracy, legislative

and judicial branches of government. The underlying thought is that the Indian middle class should be able to choose itself value-for-money-services and the 'best' service provider, following the appropriate rules and regulations.

Way Forward: Some Recommendations for Digital Unite

Encouraging Innovations

The excessive focus on rural telecentre/common service centre for providing ICT at the doorstep of the rural, as strongly advocated by NeGP, in its initial version, is being looked upon as an answer for providing easier technological access to rural and remote areas. However, this seems to be highly overrated. A constant monitoring and review of this focus is required to meet the needs of the local populace, may be by better leveraging popular trends such as mobile technology. The social hurdles to the spread of ICT in rural areas can also be met by creating awareness through television and community radio programmes. Moreover, technological Developments such as Cloud Computing and Open Source Software, Indian language software tools and contents are some barriers, though these also present positive opportunities. It should be understood that this will increase demand for their products as people in the rural areas would only demand products for which they perceive a need in their lives. Indeed mobile phones could prove to be useful, if access at cheap rates to the Internet, in local language is provided. Advances in technology to supply telephony through various other mediums like mobile, cable, 'right-of-way' networks, low earth orbiting satellites, etc., to be encouraged through proper policies and privatization. Low-cost wireless access for basic telephony services to be essentially provided for rural villages through subsidized models. It can be stated that to find solutions to the problem of the rural–urban divides in the country, a robust policy for encouraging R&D and innovation is required. This will encourage local-based solutions to grass root problems at low costs and with easy accessibility.

Enhancing Inter-Governmental Coordination

Experience and observation indicates that at present, government ministries and departments both at the centre and at the state work in silos. Although there have been efforts by the government in the form of various measures, it appears that each state is following a separate ICT model and there is no co-relation or give and take between these models. In fact, the success stories of one state could be replicated in others with slight modifications for local needs.

There is also no cohesion in the efforts of the government at the centre, state government, corporates, NGOs, educational institutions and other private parties so that in some areas there is too much being done at the cost of others. For instance, the Department of Science and Technology (DST) provides funds for research and development to universities, educational institutions and other scientific institutions. The Ministry of Rural Development provides funds for rural development through schemes like NREGA. With the increasing importance of ICT as a tool for development, a platform should be created wherein all stakeholders involved with rural development come together for a concerted and focused approach. In this context, the role of the Planning Commission assumes considerable importance. In fact it can be the nodal body for creating inter-linkages between various Ministries. Moreover, a lot of work is being done by Government, private partners, NGOs and community in different areas. All such efforts, by different agencies and departments, need to be reviewed to ensure that effort and collated. Un-served and under-served areas should be accorded priority for augmentation of its infrastructure. For this purpose, bodies like NASSCOM should be engaged more meaningfully.

Despite several elaborative policies and programmes (a la' NeGP, IT for Masses et al.), digital divide is very much existent in the current situation emphasising stronger research needs in understanding better the Indian reality. The important thing emerging out from the above-proposed recommendations in IT policy formulation is that the IT policies should be reshaped as per the local requirements/ limitations and socio-political setup. Similarly, IT policies should be conducive for promoting IT-related activities in an organisation/area. Not only the IT policy should be puissant and strong, but also the organisational/local culture should be congenial for the implementation of the policy. One can safely state that for the government to enable a digital unite in India several measures need to undertake on war footing; which include connectivity provision, content creation, capacity augmentation, innovative technologies creation and exploitation, competence building, and private/*panchayat* participation. A good IT policy should serve to bridge the cultural constraints, organisational limitations and local-power conflicts prevailing in the area, which can otherwise stifle the successful implementation of the policy. If the social feasibility and psychological acceptance of the technology or its related policy is not analysed properly, then the

technology application as well as the policy related to it could prove to be expensive failures or at best limited success. Therefore, Indian policy-makers need to reassess the digital divide both from technological as well as socio-cultural perspective, to adopt new courses of action that will help integrate Information Technology into society.

Redefining Relationships

Participation of the market players and civil society bodies must be encouraged for developing technology which is suitable for the rural areas and requires low amounts of investment for putting in place the requisite infrastructure for people to access internet and information. Industry as part of its Corporate Social Responsibility (CSR) should make efforts to cater to local needs and provide local solutions with local content to make technology worthwhile for the rural areas. In this direction, new areas of public-private partnership can also be envisaged. Design of relevant local content stays extremely important for making ICT attractive to the people. In this regard *Panchayats* can play an extremely useful role. In addition to infrastructure, successful communications and networking system relies on a variety of other public sector inputs. Legal systems must adapt to a new range of contract and liability issues, educational systems must produce a technically competent work force and people must be educated about the real benefits of digital technology. For successful digital unite, decentralization in its true form is a prerequisite and for its successful implementation, there is definitely a need for wise adjustments and balanced compromises since it is not possible to always have an optimal plan of developmental activities at the district level. Several activities can be delegated to district level whilst other activities can be controlled from the state level. In general, based on the local requirements, the IT demands should emanate from the local level. Micro-level village plans should be chalked out by local rural bodies such as *Gram Sabhas* and *Zila Parishads* (except in special cases) and should be supported by the state within the guidelines and framework provided by the centre. Apart from this, Citizen Participations through bodies like 'Telephone Advisory Committees' should be encouraged for all the services involving telecommunication sector.

Conclusion

From the past 10 years, several information communication technologies for development (ICT4D), e-government and e-governance initiatives are being launched (with a lot of fanfare) to bridge the proverbial Digital Divide. However,

this Divide still keeps glaring back at us, especially in the rural context. India, therefore, needs to cultivate its own indigenous models of utilizing emerging technologies to benefit its rural citizens so that their diverse contextual needs, capabilities and aspirations could be completely addressed. For instance, the lower cost technological innovations in telecommunication sector could be encouraged to provide cheaper, uninterrupted rural connectivity and so on. Such grassroots innovations should be then implemented using refurbished models of public private collaborations. This should be further intervened with newer models of public participation that would help the designers/implementers and policy-makers to recursively improve technology designs and related rural endeavors. Such indigenous and holistic endeavors would surely make application of information technologies more inclusive and more pervasive in nature and hence would empower and not isolate the rural citizens in the present knowledge era.

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Productivity and the growth of Productivity must be the first economic consideration at all times not the last. This is source of technological Innovation, Jobs and Wealth.

— **William E. Simon**

Supply Chain Dynamics of Indian Agriculture

SAZZAD PARWEZ

Paper tries to explore the problems faced by Indian agriculture for food security in terms of inadequate infrastructure and highly inefficient supply chain in context of information technology. This paper examines the critical issues at each sub-system of agriculture supply chain, starting from the input to the consumer, with a view to integrating them in efficient and effective manner. As proper flow of information across the chain constitutes an integral part, the role of information and communication technologies (ICTs) in improving supply chain efficiency in agriculture is discussed in detail. Thus, this paper broadly covers some of the important aspects of agriculture supply chain in India—identification of issues at different levels in the supply chain; transformation in the agriculture due to various supply chain interventions; the role of ICTs in supply chain management—and this paper also covers the suggestion to improve efficiency at different levels in supply chain. There is a wide research gap in this sector, having such potential and prospectus for overall growth there is not much research in this field. The paper concludes that ICT plays a very important role for development and contemporary issue for agriculture; therefore, government action must address the issue of infrastructure development to achieve the objective of food security for all.

Introduction

India has experienced a remarkable growth in the production of various agricultural commodities over the last four decades. Technological intervention in the mid-1960s contributed significantly towards bringing the country from deficit to surplus stage in food grain production; the recent trends of cropping system are creating a lot of problem relating to sustainability and market imbalances. Several studies and research work suggest that the reform policy of government only focused on the price measures and ignored the infrastructure and institutional changes which have caused an unfavourable effect on agricultural growth in recent decades. Various empirical studies have also shown the strong and positive impact of public investment on agricultural productivity and growth in India (Chand, 2001; Landes, 2004), which has been declining over time. But contrary to this, for competing in the world market with the emergence of World Trade Organization (WTO), Indian agriculture needs more public investment and policy support in several areas to overcome prevailing structural weaknesses such as low scale of operation, high post-harvest losses, poor rural infrastructure, a lack of product diversification, inadequate R&D spending, low productivity, an absence of marketing infrastructure and inadequate financial support.

The agricultural production is broadly categorized into these sub-system-input supply, production, processing, sales and distribution to consumer and quality and food safety measures. Integration between these components is negligible throughout the agriculture sector in India. In practice, most of these components act independently and the flow of information between different components is either missing or very poor. Due to lack of coordination between various sub-systems, the agriculture operates inefficiently at each stage of supply chain. A low level of adoption of high-yielding seeds and other modern inputs show that these inputs are not reaching the potential

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client effectively and completely. It is not only the purchasing power of farmers which hinders the adoption rate, it also the farmers' insecurity about the crop failure that prevents them for adopting any change. Likewise, at the production level, farmers' usually do not make decisions based on market trends in a planned manner, nor do they plan the use of resources in an appropriate way.

The agricultural production system is still operating at low scale with low productivity and high uncertainty in the country. There is little or no alignment between the growing for the agricultural commodities in the market and the production and supply of these commodities. Despite faster growth and increased diversification in consumer food demand, empirical studies suggest sluggish growth in the agricultural production sector in recent decades. The opportunity to strengthen growth in agriculture in India lies in value addition through agro-processing, which is at a very low level at present. The Agribusiness food processing industry is facing constraints and barriers, such as non-availability of adequate critical infrastructure facilities (cold chain, packing and grading centres) lack of adequate quality control and testing infrastructure, lack of suitable varieties of farm produce for processing, seasonality of raw material, high inventory carrying cost, and high taxation and packaging costs (Mittal and Mukherjee, 2008).

The consumption pattern in India is undergoing significant shifts towards high-value consumption commodities like fruits, vegetables, milk, meat and eggs due to an increase in per capita income, urbanization, changes in lifestyle and preferences, relative prices and increased awareness among consumers about food nutrients (Kumar and brithal, 2004; Pingali, 2007). India's consumer class is growing rapidly and becoming more and more attracted towards the availability of fresh, convenient, palatable, nutritious and safe food. Besides, these consumers are able to make purchasing decision based on criteria other than price constraints and therefore high-value processed food and beverages are gaining more space in shopping baskets. To meet these requirements the agricultural sector needs intensive and new farming techniques to address new challenges for sustainable production, processing practices and promotes a balanced approach to the problems of food quality, safety and good environmental management (Ziggers and Trienekens, 1999).

The private sector organizations' investment in the agribusiness sector is not up to mark due the high level of

government regulations including regulation governing procurement and movement, storage, warehousing and marketing of major commodities, plant-scale restriction in food processing, and restriction on contract farming and land leasing. However, the transformation in global food systems is leading to changes in food production and marketing in form of emerging contractual and sharecropping relationship between private dealers and farmers, beyond direct government intervention (Deshingkar et al., 2003; Rao and Jeromi, 2006; Joshi et al., 2007). To promote private participation in agribusiness and processing industry, most of the states in the country already initiated amendments in the existing APMC act as per the model Act on agricultural marketing suggested by the central government to encourage direct marketing and contract farming programmes, to facilitate the process by which industries and large trading companies undertake procurement of agricultural commodities directly from farmers, and to establish effective linkage between farmers and retail chain.

For strengthening agricultural production and productivity, the governments had taken various initiatives, most of which were on the production side to ensure food security in the country. As a result, agricultural production in India experienced a remarkable growth after the mid-1960s with adoption of Green Revolution technologies. This growth certainly led the country from being a food deficit country to a food surplus country, but at the cost of excessive utilization of natural resources and further, raised issues of sustainability in agriculture. The other crucial problem that constraints the growth of the agricultural sector is that public investment in agriculture as a percentage of GDP has been declining gradually. A policy analysis of agricultural system shows that there is multiplicity and duplicity of rules and regulations dealing with various components of supply chain in agriculture. Lack of coordination among these, again, leads to the poor alliance and collaboration supply chain, which in turn leads to the inefficient product and information flow.

Objectives of the Study

There are basically two most important objectives of the study:

1. To study the current status of infrastructure in the context of information technology in Indian Agriculture.
2. To assess the impact of inadequate agricultural infrastructure on supply chain and agriculture.

Research Methodology—Literature Review Method

The starting point of our research work has been literature review to understand the fundamentals of the subject. The literature review covers many areas related to the nature of the research questions put forward, and thus includes agriculture, food management, supply chain approaches, information technology and supply chain interfaces. Tracing the references by looking at the reference list is also performed and relevant papers found in journals have been tackled as well. The literature sources are mainly books, scientific journals, conference proceedings, dissertations, projects documentations and management-oriented publications. These sources are of particular importance and engender all research process development, especially the early phase for initial exploration of the food supply chain management. Published materials on the Internet, annual reports and archival records of the involved companies and organizations are helpful and are used as a compensation for some empirical shortcoming.

Limitations for the Study

The major limitations for the study are as follows:

- The paper has been prepared based on the data collected from the published and unpublished secondary sources.
- The study findings are based on the limited coverage of selected literature and data available.
- Poor availability of secondary sources of data.

Revolution in the Agricultural Supply Chain

The economic reforms and liberalization in the agriculture sector have emphasized the need for transforming the Indian agriculture by designing a comprehensive supply chain model covering innovations at the farming level which can help farmers regain profitability in a sustainable manner under changing conditions with proper assurance of market arrangement (Rao and Punwar, 2004). In recent decades, the government has introduced a number of initiatives to strengthen market linkage and diversification in the agricultural production system (Rao and Jeromi, 2006; Joshi et al., 2007). Reform in agricultural marketing system to ensure private participation for establishing direct linkage with farmers, capacity building and infrastructure development in regulated markets, extension of road network and transportation, storage and warehousing, market intelligence system, introduction of commodity trading by establishing commodity exchanges are some

important areas of interventions, but changes are taking place at very slow pace. A close look at the flow of agricultural commodities in India suggests that there are multiple routes, most of which are not recorded. The organized procurement or flows of agricultural commodities are quite low and primarily take place in the form of government market intervention schemes coupled with few special procurement licenses to private organizations and contract farming arrangements (Landes et al., 2004).

Different models of supply chain management government, cooperatives, corporate houses and MNCs have been initiated to improve production, strengthen linkage with farmers and market efficiency, particularly in high-value commodities (Brithal et al., 2005). The inclination of leading corporate organizations in India towards investing in Agribusiness chain is very vibrant, and number of organizations, for example, Hindustan Unilever Limited (HUL) and ITC, have already entered or are planning to enter agribusiness activities. This trend is creating a new business environment for agribusiness operations. In traditional business model, the flow of agricultural commodities was influenced by a number of intermediaries who added costs but no value to the agricultural commodity chain. The new corporate entries are not just participating in chain to source their required raw material (mainly indirectly from the farming community), but are more focusing in the primary source of agricultural produce. In this context, the development of direct linkages with farmers will attain greater importance. It has been very well realized by these corporate participants in the agribusiness chain that leadership in food business requires a keen understanding of supply chain for agricultural produce. The participants should have clear strategies for sourcing raw material and distributing the final products to potential consumers efficiently and effectively.

Retailing in India is undergoing an unprecedented transformation with a number of national and international organizations trying to capture the huge and exponentially growing consumer market. The Indian retail market is estimated to be worth around USD 350 billion (Khanna, 2006); it is at the 13 per cent per annum, and food retailing constitutes of a major part of the overall retailing business. The list of business houses that entered retail business or getting ready to do so includes Bharti (with Walmart), Reliance industries Ltd, Mahindra Shublabh, the Birla's, the Munjals, HUL, ITC, Adani Retail, RPG Retail and Godrej Agrovet. The liberalization of government policy towards FDI in retailing has enhanced the process of

modern retailing in the country. At present FDI is not allowed in food and grocery retailing since it is only allowed in single brand retailing, where 51 per cent FDI is allowed through the Foreign Investment Promotion Bureau (FIPB) route, where 100 per cent foreign investment is allowed through automatic route or they can enter in to technical tie-ups (Mittal and Mukherjee, 2008).

Information and Communication Technologies and Agriculture

There are various reasons for inefficiency in agricultural production and supply system, but that which has attracted the major attention of policymakers in the last decade has to do with lack of appropriate information and services related to agricultural practices (Adhiguru and Mruthyunjaya, 2004; Rao, 2007). With the emergence of globalization, liberalization and privatization of agricultural economy and increasingly complex agribusiness environment, traditional models of information dissemination and service provision have failed to meet the growing information and service demand of the farming community (Kumar and Ali, 2007). Modern agriculture is knowledge-intensive and increasingly information-driven; each participant on supply chain thrives on timely and accurate information for various decisions. According to the Rao (2007), the implementation of ICTs proposes three unique strategies—(1) a close vertical supply chain network for agribusiness enterprises; (2) an open chain network with dynamically evolving partners and supply chain situation for public, non-governmental and multilateral organization; and (3) a spatial data services network to address the natural resource management and its sustainability concerns. Therefore, knowledge and information are important factors for accelerating agricultural development by increasing agricultural production and improving marketing and distribution efficiencies (Poole and Kenny, 2003; Bertolini, 1999; Lio and Liu, 2006). In addition to connecting small farmers and artisans to markets, ICTs also facilitate most agricultural decisions—what to cultivate, how to cultivate and harvest, when and where to sell and what price to maximize the returns. Effective decision-making related to all these aspects ultimately determines efficiency in supply chain.

Therefore, efficient and effective flow among various stakeholders of any business activity is key to strengthening supply chain efficiency. The major problem faced by farming community and associated stakeholders is related to efficient and effective decision-making at different stage of agribusiness activities, right from crop

planning to marketing of final produce. At each stage of farming a farmer requires data and information on a number of variables. In the absence of timely availability or non-accessibility of this data, farmers are not able to decide what, how and how much to produce as per market needs. The fast and innovative development in ICTs can provide immense opportunity to public and private sector agencies to integrate these technologies in their supply chain systems. ICTs are extremely important for dissemination of information, provision of services, enabling various transaction and awareness creating among rural masses far removed from the government. ICTs provide a modern, effective and speedy mode of interaction and communication that conveys new resources of knowledge and information to the society.

In order to disseminate information and provide different services in a cost-effective manner, numerous ICT initiatives are being made in many countries. The developing world is looking towards ICT systems for solving their numerous information-related problems. Literature argues that use of ICT facilitates free flow of information and makes available the services even to the most marginalised sections of the society. Many public and private sector ICTs—enabled initiatives have been undertaken in India in the last decade especially to cater to the needs of agricultural or overall rural sector development. Some of these initiatives include e-Choupals by ITC, DCM Shriram Consolidated Limited (DSCL), Hariyali Kissan Bazar, Drishti, AgMarknet, Gyaandoot, iKisan, Parry Kiosks by EID parry, etc.

All these ICT initiatives share the common objective of empowering rural communities to take the right decisions related to their day-to-day activities and thereby improve their performance. Since the rural economy in India or, for that matter, in any developing country, has very strong linkage with agricultural economy, the major thrust of these initiatives has been the agriculture and allied sectors. But integration between these models lacking due to lack of proper coordination among various sub-systems in the supply chain. The Government of India (GoI) has formulated an ambitious National e-governance Plan (NeGP) which identifies 25 mission mode projects including agriculture to be implemented through different ministries at the central as well as state levels.

Integrated Knowledge Model for Agricultural Supply Chain in India

Strengthening vertical relationships between various stages of production and processing in the agribusiness sector

has always been an important area of empirical analysis by researchers and policymakers across the world. Vertical coordination in the Indian agriculture sector is limited to some selected high-value commodities such as poultry product, milk, fruits and vegetables. Empirical studies have suggested that vertically integrated agribusiness activities are reducing production cost among contract growers, as well as producer- consumer margins with a comparatively high involvement of smallholders (Landes et al., 2004; Brithal et al., 2005). However, the pace of change in supply chain integration and responsiveness of the production system towards a market-driven approach is slower in India as compared to elsewhere in the world.

Farmers are still more comfortable growing the traditional crops, particularly rice and wheat, as they have

already discovered the market for their marketable surplus—be it government procurement arrangement or private local traders. But the shift in market demand needs a balancing approach to meet the supply of deficit commodities, such as pulses, oil seeds and high-value food items. This balancing of demand and supply can be ensured by strengthening buyer–supply relationships in an efficient way, and disseminating accurate and timely information to all the participants of the business chain. The major issues in Indian agribusiness supply chain is lack of integration between different sub-systems of the chain (Figure 1). Each participant in the chain acts as an independent agent with a very low level of business relationship.

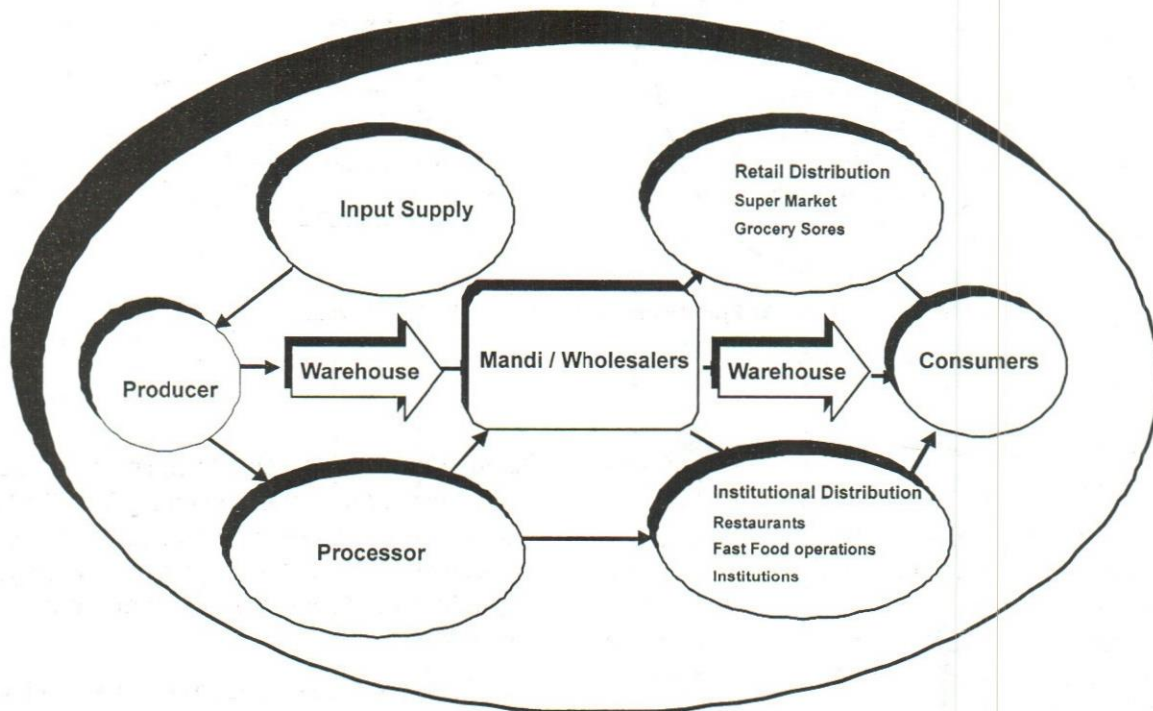


Figure 1: Agricultural Supply Chain

Source: Adapted from Mittal and Mukherjee (2008).

Based on practical experiences, Grimsdell (1996) proposed six fundamental requirements for an efficient supply chain between vegetable growers and major retail customers—scale of operation, strategic alliances, production flexibility, continuity of supply, quality control and communication. These parameters are very relevant while establishing a supply chain community between

farming community, processors, handlers, government and consumers in the country to ensure a cost-effective and safe flow of agricultural commodities through the chain, which requires extended relationship between the supply chain stakeholders. Collaboration and relationship management along the chain is a key instrument for integrating the supply chain system and the ability to

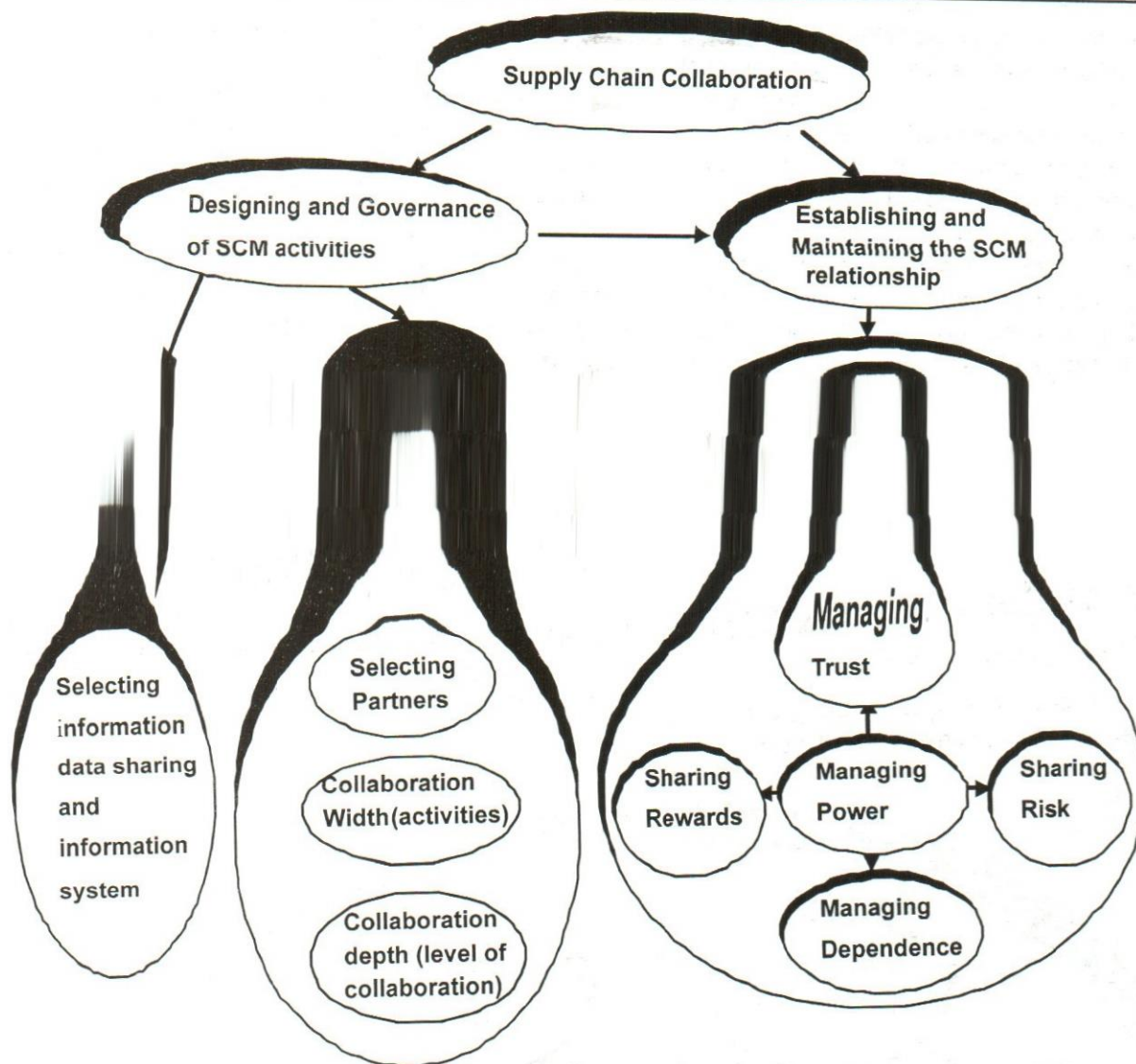


Figure 2: Framework of Supply Chain Collaboration

Source: Adapted from Matopolous et al. (2007).

establish effective relationship is necessary to reach supply chain success.

Several empirical studies have recognized the increased need for collaboration is a way to construct even more efficient and responsive supply chains, in order to deliver exceptional value to customers. According to Matopolous et al. (2007), there are two major pillars of supply chain collaboration—the design and governance of supply chain activities, and the establishment and maintenance of supply chain relationship (Figure 2).

The success of collaboration depends largely on the physical structure of the chain flow and the way relationships among various channel members are maintained in the system. An efficient physical flow system needs a governance mechanism for organizing and controlling the activities as per design. The physical structure and governance of conventional supply chains in India shows that these chains generally exclude the primary stakeholders of agriculture, i.e. the farmers, from the system (Eapen et al., 2003; Deshingkar et al., 2003;

Singh, 2006) and the supply chain of agribusiness firm start from the raw material sourcing from the traders and wholesalers of agriculture commodities. One of the major reasons of this kind of arrangement may be government regulation or direct procurement from the farming community.

The recent policy changes and amendments in the existing Agriculture Produce Marketing Committee (APMC) Act by the state government provide an opportunity to private firms to extend their supply chain to the farm level. The design of supply chain governance system depends on an efficient flow of information on various aspects of the chain, such as numbers of participants required at each stage, i.e. selection of partners, types of goods and services required to strengthen the relationship, i.e. width supply chain activity and level of decision taking relationship required (Matopolous et al., 2007).

The sustainability of supply chain collaboration largely depends on how relationship are established and

maintained among the chain partners. Generally, business relationships are maintained by adopting two basic approaches, behavioural and economic. A balance between risk and reward is considered to be an important economic factor for enhancing relationship. Similarly, trust among channel partners, power share and interdependence are other important factors for enhancing relationship in the supply chain system (Handfield and Bechtel, 2004). Empirical studies show that institutions play an important

and potential role in strengthening the markets for produced commodities produced, bought and sold by smallholders, enabling collective action and redressing missing markets.

Conclusion

On the basis of the above assessment, this paper examines the critical issues at each sub-system of agriculture supply chain, starting from the input to the consumer, with a view to integrating them in efficient and effective manner. As proper flow of information across the chain constitutes an integral part, the role of ICTs in improving supply chain efficiency in agriculture is discussed in detail. Technical intervention and policy issues have also been discussed for suggesting appropriate ways for the integration of each sub-system of the agricultural supply chain. Thus, this paper broadly covers some of important aspects of agriculture supply chain in India—identification of issues at different levels in the supply chain; transformation in the agriculture due to various supply chain interventions; the role of ICTs in supply chain management; and this paper also covers the suggestion to improve efficiency at different levels in supply chain.

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If connectedness is the chief difference between rural and urban areas, then broadband technology and other communication technology goals rise to the top of the list.

—Brad Lubben

PRP Is Not Bad: In Its Present Form in CPSEs It Needs Calibration

DIPAK KUMAR BHATTACHARYYA

Like many other countries of the world, India has also embraced the system of performance-related-pay (PRP) for employees of Central Public Sector Enterprises (CPSEs) with effect from 2007. The idea behind was to transform CPSEs institutionalizing performance-driven work culture. However, in CPSEs PRP depends on the mandated memorandum of understanding (MOU) parameters of the Department of Public Enterprises (DPEs). Many of these parameters also give credit for contributions of the organizations to several areas, other than performance, productivity and profitability. Since the year 2007, most of the CPSEs became eligible for PRP payment to their employees, and all cross-sections of employees are regularly getting the PRP payment as incentives. Operationally, PRP in CPSEs therefore become a process of doling out incentives, irrespective of performance and productivity, both at the individual and organization level. This, however, does not discredit the PRP as a system. The paper suggests use of more inclusive models like; Omni-factor and Surrogate. These two models in its pure form help organization in measuring the productivity trend and accordingly decide the incentive payment.

Introduction

Productivity is the major driver for organizations' sustainability. With improved productivity, companies can gain competitive advantages both in terms of price efficiency and increased level of motivation for workers. The concept of productivity has received international attention with the declaration of the International Year of Productivity in 1982. Traditionally, productivity was considered an input-output relational measurement. Orthodox views attribute productivity to labour efficiency as output quantification can immediately be related to labour efficiency. In terms of labour productivity, both India and China have outperformed rest of the countries of the world. However, this assumption suffers from a major lacuna, as many organizations, despite achieving high labour efficiency (measured in terms of value added in manufacturing), suffer from overall dysfunction and become sick. This we measure in terms of gap between total factor productivity (TFP) and labour productivity, which incidentally in India is increasing over the decades. Declining trend in TFP outweighs the benefit of increase in labour productivity. However, despite importance of TFP metrics, we continue to consider labour productivity as primary basis for incentivization.

Organizations operate on team effort by distributing different functional areas to different departments. Ultimate success of organizations depends on the effective joint efforts of different teams. A lapse in a single functional area or areas can offset the efficiency of other functional area or areas, so much so that it may ultimately affect corporate efficiency. Even within the ambit of an input-output relationship, the concept of input has widely changed under the present circumstances. Inputs are no longer confined within the direct materials used for production, but also consider even supportive functions in

a more abstract form. Thus, knowledge, ideas, information, etc., have also been thought to be within the definitional context of inputs. In organizations, the production section in reality transforms physical inputs to outputs. But other functional departments, though not engaged in direct material transformation, provide supportive inputs to production departments for efficient functioning. TFP is calculated factoring contributions of all the departments.

Scope of the Study

This paper investigates the process of allocation of incentives in central public sector enterprises (CPSEs) based on performance-related-pay (PRP) vis-à-vis our prevalent incentive models like; Omni Factor and Surrogate models (Bhattacharyya, 2012). Both these models provide a composite productivity index. Incentive payments to all cross-sections of employees, based on these two models, like PRP, also factor the effect of individual and group performance and correlate the same with the business results. For lack of organizational level data, the paper could not make a comparative analysis of PRP and these two models, however, for increasing dissatisfaction about PRP in CPSEs, and its resultant consequence of poor performance and productivity, the author suggests use of these two models, as these are more standardized and inclusive in nature. The paper first outlines the details of these two models, and then discusses the PRP concepts, alongwith the mandated PRP calculation formula of the Department of Public Enterprises (DPEs). To study the effect of PRP on labour productivity (measured in terms of value addition), the paper also encapsulates the data of three Maharatnas of CPSEs and finally the paper recommends the need to test PRP in CPSEs, in its present form in relation to omni-factor and surrogate models.

Productivity Measurement Models

Omni factor model considers all input and output costs of all the products. While input costs are taken for all, output costs are determined using the average marginal costs (AMC) method. Input costs are:

- raw material costs
- manpower costs
- capital costs, namely, depreciation, interest, stock investment, etc.
- indirect production costs
- cost of utilities

Output costs on AMC method worked out as under:

Assuming, we have three products, A, B and C.

Aggregate Output

$$= \text{Output A} + \text{Output B} \times \frac{(\text{AMC of B})}{\text{AMC of A}} + \text{Output C} \times \frac{(\text{AMC of C})}{\text{AMC of A}}$$

$$\text{Where, AMC percentage of A} = \frac{(\text{Total input costs of A})}{\text{Total output costs of A}} \times 100$$

Productivity = Aggregate output/Input costs

Surrogate model primarily considers some qualitative factors to measure productivity. Factors like the satisfaction of investors, employees, customers and suppliers are considered in qualitative terms. The quantification of these qualitative terms is done as under:

$$\text{Investors' satisfaction } (S_i) = \frac{\text{Net Profit}}{\text{Total Investment}}$$

$$\text{Employees' satisfaction } (S_e) = \frac{\text{Total value added}}{\text{Total number of man hours}}$$

$$\text{Customers' satisfaction } (S_c) = \frac{\text{Total Sales revenue}}{\text{Total number of customers}}$$

$$\text{Suppliers satisfaction } (S_s) = \frac{\text{Total purchases}}{\text{Total number of Suppliers}}$$

Composite Productivity Index, therefore,

$$A.S_i + B.S_e + C.S_c + D.S_s$$

A, B, C and D are constants, which indicate the relative weightage of the four parameters.

Omi-factor model makes use of our basic economic knowledge of input-output relations. However, firms may often fail to understand the mechanism of pricing all input factors, particularly those which are abstract in nature. In fact the traditional model also cannot encapsulate these input costs for better understanding of the productivity trend. However, with detailed information on input costs, the model can continue to provide useful results for productivity measurement. Surrogate model is more effective and can be customized based on the firms' requirements. The model correlates productivity with those terms, which are known contributors to organizational effectiveness. For example, quality, customer satisfaction, etc. Firms can decide on their important contributing factors to productivity, and accordingly fit those parameters to this suggested model.

Linking compensation to productivity, based on these two models, yield better results as organizations can

objectively price the labour and also, labour could get their legitimate share of productivity gain.

Performance-related-pay (PRP)

For PRP in CPSEs, we have Department of Public Enterprises (DPEs) mandated productivity attributes, which are given in the form of organization specific memorandum of understanding (MOU). Depending on the priorities of the DPEs, MOU parameters may be changed from time to time. But for the mandates from the DPEs, in India PRP in public sector companies was implemented to create an enabling culture of performance. Although the idea is good to bring efficiency in the system; from its practices, we feel constrained to observe, this is again same like doling out performance-based incentives to all, without making any changes in the compensation design and plan. Hence making the PRP a futile exercise, resulting in not much incremental change in the performance of the public sector enterprises in India (Bhattacharyya, 2013).

To achieve cost efficiency, transparency, and productivity, Government of India embraced PRP in line with many other OECD countries in the year 2008, when the sixth central pay commission report was announced (although the effect was given retrospectively, i.e., from 2007). At present 28 out of 34 OECD countries embraced PRP in government organizations (OECD Report, 2012). The root of PRP in India in public services however dates back to 1998 when Justice Mohan Committee recommended its usefulness. CPSEs in India implemented PRP linking with the MOU-based performance achievements, with effect from 1 January 2007.

Agency Theory and PRP

The root of PRP is agency theory (Jensen and Meckling, 1976). Agency theory considers the ambit of relationships between the principals (owners) and agents (managers), while deciding on the process of incentivization. For public sector enterprises (PSEs), government being the majority shareholder plays the dominant role of principals. Like government, society also becomes the important stakeholder for PSEs. Managers of the PSEs can be better aligned with the interests of the stakeholders, when PRP based compensation design is developed. Eisenhardt (1989) and Hart (1995) extended the discussions on agency theory to compensation design issues. The inherent conflict between the principals and the agents, extending the arguments of agency theory, can be better resolved through PRP-based compensation design. The

arguments for this rest on the premise that with PRP managers of CPSEs will work smarter with the expectation to earn more. Although money as a motivating factor to create a performance-driven culture in organizations have been contested by many scholars (Ambrose and Kulik, 1999; Milkovich and Newman, 2002; Bhattacharyya, 2009, 2011), PRP-based compensation design in CPSEs have been embraced globally, of which India is no exception. The rationale behind was to bring efficiency in managing CPSEs, using PRP as a driver.

Expectancy Theory and PRP

Arguments of Vroom's expectancy theory (1964) can also rationalize the PRP-based compensation design. Also PRP-based compensation design does not offend Adam's equity theory (1963). A well-designed PRP provides opportunity to managers (agents) to trace the rewards; hence, they feel motivated to perform better. So also well designed PRP can make it possible for managers to measure their efficacy in the context of equity or inequity, both through internal and external comparisons (Bender, 2004). Nick and Huber (2010) while studying the effect of PRP on public sector enterprises observed it may not work primarily for reasons like; less potentiality to motivate employees because rewards are constrained by disbursable cash availability, subjective evaluation of individual performance, and lack of diversity neutrality.

Culture and PRP

Schuler and Rogovsky (1998) based on their studies of 24 countries analyzed the link between culture and PRP-based compensation management practices. Their study reports PRP works well when it is crafted within the cultural constructs of the country. In a culture of high uncertainty avoidance, like in India, employees being more adept to stable compensation, PRP may not work. Again PRP factors individual contribution (at times even assign more weights than group and team performance), may not be the right fit for a culture of collectivism. Compensation culture nexus is the best fit in institutional theory (DiMaggio and Powel, 1983; Scott, 1987), as firms' behaviour and managerial practices, so also compensation management practices, as per this theory, are culture congruent.

PRP is often seen as narrowly focused compensation strategy, as it is more individual-based than collective (Lee, Iijima and Reade, 2011). This study also reported its poor effect on collectivist work culture of Japan, excepting its positive effect on young employees. Also researchers like Rubery (1995) observed that PRP disproportionately

distribute the income more in favour of the highly paid executives and managers. Dahlstrom and Lapuente (2009) study indicated that PRP in public sectors are more intended to enforce control over employees, emphasizing on individualization of reward systems. Problems with PRP, as observed by Perry, Engbers and Jun (2009) have typically attributed to its insignificant impact on motivation, potential problems of designing job responsibilities and its problems in implementation. Kohn (1993) argued PRP cannot ensure enduring change in performance behaviour. It often inhibits risk taking. Bregn (2008) also warned individualization of pay through PRP in public sectors (PSEs) may require caution, as it may run against the underlying philosophy behind PSEs. Hence, designing an objective PRP in PSEs may not be so easy, balancing all its important constructs.

Productivity and PRP

Gielen, Kerkhofs and Ours (2010) could observe the positive effects of PRP on labour productivity (9 percent) and employment growth (5 percent) in Dutch firms. Similar improvement in productivity and profitability (6 percent) was observed in Finnish firms by Piekkola (2005). Forest (2008) studied the effect of PRP on French Civil Service, and observed negative effects on motivation. The study suggests participative management practices along with task enlargement and enrichment can work better in motivating French Civil Servants than PRP. Schmidt's (2011) study again on the effect of PRP on German Civil Services corroborates with Forest's findings on France, as in Germany also participative management with balanced focus on material interest and social recognition can ensure better effectiveness than PRP.

PRP as a tool to reward the performance in a cost-effective manner was commended by Lewis (1998). As a moderating variable for behavioural modification also, it acts efficiently, resulting productivity enhancement (Belfield and Marsden, 2003; Latham and Huber, 1992). Despite criticisms, PRP can be factored with both individual performance and collective performance. Globally, positive effects on PRP have been empirically tested. For example, Cahue and Dormont (1997) observed 2 percent increase in productivity in French organizations after PRP implementation. Lazear (2000), however, could observe PRP-based incentives increase 20 percent productivity in US firms, when it factors individual performance. In Canadian organizations, Paarsch and Shearer (2000) observed 22 percent rise in productivity after the introduction of PRP. Scholars like Perry and Wise

(1990), Perry et al. (2009), and Houston (2000) have recommended PRP in public services as an alternative to variable pay. Booth and Frank (1996) and Lazear (1986) recommended PRP to attract quality workers in the organizations. Brown (1990) in addition to attraction and retention of competent employees observed that PRP can promote the culture of achievement and inculcate sense of responsibility among workers, resulting in increased performance and productivity.

PRP in PSEs—What Is the Debate

From the literature review above, we can understand that debates on PRP in PSEs can be grouped under two generic categories: agency theories and expectancy theories. We have briefly introduced both the pioneering concepts. But in the context of PSEs, we need to understand its extended implications on workers' performance. Implications of agency theory for the PSEs was studied by Dixit (1999), who could attribute two major problems in principal-agent relationships in PSE settings; 'moral hazard' and 'adverse selection'. 'Moral hazard' problems arise as the actions of workers (agents) ultimately lead to the pay-offs of the organization (principal). To reduce the problems related to 'moral hazard', it is necessary to make workers' actions observable for the principal suitably aligning it to outcomes. Hasnain et al. (2012) observed problems of performance measurability for 'coping' or procedural jobs. They have considered it as the most challenging task for the PSEs. However, such problem is manageable for craft jobs, like production, etc., for its easy measurability.

'Adverse selection' syndrome in PSEs is attributed to general propensity of low-quality workers to prefer a job with fixed/guaranteed pay. This can be reversed when the pay system is more merit-based (individualized).

Hence, selecting the appropriate performance measures, in both the cases, can significantly reduce the problems of ill-designed PRP in PSEs.

Though Expectancy theory is pioneered by Vroom (1964), its institutionalization is more credited to Porter and Lawler III (1968). Its psychological insights further get extended to 'reinforcement theory', pioneered by Skinner (1969) and Luthans (1973). To elicit repeated performance actions, and so also behaviour, PSEs need to make their PRP more specific and participative. Reinforcement theory on the other hand suggests the need for building an enabling culture of performance, so that workers volunteer for performance. This again requires proper alignment of

PRP, cascading DPE mandated MOU to individual workers' level. Rischer (2012) in the draft report on PRP in OECD countries (Gov/PGC/PEM (2012/3) emphasized the need for gaining acceptance of PRP from managers and employees and organizational change to set the organizational premises before its implementation. Unfortunately, most of the PSEs in India do not have balanced score card driven KRAs covering all cross-sections of workers, which often culminates to their frustration. How the individual performance is factored, are often more a discretionary mandate of executives and managers of PSEs for their people.

PRP Formula in CPSEs

A typical formula drawn in line with the recommendation of the DPEs can be illustrated as in Table 1.

Physical and financial performance weightage for PRP for a CPSE engaged in steel manufacturing has been assigned in Table 1.

Company performance (MOU rating) Unit's Performance	77.5%
• Linked to saleable steel production	02.5%
• Linked to specific energy consumption	02.5%
• Linked to yield from crude steel to saleable steel	02.5%
• Linked to actual PBT vs. Budgeted PBT	07.5%
• Individual performance	07.5%

Based on the above the CPSE has been following the under mentioned formula for PRP payment:

$[0.60 \times \text{Annual Basic Pay} \times \text{MOU Rating} \times 77.5 \text{ (performance factor for the company as a whole)} + 2.5 \times \text{Plant's Saleable Steel\%} + 2.5 \times \text{Plant's specific energy consumption\%} + 2.5 \times \text{Plant's yield from crude steel to saleable steel\%} + 7.5 \times \text{Plant's Budgeted PBT\%} + 7.5 \times \text{Individual performance rating}] \times [\text{Grade Incentive} \times \text{ratio of available to required amount}] - \text{Adjustment of performance related payments already made}.$

Another CPSE has crafted PRP formula in line with DPE guidelines, bifurcating it into two types:

PRP-1 = Pool proportion (60% of the component) x MOU rating x grade ceiling x annual basic pay x individual performance x pool availability factor (relevant for 60% component).

PRP-II = Pool proportion (40% component) x MOU rating x grade ceiling x annual basic pay x individual performance x pool availability factor (relevant for 40% component).

For calculating individual payout of PRP, PRP-I and PRP-II are added.

Pool proportion in both the cases and so also for all CPSEs is 5 percent of PBT. This 5 percent is arrived at considering 3 percent of PBT + 2 percent PBT from 10 percent incremental profit. Pool availability factor is derived by dividing amount available with amount required.

Undoubtedly, the purpose of introduction of PRP in CPSEs (in line with the global development) was to bring more efficiency and gradually institutionalize the performance driven work culture, institutional bottleneck, and governmental interference reduced it like any other new initiatives with no incremental change. A comparative study between pre-PRP and post-PRP implementation in two major CPSEs could not establish any major change in labour productivity (Bhattacharyya, 2013). Moreover, PRP issues have now become perennial industrial relations problems in organizations. Almost all 'Maharatnas' in India are alleged to have paid less incentives to their executives and managers as incentives calculated on PRP. Trade unions also are now alleging workers and non-executive category employees are being discriminated in incentive payment for differential weight on their performance. In contrast use of Omni factor model and Surrogate model for incentivization when embraced for organizations, we are able to make our incentivization process and performance management functions more efficient and equitable.

Labour productivity trends in three Maharatnas in India are presented in Table 2.

Table 2: Labour Productivity Trend in selected Maharatnas

Years	Labour Productivity—ONGC	Labour Productivity—SAIL	Labour Productivity—BHEL
2005–2006	19.7	12	–
2006–2007	6	33	–
2007–2008	4.8	7	0.49
2008–2009	33	0.5	0.61
2009–2010	12	6	0.74
2010–2011	12.2	5.7	0.93
2011–2012	1.5	No change	1.00

Source: Analysis of Annual Reports of Sample CPSEs. In all cases percentage change in labour productivity has been shown.

Note: Figures have been rounded off to 1 decimal point and approximated for better understanding of the trends.

Labour productivity trend is a known performance indicator. Hence, increasing percentage change in labour

productivity is a good performance syndrome for these organizations.

Macro-level studies in India also authenticated decadal increase in labour productivity. This substantiates decreasing trend in profitability of Maharatnas like ONGC this year is attributable to decline in TFP. However, we do not have any possible means to calculate the TFP, for difficulty in data collation.

Conclusion

The study recommends the use of Omni-factor and Surrogate models of productivity measurement for incentivization. Both these models can objectively assess the total performance. Also, it can ensure equitable distribution of allocable surplus/profits among different stakeholders, including employees (in the form of incentives), based on some pre-decided strategies. For example, employees can be incentivized based on the pre-fixed ratio, leveraging their individual and group performance and the pay grades. As the focus is on profitability or surplus, from the beginning itself, rationality is clear to all the stakeholders. In contrast, PRP though facilitates incentivization factoring organizational performance and profitability and individual team contribution, for DPEs mandates on performance criteria (in the form of MOU), it becomes more bureaucratic than professional. Many CPSEs, despite marginal change in profitability, have been rated by DPEs as excellent for organizational contribution to different other parameters of the MOU. Therefore, PRP rating is increasingly becoming meaningless in CPSEs; as DPEs mandated formula by default make each and every employee eligible for incentives. Similarly, CPSEs have also diluted the spirit of PRP, which were intended to bring efficiency in organizations, recognizing the performance. Inter-group variation in PRP rate has institutionalized the employees' grievances in most of the CPSEs.

However, the study suffers from the limitation of considering profit/surplus as the sole criteria of firms' sustainability. CPSEs are supposed to be more responsive to social commitments, align their operations with national priorities, which often may trivialize their profit/surplus making endeavour. Despite this the recommendations of this study are considered important for future research and investigation. One possible way to make the PRP system more meaningful is by unshackling control of DPEs from the CPSEs. But it all depends on the priorities of the government, government being the majority stakeholder.

Finally, the paper again reiterates that PRP in principle is not bad, but its operationalization, when moderated by extra-organizational interference, it causes more harm than good.

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India should walk on her own shadow - we must have our own development.

—A.P.J. Abdul Kalam

Labour Management Relations—Issues for the Indian Mining Industry

SHRI PRAMOD MOHAN JOHRI

Indian mining Industry has a cyclic effect. At times it has recession and sometimes the industry records high profits. Earning of foreign exchange from the export and sudden profits due to the fluctuating USD v/s INR rates has been a unique phenomenon for the industry. In various mining magazines we often read that National Mineral Development Corporation (NMDC) has made gross contribution to the national exchequer in the tune of Rs 7490 crore. It has become the single-largest producer of iron ore in India and the only mechanized diamond miner in Asia. National policy for the export of iron ore and for domestic consumption makes a lot of changes in the demand and supply system. On the other side we read that the Indian mining industry is passing through recession. The issues relating to forest clearance and environmental clearance have deep impact on the existence of this industry. As a recent development mining industry in Goa has been in a stand still for the last one year whereas the export of iron ore has been the backbone of the economy of the state of Goa. In such a rapidly changing environment of Indian mining industry, HR initiatives like rightsizing of manpower, adequate investment in human capital plays a very vital role to recognize mining industry. Industrial relations directly impact productivity, harmony and peace and competitiveness of the mining industry. It is true that employees in the organization represent rich talent pool which represents the appreciating assets for the organization.

Introduction

The following lines of Charles Dickens from the story 'A Tale of Two Cities' are truly applicable to the Indian mining industry, which go as:

It was the best of times, it was the worst of times, it was the age of wisdom, it was the age of foolishness, it was the epoch of belief, it was the epoch of incredulity, it was the season of light, it was the season of darkness, it was the spring of hope, it was the winter of despair.

Mining industry is a labour-intensive industry where a large number of workforce is unskilled, muck cleaning, and piece rated. They hail from the local vicinity. Most of these labourers are through contractors where service conditions are not defined; their facilities are not in accordance with the Contract Labour (Regulation and Abolition) Act, 1970. However, in respect of departmental labours, things are organized and benefits are in accordance with the Standing Orders of the Organization and Mines Act, 1952. The participative fora are functioning for such labourers and that had influenced harmonious and peaceful industrial relations. However, the recent trend is alarming because of the increasing trend of outsourcing. In respect of outsourced labour it is brought out glaringly that their service conditions, payment of wages and other facilities are not as per statutory. At times, this causes adverse impact on the employees' relations. Some progressive organizations like NMDC, NLC, Hindustan Copper and Hindustan Zinc, etc., have recently started and starting the concept of fair labour, fair wages, and payment of bonus and other normal benefits. Government of India has been advocating the cause of contract labour and has shown concern on the working conditions of these labourers; even th Prime Minister of India has addressed this issue in his address from time to time.

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Study of Mining Industry Related to Labour

Studies on labour related to mining industry have been carried out by many eminent scholars and researchers like Khanna, 1997; Rabe, 2006; Lahiri-Dutt, 2006; Handy et al., 2003; Kulkarni, 2007 and others. The studies are basically based on the life of the labourers in the mining industry. These scholars have tried to explore the problems faced by these workers, the health hazards faced by them, the exploitation that they witness, and the pain that gets inflicted to them. Ample efforts have been made by these researchers to bring to limelight the grief of approximately one billion mines labourers, which include around 44 million child labourers (Rabe, 2006: 21). These eminent personalities have highlighted the use of child labourers and misuse of female labourers and female child labourers in the industry. They have spoken about the welfare issues of this section of workforce. In 2006, it was highlighted that India accounted for around 27 percent of the world production of minerals and stones (Rabe, 2006: 7). UNICEF has estimated that approximately 20 percent of mine workers are children (Marshalls). Another study indicates that women make up 10–50 percent of quarry workers (Lahiri-Dutt, 2006:4), and 40 percent of these women are in the age group of 5–14 years (Nayak et al., 6).

Problems of Mining Labourers

Now analyzing these researches, we find that the major problems faced by mine workers are related to unhealthy working conditions, low wage, no welfare amenities, attitude of miners to earn profits at the cost of lives of their mine workers, occupational illnesses right from respiratory problems, silicosis, tuberculosis, leukemia, arthritis, to reproductive problems (in case of women), toxic and hazardous working environment with limited, inferior quality and sometimes Nil safety gears, retrenchment on the closure of mines, retrenchment on the introduction of new technology, lack of education for kids, lack of proper medical facility are some of the many major problems faced by these individuals.

Workers' Participation in Management in the Context of Mining Industry

In such a scenario anticipating participation from the mining workforce in the management and efficient functioning of the organization is a mere derision. A live example of this situation is the gold mining industry of South Africa wherein the labourers and the unions opposed the introduction of technology into the company with the fear of losing jobs. In a scenario as is prevalent in India, management has to

interact with the unions and the workers for settling up various matters such as wage settlement, selection of welfare items, etc. In addition to this if we go deeper into the matter we will realize that the modern workforce has educated people in it. This has resulted in the unions understanding that for raising demands to the management, they have to earn more revenue for the management for getting their demands fulfilled or else their all requests would go in vein. Hence, despite all odds, there is a little bit of workers' participation in management even in the mining industry. Considering the existence of interaction between the management and the unions in the mining industry, let us observe some works of eminent scholars in the field of workers participation in management and what they have to say about it.

Many research studies support the notion that employee participation can improve manufacturing performance (Batt and Appelbaum, 1995; Dougouliagos, 1995; Glew et al., 1995; Kochan et al., 1991; Levine and Tyson, 1990; MacDuffie, 1991; McCaffrey et al., 1995; Osterman, 1994; Womack et al., 1990). There are many organizational contexts in which worker participation takes place as a factor critical to its success (Batt and Appelbaum, 1995; Cotton et al., 1988; Kochan and McKersie, 1992; Leane and Florkowski, 1992). Several researchers, for example, argue that the productivity effects of participation are expected to be the greatest when plants adopt a coherent system of participative management structures in combination with process organization and certain human resource programmes (Kelly, 1996; Kochan and McKersie, 1992; MacDuffie, 1995). In lean production, just-in-time delivery systems help rapid problems identification (MacDuffie and Krafcik, 1992). Similarly, information such as the daily production targets, cars produced, personnel, overtime, etc., are displayed on lighted boards that are visible from every work station (Womack et al., 1990). Human resource policies also support worker participation programmes. To ensure that workers will commit themselves to the company, there is a lifetime employment guarantee, highly restrictive worker selection, a reduction of status barriers between managers and workers, and a system of promotion with a large number of job titles (MacDuffie and Krafcik, 1992). Examining the above few lines and some other similar works, we realize that almost every researcher has concentrated on the workforce as human capital and has spoken in one way or the other regarding their participation in management and has indicated that their participation is a crucial factor in enhancing the productivity of the organization.

Impact of Employees' Relations in Mining Industry

The challenges for human capital in the next decade will also be multifold. In emerging market oriented economy, there has already started a debate on public versus private sector. India's journey from mixed market economy to liberalized market economy debates has been unending with the competition for survival and superiority continuing unabated.

The economic liberalization has made the imports easier for mining industry in India; it has opened the possibilities for our products to be imported at cheaper rates. With hitherto reserved area of iron ore mining being opened to private entrepreneurs, the interest shown by MNCs to enter into mining speak. Volumes about the competition we are to face in the next millennium. The present recession in the steel industry adds to these problems. This threat forces us to explore new avenues. There are also new opportunities by way of technology and global reach for collaboration and expansion. But to benefit from them, we need to prepare our people in order to compete. People have to adapt, adopt and absorb the required change.

The human being is the only asset which appreciates, provided it receives due attention by way of positive HR intervention. Employees are the hidden treasures in the organization. Therefore, they should be treated with utmost care. Employees' involvement is the main prerequisite for any organization to justify its existence. No system or strategy, technology or process can ever succeed without human involvement. Since people are the most valuable resources available to an organization, they need to be employed as effectively as possible. At the same time people are not simply just another factor of production. All the literature of this century on the treatment of people at work emphasizes how crucially important it is that employers should understand the psychological needs of their employees and should treat them humanely and sensitively.

The issues before Indian mining industry in next millennium will be tackled successfully only if the organization develops its human capital to adapt to change. People have to understand that change is a way of life. An individual mining company should seize upon change as opportunity. It should look forward to change. It should thrive on change, but first of all it should create and force change rather than react to change created by other mining companies all over the world. Change is healthy, creating and facing change will be the prime job of any management

of mining industry in India. Because changes in role involve changes in perspective, they also have the potential to produce significant shifts in the paradigms, by which the reality will be defined. In a new role rate we shall be required to see things differently and therefore it would foster the need change our behavior using talent/abilities that appear as new skill.

Need of the Hour

In the changing scenario Indian mining companies are in severe need of restructuring for an effective administration and management of workforce. This also means changing of mind set of employees and executives who are typically obsessed with routine. To a large extent, flatter organization structure of Mining Industry in India has allowed for quick decision making and provided greater autonomy to managers, as has been the trend the world over. Apart from these, we must look into other micro-aspects of structuring like 'retraining', redeployment, 'multi skilling', 'attitudinal change' and improving productivity through awareness of cost effectiveness/waste control and value addition. This is imperative mainly due to increase in competition on a level playing field brought about by globalization and improving the quality of product. Primarily restructuring is required in Indian Mining Industry with following objectives in mind:

- (a) Redeployment of work force (Right man for right job).
- (b) Multi-skilling through retraining/specialized training of workforce to emphasize the fact that organizations must downsize to eliminate the unproductive excess among operating work force.
- (c) Change should not remain alien to organizations. It would be necessary that grass root employee's attitude also undergoes change. A motivated workman will find it easier to accept change.
- (d) Educating the workman about the status of the organization vis-à-vis market and the role they have to play in the organizational growth.

The major issues before the Indian Mining Industry are:

- Reduction in man power
- Improving techno-economic parameters
- Improvement in quality of product, a sustainable
- Quality to meet international standard
- Reduction in energy consumption

- Improvement in productivity
- Improvement in labour productivity
- New product development/diversification
- Improvement in work practices—for shift change over
- Increase of Production in first and last hour of work
- More exports
- Cost reduction/cost control
- Benchmarking
- R & D and innovation

Optimum utilization of human resources' potential is going to be an important job of the top management of any mining industry and this will be the challenge in next millennium, if they wish to retain their existence in the competitive global scenario.

Role of Trade Unions

Till recently the role of trade unions traditionally or conventionally has been to protect the interest of workmen. In order to gain and regain the majority support, irrespective of the long range consequences, adverse or otherwise the Unions used to support the cause even though at times it might meet the selfish ends of some group of individuals. This has led to the situation when unions could not speak the truth openly when some workers or even management was wrong due to fear of incurring the displeasure of somebody or the other. Public sector due to governments' policy of globalization and liberalization is sought to be closed in stages. Many PSUs have been referred to BIFR. Should the trade unions continue the same kind of 'Fight'? Should the trade unions role in the public sector and the private sector be the same? Now the time has come that every trade union has to think for the reliability of the product of the company in the national and international market, customer response and how to improve this track record in implementing the orders and how that affects the image/market of the company. Trade unions should also have commitment to organization. Cause and effects of excess manpower, redeployment and retraining, effects of the government policies of liberalization and globalization, utilization of existing infrastructure and hi-tech machinery for diversification plans are some important points for which trade unions in mining industry have to think seriously. Such SWOT (strength-weakness-opportunities-threats) analysis should be conducted by the trade unions.

The Labour Management Relations will play an important role in this regard. Participative forums will help mining organizations. Management of human resources will be the centre stage of enterprise management and a people first approach (Better people rather than better technology) will be the *new mantra* for next millennium.

Industrial Relations Machinery in Indian Mining Industry

Keeping pace with the National policy on Workers Participation in the Mining Industry many public sector undertakings have made a remarkable breakthrough in having the Forums of Joint consultations and Workers Participation since early '70s and it has become an integral part of Industrial Relations structure in mining sector. These joint fora are playing a very important role in achieving industrial peace and harmony as also achieving Production and Productivity. The Forum of joint consultation has won the confidence of both Employer and Workmen due to its impartiality understanding and integrity.

In pursuance of Government of India's Resolution in 1975 regarding Workers' participation in Industry many mining industries including NMDC have introduced a three-tier system in the direction of Workers' participation in management. These were reconstituted in 1983 in terms of new scheme introduced by Government of India. The joint councils which have been set up in three-tier structures are:

- Shop Council (Covering each production area/ other areas in all plants)
- Project Joint Council (Plant Level) (the apex body at every plant/Mine)
- Apex Joint Council (Corporate representatives from all units)

It would thus be seen that National Mineral Development Corporation Limited as a forerunner constituted three-tier participative forum and the Management has been successfully functioning for about almost three decades.

In addition to three-tier councils, NMDC has made an important breakthrough in persuading the different unions working in its production projects and other units to come under one umbrella by formation of Federation at all India Level called All India NMDC Workers' Federation (A1NMDCWF).

This has been done in one year 1971 and this Federation has helped in formation of a Bipartite Committee at the Corporate level in which all the Unions affiliated to

the Federation irrespective of their recognition by the labour machinery, affiliation to different Central Trade Unions participate as a group. This Bipartite Committee has been working very satisfactorily and all the wage settlements and other major issues relating to job specifications, work atmosphere and other service matters are settled amicably during the discussions in the Bipartite Committee. A number of sub-committees are formed comprising representatives of workmen as well as management to deliberate in detail on special assigned issues and such committees come to an agreed conclusion which is finally ratified by the main Bipartite Committee for implementation.

These for a serve a meaningful purpose for a coordinated effort towards better performance, better welfare measures and in maintaining discipline, production and productivity. Different problems are discussed mutually across the table and are sorted out in a healthy and amicable atmosphere. It has been our experience that Workers' representatives have been found to be increasingly interested in discussing matters of common interest in the overall interest of the organization rather than individual cases. Since the introduction of this scheme, there has been certain level of maturity in discussions and issues connected with the betterment of the performance of the company and rational solutions obtained.

Important Issues Discussed in the Shop Council

The following issues are being discussed in different Shop Councils of various units from time to time:

1. Production facilities
2. Storage facilities
3. Material economy
4. Operational problems
5. Control of wastage
6. Quality improvement
7. Monthly targets/production schedules
8. Cost reduction programme
9. Formulation and implementation of decisions taken
10. Cleanliness
11. *Industrial hazards*
12. Shop hygiene

Issues Discussed in Plant Council Called Project Joint Council

The following subjects are being discussed:

- i. Planning, implementation, fulfillment and review of monthly targets and appraisal of the future targets.
- ii. Profit and Loss statement and Balance sheet.
- iii. Review of operating expenses, financial results.
- iv. Improvement in productivity in general and crucial areas in particular.
- v. Pollution control.
- vi. House-keeping
- vii. Consideration of those issues referred to it by Shop Council.
- viii. Evaluation of the suggestions referred to it by Shop Council under Suggestion Scheme.

Some Insights of Management Practices

A few management thoughts, ideas, practices which shall be inevitable and beneficial to the Industry including Mining Industry are reproduced below from the pullouts 'opportunities'/ open page published by the daily *the Hindu* in the context of liberalization and globalization with special reference to industrial relations, trade unions role, participative management, building proactive organization culture and effecting change in organizations.

- (1) In the words of Jack Welch, the idea of liberation for our work force is not enlightenment, it's a competitive necessity.
- (2) Using Neuro Linguistic Programme is the latest breakthrough discovery in understanding human behaviour and to overcome resistance to change. With the business environment becoming highly competitive, there is an imperative for every organization to turn out superior products and services in order to survive in the market. However, the quality of human resources development and organization response to change has not kept pace with the changes in technology and customer expectation. Every change is painful and overcoming resistance to change is going to be challenge for many organizations. *Neuro Linguistic Programme* talks about the skills to shift the perceptual positions from 'Self' to 'other', to 'observer' to 'context' to purpose of organization's existence.

The gist is to look at the issue from the perspective of 'self', look at the issue from 'other'; i.e., other man's point of view, looking at the issue from 'observer' position by detaching from one 'oneself' and 'other' perspective; looking at the change issue in the proper 'context' and the 'purpose of the change in quality, cost, delivery and service parameters.

- (3) An authority-based organization (ABO) has to convert itself into a relationship based organization in order to survive and succeed in the changed and ever changing market environment.
- (4) As a catalytic agent the human resource manager has to change the mindset of the workers so that the latter accepts radical changes in system structure and processes which the organization is contemplating to introduce in order to compete with the rivals. What is most important is to change the key value, beliefs and norms established by the top management.
- (5) For building proactive organization culture and for down-to-earth people oriented and sensible turn around three simple questions are to be asked: (a) What is happening? (b) What should happen and where should the organization be taken? (c) What should one do to get there?
- (6) The introduction of new technology and new processes will become routine with liberalization and globalization. The trade unions will have to accept the consequences that follow from this and take follow-up measure. One step in this direction is that they should advise the workers to undergo training and accept the restructured jobs.
- (7) According to Charles Handy the three assumptions behind the concepts of empowered organizations are competence, trust and teamwork.
- (8) Both the management and the workmen/unions must be totally focused on customers—both internal and external. The trade unions to maintain the status and esteem of Indian labour should address themselves to taking the role of 'facilitators' for adoption of new technologies, improved quality of products and in greater participation of Indian industries in foreign trade/collaborations/investments.

- (9) Participation of employees, both in the planning of change and installing in it goes a long way in reducing resistance to change. It helps those involved to understand it and helps them in feeling that they have had a part in setting it up.
- (10) Earlier each wanted to get maximum advantage over the other. Labour wanted to work as little possible and earn as much as possible. Management wanted to pay as little as possible and extract as much work as possible.

Conclusion

Optimization of Human Resources is going to be the most important task for Indian Mining Industry if the Organization wishes to have the same pace of progress and success in the next Millennium. In the recent National Seminar organized by National Institute of Personnel Management, it is reported that our country has maximum potential to meet the requirement of Human Capital in the next Millennium. The percentage of young engineers, scientist, doctors and other professionalized field is maximum in India. A lot of developed countries have started establishing their R & D units in India. Foreign earnings to a large extent will be through utilization of Indian human capital by international companies. Thus our country has an important responsibility to develop its human capital to meet the challenges and requirement of next millennium. In this context, optimum utilization also becomes essential and important to meet the competition in view of liberalized policy of central government and when international organizations are stepping in India with higher and advance technological exposure.

The Indian Mining Industry will have to relook on their part in the context of labour management relations and have to take the participation that should reflect a process of transparent consultation on business strategies. The veil of secrecy need have to be lifted by the management from the process of business decisions. Unions should realize and start considering the participative fora as a business advisory and consultative machinery instead of a collective bargaining machinery or a dispute resolution forum. A Works Committee or a Production Committee at a shop floor level should not duplicate for a Grievance Resolution Committee or a demand settlement fora. The sole objective of workers participation fora should be to promote the business interest of the company. The participative forum is to reconcile in a reciprocal and incremental way, the interests of the individual employee with the interest of the organization and its business

objective. In the context of Labour Management relations Liberalization in true sense means empowerment of all. Empowering is possible only in one way; i.e., by making every worker, employee and unions and management alike, clearly see where lies their best interest and work for it in tandem. Harmonious Labour management Relations could provide the ideal climate to make it possible.

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Labor was the first price, the original purchase money that was paid for all things, it was not by gold or by silver, but by labor, that all wealth of the world was originally purchased.

— Adan Smith

Economic Reforms and Inclusive Growth of Higher Education in India

DR. A. ABDUL SALIM

The importance of education in socio-economic development has been well-recognized with the 'human investment revolution in economic thought' since the 1960s. This has resulted in the substantial public investment flowing in to education and spectacular growth in enrolment both at the levels of school and higher education in both developing and developed countries of the world. But when the term economic crisis was unveiled with the oil shocks, world inflation, mounting foreign debt and world recession, countries began introducing Economic Reforms through various stabilization and adjustment policies. These policies have a lot of indirect and adverse effects on education and human development. The policy-makers in our country do not seem to realize the mutually reinforcing relationship between education and economic development; rather they go in for recommending public expenditure cuts in education particularly higher education. Even when our economy was growing 6 percent to 8 percent per annum, there was no significant increase in the allocation of government resources to higher education. Instead, the government aims to realise the promised expansion of higher education with the active involvement of the private sector and through various modes of public-private partnership. This has serious adverse effects on access and equity of various socioeconomic groups in higher education. In India, there exists wide disparities in educational attainment among regions and states, between males and females, poor and non-poor, religious categories, castes and occupational groups. Inclusive growth by reducing these disparities calls for increased allocation of government resources as has been done in the case of Asian Miracle Countries; not by withdrawing from the higher education sector by offering a few subsidies. In this context, this paper attempts to discuss the economic reforms and inclusive growth of higher education in India, in the light of the Twelfth Five-Year Plan recommendations.

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Introduction

The higher education system in India enrolls the second-largest number of students (22 million) in the world after China. In the past two decades, enrollment grew by 7.7 percent per annum and more than quadrupled. The number of institutions has grown even more rapidly from 6,000 in 1990/91 to more than 46,000 in 2013, the most of any country in the world. The gross enrollment ratio (GER) increased from 12.3 to 19.4, which was calculated for 18–23 years of age group. GER for male population is 20.8 and for females it is 17.9. For Scheduled Castes, it is 13.5 and for Scheduled Tribes, it is 11.2 percent as compared to the national GER of 19.4 (Agarwal, 2009; GOI, 2013). In spite of this growth in enrolment, the GER in higher education in India is still lower than the world's average and many developing countries and much lower than that of developed nations (58%). The Twelfth Five-Year Plan (FYP) sets 25 percent GER as a goal for 2017, a target that would add ten million enrollees over the next five years at an annual growth rate of 7.8 percent.

It is a fact that higher education in India is passing through a phase of phenomenal expansion, marked by substantial growth in a number of institutions, enrolment and public funding. But India's higher education system faces a number of challenges including rapidly expanding demand for higher education, widely varying quality among institutions and unequal access to higher education for disadvantaged groups and regions. This article discusses various aspects of economic reforms and inclusive growth of higher education in India. More specifically this article deals with the issues of access and equity, financing, subsidisation and privatisation in higher education in the context of economic reforms. It also looks in to the initiatives proposed in the Twelfth Five-Year Plan in addressing these issues.

Higher Education and Economic Reforms

The importance of education in socio-economic development has been well recognized ever since the

'human investment revolution in economic thought' (Schultz, 1961). This has resulted in the substantial public investment flowing in to education and spectacular growth in enrolment both at the levels of school and higher education in both developing and developed countries of the world. But when the word economic crisis was unveiled with the oil shocks, world inflation, mounting foreign debt and world recession, countries began introducing Economic Reforms through various stabilization and adjustment policies. These policies have a lot of indirect and adverse effects on education and human development. The adverse effects are feared to be brutal as human development and structural adjustment are believed to be antithetical (Tilak, 1993; 2012). The policy-makers in our country do not seem to realize the mutually reinforcing relationship between education and economic development; rather they go in for recommending public expenditure cuts in education particularly higher education. Even when our economy was growing 6 percent to 8 percent per annum, there was no significant increase in the allocation of government resources to higher education. Instead, the government aims to realise the promised expansion of higher education with the active involvement of the private sector and through various modes of public-private partnership. This has serious adverse effects on access and equity of various socio-economic groups in higher education.

Issues on Access and EQUITY in Higher Education and Economic Reforms

Despite several decades of policy innovations, equity remains a key dilemma and access still of concern for low socio-economic groups. The policy-makers instead of looking into this inequity dilemma have gone in for the easier option of leaving higher education to market forces. In India, there exists wide disparities in educational attainment among regions and states, between males and females, poor and non-poor, religious categories, castes and occupational groups (Thorat, 2009). Rural urban divide in higher education is immense. Access to HE is dramatically lower and quality tends to be lower still in rural than in urban areas. Disparity between the affluent urban areas and vast interiors is significant. There is a dismal picture of nearly two times GER in urban areas (19%) compared to the rural areas (11%) in 2007/8 (NSS 64th Round, 2007/08). Gender disparities continue to exist in respect of girls from rural areas. The GER for males was 19 percent whereas it is 15.2 percent for females in 2007/08. Gender disparities have ceased to

exist at the overall level in some states, more so in the urban areas of several states. This shows that a focused effort is now required which is geographically targeted towards states where significant gender disparities continue to exist in respect of girls from rural areas. Inter-State variations in access to higher education are the largest for some of the states in the central, eastern and north-eastern regions. The estimated GER in 2007/08 was the lowest for Bihar (7.5%) and the highest for Kerala (37.2%). The tribal-dominated states such as Chattisgarh, Orissa, Tripura, Manipur and Arunachal Pradesh have very low GER. This indicates the need for more institutions in the backward states and the need for launching programmes which can increase effective demand for higher education.

Poor-non poor divide in higher education is also predominant. One notable feature is that the GER is much higher among the children of the business and self-employed communities as well as salaried people. The worst condition is faced by the casual wage labour which is a socioeconomic problem which has serious implications. A study by University Grants Commission (UGC) also found that nearly 80 percent of the beneficiaries of university education in India belonged to top 30 percent of the income group. Their parents concentrate in urban areas, send children to elitist institutions for quality education in medicine, engineering and science. Only low-quality government/aided colleges are accessible to low-income groups. Despite a large number of remedial measures taken in the different Five-Year Plan periods, there exists a staggering difference in enrolment among different social groups. It is notable that in 2006/7, the GER in the ST category (7.67 %) is one-fourth that of the general category students (26.64). It is less than half for the SC (11.54%) and more than half for the OBC students (14.74%). GER for the Muslim population (9.51 %) is half that of the non-Muslim students. When compared with the 2004/05 data, there is improvement in the situation for the SC and the OBC groups, but a lowering of the figures for the ST group. This is a serious situation and needs immediate attention (UGC, 2011). It can be observed that SC/ST/OBC are untouchables in many Centres of Excellence either as faculty member or student. Even the statutorily reserved positions are not filled. Thus higher education in India is still a status stabiliser, rather than an invader of status rigidities. Quality higher education has not filtered down to the lowest sections. Thus, the policy of equal access is more rhetoric than reality for unequal groups. Access to higher education is still less than the

minimum international threshold levels; enrolment in public universities is largely concentrated in the conventional disciplines whereas in the private self-financed institutions, enrolment is overwhelmingly in the market-driven disciplines.

Economic Reforms and Financing Higher Education

Inclusive growth by reducing these disparities calls for increased allocation of government resources as has been done in the case of Asian Miracle Countries; not by withdrawing from the higher education sector by offering a few subsidies. However, following the introduction of structural adjustment policies, a fiscal squeeze is experienced in all social sector investments in many developing countries, including in India. This has trickled down to public expenditure on education in general, and higher education in particular. With economic reforms, cuts in public budgets for higher education have been very steep, severely impairing the growth of higher education. As the process of globalization is technology-driven and knowledge-driven, the very success of economic reform policies critically depends upon the competence of human capital. But what is observed is the reverse.

The funding is also heavily skewed, with most spending going to a small number of central universities while many state colleges are severely underfunded and most private colleges are left to fend for themselves (Agarwal, 2009). Reform measures in India have called for reduction in higher education subsidies. It has also called for realisation of a larger share of costs from the students. No doubt these measures will relieve the government from its financial commitment. However, unleashing market forces in higher education sector is highly dangerous for India with vast socio-economic inequalities and very low enrolment. The policy of making access to higher education dependent on the capacity to pay could result in the exclusion of children from low socio-economic background who have the potential intelligence and talent of making signal contribution to social development.

Recent policy changes in India often favour to divert resources from higher to primary level of education; they also favour for full cost recovery from students even in public higher education institutions. Cost recovery measures comprising of increase in fees, student loans currently operated by commercial banks and privatisation will perpetuate inequality in the society. Increasing reliance on these measures without considering the low-income groups will produce regressive effects in the society. For instance, there is no special provisions of any kind for the

weaker sections in terms of security, government guarantee, lower rate of interest, repayment period, repayment in accordance with earnings and waivers. Thus, these measures do not adhere to the equity principles unlike in many other countries. Given the world experience on student loan schemes, the new scheme in India is insensitive to the needs of the poor and does not concern equity aspects as there are no special provisions of any kind for the weaker sections (Rani, 2003).

Faulty Subsidisation Policy

Scholars argue that our subsidisation policy is faulty. It is non-discriminatory in the sense that all people irrespective of rich and poor are treated alike. In India higher education mainly professional and technical education has been provided at prices much below its costs. For instance, the students in government/aided institutions like IITs, IIMs, Engineering and Medical colleges pay very low amount by way of tuition and non-tuition fees. This public subsidy is available to all students irrespective of their capacity to pay. For the rich, subsidy is non-essential; for the poor it is inadequate. Studies have shown that annual parental costs of medical students even in government/aided colleges were higher than the annual household income of low-income groups. Then not to think of affordability for the low-and middle-income groups in self-financing colleges! Scholarships and fee concessions given to the low-income group students are not sufficient even to cover the direct academic costs (Salim, 2008; Kumar and George, 2009). World Bank study also reveals that 10 percent of the best educated Indians received 61 percent of the resources of higher education against 36 percent across Asia. Then the benefit of subsidy largely goes to the privileged sections of society. It shows that most of the costs of higher education of the elite is being subsidised out of the tax revenues extracted from the poor who form the majority in India (Salim, 1997; Altbach, 2009; Tilak, 2013). Thus, there is a negative transfer of resources from the poor to the rich. Many 'positive discrimination policies' mainly through reservations are largely ineffective in raising the status of the groups it is intended to help (Mahajan, 2007).

Equity and Privatisation

Deceleration in the government expenditure on higher education leads to growing privatisation of this sector. Owing to lack of resources, even vulgar forms of privatisation get government and societal approval. Though self-financing institutions do provide financial relief to the government, the long-term economic and non-economic

costs to the society is huge. It leads to a dual system of higher education—one for the haves and other for the have-nots.

Further, increased role of market jeopardizes the participation of meritorious students from economically disadvantaged groups, women and minorities. Again, private investment in higher education would be socially sub-optimal. It is because the private and households do not come forth to invest on non-market oriented courses in higher education and research and development. Further, markets can crowd out important educational duties and opportunities (UNESCO, 2000).

Moreover, it is important to notice that self-financing courses are short term in nature and heavy reliance on them will have repercussions on the equity, balance and quality of education system in the long run. This will also lead to lack of teachers and researchers in pure and basic disciplines in the near future as it is being experienced in United Kingdom. Thus, under the deep waves of globalisation and competition, important economic rationale for government funding especially for higher education is neglected. Public support for higher education remains essential to ensure a balanced achievement of educational and social missions, apart from surviving in the knowledge-based society (Rani, 2002).

Inclusive Growth and Twelfth Five-Year Plan

The enormity of the challenge of providing equal opportunities for quality higher education to ever-growing number of students is a historic opportunity for correcting sectoral and social imbalances (UGC, 2011). To address these concerns, the FYP calls for a paradigm shift in India's system for higher education governance, granting greater autonomy and accountability to institutions and shifting from a 'command and control' model to a 'steer and evaluate' model. In addition, the FYP calls for an increase in funding for quality efforts to align funding with the new priorities for quality improvement (Daugerty et al., 2013). The Twelfth FYP focuses on utilizing this historic opportunity of expansion for deepening excellence and achieving equal access to quality higher education. To materialize a 'quantum jump' in achieving the triple objectives of access and expansion, equity and inclusion, and quality and excellence, it is proposed to focus on the following strategies during the Twelfth FYP:

1. Achieving higher access through expansion by consolidation, up gradation and better utilization of the existing infrastructure, and creation of new

institutions primarily to meet the objective of regional equity.

2. Increasing and enhancing access through a mission mode national programme, 'Rashtriya Uchch Shiksha Abhiyan (RUSA)' aimed to achieve 25 percent national level GER (UGC, 2011).
3. Promoting equity at all levels and all branches of higher education, from enrolment to pass-out stage.
4. Reducing regional/disciplinary/gender imbalances by setting up Polytechnics, Model Colleges in the identified Educationally Backward Areas of low GER districts and establishing exclusive universities for women.
5. Enhancing financial support to girl students and students from SC/ST, Minorities and Other Backward Category (OBC) at all levels of higher education and for all branches.
6. Strengthening the remedial system for students from socially deprived backgrounds in order to enable their retention and better performance.
7. Setting up Equal Opportunity Cells which were initiated in the Eleventh FYP, in all institutions for monitoring the implementation of policies and programmes for the weaker sections and their progress in the respective institutions in achieving social inclusion.

The achievement of the goals for equity and inclusion would call for a strengthening of the following approaches during the Twelfth FYP:

- (a) Building of capacity and improvement of infrastructure which can attract and facilitate the retention of students from rural and backward areas as well as differently-abled and marginalised social groups.
- (b) Providing for pro-active measures through proper implementation of reservation policy for students belonging to SC/ST/OBC and the disadvantaged.
- (c) Increasing the incentives offered to differently-abled students as well as those from the marginalised sections so that they can participate in higher education with facility.
- (d) Strengthening measures to increase the achievement capacity of SC/ST students and

those from marginalised sections so as to reduce drop-out and to improve performance.

- (e) Monitoring of performance with respect to improving equity at the institutional level as well as higher (state and country) levels.

In order to achieve the goals of access and equity, the government proposes to allocate Rs 16,260 Crores (8.8%) from a total allocation of Rs 184,740 Crores. But the allocation and the measures mentioned above are piecemeal and not sufficient to solve the phenomenal problem of access and equity of higher education in India. The experience of the Eleventh FYP shows that many of these measures which were already started during the period, were least effective for lack of proper implementation. The approach paper on 11th Five-Year Plan was titled 'Towards Inclusive Growth'. No doubt, growth had taken place in the plan period. But scholars argue that the growth has not been inclusive with widening inequalities between the rich and the poor (Tilak, 2012). According to the latest round of the National Sample Survey data, inequalities in higher education have increased and the absolute numbers of those attaining higher education in the bottom income groups have come down in the last decade. Now the Twelfth Five-Year Plan document titled 'Faster, Sustainable and more Inclusive Growth' aims at inclusive growth with an enhanced role for private sector in higher education. It is doubtful whether inclusive growth can be realised with incompatible strategies that promote privatisation. All the statistics on the number of educational institutions and the allocation of resources reveal that the government is gradually withdrawing from the scene of higher education. The statement in the approach paper of the Twelfth Plan that 'the central principle should be that no student who is eligible to be admitted should be deprived of higher education for financial reasons' may remain a mere rhetoric than reality.

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There are no great limits to growth because there are no limits of human intelligence, imagination and wonder.

— Ronald Reagan

Rural Development: India vis-à-vis Other Countries

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Introduction

The Millennium Development Goals for India have set a target of reducing poverty by 50 per cent by 2015 of what it was in 1993. About 30 per cent of the population of the country is still living below poverty line. While the proportion of the people living below poverty line has been declining over the years, the rate of such decline has been quite low, except during the recent past. Nearly 80 per cent of the people living below poverty line are located in rural areas, with a large share coming from the category of wage-workers.

The policies and programmes have been designed to alleviate rural poverty, one of the primary objectives of planned development. The sustainable strategy of poverty alleviation had to be based on increasing productive employment opportunities through the process of growth. Elimination of poverty, ignorance, disease and inequality and providing a better and higher quality of life were the basic premises upon which all the plans and blueprints of development were built. As per the outcomes of programme implementation in the year 2012–13 (upto 31 December 2012) as given in the 2012–13 Annual Report of Ministry of Rural Development, there has been employment generation of 141 crore person-days with 4.16 crore households.

Rural development implies both the improved quality of life in rural areas as well as greater social transformation. In order to provide people with better prospects for economic development, increased participation of people in the rural development programmes, decentralization of planning, better enforcement of land reform and greater access to credit are envisaged. To ensure that the fruits of economic reforms are shared by all sections of the society, five elements of social and economic infrastructure, critical to the quality of life in rural areas, namely health, education, drinking water, housing and roads require more focus.

For the 70 per cent of the world's poor who live in rural areas, agriculture is the main source of income and employment. It takes up more than one-third of the world's area and more than two-thirds of the world's water withdrawals. Competition for these resources is increasing with growth of population, cities and demand for food. But depletion and degradation of land and water pose serious challenges to producing enough food and other agricultural products to sustain livelihoods and meet the needs of urban populations. Data presented here include measures of agricultural inputs, outputs, poverty rates and productivity; rural population and land use compiled by the UN's Food and Agriculture Organization.

Table 1: Structure of Output

Sr. No.	Countries	Gross Domestic Product \$ billions		Agriculture % of GDP		Industry % of GDP		Manufacturing % of GDP		Services % of GDP	
		2000	2012	2000	2012	2000	2012	2000	2012	2000	2012
1	Australia	415	1,532	3	2	27	28	13	8	70	69
2	Bangladesh	47	116	26	18	25	28	15	18	49	54
3	Brazil	645	2,249	6	5	28	26	17	13	67	69
4	China	1,199	8,230	15	10	46	45	32	32	39	45
5	France	1,326	2,611	2	2	23	19	15	10	75	79
6	Germany	1,886	3,426	1	1	31	31	22	22	68	69
7	India	477	1,859	23	18	26	26	15	14	51	56
8	Indonesia	165	877	16	15	46	47	28	24	38	39
9	Japan	4,731	5,938	2	1	31	26	21	18	67	73
10	Malaysia	94	305	9	10	48	41	31	24	43	49
11	Philippines	81	250	14	12	34	31	24	21	52	57
12	Singapore	96	287	0	0	35	27	28	20	65	73
13	South Africa	133	382	3	3	32	28	19	12	65	69
14	Sri Lanka	16	59	20	11	27	32	17	18	53	57
15	Thailand	123	366	9	12	42	44	34	34	49	44
16	United Kingdom	1,494	2,462	1	1	27	21	16	10	72	79
17	United States	10,290	16,245	1	1	23	20	16	13	75	79
18	World	32,981	72,905	4	3	29	27	19	16	67	70
19	South Asia	623	2,303	24	18	26	26	15	14	51	56

Source: <http://worldbank.org>, <http://www.fao.org> and <http://rural.nic.in>.

Table 2: Agricultural Inputs

Sr. No.	Countries	Agricultural land			Land under cereal production		Agricultural employment	
		% of land area		% irrigated	hectares thousands		% of total employment	
		2000-02	2009-11	2009-11	2000-02	2010-12	2000-02	2010-12
1	Australia	58	53	0.5	17,486	19,425	4.4	-
2	Bangladesh	72	70	-	11,588	12,479	62.1	-
3	China	56	56	-	81,466	92,648	50	34.8
4	France	54	53	-	9,327	9,434	4.1	2.9
5	Germany	49	48	2.2	6,941	6,513	2.5	1.5
6	India	61	60	35.2	94,471	97,000	59.9	47.2
7	Indonesia	26	30	-	14,648	17,403	44.3	35.1
8	Japan	13	13	34.5	2,002	1,912	4.7	3.7
9	Malaysia	24	24	-	702	715	14.9	12.6
10	Myanmar	17	19	-	7,232	9,083	-	-
11	Nepal	30	30	-	3,324	3,474	65.7	..
12	Pakistan	35	34	70.2	12,016	13,051	42.1	45.1
13	Philippines	37	41	9.4	6,442	7,284	37	32.2
14	South Africa	81	79	1.7	4,706	4,058	12.6	4.6
15	Sri Lanka	38	42	-	849	1,056	34.5	39.4
16	Switzerland	38	38	2.4	171	147	4.1	3.5
17	Thailand	39	41	-	10,942	13,888	46.1	39.6
18	United Kingdom	70	71	-	3,246	3,141	1.4	1.2
19	United States	45	45	-	53,561	60,273	2.5	1.6
20	World	38	38	-	660,433	703,115	37.9	30.5
21	South Asia	55	55	-	124,544	130,250	59.2	47.1

Source: <http://worldbank.org>, <http://www.fao.org> and <http://rural.nic.in>.

Table 3: Rural Land Use

Sr. No.	Countries	Rural population			Land sq. km ('000)	Land use % of land area						Arable land hectares per person	
		% of total		growth (annual %)		Forest area		Permanent cropland		Arable land			
		2000	2012	2012	2000	2011	2000	2011	2000	2011	2000	2011	
1	Bangladesh	76	71	0.5	130	11.3	11.1	3.5	6.9	64.1	58.6	0.06	0.05
2	Brazil	19	15	-0.9	8,459	64.5	61.2	0.9	0.8	6.8	8.5	0.33	0.37
3	China	64	48	-2.1	9,328	19	22.5	1.2	1.6	13	12	0.1	0.08
4	France	23	14	-3.2	548	28	29.2	2.1	1.9	33.7	33.5	0.3	0.28
5	India	72	68	0.7	2,973	22	23.1	3.1	4.1	54.7	52.9	0.16	0.13
6	Indonesia	58	49	-0.3	1,812	54.9	51.7	7.7	11	11.3	13	0.1	0.1
7	Japan	21	8	-7.1	365	68.2	68.6	1	0.8	12.3	11.7	0.04	0.03
8	KoreaDem. Rep.	41	40	0.2	120	57.6	46	1.7	1.7	19.1	19.1	0.1	0.09
9	Malaysia	38	27	-0.9	329	65.7	62	17.6	17.6	5.5	5.5	0.08	0.06
10	Pakistan	67	63	1.2	771	2.7	2.1	0.9	1.1	27.6	26.9	0.15	0.12
11	South Africa	43	38	0.2	1,213	7.6	7.6	0.3	0.3	11.4	9.9	0.31	0.23
12	Sri Lanka	84	85	-2.7	63	33.2	29.4	15.9	15.6	14.6	19.1	0.05	0.06
13	Thailand	69	66	-0.3	511	37.2	37.2	6.6	8.8	30.6	30.8	0.25	0.24
14	United Kingdom	21	20	0.1	242	11.5	11.9	0.2	0.2	24.3	25.1	0.1	0.1
15	United States	21	17	-0.6	9,147	32.8	33.3	0.3	0.3	19.1	17.5	0.62	0.51
16	South Asia	73	69	0.7	4,771	16.6	17.1	2.4	3.2	42.6	41.3	0.15	0.12

Source: <http://worldbank.org>, <http://www.fao.org> and <http://rural.nic.in>.

Table 4: Poverty Rates

Sr. No.	Countries	Population below national poverty line ^a (%age)								Poverty gap at national poverty line ^a (%age)			
		Survey year ^b	Rural	Urban	National	Survey year ^b	Rural	Urban	National	Survey year ^b	Rural	Urban	National
1	Bangladesh	2005	43.8	28.4	40	2010	35.2	21.3	31.5	2010	7.4	4.3	6.5
2	Bhutan	2007	30.9	1.7	23.2	2012	16.7	1.8	12	2012	3.6	0.3	2.6
3	Brazil	2011 ^e	-	-	11.1	2012 ^e	-	-	9		-	-	-
4	China	2011 ^e	12.7	-	-	2012 ^e	10.2	-	-		-	-	-
5	India	2010	33.8	20.9	29.8	2012	25.7	13.7	21.9	2012 ^c	4.6	2.5	4
6	Indonesia	2012	15.1	8.8	12	2013	14.3	8.4	11.4	2013	2.2	1.3	1.8
7	Malaysia	2009 ^e	8.4	1.7	3.8	2012 ^e	3.4	1.0	1.7		-	-	-
8	The Philippines	2009 ^e	-	-	26.3	2012 ^e	-	-	25.2	2012 ^e	-	-	5.1
9	South Africa	2000	-	-	38	2006	-	-	23	2006	-	-	7
10	Sri Lanka	2010	9.4	5.3	8.9	2013	7.6	2.1	6.7		-	-	-
11	Vietnam	2010	26.9	6	20.7	2012	22.1	5.4	17.2	2012	5.9	1	4.5

Note: (a) Based on per capita consumption estimated from household survey data, unless otherwise noted; (b) refers to the year in which the underlying household survey data was collected and, in cases for which the data collection period bridged two calendar years, the year in which most of the data was collected is reported; (c) World Bank estimates; (d) estimates based on survey data from earlier year(s) are available, but are not comparable with the most recent year reported here; these are available online via www.povertydata.worldbank.org; (e) based on income per capita estimated from household survey data; (f) relative poverty; (g) based on per adult equivalent income/consumption.

Source: <http://worldbank.org>, <http://www.fao.org> and <http://rural.nic.in>.

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