

*AEC 201: Principles of agricultural and resource economics Course Outline and notes*

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(Reference: Samuelson and Nordhaus, Economics, 18<sup>th</sup> Ed, Tata McGraw Hill, New Delhi – has excellent summary, questions for discussion, power point presentations for each chapter)

website: [www.powerofeconomics.com](http://www.powerofeconomics.com) ; [www.mhhe.com/economics/samuelson18](http://www.mhhe.com/economics/samuelson18)

Economics: meaning, definition, subject matter, twin themes of economics – scarcity and efficiency, meaning of scarcity, meaning of efficiency

Divisions of economics: Micro economics (Adam Smith's The Wealth of nations, 1776), Macro economics (JM Keynes, General Theory of Employment, Interest and Money, 1936)-I

Goal of economics, Importance of Economics – Problems of economic organization, How are goods produced, for whom are goods produced

Types of economies: Market economy, command economy, mixed economy

Opportunity cost – cost of foregone alternative, Production possibility curve

Goods, services, utility: concept of individual choice, meaning of utility, ordinal utility, cardinal utility, Theory of consumption, law of diminishing marginal utility, meaning, definition, assumptions, ceteris paribus conditions, limitations, Importance, Total utility, marginal utility, law of diminishing marginal utility, Equi marginal utility principle

Demand curve slopes downwards due to (i) substitution effect, (ii) income effect (iii) equi marginal utility principle, and explanation of substitution and income effects with examples

Value, price, wealth, welfare.

Wants: meaning, characteristics, Classification of wants, importance.

Consumer's surplus, meaning, definition, application of consumer's surplus

Importance of demand: meaning, definition, kinds of demand, demand schedule, demand curve, laws of demand, ceteris paribus conditions, extension and contraction (movement along demand curve) increase and decrease in demand (shift in demand, demand shifters – income population, price of related goods, tastes, special influences like alternate forms of transportation, safety of automobiles, expectations of future prices etc)

Engle's law of consumption, demand curve for inferior goods, giffen goods, conspicuous consumption (demand for gold),

Elasticity of demand: difference between elasticity of demand and slope of demand curve, elasticities of demand for linear demand curve, types of elasticity of demand – price elasticity of demand, income elasticity of demand, cross elasticity of demand,

Income elasticity of demand – elastic for luxuries, inelastic for necessities, positive for normal goods, negative for inferior goods, Giffen goods (examples)

Cross price elasticity of demand – positive for substitutes, negative for complements, examples of substitutes and complements,

Degree of price elasticity of demand - perfectly elastic, perfectly inelastic, relative elastic, relatively inelastic demand, examples computing arc elasticity of demand, methods of measuring elasticity - arc

elasticity of demand : Elasticity of demand for linear demand curve: (length of lower segment of linear demand divided by length of upper segment of linear demand curve); point elasticity of demand: (elasticity of demand at a point p and point q is estimated using  $[dq/dp](p/q)$ )

Elasticity and total revenue: when demand is price inelastic, then when price decreases, total revenue decreases; when demand is price elastic, when price decreases, total revenue increases, when demand is unitary elastic, when price decreases, total revenue is unchanged.

Factors influencing elasticity of demand Importance of elasticity of demand – price discrimination by monopolist depending on price elasticity of demand in different markets

Supply: meaning of supply, definition, law of supply, factors determining supply, supply schedule, supply curve, movement along supply curve, shift of supply curve, supply shifters – technology, input prices, price of related goods, weather, government policy – quotas, tariffs, effect of regulations (to improve air, water quality – determine supply of automobiles), special influences – pollution standards,

Elasticity of supply – meaning and importance

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Paradox of plenty: in agriculture, due to relatively inelastic demand and relatively inelastic supply of commodities, even though supply shifts to the right due to technological change (as happened in green revolution), the farmers total revenue does not increase, but infact the total revenue decreases

Returns to scale: when all inputs are increased simultaneously (which can happen in the long run and not in the short run), then if the output increases more than proportionately to the change in inputs, farmers have increasing returns to scale; if output increases less than proportionately to change in inputs, farmers have decreasing returns to scale, and if output increases proportionately to change in inputs, farmers have constant returns to scale.

Welfare economics: welfare – maximizing economic surplus = maximizing sum of consumer surplus and producer surplus,

Concept of consumer surplus - revisited – area above price line, below the demand curve  
producer surplus – area above supply curve, below the price line

Consumer surplus = total benefit minus total expenditure

Producer surplus = total revenue minus total cost

How supply curve = marginal cost curve of the firm (Considering  $Y=f(X)$ , output is a function of one input, Total revenue =  $Y.P_y$  ; Total Cost =  $FC + VC = K + X.P_x$  .

$\Pi = \text{Profit} = TR - TC = Y.P_y - (K + X.P_x)$ , For maximum profit,  $\Pi_{\max}$ ,

$d\Pi/dx = 0$  implies,  $P_y dY/dX - 0 - P_x(1) = 0$ , therefore  $P_y dY/dX = P_x$ ,

or  $P_y = P_x/MP = MC$ , where  $MP = dY/dX$

This proves that  $P = MC$  is the condition for supply curve

And supply curve begins from the Min AVC, since in the short run the farmer has to cover at least the variable costs, since he cannot cover the fixed costs. Thus, the supply curve is the MC of the farm from the point of Min AVC

Key concepts are

1.  $P = MC$  is the profit maximizing condition (as proved above)
2. Farm's supply curve = its Marginal cost curve, because the point above the Min AVC on MC curve is supply curve
3. Zero profit condition is where  $P = MC = AC$  or  $ATC$
4. Shut down point is where  $P = MC = AVC$
5. Sum of individual supply curves, will give industry's supply curve

Short run: When demand shifts to the right for fishery, in the short run, due to inelastic supply of fishery, there is sharp increase in prices of fishery. Due to rise in prices, the fisherman fish for longer hours, hire new crews, hire extra labour, and catch more fish, but with the same number of boats, shipping yards and fishing capacity. In the short run, fisherman cannot increase their fixed capital (boats, shipping yards etc). The quantity supplied increases only because of variable costs such as increase in shipping hours, new crews, new labour etc.

Long run: High prices of fishery in short run, leads to high profits and in the long run, as there is no restriction on entry or exit, it attracts more fisherman to industry. Fishermen enter with new boats, and new shipping yards will be built, expanding the fishing fleet and capacity. Due to competition, the long run supply curve will be relatively elastic. Thus in the long run, there is increased supply of fishery not only due to higher variable capital like labor, but also due to increase in fixed capital like boats, fishing capacity, ship yards,..... In the long run all costs are variable and there are no fixed costs.

Long run zero profit condition: In the long run all farms / firms earn normal profits. In the short run, firms may either earn subnormal or abnormal profits.

Pareto's optimality

Pareto optimality is also called Pareto efficiency, allocative efficiency or efficiency.

Pareto optimality or allocative efficiency occurs when one person's satisfaction or utility can be increased by lowering some one else's satisfaction or utility

Efficiency or competitive equilibrium: allocation of resources by perfectly competitive markets is efficient. Conditions and characteristics of perfect markets

1. Therefore Price = Marginal utility

(proof: Acc to Equi Marg principle,  $MU_x/P_x = MU_y/P_y = MU_z/P_z = 1$ . So  $MU_x = P_x$ , therefore  $P = MU$ )

2. Price = MC

Proof: Considering  $Y=f(X)$ , output is a function of one input, Total revenue =  $Y.P_y$  ; Total Cost =  $FC + VC = K + X.P_x$  .

3.  $\Pi = \text{Profit} = TR - TC = Y.P_y - (K + X.P_x)$ , For maximum profit,  $\Pi_{\max}$ ,

$d\Pi/dx = 0$  implies,  $P_y dY/dX - P_x = 0$ , therefore  $P_y dY/dX = P_x$ ,

or  $P_y = P_x/MP = MC$ , where  $MP = dY/dX$

From 1,  $P = MU$ , from 2,  $P = MC$ , therefore,  $MU = MC$

$MU =$  demand curve,  $MC =$  supply curve

Thus interaction of  $MU$  and  $MC$  curves gives the price and quantity demanded / supplied

### Factors of production

**Land:** characteristics, susceptible to the operation of LDMR. Rent is return to land

**Labour:** Demand curve for labor slopes downwards to the right like any demand curve for two reasons

(i) as wage rate falls, the qty demanded of labour increases (ii) as more labour days are hired, the marginal productivity of labour falls. Therefore demand curve for labour reflects falling marginal productivity of labour

**Supply of labour:** follows the backward bending supply for two reasons

**Substitution effect:** As wage rate increases, the labourer offers himself to work more and sacrifices leisure, since leisure is more expensive (i.e. s/he loses more if s/he does not work more, when wage rates are rising). But, due to

**Income Effect:** as the wage rates increased, the income of labourer also increases from which s/he enjoys more goods and services (for eg like TV). For this, s/he has to have leisure and thus s/he offers less in terms of labour days when wage rate rises.

Since income effect is more than substitution effect, the supply of labour takes backward bend and hence called backward bending supply curve for labour.

Wage is return to labour

**Capital:** is produced means of production, i.e. capital is produced by human beings, unlike land and labour. Capital or capital goods are durable produced goods which are in turn used to produce other goods, eg. Machines, tools, computers, cars, etc

Interest rate is the return to capital, because when people save, they expect a return, and that is the interest rate.

**Management:** is organization. Return to management is profit which is the residual after paying for land, labour, capital = total revenue minus total costs.

Real income = nominal income minus inflation (eg. If nominal income = Rs. 50,000 per month for a Professor, real income = 50,000 minus 50,000Xinflation rate = 50,000-50,000(inflation of 5 %) = 50,000-2500 = 47500)

Similarly real wage, real price etc

National income: concept: aggregate of all incomes, all the incomes paid to factors of production

Measurement – (i) labor income – wages, salaries, benefits (pension, provident fund), (ii)

Proprietor's income – rental income, corporate profits, net interest (interest on savings)

GDP, Net domestic product, Depreciation, disposable income, PPP - Purchase power poverty – example,

Public finance: meaning, 2 principles of taxation, benefit principle and ability to pay principle, horizontal and vertical equity.

Public resource: meaning, service tax, meaning and classification of taxes – regressive taxation, proportional taxation, progressive taxation,

Types of taxes: direct tax (income tax), indirect tax (excise duty, sales tax, import tariffs)

5 Canons of taxation – economic efficiency, administrative simplicity, flexibility, political responsibility, fairness

Public expenditure: is expenditure on public goods

Public goods: concept of rival consumption: If a good is used by one person, it cannot be used by another person (eg. If Chandrakanth drinks a glass of apple juice, Bharathkumar cannot drink the same glass of apple juice)

Non rival consumption: The marginal cost of an additional individual's enjoying the good is zero. i.e. one person's consumption does not prevent another person's consumption (eg. National defense: If the Govt spends on defense, and protects the country from attack, all citizens are protected)

Exclusion: If it is possible to exclude any individual from the benefits of public good without incurring high costs; eg. A ship going past a light house cannot be excluded from benefits of light house, it is difficult to exclude any one from the benefits, and Another eg is national defense. If national defense protects A, it also protects B. In the case of public goods, it is not possible to exclude (but pvt goods can be excluded, since it is owned by a person, unless the person pays, s/he cannot enjoy the pvt good). Thus public goods are non rival and non excludable. Pvt goods are rival and excludable. Pure public goods are perfectly non rival in consumption and are non excludable. (Publicly provided private goods are: education, water, medical services )  
Externality: is associated with public goods.

Public expenditure is expenditure on public goods. Eg. Bridge, national defense

Pure and impure public goods: Pure public good is one where marginal cost of providing it to an additional individual is strictly zero, and it is impossible to exclude people from using or receiving the good: National defense is example of pure public good

Inflation: meaning: denotes a rise in the general level of prices

Rate of inflation: Suppose inflation rate is 5 percent for 2007, then, if a book costs Rs. 100 in year 2006, it would cost Rs. 105 in 2007.

Definition: Inflation occurs when the general level of prices is rising.

Levels of inflation:

Low inflation – Price level rises slowly and predictably (as in US)

Galloping inflation: very high inflation common in countries with weak governments, war, or revolution (eg. Latin American countries Argentina, Brazil, Chili, had 50 to 700 percent inflation in 1970, 1980s)

Types of inflation:

1. Demand pull inflation: occurs when too much spending chases too few goods

2. Cost push inflation: Due to rising costs, costs of production rise

Effects of inflation: Inflation affects efficiency of resource use, affects those who lend, fixed income classes, Inflation distorts relative prices, tax rates, real interest rates

Agricultural Economics

Broadly agricultural and resource economics deals with the application of principles of economics and institutional economics to the study of agriculture and resources, with the objective of sustainable development

Role of 'Great Economic Depression' in shaping Agricultural Economics

The effect of Great Economic Depression of the 1930 was more pronounced on agricultural sector than any other sector, since the fall in prices, fall in wages and fall in profits were all demotivating factors for further production. In fact it was after the 1930s, after the effect of Great Depression was felt, the role of agricultural economics in framing farm and agricultural policies caught up prominence.

Relationship of Agricultural Economics with (i) Agronomy, (ii) Soil Science, (iii) Plant Pathology, (iv) Bio Technology, (v) Agricultural Extension.

Main focus of Farm Management Economics, ii) Natural Resource Economics, iii) Agricultural Finance, iv) Agricultural Policy, v) Agricultural Marketing

Role and importance of agriculture in Indian economy, contribution of agriculture to Indian economy

Characteristics of developing countries: Low per capita income, Occupational pattern: 67 percent of workers are engaged in primary sector, Population pressure: India's population growth rate is 2 percent, A rising population imposes greater economic burdens; Employment: Prevalence of chronic unemployment and underemployment due to heavy pressure of population, Low Capital formation, Maldistribution of assets: The top ten percent of the population receive 25 percent of income, while the bottom 10 percent receive only 4 percent of the income, Poor quality of human capital: Based on The Human Development Index which is based on life expectancy, literacy, enrolment for primary class, real per capita GNP, India's rank is 135 while that of China is 108, Low Level of technology: Due to technological sluggishness, the productivity per unit area is low, Low standard of living, Dependence on agriculture: About 21 percent of India's GNP is derived from Agriculture and 60 percent of active population are employed in agriculture. Agriculture also contributes to 19 percent of the exports.

Significant economic problems in Indian agriculture,

Causes of low productivity in Indian agriculture: proportion of active workers supported by agriculture is 60 percent, overcrowding in agriculture, low land-man ratio.

Inadequate non farm services such as finance, marketing: The village money lenders and village commission agents still play a dominant role in the rural economy with an objective of exploitation of farmers

Small sized and fragmented holdings: subdivision and fragmentation - size of holdings is reducing and number of fragments are increasing, uneconomic holding

Inadequate irrigation facility, Even though India has the largest area under irrigation in the world, our irrigation is largely dependent on rainfall. In fact 84 percent of rural poor live and depend on rainfed agriculture for their livelihood. At least 70 percent of the agricultural land is largely dependent on rainfall.

Agricultural credit: money lenders still dominate and exploit,

Poverty, 30 percent of population is below poverty line, debt is inherited along with property, Unproductive loans for social functions, fighting litigations

Rainfed lands of India should receive greater attention than irrigated lands : 84 percent of the rural poor are living in rainfed lands, Rainfed lands of India contribute to 40 percent of food grains production, main producers of coarse grains and oilseeds, Future irrigation source: Considering surface water and groundwater resource:

At present 72 percent of total irrigated area is irrigated by groundwater and 28 percent of total irrigated area is irrigated by surface water in India;

Causes for slow growth of agriculture in the Five Year Plans: Indian agriculture is still a gamble on the monsoon, since 70 percent of the net cropped area is still dependent on rainfall, producing 40 percent of food grain output New agricultural technology spread largely to rice, wheat, while other food crops like coarse cereals which are dependent on rainfall did not develop. The direct investment on agriculture from the public which formed 35 percent of the total investment in 1960 fell to 16 percent in 1996. The private investment in agriculture which was 65 percent of the total in 1960 fell to 84 percent of the total in 1996. The private investment is also concentrated in parts of India like Punjab, Haryana, and Western UP, further increasing the disparities. Thus there is fall in investment in agriculture which is also responsible for the slow growth. The land reforms have not made perceptible impact on the production process as envisaged.

NSSO 2005 results on different aspects of farming

- An estimated 27% of farmers did not like farming because it was not profitable. In all, 40% felt that, given a choice, they would take up some other career.
- Nearly 5% of farmer households had a member who belonged to a self-help group. Only 2% had a member who belonged to a registered farmers' organisation.
- About 18% of farmer households knew what bio-fertilisers were and 29% understood what minimum support price meant. Only 8% had heard of the World Trade Organisation.
- Only 4% of farmer households had ever insured their crops and 57% did not know that crops could be insured.
- About 29% of farmer households included a member of a cooperative society. Only 19% had availed themselves of services from a cooperative. Most of these households availed themselves of either credit facilities, or services related to seeds or fertilisers.

- Almost 48% of farmer households purchased their seeds and 47% used farm saved seeds. Whereas 30% farmers replaced seed varieties every year, another 32% replaced them every alternate year.
- Fertilisers were used by 76% farmer households during the kharif and 54% during the rabi season. For 27% households, fertilisers were available within the village.
- Organic manure was used by 56% farmer households during the kharif and 38% during the rabi season. It was available within the village for 68% households during the kharif and 75% households during the rabi season.
- Improved seeds were used by 46% farmer households during the kharif and 34% during the rabi season. They were available within the village for 18% farmer households.
- Pesticides were used by 46% farmer households during kharif and 31% during rabi. Veterinary services were used by 30% during kharif and 22% during rabi. Only 1.5-2% of farmer households said facilities for testing of fertilisers or pesticides were available to them.
- Among the various agricultural activities covered in the survey, 96.2% of all land used for farming during the kharif and 95.1% during the rabi season was devoted to cultivation, including horticulture, sericulture and vermiculture. In the case of leased-in land, 98.2% during the kharif and 97% during the rabi season was cultivated.
- The share of orchards and plantations in total farmed land was 3% during the kharif and 4% during the rabi season. In land farmed by Scheduled Caste households, the share of orchards and plantations was 1-2%.
- Farmer households possessing less than 0.01 hectares of land - who devoted only 14% of farmed land to cultivation - reported 69% of farmed land as used for dairying, compared to 0.35% for all farmer households taken together.
- Almost 50% of all land irrigated during the kharif season and 60% during the rabi season was irrigated by tube-wells. Wells were used to irrigate 19% of land during kharif and 16% during rabi. Canals accounted for irrigation of 18% land during kharif and 14% during rabi.
- An estimated 62% of net irrigated area during kharif and 69% during rabi was devoted to cultivation of cereal crops.
- Gross irrigated area accounted for 42% of cropped area during the kharif and 56% during the rabi season.
- About 79% of gross irrigated area during the kharif and 83% during the rabi season was irrigated without the use of any device. Around 5% was irrigated with the help of diesel pumps and 4% with electric pumps.
- Of the farmer households using non-human energy for ploughing, about 47% used diesel tractors while 52% relied on animal power. Among those using non-human energy for harvesting, 59% used diesel-powered machines. Of those reporting non-human energy use for irrigation, 66% used diesel pumps and 33% used electric pumps.

#### Access to Modern Technology for Farming, 2003

- At all-India level, 40% of farmer households accessed various sources of information for Modern Technology for Farming.
- At all-India level, of the sixteen different sources canvassed for accessing information for Modern Technology for Farming, the most popular was 'other progressive farmers' with percentage of farmer households accessing information through the source as 16.7%, followed by input dealer (13.1%) and radio (13.0%).
- Percentage of farmer households accessing information through 'other progressive farmers' was highest in Andhra Pradesh (34%), followed by Gujarat (30%) and West Bengal (25%).
- Percentage of farmer households accessing information through 'input dealers' was highest in West Bengal (36%), followed by Andhra Pradesh (30%) and Gujarat (24%).
- Percentage of farmer households accessing information through 'radio' was highest in Jammu & Kashmir (36%), followed by Kerala (31%) and Assam (29%).
- The two most popular sources, namely 'other progressive farmers' and 'input dealer' were contacted by the farmer households mainly on 'need basis' or 'seasonally'.
- Among the farmer households accessing information for cultivation from 'other progressive farmers', 40% received information on 'improved seed variety', 31% on 'fertiliser application', 15% on 'plant protection' and 14% on 'others'.

#### Indebtedness of Farmer Households

- At all-India level, estimated number of rural households was 147.90 million, of whom 60.4% were farmer households.
- Out of 89.35 million farmer households, 43.42 million (48.6%) were reported to be indebted.
- Estimated prevalence of indebtedness among farmer households was highest in Andhra Pradesh (82.0%), followed by Tamil Nadu (74.5%) and Punjab (65.4%).
- Estimated number of indebted farmer households was highest in Uttar Pradesh (6.9 million), followed by Andhra Pradesh (4.9 million) and Maharashtra (3.6 million).
- Going by principal source of income, 57% farmer households were cultivators. Among them 48% were indebted.
- Households with 1 hectare or less land accounted for 66% of all farmer households. About 45% of them were indebted.
- More than 50% of indebted farmer households had taken loan for the purpose of capital or current expenditure in farm business. Such loans accounted for 584 rupees out of every 1000 rupees of outstanding loan.
- Marriages and ceremonies accounted for 111 rupees per 1000 rupees of outstanding loans of farmer households. Among the states the proportion was highest in Bihar (229 rupees per 1000 rupees), followed by Rajasthan (176 rupees per 1000 rupees).
- The most important source of loan in terms of percentage of outstanding loan amount was banks (36%), followed by moneylenders (26%).
- Average outstanding loan per farmer household was highest in the state of Punjab, followed by Kerala, Haryana, Andhra Pradesh and Tamil Nadu.

#### Household Consumer Expenditure

- During 2004, the all-India average monthly per capita consumer expenditure (MPCE) was Rs. 565 for rural India and Rs. 1060 for urban India. Thus, average urban MPCE exceeded average rural MPCE by 88%. However, urban price levels being higher than rural price levels, the differential would be narrower in real terms.
- one-half of the rural population of India had MPCE below Rs. 471. About 20% had MPCE below Rs. 340. Among the urban population, 82% had MPCE above Rs.500. About 18% had MPCE above Rs.1500.
- For rural India, average MPCE of Rs. 565 comprised Rs. 305 for food and Rs. 260 for non-food. Food expenditure included Rs. 103 for cereals and cereal substitutes, and Rs. 107 for milk and milk products, vegetables and edible oil. Non-food expenditure included Rs. 54 for fuel and light, and Rs. 45 for clothing and footwear.
- For the urban population, average MPCE of Rs. 1060 comprised Rs. 441 for food and Rs. 619 for non-food. Of food expenditure, only Rs. 106 went towards cereals and cereal substitutes while Rs. 165 was spent on milk and milk products, vegetables and edible oil. Rs. 96 was spent per person per month on fuel and light, and Rs. 74 on clothing and footwear.
- The share of cereals in total consumption expenditure was 18% in rural India during January-June 2004 compared to 26% in 1987-88. In urban India it was 10% during January-June 2004 compared to 15% in 1987-88.
- The decline in the share of food in total expenditure seen over the past several rounds continued. The share of food was 54% in rural areas compared to 64% in 1987-88 and 42% in urban areas compared to 56% during 1987-88.
- The rural-urban differences in the share of expenditure were considerable for cereals (18% for rural against 10% for urban), miscellaneous consumer services (rural 7%, urban 12%) and education (rural 3%, urban 7%).
- In the rural sector, among the major states, Jharkhand, Orissa, Chhattisgarh, Madhya Pradesh and Bihar had MPCE less than Rs. 450. Kerala had the highest MPCE (Rs. 990), followed by Punjab (Rs. 947). In the urban sector, among the major states, Bihar and Madhya Pradesh had MPCE less than Rs. 800. Kerala had the highest MPCE (Rs. 1372), after which came Maharashtra (Rs. 1259).

#### Income, expenditure and productive assets of farmers in India

About 60 per cent of the rural households were farmer households engaged in farming activities like cultivation, plantation, animal husbandry, fishery, beekeeping and other agricultural activities.

- There was only one tractor per 100 ST or SC farmer households, while there were three per 100 OBC farmer households and 5 per 100 Other farmer households.
- Among large farmer households possessing 10 hectares or more land, there were 38 tractors per 100 households. For every 100 households with medium sized farm of 4-10 hectares, there were 18 tractors. For small farmers with land in the range of 0.4 –1.0 hectare, there was only one tractor per 100 households.
- Tribal farmer households possessed larger number of cattle heads compared to farmer households of other categories. There were 173 heads of cattle per 100 Tribal farmer households. While SC farmer households had 98, OBC farmer households had 126 and the Others had 132 cattle per 100 farmer households.
- While ST/SC farmers had 40 to 45 buffaloes per 100 farmer households, the OBC and Other category had 78 to 80 buffaloes per 100 farmer households.
- Farmer households in the lowest monthly expenditure class or the poorest category had 31 buffaloes per 100 households, whereas the highest monthly expenditure class had 113 buffaloes per 100 households.
- Of the average monthly income of a farmer household, Rs.969 came from cultivation. Wage earning contributed Rs.819 while the non-farm business generated Rs.236 and income from farming of animals brought in only Rs.91 per farmer household.
- Of the average monthly expenditure incurred by farmer households in purchase and maintenance of productive assets, 81 percent went for farm related assets, 13 percent for residential building and 6 percent for non-farm business.
- About 58 percent of the farmers kept some kind of farm animals. Households engaged in dairying spent on an average Rs.814 per month on dairy farming. Farmer households who kept poultry spent on an average Rs.129 per month on poultry farming.
- The break-up of the total annual cultivation expenses showed that 23 percent of the expenditure went for fertilizers and manure, 22 percent towards labour charges, 16 percent for seeds and 12 percent for irrigation.
- The survey found that the standard of living of the average farmer household measured in terms of total monthly consumer expenditure was no different from that of the average rural households at the all India level.

#### Employment and wage earnings

About 43 per cent of persons in the rural areas and 35 per cent in the urban were employed as per their usual status. For males, the proportion was 54 per cent in both the rural and urban, and for females, only 32 in the rural and 15 in the urban areas.

In rural India, on an average, a male casual labourer earned Rs. 56.53 in a day whereas; a female casual labourer earned Rs. 36.15 in a day – showing a difference of about Rs. 20.

In urban India, the wage difference between males and females was even more prominent. A male casual labourer in the urban areas earned Rs. 75.51 in a day and a female, Rs. 44.28 in a day.

#### Livestock

- An estimated 69% of rural households and 11% of urban households operated some land during the kharif season of 2002-03.
- As many as 79% of rural households in 2002-03 (kharif season) possessed land of size 1 hectare or less. About 32% possessed less than 0.002 hectare of land.
- The *cattle* population in rural India, which was between 160 million and 170 million during the 20 years prior to 1991-92, declined to 154 million in 2002-03.
- The *buffalo* population in rural India continued to grow from 69 million in 1991-92 to 76 million in 2002-03.
- The stock of *poultry* in rural areas declined from 193 million in 1991- 92 to 182 million in 2002-03.
- The stock of *working cattle* in rural areas declined by 25% between 1991-92 and 2002-03, reflecting the falling importance of bullock power in cultivation and allied activities.
- The stock of *in-milk cattle* in rural India showed a slight fall of about 2 million from its 1991-92 level of 30 million.

- The number of *sheep and goats* in rural areas declined from 85 per 100 rural households in 1991-92 to 64 per 100 households in 2002-03.
- The share of marginal holdings in total stock of in-milk bovines, which was only 20% in 1971-72, continued to rise from 44% in 1991- 92 to 52% in 2002-03.
- The share of marginal holdings in total poultry stock continued to grow from 55% in 1991-92 to 63% in 2002-03.

#### Distribution of cattle and buffaloes among marginal and small farmers

Considering the distribution of cattle and buffaloes among farmers in India,  
 Landless agricultural laborers have 3 percent of cattle, 5 percent of buffaloes  
 Marginal farmers have 36 percent of cattle, 27 percent of buffaloes  
 Small farmers have 22 percent of cattle, 16 percent of buffaloes  
 Medium farmers have 22 percent of cattle, 22 percent of buffaloes  
 Large farmers have 16 percent of cattle, 30 percent of buffaloes

#### Poverty line

Poverty line refers to the expenditure required to buy a per capita daily minimum food prescribed according to medical standards

The poverty line for urban India is the expenditure required to obtain a per capita daily calorie intake of 2100 calories

#### Farm mechanization

In Mechanization, animal and human labor used in agriculture is replaced by machinery as ploughing is done by tractor/power tiller, sowing and fertilizer application by seed cum fertilizer drill, irrigation water lifted by irrigation pump sets, transportation by tractor, harvesting and threshing by combined harvester and so on.

#### Immediate impact of Farm mechanization on agricultural labor:

The immediate impact on agricultural labor is displacement of agricultural labor in a chronically unemployed and underemployed situation which will worsen the purchasing power of agricultural labor since even though 11 percent of holdings are landless, 30 percent of holdings are below 0.5 acre who can be regarded as semi-landless and hence 41 percent of the holdings are landless which are the landless labor class. Their subsistence farming produces only 50 percent of the food requirement of the households and hence mechanization will worsen the purchasing power of 40 percent of the agricultural households.

#### Major change in the share of use of draft animals in farm power over time, due to mechanization

There has been declining trend in the use of animal draft power due to mechanization. During 1961, the share of draft animals in farm power was 72 percent, and during 1991, the share of draft animals in farm power was 23 percent.

The poverty line for rural India is the expenditure required to obtain a per capita daily calorie intake of 2400 calories

At present around 30 percent of the population in India live below the poverty line. In the developing countries about 30 percent of the population live in absolute poverty receiving a per capita income of less than one US \$ per day.

#### Natural Resource Economics

The natural resources are the gift of nature to the human kind. They may be renewable / non renewable. Renewable natural resources are those which can be renewed within a reasonable time frame, eg. Water, forests, fishery. Non - renewable resources are those which cannot be renewed at all; eg. Minerals, petroleum. Non-renewable resources are also called exhaustible resources, since their supplies get exhausted as more is exploited.

#### Differences between agricultural economics and natural resource economics

Particulars	Agricultural Economics	Natural Resource Economics
Main focus	Inputs - seeds, fertilizers	Resources - water, land, forests, fishery,

Type of cost	Marginal cost = additional cost due to additional output	environmental services, biodiversity Transaction cost = cost due to externality which arises due to lack of well defined property rights, lack of information
Relevance of Market Price / Value	Market price is relevant since markets for agricultural commodities are well defined	Valuation of natural resource is relevant since property rights are not definable
Market	Well defined market exists for agricultural commodities	Well defined markets do not exist for natural resource, due to lack of well defined property rights and lack of information.
Stake holders	Farmers, Consumers, Government	Virtually every one in the society is a stake holder since natural resources are indispensable and there are no substitutes and all need them.
Policy term	Short term policies are relevant due to dynamic implications (eg. Subsidy policy, price policy, credit policy, all have short term focus)	Long term policy is a must for sustainable use of natural resources (like forest policy, water policy, land policy)
Scarcity	Scarcity of agricultural commodities is not relevant	Scarcity of natural resources is relevant due to the difficulty in their non-renewability in the short run. MR = MC + user cost
Optimality rule	MR=MC	User cost or royalty or scarcity rent = cost imposed on the future generation for using a unit of the resource now

### Important properties of natural resources of relevance to agriculture

Natural resources Ex: Water, Forests, Fisheries, Land, Environment, Biodiversity and their services exhibit

- (i) uniqueness (property of zero or low cross elasticity of substitution) (Water is unique)
- (ii) indispensability (efficiency and equity implications over space, time and generations) (hence sustainability, equity are crucial)
- (iii) irreversibility (with varying degrees of externalities and resilience potentials)
- (iv) uncertainty (in information and sourcing and availability with transaction costs, imperfect info),
- (v) invisibility (of resources like groundwater, which renders it difficult to define property rights),
- (vi) remoteness (of certain flora, fauna)
- (vii) intricacy – complex effects over time and space (green house effect, global warming)
- (viii) independence to interdependency, symbiosis and synergy – can be neg, pos, zero (A+B = A+B+AB or A-B-AB or A+B-AB or A-B+AB)
- (ix) In the case of natural resources, no damage or zero damage is considered as a benefit

Uniqueness: This implies that there are no perfect substitutes and are required for every one.

Endangered species are unique; Unique scenic views

Irreversibility: Once natural resources are over exploited or degenerated, it is impossible to get back to their original shape or position. For instance, natural forests, once destroyed, are difficult to regain their original properties and shape; groundwater once over exploited, results in secular or long term overdraft and takes a very long time to regain the original position;

Uncertainty: If natural resources are eliminated, the society has to bear huge costs as we do not know how eco systems work, we do not know what else we are likely to lose.

### Characteristics of 'property rights' and their relation with market failure in respect of natural resources

Property Right refers to a bundle of entitlements such as owner's rights, privileges and responsibilities for the use of a resource. Unless Property Rights are completely specified and properly defined for a commodity or resource, market cannot function properly. Natural Resources are exceptions to all of the following characteristics of Property Rights:

Universality: All resources are privately owned and all entitlements are completely specified. This is not possible with respect to natural resources, since they cannot be privately owned and all entitlements cannot be completely specified.

Exclusivity: All benefits and costs of owning and using a natural resource should accrue to the owner and to none else. This implies that the owner of a resource should be able to exclude others from using the resource. For instance, even though farmer may own land, he cannot exclude other farmers from using groundwater to which his land may also contribute through recharge. It is also likely that a farmer's well may fail, due to neighboring farmer's drilling actions due to cumulative interference.

Transferability: All property rights must be transferable from one owner to another in voluntary exchange. This implies that the owner of a resource should be able to sell to another one, voluntarily and not by force.

Enforceability: The property rights must be secure from involuntary seizure or encroachment by others. In the case of natural resources, it is virtually difficult to enforce property rights, since some of them are fugitive in nature, i.e. they run away and are difficult to catch and put to use.

### Price' or 'value' relevance for natural resources

In the case of natural resources, since the property rights are not properly definable, markets in the conventional sense cannot exist. Since markets cannot exist, the market price cannot be the representing the value of natural resource. Even if markets exist for some resources (like minerals, forest produce), they may only represent the tip of the iceberg of value equivalent to USE VALUE. But natural resources in addition have Option value, Vicarious Value, Bequest value, Existence Value and Intrinsic value which are not captured in the market. Hence 'VALUE' is relevant for natural resource rather than 'PRICE'.

Natural resource value or environmental value involves a multiplicity of values. Each type of value has its own moral standing.

Use value: or user value or user benefit is the value of benefit from the actual use of the resource at present. For example, teak timber has a use value in construction, hunter nuts a wild animal and derives an immediate benefit,

Option value: Value of a resource as a potential benefit in future. For instance during early 1970s, the plant Vinca rosea was considered as a weed and had no use value. But during 1975, Vinca rosea was found to have anti-carcinogenic properties through research. Due to generation of research information, the Option value increased enormously and commercial cultivation of this plant is providing livelihood to a few farmers. The roots of vinca rosea are used to as anti-carcinogenic agent. If this plant were to vanish by some reason, as it is happening to several medicinal plants of the Himalayas, option value would never have been estimated.

Vicarious value: is the value paid to preserve a resource for the benefit of others (eg. Benefit shows of worldwide fund for nature; Debt-for-nature swap programs of Green Peace, or Sierra Club in the USA, where in funds are raised from the US public, in order to pay the debts of south American countries to the world bank, in return for preservation of the Amazonian forests).

Bequest value: is the value paid to preserve a resource for the benefit of our future generation. People in their 'will' bequeath the natural resources or property to their children.

Existence value: is the value expressed by individuals which is not associated with present or future use of a resource. Example: High existence values can be seen in South Kodagu, where Kodagas have resisted encroachment of Devara Kadu (Sacred groves) and have preserved and maintained them exclusively for the purpose of their mere existence, may be for ecological or spiritual purposes which are not related present or future use. In North kodagu, existence value is not strong as there are encroachments in to the Devara kadu (sacred groves), and hence their existence value is relatively lower.

Intrinsic value: is the value totally unrelated to human use, and includes concern for rights and welfare of the non-human beings. For example, a rock which has no value for humans may have a large intrinsic value for a flying bird which may sit on it and relax.

Externality: An externality exists when an unintended side effect of one or more parties' actions affect the utility or production possibilities of one or more other parties and there is no contract between parties or price system governing the impact (Baumol and Oates)

Four conditions for presence of externality

1. Action of person (B) should enter the production / consumption function of the person (A) and this Action of B is only a side effect (not main effect of B) on A
2. Action of person (B) should be unintended or should not be deliberate
3. There should be no contract between A and B governing the impact (i.e B does not have any contract or rule regarding the impact)
4. There should be no price system between parties A and B governing the impact (i.e. market fails to account the impact, which can be positive or negative or in other words, B does not pay A for inflicting the damage)

The effect of externality: Both positive and negative externalities result in (i) inefficiency and (ii) welfare loss

#### Positive and negative externalities in agriculture with examples

Positive externality refers to uncharged benefit enjoyed by one economic agent due to action of another economic agent. The sunflower farmer next to an apiculturist, derives the benefit of successful pollination in sunflower and thus increased output; the apiculturist on the other hand realizes increased output of honey due to good collection of nectar from sunflower. Both in fact are enjoying positive externality due to actions of each other.

Negative externality refers to unreimbursed costs due to action of one economic agent on the other. The mulberry silk worm rearer next to a cabbage farmer, suffers loss of cocoon yield by feeding the mulberry leaves, on which the pesticide spray deposits of the neighboring cabbage farmer are apparent due to drift of Plant protection chemical sprays.

Pecuniary externality: occurs when one party's actions change prices and these price changes affect other parties' welfare. These are not externalities and they do not result in economic inefficiency, but result in welfare loss.. Eg: advent of cheaper personal computers, has increased efficiency, but displaced labour resulting in welfare loss.

Sustainability: is a long term phenomenon. Sustainability requires sacrifice and entails greater opportunity costs.

Efficiency: in developmental connotation refers to the context of Myself and Today. As long as the single farm maximizes the profit for today, it is efficient, as it does not bother about the evil effects on its own environment or on the neighbor. There is not much of a sacrifice here, since farmer is considering only at his/her farm.

Equity refers to the context of Myself and Ourselves for Today: So Equity bothers about the effect of efficiency on the farm, on the neighboring farm but for today. There is some sacrifice here since farmer is considering effects not only on his/her farm, but also on neighbouring farm/s today (or this year)

Sustainability refers to the context of Myself and Ourselves for Today and for Tomorrow: Here there is much more sacrifice by the farmer than equity and efficiency, since the farmer considers the effects on his/her farm as well as effects on neighbouring farm/s not only today (or this year) but also tomorrow (or coming years).

## I. Economics

### 1. Define economics:

Economics is the study of how societies use scarce resources to produce valuable commodities and distribute them among different people

### 2. What are the Two key ideas of Economics

#### a. Goods are scarce

#### b. Society must use resources efficiently

### 3. Why Economics is an important subject

**Economics is an important subject because of the fact of Scarcity and the desire for efficiency. Economic growth is a race between depletion and invention**

### 4. What if all goods are free?

If all goods are free, then all prices are zero and markets are unnecessary and economics will no longer be an useful subject. But our world is full of scarcity and full of economics goods

### 5. What is Scarcity:

Scarcity means, goods are limited in relation to desire

### 6. What is Abundance?

Abundance means, goods are not limited in relation to desire

### 7. What is Efficiency:

Efficiency denotes the most effective use of society's resources in satisfying people's wants and needs

### 8. When do we say an economy is producing efficiently?

When the society cannot make any one economically better off without making someone else worse off.

### 9. What is pareto optimality or pareto optimal allocation or pareto efficiency?

According to Pareto optimality, economic well being of one person can be improved, only by lowering the economic well being of another person. Pareto efficiency can only be achieved in perfectly competitive markets where the total surplus (sum of consumer surplus and producer surplus) is maximized. Therefore Pareto optimality is the characteristic of perfectly competitive markets

### 10. What are perfectly competitive markets?

A perfectly competitive market is one where

1. there are large number of small sellers who sell a homogeneous product

2. there are large number of substitutes for the product

3. there are no restrictions for entry or exit into / from the market

The resources land, labour, capital, organization are perfectly mobile and there are no restrictions on mobility of resources (example: if farmer is offered a higher wage in the neighboring village, he works in the neighboring village than working in his village. This is perfect mobility of labour. Similarly if farmer gets higher profit from selling his land to industry, he will sell his land. But this is not easily possible, since there are land laws and rules, which do not easily convert agriculture land to non agricultural land. This is a restriction, which makes land mobility difficult and hence is a market imperfection. Thus there are no restri

4. there is perfect information regarding both inputs (factors of production) and product (or output) among buyers and sellers in the market (i.e. all consumers know the price offered by different sellers)

5. no single buyer or seller can influence the market price and hence they are price takers. No single consumer or seller can change / alter the market price and if he/she does, then he/she will be the most inefficient. For example, if a farmer wants to sell paddy at a price lower than market price, then theoretically, all the consumers will surround, but he cannot supply. If he rises his price above market price, then no one will buy paddy from him. Therefore the farmer takes what ever price is there in the market and sells paddy at that price. He is therefore a price taker.

#### 11. What is an example for perfectly competitive market

No market is perfectly competitive in this world. You can only find relatively perfectly competitive market. Agriculture can be said to be relatively perfectly competitive compared with industry.

#### 12. What is Microeconomics ?

Microeconomics deals with How prices are set, How price of land, labour, and capital are determined.

#### 13. How Economic benefit comes ?

Economic benefit comes from self interested actions of individuals

#### 14. What is Macro economics

Macro economics deals with how total investment and consumption are determined, How reserve bank of India manages money and interest rates, what causes international financial crisis, Why some nations grow rapidly and why some nations stagnate?

#### 15. What is the Ultimate goal of economics:

The ultimate goal of economics is to improve the living conditions of people in their everyday life

#### 16. What are the 3 fundamental questions of economic organization?

1. What commodities are produced and in what quantities
2. How commodities are produced i.e. using what technology, using what resources
3. For whom goods are produced, who eats the fruits of economic activity, Is the distribution of income and wealth fair and equitable. Are many people poor and a few rich? Will society provide minimal consumption for the poor

#### 17. What is positive economics:

Positive economics describes the economy as it is (eg. What it is):.

Example: 1. Why doctors earn more than peons, 2. What is the impact of computers on productivity  
3.No thoroughly egalitarian society has been able to maintain an efficient and progressive economic system

#### 18. What is normative economics:

Normative economics prescribes how an economy should be (eg. What ought to be)

This prescribes how an economy should grow.

Eg. Some system of differential rewards is necessary to stimulate workers

## II. Demand

### 1. State the law of downward sloping demand

Other things being equal (*ceteris paribus*), when price of a commodity falls, the quantity demanded of that commodity increases.

Other things being equal are:

1. Average income (as income rises, people increase their purchases)
2. Population : growth in population increases their purchase
3. Price of related goods: Lower price of petrol, raises demand for cars
4. Tastes: Having new car is a status symbol
5. Special influences: Availability of alternate transport like trams, availability of safety of automobiles

These are also called demand shifters

(Note: Other things being equal means, other things kept constant. You cannot keep anything constant in reality. For instance, no one can keep income constant, no one can keep population constant, no one can keep price of related goods constant, no one can have tastes all the time to be the same, etc.

Other things being constant, only means that we ignore other things such as population, price of related goods, tastes and preferences, special influences, while we discuss the relationship between quantity demanded of a good and the price of that good. Instead of saying ignoring, we say kept constant. When you keep some things constant in life, you don't worry about them, but only worry about thing which varies and influences the quantity demanded, and this is the price of the commodity.

## 2. What is the difference between change in demand and change in quantity demanded

Change in demand refers to shift in demand curve, which happens only due to demand shifters such as change in income, population, price of related goods, tastes, special influences. Example, demand for rice increases, due to increase in income. Demand for rice increases due to increase in population. Demand for rice increases due to improvement in status of person. When we say demand increases, it refers to shift in demand.

Change in quantity demanded refers to movement along the demand curve. The movement along demand curve is only due to change in the price of the commodity. When we say quantity demanded increases, it refers to movement along the demand curve which is exclusively due to change in the price of the commodity in question.

For example, There is increase in quantity demanded of rice due to fall in price of rice

## 3. Why the Demand slopes downwards

Demand curve slopes downwards because of a. Substitution effect and b. income effect

### 4. What is substitution effect

When price of a good increases, the consumer will substitute similar goods which are cheaper. For instance, if price of apple increases, consumer may eat orange which is cheaper. Thus, substitution effect makes the consumer to substitute the goods which are cheaper and the consumer reduces the consumption of the good whose price has risen. Thus, demand for the good slopes downwards

### 5. What is income effect?

Income effect: when price increases, this reduces consumers' purchasing power. Therefore the quantity demanded of this commodity falls. Eg. When price of apple increases, consumer's purchasing power or income goes down. Now the consumer becomes poorer than what he was before the price rise. Therefore the consumer spends less on apple and therefore demand slopes downwards

### 6. What is Equi Marginal utility principle?

The Equi marginal utility principle indicates that the consumer obtains the greatest satisfaction or utility if the marginal utility per rupee is the same across all the commodities he consumes

To state :  $MU_x/P_x = MU_y/P_y = MU_z/P_z$ , where MU = marginal utility, P is the price, x, y z are commodities

### 7. What is utility

Utility is the want/need satisfying capacity of a commodity

### 8. Explain the operation of equi marginal utility with an illustration.

If a consumer has an income of Rs. 10, let us find the equimarginal allocation of Rs. 10 which maximizes his total satisfaction consuming apples and mangoes, given the information on marginal utility of eating mangoes and apples as below. Say One mango costs Rs. 1, One apple costs Rs. 2.

Unit	Marginal utility from Mango consumption	Marginal utility ÷ Price of mango (Px = Rs.1)	Marginal utility from Apple consumption	Marginal utility ÷ Price of apple (Py = Rs.2)	Allocation (from income of Rs ten)
1 <sup>st</sup>	10	10/1=10 (II)	24	24/2=12 (I)	I Apple = Rs. 2, 10-2=Rs. 8 left
2 <sup>nd</sup>	8	8/1=8 (V)	20	20/2=10 (III)	II Mango = Rs. 8 – Rs. 1= 7 left
3 <sup>rd</sup>	7	7/1=7	18	18/2=9 (IV)	III Apple = Rs.7-Rs. 2= Rs5 left
4 <sup>th</sup>	6	6/1=6	16	16/2=8 (VI)	IV Apple = Rs.5-Rs.2=Rs.3 left
5 <sup>th</sup>	5	5/1=5	12	12/2=6	V Mango = Rs. 3-Rs. 1=Rs.2left
6 <sup>th</sup>	4	4/1=4	6	6/2=3	VI Apple = Rs. 2-Rs.2= Nil balance
7 <sup>th</sup>	3	3/1=3	4	4/2=2	Consumer consumes total of 4 apples, 2 mangoes with Rs. ten and this yields maximum satisfaction for him/her

Demand curve slopes downwards also because of the operation of Equi marginal utility principle

### III. Supply

1. What is Law of supply: Other things remaining the same, the quantity supplied increases with the price of the commodity. Other things being equal are called supply shifters. They are

1. Technology . eg. Computerized manufacturing lowers production costs and increases supply
2. Input price: a reduction in wages paid to farmers lowers production costs and increases supply
3. Price of related goods: If price of diesel falls, supply of tractors or cars rises
4. Govt policy: Removing quotas and tariffs on imported tractors increases total tractor supply
5. Special influences: Internet shopping allows consumers to compare prices and increases supply

2. What is the difference between change in supply and change in quantity supplied demanded

Change in supply refers to shift in supply curve, which happens only due to supply shifters such as change in technology, input price, price of related goods, govt policies, special influences.

Example, supply of paddy increases, due to adoption of improved varieties of paddy by farmers

Change in quantity supplied refers to movement along the supply curve. The movement along supply curve is only due to change in the price of the commodity.

For example, There is increase in quantity supplied of paddy due to increase in price of paddy

3. What is the Effect of demand and supply shifts on price and quantity

1. If demand curve shifts to right from D1 to D2, price increases from P1 to P2, quantity increases from Q1 to Q2.
2. If demand curve shifts to left from D1 to D2, price falls from P1 to P2, quantity falls from Q1 to Q2
3. If supply shifts up from S1 to S2, price increases from P1 to P2, quantity falls from Q1 to Q2. Supply shifting up means supply shifts left or supply reduces.
4. If supply shifts down from S1 to S2, price falls from P1 to P2, quantity rises from Q1 to Q2. Supply shifts down means supply shifts right, or supply increases

4. Explain why each of the following are false

1. Cold temperature in Kodagu district of Karnataka where coffee is cultivated, will lower the price of coffee – FALSE

Reason: Due to cold temperature, coffee production in Kodagu falls and this results in supply shifting up (or to left). Therefore given the demand, the supply falls and the price rises

2. Protecting Kolar silk farmers from Chinese silk imports, will lower silk clothing prices in Kolar – FALSE

Reason: If we protect Kolar farmers by stopping silk imports from China, the supply shifts left and so the silk clothing prices rise in India, given the demand. Hence farmers will continue to get higher prices for their silk yarn and therefore silk cocoons.

#### 5. Fill in the blanks

1. Increase in demand raises price and raises quantity demanded
2. Decrease in demand decreases price and decreases quantity demanded
3. Increase in supply lowers the price and raises quantity demanded
4. Decrease in supply raises price, lowers quantity demanded

6. For each of the following, explain whether quantity demanded changes because of demand shift (demand shifters) or movement (i.e. change in price of good)

1. Due to decrease in military spending, price of army boots falls

Here price of boot is falling, not because of demand factor, but because army has reduced the purchase of army boots. Therefore this results in demand shift to the left and price fall

2. Fish prices fall after pope allows Catholics to eat meat on Friday

Here, meat is a substitute for fish. Therefore demand for fish falls due to shift to meat. Here Pope's permission is a special influence which is shifting consumption of fish to the left, since Catholics now substitute meat for fish. Therefore this results in demand shift to the left due to Pope's permission which is a non-price factor.

3. Increase in tax on petrol, shifts the demand for petrol to left.

Due to increase in tax on petrol, petrol price increases, and this results in reduction in quantity demanded (this is movement along the demand curve)

7. Consider the demand schedule for oranges.

Price per orange	Quantity demanded of orange	Quantity supplied of orange
10	0	40
8	10	30
6	20	20
4	30	10
2	40	0
0	125	0

1. What will happen if demand for orange triples at each price

If demand for orange triples at each price, then demand shifts to right

2. What happens if price is initially at Rs.4 per orange

At Rs. 4 per orange, demand is greater than supply, and there will be scarcity

3. What is the equilibrium price and quantity:

At equilibrium, quantity demanded = quantity supplied. The equilibrium price is Rs. 6 and quantity demanded is Rs. 20

8. Consider price of petrol using supply-demand curve. Illustrate the impact of the following on price and quantity demanded (Illustrate them with curves and diagrams)

1. Due to conveyance pipe laid from Iraq to New Delhi, this lowers the cost of transportation of oil to India

If the cost of oil transport which is cost of oil import, falls, supply of oil increases from S1 to S2, and therefore price of oil falls from P1 to P2 and quantity rises from Q1 to Q2

2. After 1973, Oil producers have cut oil productions sharply

Due to war, oil supply shifts left (shifts up) from S1 to S2, and so price increases from P1 to P2, Quantity decreases from Q1 to Q2

3. After 1980, small cars yield higher mileage per liter of petrol

Due to higher fuel efficiency of cars, the demand curve for cars will shift up from D1 to D2. Therefore given the supply, price of cars increases from P1 to P2.

4. Due to cold winter, there is increase in demand for heaters

Due to cold, there is shift in demand to the right for heaters at home from D1 to D2. Therefore prices of heaters rise from P1 to P2

5. Due to economic recovery oil prices rise

Due to economic recovery, shift for oil shifts to the right from D1 to D2 and price increases from P1 to P2

9. Indicate why A good harvest lowers the income of farmers.

This is also called the 'Paradox of Plenty'. Since the demand curve and supply curve of agricultural commodities are both relatively inelastic, due to bumper harvests, the supply curve shifts to the right increasing supply. But this decreases the total revenue to the farmers, since demand is relatively inelastic and just because supply increases, it does not mean demand also shifts to the right. Therefore the total revenue in fact falls when supply increases or shifts right due to improvement in technology. This results in price fall and ultimately benefits the consumers more than the producers. This precisely happened during green revolution. Therefore whenever there is improvement in technology of agricultural production, farmers need to realize that this does not necessarily improve their incomes, since the demand for agricultural commodities is relatively inelastic as is their supply. Only if the demand also shifts up, more than the supply shifting to the right, the farmers will increase their incomes. This can happen only due to demand shifters such as population, income, tastes.

IV. Price Elasticity of Demand

1. What is Price elasticity of demand ?

Percentage change in the quantity demanded due to one percent change in the price of the commodity

2. Explain unitary price elastic demand:

For a one percent fall in price, if there is a one percent increase in quantity demanded, it is the case of unitary elastic demand

3. Explain price elastic demand

For a one percent fall in price, if there is more than one percent increase in quantity demanded, it is the case of Elastic demand (eg. Cosmetics, luxuries)

4. Explain price inelastic demand

For a one percent fall in price, if there is less than one percent increase in quantity demanded, it is the case of Inelastic demand (eg. Necessities, food grains)

5. What is the Formula for Arc elasticity of demand:  $[(Q_2 - Q_1) / (Q_2 + Q_1) / 2] \div [(P_2 - P_1) / (P_2 + P_1) / 2]$   
(Students: Do not remember this as  $[\Delta Q / Q \div \Delta P / P]$ . Remember as above.)

[Arc elasticity is average elasticity between two points  $Q_2$  and  $Q_1$ ,  $P_2$  and  $P_1$ .

6. What is point elasticity of demand?

Point elasticity, is elasticity at a point of price and quantity demanded (for this you need to use differential calculus)

7. Explain with an example working out arc or average price elasticity of demand

Q	$(Q_2-Q_1)$	P	$(P_2-P_1)$	$(Q_2+Q_1)/2$	$(P_2+P_1)/2$	$E_p = [(Q_2-Q_1)/(Q_2+Q_1)/2] \div [(P_2-P_1)/(P_2+P_1)/2]$
0		6				
10	10	4	-2	$10/2=5$	$10/2=5$	$[(10/5) \div (-2/5)] = -5$ <i>ELASTIC</i>
20	10	2	-2	$30/2=15$	$6/2=3$	$[(10/15) \div (-2/3)] = -1$ <i>UNIT ELASTIC</i>
30	10	0	-2	$50/2=25$	$2/2=1$	$[(10/25) \div (2/1)] = -0.2$ <i>INELASTIC</i>

8. Explain why Slope and elasticity of demand are not the same

For a straight line demand curve, the slope all through the demand curve is constant. But elasticity of demand varies from point to point.

9. What is the elasticity of demand for a straight line demand?

The elasticity of demand of a straight line demand at any point = Length of the line segment below the point  $\div$  Length of the line segment above that point

10. What is the relationship between Elasticity and Total revenue

When demand is price inelastic, a price increase, increases the total revenue

When demand is price elastic, a price increase, reduces the total revenue

When demand is unitary elastic, a price increase or decrease, keeps the total revenue constant

11. What is perfectly inelastic demand

For good like salt, the demand is perfectly inelastic, implies, irrespective of the price of salt, virtually the same quantity is consumed.

V. Elasticity of supply

1. What is Elasticity of supply:

Percentage change in quantity supplied divided by percentage change in price. Price elasticity of supply is positive, unlike price elasticity of demand

2. What are the major factors influencing the supply elasticity

a. the ease with which output can be increased, b. time period under consideration.

3. For each pair of commodities, state which is price elastic, inelastic with reason

1. Perfume and salt: Elastic demand for perfumes because perfume is a luxury; perfectly inelastic demand for salt since salt is an absolute necessity

2. Penicillin and ice cream: Penicillin is an antibiotic, and is a necessity. Therefore it has inelastic demand. Ice-cream is a luxury and hence demand is relatively elastic

3. Car and Car tyre: Car is a luxury and hence demand is elastic. Car tyre is a necessity hence demand for car tyre is relatively inelastic

4. Ice cream and chocolate ice cream: Ice cream is a necessity compared to chocolate ice cream. So, demand for ice cream is relatively inelastic, but demand for chocolate ice-cream is elastic since chocolate ice cream is a luxury

## VI. Impact of government policies on supply and demand

### 1. What is the Impact of tax on price and quantity demanded?

Due to imposition of tax on say petrol, the cost of petrol goes up, i.e. the marginal cost of petrol goes up, therefore supply curve shifts up, therefore the price goes up, and quantity demanded falls.

### 2. What is the Impact of subsidy on price and quantity supplied

Taxes discourage consumption of a commodity, but subsidies encourage production of a commodity. Subsidies for fertilizers in agriculture have shifted supply curve to the right. During green revolution, due to subsidies on fertilizers, agricultural credit, pesticides, farmers shifted their supply of farm produce to the right since inputs were cheaper than before.

### 3. What is the Impact of ceiling price.

When the equilibrium price is high in the market, if there is a price ceiling, then this will increase the demand. Therefore since the price is below equilibrium price, there is shift in demand curve to the right

### 4. What is the Impact of floor price or support price

Floor price means if support price is offered, then this results in shift in supply to the right. Precisely this happened during green revolution, when farmers were offered support prices, these were above the market prices, due to which, supply of agricultural produce shifted to the right.

## VII Utility

1. What is the meaning of utility: Utility is want satisfying capacity of a commodity

2. What is Total Utility: is the utility obtained by consuming X quantity of a good

3. What is Marginal Utility:

Marginal utility obtained by consuming the Xth quantity of good. Example: utility obtained by eating the second mango, utility obtained by eating the third orange etc, (assuming that the good is consumed continuously without any break)

4. What is Law of Diminishing Marginal Utility:

As the quantity consumed of a good increases, the marginal utility of that good diminishes, other things being equal. (The good should be consumed continuously without break)

5. Each week a consumer buys two apples at Rs.2 per each, 8 buttermilk at 50 paise each, 8 idlies at Rs. 1 each, zero bajjis at Rs.1.5 each. Indicate about their marginal utility to this consumer.

According to equimarginal utility principle,  $MU_x/P_x = MU_y/P_y = MU_z/P_z = \dots$

Since price of goods are given here, since Apple priced at Rs. 2, according to the equi marginal utility principle, Apple has a MU of 2. Similarly butter milk has MU of 50 paise, idli has MU of Rs. 1 and Bajji has MU of Rs. 1. In an order, MU of apple > MU of Bajji > MU of idli > MU of buttermilk for this consumer.

6. When is Utility is maximized

Utility is maximized when MU per rupee spent on every good is the same – Right  
(Utility is maximized when the MU of all goods are exactly equal – is Wrong)

For maximizing utility the rule is  $MU_x/P_x = MU_y/P_y = MU_z/P_z = MU$  per Rupee should be the same across all goods consumed

7. Consider the following table. You are given consumption of mangoes and total utility from mangoes. Find out the MU and the price. Indicate the quantity demanded when the price is Rs 40

Kgs of	Total	Marginal utility	Acc to Equi Marg,	Quantity
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mangoes	utility		MU = Price, Therefore Price =	demand
0	0			
1	70	$(70-0) \div (1-0) = 70$	70	1
2	110	$(110-70) \div (2-1) = 40$	40	2
3	146	$(146-110) \div (3-2) = 36$	36	3
4	176	$(176-146) \div (4-3) = 30$	30	4
5	196	$(196-176) \div (5-4) = 20$	20	5
6	196	$(196-196) \div (6-5) = 0$	0	6

Since  $MC = P = MU$ , at Price =40, the consumer consumes 2 kgs of mangoes

### VIII. Production

#### 1. What is production function

Production function gives relationship between output that can be produced using given inputs

#### 2. What is Total Product

Total product is the total quantity of output. Example: Farmer has produces total product of 10 quintals of ragi from 2 acres.

#### 3. What is Marginal product of an input

Marginal product of an input is the output produced by a specific unit of input ceteris paribus

#### 4. What is LDMP:

The farmer will obtain less and less of output from his land when he adds additional doses of input say fertilizer, holding other inputs like technology, climate, input prices, constant. Thus, Marginal product of each unit of input will fall, as he uses more and more of that input, holding other inputs constant.

#### 5. What is short run, explain with example

Due to increase in demand for fishery, suppose a fisherman wants to increase his fish catch, then he will increase his fish catch by working for longer hours, employing more labour etc. Thus, he relies more on his variable input like his labour and hired labour to increase his fish catch. This is a short run phenomenon. Thus in the short run, the fish catch increases only through increase in variable capital and fixed capital remains constant. Here fisherman can recover above-normal profits.

#### 6. What is Long run, explain with example

Looking into above-normal profits of fisherman in the short run, fisherman enters the ocean to increase his fish catch through more boats and fleet. This can happen in the long run when he can invest on capital by investing on new boats. This results in increase in fish supply, due to increased boats, fleet. New shipping yards will be built to improve logistics. Thus, in the long run fixed cost itself will increase and hence all costs becomes variable costs. There is no fixed cost in the long run and all are variable costs.

#### 7. What is Technological change

Technological change results in shift in production function. For example, green revolution technologies shifted production function to the right.

#### 8. What are Fixed costs

Fixed costs are those which do not vary with the output. Eg: depreciation, payment to permanent labour, Life insurance premium all have to be incurred whether the farmer produces output or not Marginal costs are not influenced by fixed costs. Hence fixed costs do not influence decision making regarding optimal or efficient level of output

#### 9. What are Variable costs

Variable costs are those which vary with the output. Eg. Cost of seeds, fertilizers, manures etc.  
 Marginal costs are influenced by variable costs. Hence only marginal costs influence the decision making regarding optimal or efficient level of output.  
 Total cost = VC+FC.

#### 10. What is Marginal cost:

Marginal cost is the additional cost of producing additional output  
 Precisely, MC = cost of producing Xth unit of output. Example: the cost of producing the first unit of output, cost of producing 10<sup>th</sup> quintal of paddy is the marginal cost tenth quintal of paddy  
 Marginal cost varies inversely with marginal product. If marginal cost is low, then marginal product is high. Marginal cost becomes the least, when Marginal product becomes maximum. When marginal product falls, marginal cost rises. This is because  
 $MC = P_x/MP$

#### 11. What is average cost

Average cost is cost of production per unit of output =  $P_x/AP$ . Average cost is inversely proportional to average product. If AP increases, Avg cost decreases. Where AP reaches the maximum, the average cost reaches the minimum. When average product falls, the average cost rises.

#### 12. Explain why the following are wrong

##### 1. Average costs are minimized when marginal costs at their lowest point:

Wrong – Average costs and marginal costs are not related. Instead average cost is (inversely) related to average product, marginal cost is (inversely) related to marginal product  
 Therefore when average cost is minimum, AP is maximum.

##### 2. Because fixed cost never changes, Average fixed cost is a constant for each level of output

Wrong - Average fixed cost is not a constant, but it falls for each level of output, since a fixed or a constant fixed cost is divided among different units of output.

##### 3. Average cost is rising, whenever MC is rising.

Wrong - AC is rising, when AP is falling. AC rising has nothing to do with MC rising

##### 4. Opportunity cost of drilling for groundwater in Banneghatta National Park is zero because no farmer produces anything there

Wrong: With the amount used for drilling a well, you can use that amount anywhere else and earn a return. Hence the opportunity cost is not zero.

##### 5. A farmer minimizes costs when he spends the same amount on each input

Wrong: A farmer minimizes costs when he spends in such a way that Marginal product of each input to price of each input is equal across all inputs. This is similar to  $MU_x/P_x = MU_y/P_y = MU_z/P_z$  (denoting equi marginal utility principle). Similarly,  $MP_x/P_x = MP_y/P_y = MP_z/P_z$  (denoting equi marginal returns principle)

##### 6. A competitive farmer will produce output upto the point where $P=AVC$

Wrong: A competitive farmer will produce output upto the point where  $P = MC$

##### 7. A farmer's shut down price comes where price is less than the Min AVC

Wrong: Shut down point is where Price = AVC = MC or you can say  $P = \text{Min AVC}$

##### 8. Farmer's supply curve depends only on his/her MC. Any other concept is irrelevant to his/her supply decision.

Wrong: A farmer's supply curve depends on his/her Marginal cost, from the point of Min AVC

##### 9. Price = MC holds for upward sloping, horizontal and downward sloping MC curve

Wrong.  $P=MC$  holds for upward sloping MC curve

10. The competitive farmer sets price = MC

Wrong: The competitive farmer takes Price = MC

## IX. FACTORS OF PRODUCTION

## 1. What is Land:

Land is a natural resource, free gift of nature.

Clean air and potable water are also natural resources

2. What is Labour:

Labour is Human time spent in production, in cultivating land, in teaching students. Labour is the most crucial input in a growing economy

3. What is Capital:

Capital is produced to produce other inputs. Includes machinery, road, personal computers, tractors, combined harvesters, washing machine. Therefore capital is called 'produced means of production'

4. What are the Three economic problems in terms of inputs and outputs

1. What output to produce and in what quantity
2. What technology should be used to produce
3. For whom the outputs be produced and distributed

5. Define Opportunity cost

Opportunity cost of a resource or input is the return sacrificed in the next best alternative use of the input or resource. Opportunity cost is also called economic cost.

6. Write a note on Opportunity cost:

Opportunity cost has two words, opportunity and cost. Obviously opportunity cost exists if there are opportunities for an input or resource to earn a return. An opportunity to earn a return becomes a cost, since this opportunity to earn a return is sacrificed, since two things cannot occupy the same place at the same time. Thus in most cases opportunity cost exists for all resources.

Example: If Dr Chandrakanth is working as a Professor in UAS and earning Rs. 50,000 per month and if he could have earned Rs. 56,000 if he had worked in Canara Bank;

Or Rs. 4 lakhs per month if he had worked in World Bank' or Rs. 45,000 in Govt of India; or Rs. 30,000 if he had worked in the Dept of Agriculture, GOK, then his opportunity cost of working in UAS is = 50,000-45,000= Rs 5000.

Logic: what ever Dr Chandrakanth is doing at present is his best choice. Since two things cannot occupy the same place at the same time, he has foregone or sacrificed the next best alternative which is receiving an income of Rs. 45000 if he had worked in GOI. Certainly the opportunity cost income foregone is not that which is above Rs. 50,000, since if he were capable, he would have accepted an income above Rs. 50,000. Since he has not received an income above Rs. 50,000, he is capable of only that. Hence the definition of opportunity cost.

7. If your father gifts you a sum of Rs 10000, then is there an opportunity cost for this gift?

Yes, the opportunity cost of this gift, is an interest of Rs 1000 per year which you would have earned in a FD in a Bank (assuming an interest rate of 10 percent.)

8. If your father is a farmer working on his land, is there an opportunity cost for his own labour?

Yes, opportunity cost of own labour is the market wage rate of say Rs 50 per day which he could have earned if he had worked on some one else's land in the village. But father has sacrificed this since he is working on his own land.

9. If your father is cultivating his land of 1 acre, is there an opportunity cost of his own land?

Yes, the opportunity cost of own land is the rent of say Rs 600 which father would have earned if he had leased out his land for one season

## Meaning and scope of agricultural economics

Broadly agricultural and resource economics deals with the application of principles of economics and institutional economics to the study of agriculture and resources, with the objective of sustainable development

1. Relationship of Agricultural Economics with (i) Agronomy, (ii) Soil Science, (iii) Plant Pathology, (iv) Bio Technology, (v) Agricultural Extension.

- i. *Agri Economics with Agronomy:* Agronomy deals with cultural operations involved in crop production. Agri Econ can test cost effectiveness of these cultural operations.
- ii. *Agri. Econ with Soil Science:* Soil science deals with study of soil physical, chemical properties including the methods to reclaim soil, like soil amendments, correction of saline-alkaline soils and the technologies for soil amendment. Agri Econ provides the cost effectiveness of different methods of soil amendment for instance.
- iii. *Agri. Econ with Plant Pathology:* Plant Pathology deals with study of different crop diseases and their control. Agri Economics studies the cost effectiveness of different methods of disease control including those of IPM.
- iv. *Agri. Econ with Bio Technology:* Bio technology provides different methods of mass production of seeds, seedlings using different technologies like Tissue culture for instance. Agri Econ studies the cost effectiveness of different methods of bio technology in meeting the seed requirement.
- v. *Agri. Econ with Agricultural Extension:* Agri Extension provides different methods of diffusion of innovations like result demonstration, method demonstration for instance. Agri Economics can contribute to measurement of the economic contribution of agri extension to farmers.

### Differences between Accounting profit and economic profit

*Accounting profit:* Here only the accounting costs, or costs for which payments are made are considered. For e.g. Purchase of seeds, purchase of fertilizers, loan amount borrowed etc. Here the opportunity cost or economic cost of own resources like own family labor, own land, own sources of funds are not considered.

*Economic profit:* Includes opportunity costs of resources like farm family labor, own sources of fund invested on the farm, and similar costs, in addition to accounting costs. For instance, if a farmer invests his own working capital, interest on working capital is charged, treating as if the working capital is borrowed. Similarly, rental value of own land is the opportunity cost of land, family labor charged at market wage rate is the opportunity cost of labor. Thus, economic profit will be lower than accounting profit

## **Main focus of the following subjects and their role in agricultural economics**

i) Farm Management Economics, ii) Natural Resource Economics, iii) Agricultural Finance, iv) Agricultural Policy, v) Agricultural Marketing.

- i. *Farm management economics*: Studies the management of individual farm for maximizing net returns and efficiency with the satisfaction of farm family.
- ii. *Natural Resource Economics*: Studies the externalities, transaction costs, optimal extraction of natural resources like groundwater, valuation of natural resources like water, forests, land and fishery
- iii. *Agricultural finance*: Studies the credit institutions of assistance to agriculture, returns, repayment capacity and risk bearing ability of the farmer, different sources of funds, where, when and how much to borrow for agriculture
- iv. *Agricultural policy*: Studies the role of price policy, buffer stock, public distribution system on food security, how to motivate farmers to meet the national objectives of achieving food security.
- v. *Agricultural marketing*: Studies the different utilities created in marketing such as time, form, place and possession utilities, price spread in different agricultural commodities, how to increase the farmer's share in consumer rupee.

## **Role of 'Great Economic Depression' in shaping Agricultural Economics**

The effect of Great Economic Depression of the 1930 was more pronounced on agricultural sector than any other sector, since the fall in prices, fall in wages and fall in profits were all demotivating factors for further production. In fact it was after the 1930s after the effect of Great Depression was felt, the role of agricultural economics in framing farm and agricultural policies caught up prominence.

## **India in comparison with other countries in the world with respect to Rice, Wheat, Milk, Pulses, Cattle, Buffaloes and Tractors**

India stands first in the world in the production of pulses, milk, and number of cattle and buffaloes; and second in the world with regard to production of rice, wheat, groundnut, sugarcane, vegetables; India stands fourth in the world with respect to number of tractors.

## **Contribution of agriculture to Indian economy**

At present agriculture contributes to 24 percent of national income (1997) and employs 60 percent of total workers in India.

It provides cotton, jute, sugarcane, oilseeds, plantation crops to industries dependent on these commodities.

Agriculture contributes to 19 percent of total exports, the major commodities are fish and fish preparation (3.42 percent) followed by oil cakes (2.7 percent), rice (2.59 percent), coffee (1.29 percent).

Agriculture provides raw material to clothing and textile yarn, fabric exports which together account for 28 percent of India's exports

Between 1951 and 1998, even though the population of India increased by 180 percent, the food production has increased by 250 percent increasing the per capita net availability of food grains from 395 grams per day per capita to 484 grams per day per capita (451 gms of cereals + 33 grams pulses)

## **Differences between Agriculture and Industry**

Agriculture is largely dependent on nature (monsoons, soils, water) while Industry is largely dependent on man made capital;

Law of diminishing marginal returns operates early in agriculture since it is largely dependent on land, in Industry, operation of LDR is postponed due to use of capital intensive inputs;

In Agriculture, farmer faces relatively a competitive market and hence is a price taker, while in Industry, the entrepreneur is a price maker as the market is not as competitive as in agriculture

Agricultural operations are season bound, results in rigidities in production and supply, planning is relatively difficult

Industrial operations are not season bound and offers flexibilities in production, supply and planning

Division of labor is possible in industry, but not agriculture, because agriculture operations are subjected to a sequence and timing along a single line. For instance a farmer has to sow the seed, wait for germination, then wait for performing interculture operations, irrigate his crop, and finally harvest. Each work is dependent on earlier work. Farmer cannot parallelly perform different operations unlike in Industry, where a person can specialize in different skills and then those works can be added up on cumulative basis.

## **Development**

Development refers to raising per capita incomes of people together with improving quality of life, better health services and educational opportunities, greater participation in public life, clean environment, intergenerational equity and more. But growth largely refers to increase in per capita income and does not give so much weightage to income distribution.

*Development has four basic frames:*

Structural: includes honest, competent governments committed to fight against corruption; strong property and personal right laws supported by an efficient and honest legal and judicial system; a well supervised financial system that promotes transparency; and a strong social safety net.

Human development: includes universal primary education and strong secondary and tertiary stems, and a health system that focuses on family planning and child care.

Physical: concerns center around the efficient provision of water and sewerage; expanded access to reliable electric power, access to road, rail, and air transportation and to telecommunications; preservation of the physical environment; and a commitment to preserving cultural and historical sites and artifacts that support indigenous cultures and values.

Sectoral: elements include an integrated rural development strategy, a strong urban management approach and an enabling environment for the private sector.

## **Characteristics of developing countries**

*Principles of agricultural and resource economics Course Outline and notes, 2007*  
 Teacher: MG Chandrakanth, Professor and Head, Dept of Agri Economics  
 UAS, GKVK, Bangalore - 560065

Low per capita income: In 1998, India's per capita GNP was \$ 430, with a rank of 165 and the Purchasing power parity income of \$1700 with a rank of 163. Switzerland has the highest per capita income of \$40,080 (PPP of \$ 26,620), followed by Norway (\$34,330, PPP of \$ 24,290), Denmark (\$33,260, PPP of \$23,830); Japan (\$32,380, PPP of \$23,180); Singapore (\$ 30,060, PPP of \$ 28,620) and the USA (\$29,340, PPP of \$29,340).

Occupational pattern: 67 percent of workers are engaged in primary sector, 13 percent of workers in secondary sector (mining, quarrying, household industry, construction) and 20 percent of workers are engaged in tertiary sector (trade, commerce, transport, communications etc).

Population pressure: India's population growth rate is 2 percent, 32 percent of labor force is female population, 13 percent of the labor force is children. A rising population imposes greater economic burdens.

Employment: Prevalence of unemployment: 60 percent of active workers are supported by agriculture. Agriculture sector has much larger number of laborers than are needed rendering the marginal productivity of labor as close to zero or negative. There is chronic unemployment and underemployment due to heavy pressure of population and absence of alternative employment opportunities in other sectors.

Capital formation: India has low level of capital formation. The gross capital formation in India is less than that of developed countries. The per capita commercial energy use in India is 260 kgs of oil equivalent, while that in the USA is 7905 kgs of oil equivalent.

Mal distribution of assets: The top ten percent of the population receive 25 percent of income, while the bottom 10 percent receive only 4 percent of the income; about 24 percent of rural households have less than Rs. 5000 of assets and their assets form 1.5 percent of the total assets, while 8 percent of rural households have assets worth Rs. 1 lakh or more and their assets form 46 percent of total assets.

Poor quality of human capital: Based on The Human Development Index which is based on life expectancy, literacy, enrolment for primary class, real per capita GNP, India's rank is 135 while that of China is 108. Due to poor quality of human capital, credibility is seriously affected.

Low Level of technology: Due to technological sluggishness, the productivity per unit area is low. India's productivity of paddy is 2915 kgs per ha, while that of Egypt is 8567 kgs per ha; similarly India's wheat productivity is 2654 kgs per ha, while UK is 7468 kgs per ha; groundnut productivity is 988 kgs per ha while that of USA is 2828 kgs per ha.

Low standard of living: About 30 percent of the population in India's cities with a population of more than one million, are slum dwellers. The slum population with a low standard of living form 35 percent of Calcutta's population, 38 percent of Bombay, 32 percent of Chennai, 30 percent of Delhi, 40 percent of Kanpur, 40 percent of Lucknow.

Dependence on agriculture: About 24 percent of India's GNP is derived from Agriculture and 60 percent of active population are employed in agriculture. Agriculture also contributes to 19 percent of the exports.

### Comparison of development indicators across nations

Indicators	Units	India	China	USA
GDP	MI \$s	359812	825020	7745705
International reserves	MI \$s	28383	146683	134880
High technology exports as percentage of manufacturing exports	%	5	21	44
Electrical power consumption per capita	KWHs	339	637	11571
Number of patent applications filed	No.	6500	42000	234000
External debt as percentage of GNP	%	22	17	0
Females as percentage of tot labor force	%	25	43	41
Percent of HH income spent on food in mega cities	%	40-60	52	12-16
Per capita commercial energy use in Kgs of oil equivalent per capita per year	Kgs oil eq	476	902	8051
Carbon dioxide emissions	MI tons	997	3363	5301
CO2 emission per capita	Tonnes	1.1	2.8	20
Contribution of Agriculture to GNP	%	27	20	3
Contribution of Industry to GNP	%	30	51	33
Contribution of services to GNP	%	43	29	64
PER CAPITA INCOME	\$	430	750	29340
PER CAPITA INCOME (PPP)	\$	1700	3220	29340
Fertilizer use in Kgs/ha of crop land	Kgs/ha	73	284	99
No. of Tractors	Lakhs	14	10	47
Grains fed to livestock as % of total food grains	%	3	19	69
Agricultural research expenditure	ml \$s	450	1712	1423
Natural forest area	000 ha	51729	115047	209573
Reserves of crude oil	ml tons	810	3264	3560
Annual (fish + sea) food per capita	kgs	3.3	9.6	21
Length of coast line (for fishery)	Kms	12700	14500	19024
Metehane emission from wet paddy	000 tons	19000	19000	750
Emission of chloro fluoro carbons	000 tons	3	8	90
Emission of chloro fluoro carbons	No	39	40	27
Globally threatened species of mammals	No	72	83	43
Globally threatened species of Birds	No	1331	307	2279
Globally threatened sp of higher plants	No	17	7	25
Globally threatened species of Reptiles	No	3	1	22
Globally threatened sp of Amphibians	No.	2	7	164
Globally threatened species of Fish	MI \$s	105188	231322	11308779
Stock market capitalization	No.	5843	764	8851
No. of listed domestic companies	%	69	49	86
Private investment as a % of gross domestic fixed investment				

### Causes of low productivity in Indian agriculture

Even though the contribution of agriculture to GNP has reduced from 57 percent in 1951 to 24 percent in 1997, the proportion of active workers supported by agriculture is still as large as 60 percent, since other sectors like industry/service have not been able to employ them. There is hence overcrowding in agriculture as rural population is still 74 percent in India. Thus the area cultivated per capita has reduced to 0.5 acre which shows low land-man ratio.

*Inadequate non farm services such as finance, marketing:* The village money lenders and village commission agents still play a dominant role in the rural economy with an objective of exploitation of farmers

*Small sized and fragmented holdings:* Due to subdivision and fragmentation the size of holdings is reducing and are distributed in different parts of village increasing the management costs, litigation, difficulty in proper use of infrastructure facilities like irrigation, etc

*Inadequate irrigation facility:* Even though India has the largest area under irrigation in the world, our irrigation is largely dependent on rainfall. In fact 84 percent of rural poor live and depend on rainfed agriculture for their livelihood. At least 70 percent of the agricultural land is largely dependent on rainfall.

#### Agricultural credit

The flow of institutional credit to agriculture in India was Rs. 31,000 crores during 1997 of which 36 percent was medium and long term credit, the 64 percent was short term credit. The cooperatives lent 46 percent of the total credit and the commercial banks lent the remaining 54 percent to farmers. Out of the total credit lent by cooperatives, 77 percent was for short term loan. Out of the total credit lent by commercial banks, 53 percent was for short term loan. The ratio of over dues to demand is 45 percent in cooperatives, thus increasing the non-performing assets (NPAs are those loans which do not earn any interest. If farmers had repaid, the banks would have lent the same to other needy farmers and would have earned interest on those loans). The average debt per debtor farm family was Rs. 661 in 1981.

The major causes of rural indebtedness in India are:

1. Poverty: As 30 percent of population is below poverty line and as a majority of this population is farmers their repaying capacity is poor due to poor savings. Poverty forces them to borrow and also be indebted.
2. Much of the debt may be inherited: As farmers inherit property, they also inherit the debt associated.
3. Unproductive loans for social functions, fighting litigations

#### Rainfed lands of India should receive greater attention than irrigated lands

Rainfed lands of India should receive greater attention because 84 percent of the rural poor are living in rainfed lands and this is an equity implication.

#### Contribution of rainfed lands and irrigated lands to India's agriculture

Rainfed lands of India contribute to 40 percent of food grains production. Rainfed lands of India are the main producers of coarse grains and oilseeds

#### Future irrigation source: Considering surface water and groundwater resource:

At present 54 percent of total irrigated area is irrigated by groundwater and 46 percent of total irrigated area is irrigated by surface water in India. In Karnataka, surface water is irrigating 66 percent

of the irrigated area, while groundwater is irrigating 33 percent of irrigated area. The future potential in irrigation lies in the use of largely underutilized groundwater potential.

#### Causes for slow growth of agriculture in the Five Year Plans

Indian agriculture is still a gamble on the monsoon, since 70 percent of the net cropped area is still dependent on rainfall, producing 40 percent of food grain output. New agricultural technology spread largely to rice, wheat, while other food crops like coarse cereals which are dependent on rainfall did not develop. The direct investment on agriculture from the public which formed 35 percent of the total investment in 1960 fell to 16 percent in 1996. The private investment in agriculture which was 65 percent of the total in 1960 fell to 84 percent of the total in 1996. The private investment is also concentrated in parts of India like Punjab, Haryana, and Western UP, further increasing the disparities. Thus there is fall in investment in agriculture which is also responsible for the slow growth.

The land reforms have not made perceptible impact on the production process as envisaged.

India's potential in export market: Much against the popular belief that India can gain substantially by exporting processed foods like jams, jellies, fresh vegetables and so on, the following table clearly indicates in which of the commodities India has comfortable position with regard to exports and with which other commodities it does not.

<u>Commodities where India has a winning position in exports</u>	<u>Commodities where India has losing position in exports</u>
<ol style="list-style-type: none"> <li>1. Bovine meat fresh and frozen</li> <li>2. Fish fresh, chilled and frozen</li> <li>3. Fresh Grapes</li> <li>4. Leguminous vegetables dry</li> <li>5. Vegetable oil residues</li> <li>6. Oil seeds, nut</li> <li>7. Castor oil</li> </ol>	<ol style="list-style-type: none"> <li>1. Shell fish, fresh, frozen</li> <li>2. Cereal + cereal preparations</li> <li>3. Edible nuts- fresh and dry</li> <li>4. Fresh fruits</li> <li>5. Fruit jams, jellies</li> <li>6. Other fresh vegetables</li> <li>7. Tea</li> <li>8. Pepper</li> </ol>

#### Benefits of warehousing to farmers

When farmers store their produce in a Central or a State ware house, they are assured of scientific storage free from quantity loss, quality loss during storage. They are issued a "Warehouse Receipt". This receipt is a negotiable instrument which can be pledged to obtain loan from institutional sources.

#### Utilities created by marketing

- By development of Transportation facility, marketing creates 'space' utility, where the produce is transported to the place where it is needed the most
- By development of Storage facility, marketing creates 'time' utility, where the produce is made available at the right time, when it is needed by consumers.
- By development of Processing facility, marketing creates 'form' utility where the produce is transformed to the right form to meet the needs of the consumers by processing.

- Marketing creates Possession utility, by transferring ownership rights during the process of marketing / exchange of goods and services. Possession utility is the pivot for all marketing activities which motivates consumers to buy and farmers to sell.

India with the World with the rank of India with regard to:

- (i) Irrigated area: India's irrigated area of 57 ml ha (is 35 percent of sown area), forms 24 percent of world's irrigated area, ranks first in the world wrt to absolute area irrigated
- (ii) Proportion of population depending on agriculture : 60 percent of active workers are employed in agriculture and 74 percent of the population is depending on agriculture. India's agricultural population forms 21 percent of world's population and ranks second to China
- (iii) Production of Rice: India produces 123 ml tones of rice, contributing to 21 percent of world's rice, and ranks second to China
- (iv) Production of Wheat : India produces 69 ml tones of wheat, contributing to 11 percent of world's wheat and ranks second to china
- (v) Production of pulses : India produces 15 ml tonnes of pulses contributing to 26 percent of world's share, is the world's largest producer of pulses
- (vi) Production of milk: India produces 72 ml tonnes of milk contributing to 13 percent of world's share, is the world's largest producer of milk
- (vii) Production of Tea: India produces 0.79 ml tonne of tea contributing to 29 percent of world's share, is the world's largest producer of Tea
- (viii) Number of Cattle: India has 209 ml cattle forming 16 percent of World's cattle population, has the world's largest cattle population
- (ix) Number of buffaloes: India has 92 ml buffaloes, forming 55 percent of World's buffalo population, has the world's largest buffalo population
- (x) Number of tractors: India has 14 lakh tractors forming 5 percent of world's tractors and ranks fourth in the world in tractor use, next to Italy

Agricultural commodities arranged in the descending order of magnitude of their contribution to the agricultural exports in India (1997 figures)

1. Fish and fish preparation; 2. Oilcakes; 3. Rice; 4. Tea and 5. Processed foods (includes processed fruits, juices)

Agricultural commodities arranged in the descending order of magnitude of their contribution to the total value of agricultural output in India)

1. Milk group (20 percent); 2. Paddy (19.6 percent); 3. wheat (10 percent);, Sugarcane (6.6 percent), Cotton (3.3 percent)

Comparison of Rate of growth of population and rate of growth of food production and implications on the physical access to food

Simple growth rate of population (of 180 percent between 1951 and 2000) is 3.67 percent, while the simple growth rate in production (of 250 percent between 1951 and 2000) is 5.1 percent, with the result

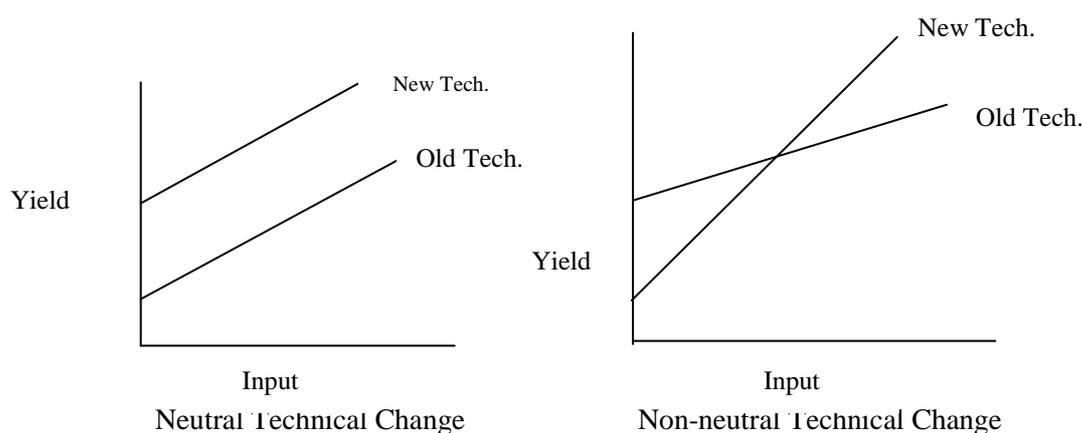
that the physical access to food increased from 395 gms per capita per day in 1951 to 484 gms per capita per day in 1998.

### **Agricultural Research , Education and Institutions**

Dr Evenson's name finds a prominent place among economists who measured the contribution of different branches of agricultural research to total output. These are discussed further below. In India the Indian Council of Agricultural Research , the prime institution at the Apex level was initiated due to the recommendation of the Royal Commission on Agriculture during 1929, and it was called the Imperial Council of Agricultural Research at that time. The ICAR has take the prime role in shaping the academic programmes in Agriculture and allied subjects in the 32 Agricultural Universities / Institutions in India with an objective of promoting and funding agricultural education, agricultural research and agricultural extension. The ICAR has All India Coordinated Research Projects initiated in major crops, livestock, dry farming and other production systems, with a view to generate research information pertaining to both stability and adaptability of agricultural research. UAS Bangalore also AICRP in Sunflower, small millets, dry farming , to name a few. The ICAR launched various programmes to promote research like the NATIONAL AGRICULTURAL RESEARCH PROJECT, NATIONAL AGRICULTURAL EXTENSION PROGRAMME and currently the NATIONAL AGRICULTURAL TECHNOLOGY PROJECT (NATP). The NATP has granted the Team of Excellence in Natural Resource Economics to the Dept of Agricultural Economics at UAS, Bangalore for four years to do research and train faculty in the field of natural resource economics.

### **Technical Change**

Technical change refers to realization of higher output with the use of same level of resources or realization of same level of output with lower level of resources.



A shift in the intercept of the production function represents Hicks Neutral technical change. Shift in the intercept as well as change in the slope of the production function represents non-neutral technical change.

Embodied technical change refers to improvement in yield due to the use of new seeds.

Disembodied technical change refers to improvement in yield due to the use of non-seed inputs like fertilizers, agronomic practices, irrigation etc. In green revolution, the contribution of embodied technical change was larger than the contribution of disembodied technical change. The role of technical change is measured through TOTAL FACTOR PRODUCTIVITY.

#### Contribution of Agricultural Research - Total Factor Productivity

TFP = Total Factor Productivity measures increase in total output which is not accounted by the increase in use of total inputs. TFP is thus a measure of contribution of technical change. According to Evenson, investment in agricultural research contributed to 75 percent of the growth in total factor productivity.

In India, between 1956 and 1987, the growth in TFP for Indian agriculture was 1.31 percent. Out of this growth in TFP, the contribution of different components are as under:

1. Percentage of area under HYVs contributed to 11 percent of growth in TFP
2. Investment on research by Government contributed to 38 percent of growth in TFP
3. Investment on research by Private contributed to 14 percent of growth in TFP
4. Investment on extension efforts contributed to 58 percent of growth in TFP
5. Investment on improved markets contributed to 7 percent of growth in TFP
6. Investment on irrigation contributed to 9 percent of growth in TFP
7. Investment on use of chemicals contributed to 21 percent of growth in TFP.

The real expenditure on agricultural research in India has been as follows:

33 percent of the total real agricultural research expenditure on research on cash crops

23 percent on horticulture crops, 21 percent on food grains, 9 percent on pulses and 9 percent on oilseeds.

### **Green Revolution and programmes for increasing food production**

The revolutionary genes from CIMMYT Mexico for wheat and from IRRI, Philippines for rice, were largely responsible for increasing food production through high yielding varieties HYVs. The traditional varieties were low yielding, had greater fodder potential, and were not very responsive to modern inputs such as fertilizers and irrigation. Green revolution helped in increase of food production by 250 percent increasing the per capita net availability of food grains from 395 grams per day per capita to 484 grams per day per capita (451 gms of cereals + 33 grams pulses surpassing the growth of population of 180 percent. Similarly production of commercial crops (sugarcane by 136 percent, cotton by 83 percent, oilseeds by 242 percent) increased. Thus the production of cereals increased by 3 percent per year but the production of pulses stagnated. The share of rice remained static at 46 percent, that of wheat increased from 15 percent to 36 percent and the share of coarse cereals reduced from 37 percent to 18 percent of

total food cereals between pre and post green revolution phases. Associated with green revolution are white revolution (increased milk production), blue revolution (increased fishery catches), yellow revolution (increased edible oil production) in the post green revolution phase.

First let us examine the strengths made on the food front. It is heartening to note that India achieved self sufficiency in food grains in the 1980s and 80 per cent of Indian households now are getting two meals a day. The physical access to food has increased as the per capita net availability of food grains increased from 395 grams per day per head in 1951 to 466 grams per day per head in 1987. In addition the economic access to food has also increased. For instance, between 1970 and 1980, the per capita incomes increased by 147 per cent while the food grain prices increased by 124 per cent. Also, the proportion of income spent on food has reduced from 12.9 per cent of the per capita income (to buy a quintal of wheat) in 1970 to only 7 per cent of the per capita income in 1980, thus increasing the purchasing power of people to buy capital goods.

The above achievements are especially due to use of new technology in farming. For example, at present, 83 per cent of the area under wheat and 57 per cent of the area under paddy are under high yielding varieties. About 47 per cent of the area under irrigation is irrigated by groundwater (wells) and 38 per cent of the area is irrigated by the canal irrigation system. High yielding varieties and their need for increased moisture levels, have resulted in increasing the level of use of chemical fertilizers. The level of use of chemical fertilizers has increased from 7.4 kgs per hectare in 1966 to 57 kgs per hectare in 1986, registering an increase of 40 per cent per year. The Philip given to groundwater irrigation has not only increased our productivity of food grains, but have also helped to diversify our farming to include a diverse range of enterprises towards commercialized farming.

Our price policy, buffer stock policy and the food distribution system have provided models for mitigating famines. India experienced a great famine in 1943 called the Great Bengal Famine where 1.5 million people died of starvation. But now we do not even speak of starvation deaths. For instance we will all be surprised to note that though the country suffered great famine in 1987 since the food production reached a very low 114 million tonnes, we did not feel the pinch of this famine and this achievement on the food front is due to our buffer stock policy. About 12 per cent of the food grains produced is procured and distributed through 3,21,000 fair price shops all over the country with each fair price shop covering a radius of 13 square kilometers and serving 2,500 persons. About 2,50,000 shops are in the rural areas and the remaining are in the urban areas. The price policy helped in stabilizing the prices of essential goods, equitable distribution of essential goods and providing essential items to the target groups of the population.

Several anti-poverty programs notably the Integrated Rural Development Program, the National Rural Employment Program and the Rural Landless Employment Guarantee Program have helped the rural

people to grow above the poverty line. They also helped to improve their bargaining power to seek better wages in the rural areas.

### **Land Reforms**

*Objectives:*

1. Conferring ownership to tenants
2. Redistribution of surplus lands available after land ceiling to the deserving

### Definition of Family according to Karnataka Land Reforms Act

Family means :

- (a) husband, wife, minor sons and unmarried daughters (Unmarried daughter is a daughter who has never been married),
- (b) if both husband, wife are not alive, family includes minor sons and unmarried daughters

### Standard acre and types of land according to Land Reforms act of Karnataka

1 UNIT of land is one acre of A class land, which is yielding  $\geq 50$  percent crop

*A class land:* is land having assured irrigation from Government canals and tanks to grow two crops of paddy or one crop of sugarcane in a year

*B class land:* is

- (a) land having assured irrigation from Government canals and tanks to grow one crop of paddy in a year ;
- (b) land irrigated by lift irrigation project of State government to grow two crops of paddy or one crop of sugarcane in a year (Lift irrigation project is water pumped by State Government from surface water source)

*C class land:* is

- (a) land irrigated by government canal, or tank or lift irrigation project other than those in A class and B class , supporting light irrigated crops
- (b) land which can grow paddy or arecanut with the help of rainwater
- (c) land irrigated by government canal, or tank or river but water is lifted by the lifting device of the farmer
- (d) land growing light irrigated crops or garden crops.

*D class land:* is

Land classified as dry, which does not have any irrigation facility from Government source.

### Equivalents:

- 1 acre of A class land yielding  $> 50$  % crop = 1.5 acres of A class land yielding  $< 50$ % crop
- = 1.5 acre of B class land yielding  $> 50$  % crop
- = 2 acres of B class land yielding  $< 50$  % crop
- = 2.5 acres of C class land yielding  $> 50$  % crop
- = 3 acres of C class land yielding  $< 50$  % crop
- = 5.4 acres of D class land

### Ceiling on land Holdings:

1. Ceiling limit for a person or a family is 10 Units of land
2. If a family has  $> 5$  members, then the ceiling area is 10 units + additional 2 units then for every member in excess of five members, totally  $10 + 2(5) = 20$  Units in all.

Thus, the maximum ceiling of A class land is  $20 \times 1$  acre of A class land = 20 acres or  $20 \times 5.4$  acres of D class land = 108 acres of D class land

### Important amendments made in 1995 to Karnataka Land Reforms Act:

1. Agriculture includes aquaculture also

2. Farmers can now lease up to 40 units of land (which was not permitted in the 1974 KLR rules) in Uttara kannada and Dakshina kannada districts for the purpose of aquaculture for 20 years on the basis of mutually agreed lease rent
3. Any person whose annual income from non - agricultural sources is up to Rs. Two lakhs can purchase or inherit agricultural land (earlier this ceiling was Rs. 50,000)
4. Farmers can now lease upto
  - a. 20 units of land for industrial development
  - b. 4 units of land for educational institutions recognized by State/GOI
  - c. 20 units for a housing project
  - d. 20 units for horticulture including floriculture and agro based industries

Karnataka Land Reforms Act treats the rainfed lands irrigated by Groundwater wells as dry land. Land Reforms Act treats the land irrigated by government source of surface water as irrigated lands in Karnataka.

Cooperative farming: is a solution to the problem of small and scattered holdings.

Coop farming stands for different types with the following features:

Farmers join the co-operative farming voluntarily . Farmers retain title to land; they pool their land, livestock and other assets; farm is managed as one unit; the management is elected by all members of cooperative farm, every member of coop farm gets a share in the produce according to the land contributed and the labour services offered.

#### Subdivision of holdings and Fragmentation of holdings

Subdivision of holdings refers to division of holding among heirs who are successors of a family according to established rules. Subdivision reduces the size of holding depending upon the number of heirs. Uncontrolled subdivision of holdings results in uneconomic size of holdings and inefficiency in production, as fixed costs of agricultural operations and management costs increase.

Fragmentation of holdings refers to the way the plots or fragments or a holding are distributed. If a farmer has wet land and dry land, there are at least two fragments or plots. However as the holdings are located in different parts of the village, while subdivision increases the number of holdings, fragmentation will reduce the size of each fragment / plot as each fragment gets further subdivided.

#### **Water Resources**

The total volume of water on the earth is 1400 ml cubic kilometers. This can cover the earth 3 kilometers deep. But 97.3 of this water is salt water, only 2.7% of this water is fresh water useful for drinking and irrigation. Out of this 2.7% fresh water, 75% lies frozen in polar regions. 22.6% is available as groundwater, 2.2% is available as surface water in lakes, rivers, atmosphere and moisture.

**Irrigated area in India**

(ml ha)

Year	Net area	Area sown			Irrigated area		
		Foodgrain	All crops	Area sown > once	Net area	All crops	Area irrigation > once
1950-51	119	97	132	13	21	23	1.7
1993-94	142	125	186	44	52	68	1.7

In 1950, 17 percent of area sown was irrigated; In 1993, 37 percent of area sown is irrigated; In 1994, 67 per cent of area is devoted to foodgrains.

Net area irrigated = area irrigated once

Gross area irrigated = area irrigated once + area irrigated twice + .....

<u>Source of irrigation (1993-94)</u>	<u>ml ha of net area irrigated</u>	<u>%</u>
Canals	17	33
Tanks	3	5
Borewells	11	33
Openwells	4	21
Others	4	8
<b>Total</b>	<b>52 ml ha</b>	

Area irrigated by surface water forms 46 percent of total irrigated area, while area irrigated by groundwater forms 54 percent of irrigated area. Only 32 percent of the groundwater is utilized. This shows that future potential for irrigation exists largely in using groundwater.

Irrigation scenario in Karnataka (1993-94)

<u>Sources of irrigation</u>	<u>ml.ha</u>	<u>Percentage</u>
Canals	0.93	40
Tanks	0.27	12
Borewells	0.29	12.5
Openwells	0.49	22
Others	0.34	14.5
<b>Total</b>	<b>2.32</b>	

In Karnataka surface water irrigation forms 66 percent of irrigated area, while groundwater irrigation forms 34 percent of the irrigated area. In Karnataka too only 31 percent of the groundwater has been utilized. Thus, future irrigation potential both in India and in Karnataka lies in groundwater irrigation.

In Karnataka, agriculture is contributing to 34 percent of State's net domestic product (1995-96)

At all India level, there are 15 ml irrigation wells of which 67 percent are dug wells and 33 percent are bore wells.

Production of foodgrains in kharif and rabi

<u>Year</u>	<u>Kharif</u>	<u>Rabi</u>
1966	66%	34%
1995	53%	47%

Considering the increasing contribution of rabi to food grains, there is a clear indication of the role of irrigation in enhancing production of food grains in rabi season, which is not a prime rainy season.

Water rates, working expenses and gross receipts

(in rupees per ha)

<u>Water rates :</u>	<u>Working expenses</u>	<u>Gross receipts</u>	<u>water rate (Rs./ha)</u>
Karnataka	2056	109	20 to 556
All India	1334	171	15 to 800

Requirement of water for domestic purpose

Rural areas: 70 litter per capita per day ; Urban areas: 200 litters per capita per day

Rural Karnataka : 793824 TCM ; Urban Karnataka : 1015269 TCM;

Mysore Rural : 56842 TCM ; Mysore Urban : 68641

TCM; Mandya Rural : 35197 TCM; Mandya Urban: 19477 TCM

Bangalore Rural: 17116 TCM; Bangalore Urban: 304355

**Groundwater**

In 1995, total replenishable groundwater from natural recharge =34 ml ha meter per year

Water for domestic + individual uses : 6 ml ha meter per year

Available groundwater for irrigation : 28 ml ha meter per year

How much of groundwater is actually extracted: 8 ml ha meter per year = 30% of availability. In Karnataka 1.41 ml ha meter per year of groundwater is replenishable; 0.22 ml ha meter per year is for domestic + industrial use.

Available groundwater for irrigation = 1.2 ml ha meter. Groundwater extracted: 32%

River basins and surface water potential in India

River basin	Utilizable surface water (cubic kilometer)	Presently used surface water (cubic kilometer)	Percentage
Indus	46	40	87
Godavari	76	38	50
Krishna	58	47	81
Cauvery	19	18	95
Pennar	7	5	71
Narmada	35	8	23

Note that among the different river basins in southern India, Cauvery basin offers the most to irrigation which is the very reason it is called the 'Jeeva Nadi' or perennial river.

Irrigation status of agricultural holdings in India

According to all India agricultural census, the irrigation status of holdings is as under:

Irrigation status	No. of holdings (millions)	Net area sown (million hectares)	Area irrigated (million hectares)
Wholly irrigated	25 (27%)	26.5 (19%)	21.5 (66%)
Partially irrigated	16.6 (18%)	35 (26%)	14 (34%)
Total irrigated	42 (45%)	62 (45%)	40.5 (100%)
Wholly unirrigated	51 (55%)	75 (55%)	-

All holdings	93 (100%)	137	-
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Around 45 percent of the holdings in India have (partial or full) irrigation facility and possess an area irrigated of 40 ml ha.

Proportion of different classes of farmers having irrigation facility in India (1985 Agricultural Census)

Class	Net area irrigated (million hectares)	Net area sown (million hectares)	Percentage of area irrigated to area sown
Marginal (< 1 ha)	8 (20%)	18.8 (14%)	43
Small (1-2 ha)	7.6 (19%)	22 (16%)	34
Semi medium (2-4 ha)	9.7 (24%)	31.6 (23%)	31
Medium (4-10 ha)	10.4 (26%)	39.7 (29%)	26
Large (> 10 ha)	4.7 (12%)	25 (18%)	19
Total	40.5	137	29

Implications:

Thirty nine percent of area irrigated is with small and marginal farmers who possess 30% of net sown area.

Thirty eight percent of area irrigated is with medium and large farmers who possess 45% of net sown area

Atleast 43% of net sown area of marginal farmers is irrigated

Atleast 34% of net sown area of small farmers is irrigated.

Percentage of area irrigated by different sources held by different classes of farmers :

	Marginal	Small	Semi medium	Medium	Large
Canals	20	19	23	25	13
Tank	29	23	23	18	7
Open wells	13	17	24	30	16
Borewells	20	19	25	27	10
Others	27	21	24	20	8

- Thirty nine percent of area irrigated by canals is with marginal + small farmers
- Fifty three percent of area irrigated by tanks is with marginal + small farmers
- Thirty percent of area irrigated by open wells is with marginal + small farmers
- Thirty nine percent of area irrigated by borewells is with marginal + small farmers
- Forty eight percent of area irrigated by other sources is with marginal + small farmers

In the context of water users associations proposed to be formed in a big way in Karnataka, small farmers facing difficulty in getting canal water due to wrong practices of big farmers may get relief.

Loss of irrigation potential due to siltation of big dams in India.

According to Central Water Commission, the defects in canal irrigation are:

Excessive canal seepage  
 Inadequate or no supply of water at tailends.  
 Insufficient drainage and water logging  
 Improper or mismanaged cropping pattern and calendar.  
 Excessive water application and lavish use of water.  
 Inadequate maintenance.  
 Poor revenues and returns.

In Karnataka, the first Water Users Association (WUA) was formed in 1980 in Arekur in Malaprabha command. Now around 49 WUAs are working. Task of organizing WUAs was assigned to co-operative department.

According to IWMI, One third of India's population will live in regions that will face by absolute water scarcity by 2025.

#### Market for agricultural commodities and Interlocked market for agricultural labor

Agricultural commodities usually have a near perfectly competitive market as there are a large number of small growers who supply homogeneous commodity to the market, without restrictions on entry or exit from the market.

Interlocked market for agricultural labor implies that due to poverty many agricultural laborers are forced to borrow for subsistence from either land lords or money lenders. In turn, the laborers are forced to work for low and unremunerative wages and get exploited. The land less laborers are thus interlocked with the land lords or money lenders.

#### Percapita income and Purchasing power parity income

Per capita income is the gross national product divided by the population in order to obtain the income per head per year in a nation. The per capita income does not give any indication regarding the true purchasing power of a country's currency. A mere direct comparison of per capita incomes does not clearly portray the purchasing power of the currency.

Purchasing power parity income refers to the number of units of that currency required to purchase the same representative basket of goods and services that the US dollar (the reference country) would buy in the USA. India's per capita income according to purchase power parity is US\$ 1650 in 1997, while that of USA is \$ 28,740. This indicates that in order to purchase the Indian basket of goods needed for an average Indian in the USA, Indian has to spend \$1650 per year in USA, i.e. what an Indian eats in India, will cost \$1650 in the USA. That is even though the per capita income of an Indian is only \$ 390, his/her PPP income is \$1650.

### **Human Resource**

India's population growth rate is 2 percent, 32 percent of labor force is female population, 13 percent of the labor force is children. A rising population imposes greater economic burdens.

*Principles of agricultural and resource economics Course Outline and notes, 2007*  
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### Occupational structure:

67 percent of workers are engaged in primary sector, 13 percent of workers in secondary sector (mining, quarrying, household industry, construction) and 20 percent of workers are engaged in tertiary sector (trade, commerce, transport, communications etc).

### Features of population policy in India

One of the major causes of high population growth in India is the large size of the population in the reproductive age group. The number of married women in the age group 15-44 years increased from 79 million in 1961 to 144 million in 1991.

1. Universalization of primary education and reduction in drop outs at primary and secondary levels to below 20 percent. Emphasizing on education of girls to raise the age of marriage
2. Reduction in the incidence of marriage of girls below 18 years to zero
3. Promotion of spacing methods and lowering the age of sterilization acceptors. ( at present 97 percent of sterilization is accepted by only women that too after giving birth to 3 or 4 children). It is desirable to persuade them to accept sterilization after the birth of second child or incase the first two children are daughters, after the birth of the third child (presumably a son, as an insurance for old age !). The mean number of children of women at the time of accepting sterilization (tubectomy) was 3.7 in 1981 and 3.2 in 1990. The age of sterilization needs to be brought down further.
4. Strengthening PHCs with a male doctor, a female doctor and one more doctor for population control services
5. Involvement of practitioners of Indian system of medicine in family planning campaign

### Features of food policy in India

Two main objectives of food policy are (i) equitable distribution of food grains at (ii) reasonable prices.

In order to achieve these objectives the policy has been:

1. Increase in production of food grains through improved seeds, fertilizer use, irrigation
2. Expansion of public distribution system - at present PDS handles 20 ml tonnes of food grains
3. Stabilization of foodgrain prices by increasing procurement of foodgrains and supplying them through fair price shops (FPS)
4. Price incentive to farmers (the procurement price of wheat is Rs. 550 per qntl, and that of paddy is Rs. 440 per qntl)

### Agricultural labor

Agriculture labor and rural labor are synonymous since agriculture labor households formed 77 percent of all rural labor households. Eleven percent of holdings in India are landless. In addition, 30 percent of holdings are below 0.5 acre who can be regarded as semi-landless and hence 41 percent of the holdings are landless labor class in India. Their subsistence farming produces only 50 percent of the food requirement of the households.

### Causes for poor condition of agricultural labor in India

1. Agriculture laborers are illiterate, ignorant, scattered and unorganized
2. Seasonal employment: Agricultural laborers do not have continuous work as they get work for about 200 days. Thus they are unemployed and underemployed
3. Paucity of non-agricultural jobs: Paucity of non agricultural jobs is also responsible for low wages of agricultural labour
4. Indebtedness: Agricultural labor is heavily indebted with poor savings, poor purchasing power
5. Interlocked market for labor: Interlocked market for agricultural labor implies that due to poverty many agricultural laborers are forced to borrow for subsistence from either land lords or money lenders. In turn, the laborers are forced to work for low and unremunerative wages and get exploited. The land less laborers are thus interlocked with the land lords or money lenders

### **Minimum Wages Act**

Minimum Wages Act was passed in 1948 and serve as a base reservation wage. The Minimum wages vary widely from State to State. The latest revision to Minimum Wage in Karnataka was in 1994, and was fixed at Rs. 26 per day for unskilled agricultural workes. Tamilnadu is the State with the latest revision of minimum wages at Rs. 29 per day (revised during 1997). The actual wages usually rule higher than the Minimum wages during peak season and rule lower than the Minimum wages during lean season.

### **Poverty line**

Poverty line refers to the expenditure required to buy a per capita daily minimum food prescribed according to medical standards

The poverty line for urban India is the expenditure required to obtain a per capita daily calorie intake of 2100 calories

The poverty line for rural India is the expenditure required to obtain a per capita daily calorie intake of 2400 calories

At present around 30 percent of the population in India live below the poverty line. In the developing countries about 30 percent of the population live in absolute poverty receiving a per capita income of less than one US \$ per day.

### Details of the poverty alleviation programs of the Government

*NREP: National Rural Employment Programme:* is essentially a food for work programme to create additional employment for the unemployed and underemployed people, who will work for creating rural infrastructure like village tanks, minor irrigation works, rural roads, schools, drinking water wells and so on.

*RLEGP: Rural landless employment guarantee program:* generates gainful employment by creating rural infrastructure and improving the overall quality of rural life for rural landless laborers women, SCs and STs. Wages are paid according to the Minimum Wages Act and part of the wages are paid in terms of subsidized food grains.

*IRDP: Integrated Rural Development program:* to promote self employment of poor households to enable them to cross poverty line. The principal type of asset creation is in the form of dairy animals, goats, sheep, bullocks, bullock carts, minor irrigation, and non farm activities.

*JRY: Jawahar Rozgar Yojana:* to generate gainful employment for unemployed and underemployed men and women below poverty line, in rural areas by creating rural infrastructure like road side plantations, plantations along canal banks or wastelands or sides of railway tracks, soil and water conservation works, minor irrigation works, community irrigation wells, drains and field channels, construction of community sanitary latrines, construction of houses for SCs, STs, and freed bonded laborers, construction of rural roads, land development and reclamation of waste lands, degraded lands, construction of community centers, mahila mandals, market yards, dispensaries, anganwadis, balawadis, construction of school buildings and other social assets. The aim is to bring about positive impact on wage levels and overall improvement in quality of life in rural areas. At least 30 percent of employment is to be provided to women under JRY.

*Million Wells Scheme:* launched as a subscheme of NREP/RLEGP to provide open wells / bore wells free of cost to poor small and marginal farmers belonging to SCs/STs and other groups and freed bonded laborers.

*Indira Awas Yojana:* to provide houses free of cost to members of SC/ST, freed bonded laborers and other poor categories.

*Unemployment:* A person working 8 hours a day for 273 days in a year is considered as employed. Thus all those who do not meet this standard are unemployed. Unemployed are those who remain unemployed for a major part of the year. About 5 percent of the total labor force is unemployed.

*Underemployment:* People working less than 28 hours a week are considered as underemployed and about 16 percent of rural labor force and 11 percent of urban labor force is underemployed. This brings down the marginal productivity of labor.

### **Farm mechanization**

In Mechanization, animal and human labor used in agriculture is replaced by machinery as ploughing is done by tractor/power tiller, sowing and fertilizer application by seed cum fertilizer drill, irrigation water

lifted by irrigation pump sets, transportation by tractor, harvesting and threshing by combined harvester and so on.

### Immediate impact of Farm mechanization on agricultural labor:

The immediate impact on agricultural labor is displacement of agricultural labor in a chronically unemployed and underemployed situation which will worsen the purchasing power of agricultural labor since even though 11 percent of holdings are landless, 30 percent of holdings are below 0.5 acre who can be regarded as semi-landless and hence 41 percent of the holdings are landless which are the landless labor class. Their subsistence farming produces only 50 percent of the food requirement of the households and hence mechanization will worsen the purchasing power of 40 percent of the agricultural households.

### Major change in the share of use of draft animals in farm power over time, due to mechanization

There has been declining trend in the use of animal draft power due to mechanization. During 1961, the share of draft animals in farm power was 72 percent, and during 1991, the share of draft animals in farm power was 23 percent.

### **Livestock sector**

The share of livestock sector in agricultural GDP increased from 17 percent in 1980 to 26 percent in 1996. The share of livestock sector in total GDP increased from 5.7 percent to 6 percent in this period. The technical change in livestock sector contributed to 30 percent of the overall output growth in livestock sector. Within livestock sector, milk group constitutes 63 percent. Even though India has the world's largest cattle and buffalo population, the share of animal draft power in farm power is reducing due to mechanization of agriculture.

### Composition of Livestock (1992)

Cattle	205 million	Bovine = 289 million
Buffalo	84 million	
Sheep	51 million	Small ruminants = 166 million
Goat	115 million	
Total Livestock	470 million	

### Composition of Livestock feed

Feed	1950	1995
Dry fodder	60%	35%
Green fodder	38%	57%
Concentrates	2.5%	8%

### Economic importance of livestock sector

Contribution of livestock sector to GDP increased from 5.7% in 1980 to 6% in 1995 (at 1980 prices).

Contribution of livestock sector to agricultural GDP increased from 17% in 1980 to 23% in 1995 and to 26% in 1996.

### Contribution to livestock output value in 1995

<u>Item</u>	<u>Percentage</u>
Milk group	63
Eggs + Poultry meat	9
Meat + Meat products	8.5
Dung	7.4
Draft power	6
Hides and skin	1.43
Wool and Hair	0.34
Others	3.87

There is increase in demand for livestock products due to raise in income.

The expenditure elasticity of demand for milk is 1.47% in rural areas and 1.01% in urban areas and for eggs and meat this elasticity is 1.04% in rural areas and 0.75% in urban areas i.e. for 1% increase in expenditure, there is 1.47% increase in demand for milk.

Growth in per capita income and changing consumption patters would lead to acceleration in demand for livestock products.

### Declining trend of animal draft power due to mechanization of Agriculture

During 1961 the share of draft animals in farm power was 72 percent. During 1991 the share of draft animals in farm power was 23 percent, and since then, a majority of the farm operations depends on electrical power.

Indigenous cattle population is larger than the buffalo population. The buffalo population is larger than the crossbred cattle. It is estimated that considering the population of indigenous and crossbred cattle, among the indigenous cattle population, 27 percent were indigenous cows yielding milk. Among the crossbred cattle, 25 percent were cows in milk. Among the buffaloes 30 percent of buffaloes were milk yielding. On the whole, the proportion of cross bred cows form a meager 7 percent of the total population of cows. Thus, a large cattle population still like to graze the land, while on the other hand there is a general feeling that the village grazing land is virtually encroached and hence generated. According to Pandey (1995), considering 0.5 ha of land required for one adult cattle unit to meet its grazing requirements, and the common property grazing lands of 139 ml ha, the optimum adult cattle units is 278 million, while the actual adult cattle units is 233 million adult cattle units. Thus our CPRs can still support about 45 million adult cattle units as against the popular belief that the our grazing lands have degraded and the cattle have to be stall fed.

Out of the total milk production, the cow milk is 47 percent and that from she buffalo milk is 53 percent. There are virtually no crossbreeds among she buffaloes. The total number of indigenous cows in

milk is 27 million; the total number of crossbred cows in milk is 3 million. The total number of she buffaloes in milk is 24 million. Thus, buffaloes have outbeaten cows in their contribution to milk output, since even though their total number (24 millions) is smaller than indigenous + crossbred cows (30 million), their contribution to total milk is 53 percent. And given the fact that India is chronically deficit with regard to cakes (gap is 476 ml tonnes), green fodder (gap is 1740 ml tonnes) and dry fodder (gap is 462 ml tonnes), the contribution by our indigenous cows, cross bred cows and she buffaloes speaks of the excellent feed conversion ability especially of buffaloes, making India the number one producer of milk in the world.

#### Distribution of cattle and buffaloes among marginal and small farmers

Considering the distribution of cattle and buffaloes among farmers in India,  
 Landless agricultural laborers have 3 percent of cattle, 5 percent of buffaloes  
 Marginal farmers have 36 percent of cattle, 27 percent of buffaloes  
 Small farmers have 22 percent of cattle, 16 percent of buffaloes  
 Medium farmers have 22 percent of cattle, 22 percent of buffaloes  
 Large farmers have 16 percent of cattle, 30 percent of buffaloes

Equity implications are that for landless laborers, marginal and small farmers in India, dairy has been a hope for life as almost 50 percent of cattle, 50 percent of buffaloes are possessed by these classes of farmers.

#### Contribution of agricultural research to growth in agriculture

TFP = Total Factor Productivity measures increase in total output which is not accounted by the increase in use of total inputs. TFP is thus a measure of contribution of technical change. According to Evenson, investment in agricultural research contributed to 75 percent of the growth in total factor productivity.

In the live stock sector, 30 percent of over all output growth is contributed by technical change. It is estimated that 66 percent of the growth in milk production is due to increase in productivity or technical change component.

Prominent agricultural scientists from Karnataka who made significant contributions to Ragi and Paddy crops : Ragi: Sri Lakshmaniah Paddy: Dr M Mahadevappa,

#### **Natural Resource Economics**

The natural resources are the gift of nature to the human kind. They may be renewable / non renewable. Renewable natural resources are those which can be renewed within a reasonable time frame, eg. Water, forests, fishery. Non - renewable resources are those which cannot be renewed at all; eg. Minerals,

petroleum. Non-renewable resources are also called exhaustible resources, since their supplies get exhausted as more is exploited.

### Differences between agricultural economics and natural resource economics

Particulars	Agricultural Economics	Natural Resource Economics
Main focus	Inputs - seeds, fertilizers	Resources - water, land, forests, fishery, environmental services, biodiversity
Type of cost	Marginal cost = additional cost due to additional output	Transaction cost = cost due to externality which arises due to lack of well defined property rights, lack of information
Relevance of Market Price / Value	Market price is relevant since markets for agricultural commodities are well defined	Valuation of natural resource is relevant since property rights are not definable
Market	Well defined market exists for agricultural commodities	Well defined markets do not exist for natural resource, due to lack of well defined property rights and lack of information.
Stake holders	Farmers, Consumers, Government	Virtually every one in the society is a stake holder since natural resources are indispensable and there are no substitutes and all need them.
Policy term	Short term policies are relevant due to dynamic implications (eg. Subsidy policy, price policy, credit policy, all have short term focus)	Long term policy is a must for sustainable use of natural resources (like forest policy, water policy, land policy)
Scarcity	Scarcity of agricultural commodities is not relevant	Scarcity of natural resources is relevant due to the difficulty in their non-renewability in the short run.

### Important properties of natural resources of relevance to agriculture

**Uniqueness:** This implies that there are no perfect substitutes and are required for every one.

Endangered species are unique; Unique scenic views

**Irreversibility:** Once natural resources are over exploited or degenerated, it is impossible to get back to their original shape or position. For instance, natural forests, once destroyed, are difficult to regain their original properties and shape; groundwater once over exploited, results in secular or long term overdraft and takes a very long time to regain the original position;

**Uncertainty:** If natural resources are eliminated, the society has to bear huge costs as we do not know how eco systems work, we do not know what else we are likely to lose.

### Characteristics of 'property rights' and their relation with market failure in respect of natural resources

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Property Right refers to a bundle of entitlements such as owner's rights, privileges and responsibilities for the use of a resource. Unless Property Rights are completely specified and properly defined for a commodity or resource, market cannot function properly. Natural Resources are exceptions to all of the following characteristics of Property Rights:

Universality: All resources are privately owned and all entitlements are completely specified. This is not possible with respect to natural resources, since they cannot be privately owned and all entitlements cannot be completely specified.

Exclusivity: All benefits and costs of owning and using a natural resource should accrue to the owner and to none else. This implies that the owner of a resource should be able to exclude others from using the resource. For instance, even though farmer may own land, he cannot exclude other farmers from using groundwater to which his land may also contribute through recharge. It is also likely that a farmer's well may fail, due to neighboring farmer's drilling actions due to cumulative interference.

Transferability: All property rights must be transferable from one owner to another in voluntary exchange. This implies that the owner of a resource should be able to sell to another one, voluntarily and not by force.

Enforceability: The property rights must be secure from involuntary seizure or encroachment by others. In the case of natural resources, it is virtually difficult to enforce property rights, since some of them are fugitive in nature, i.e. they run away and are difficult to catch and put to use.

### **Price' or 'value' relevance for natural resources**

In the case of natural resources, since the property rights are not properly definable, markets in the conventional sense cannot exist. Since markets cannot exist, the market price cannot be the representing the value of natural resource. Even if markets exist for some resources (like minerals, forest produce), they may only represent the tip of the iceberg of value equivalent to USE VALUE. But natural resources in addition have Option value, Vicarious Value, Bequest value, Existence Value and Intrinsic value which are not captured in the market. Hence 'VALUE' is relevant for natural resource rather than 'PRICE'.

Natural resource value or environmental value involves a multiplicity of values. Each type of value has its own moral standing.

Use value: or user value or user benefit is the value of benefit from the actual use of the resource at present. For example, teak timber has a use value in construction, a hunter nuts a wild animal and derives an immediate benefit,

Option value: Value of a resource as a potential benefit in future. For instance during early 1970s, the plant Vinca rosea was considered as a weed and had no use value. But during 1975, Vinca rosea was found to have anti-carcinogenic properties through research. Due to generation of research information, the Option value increased enormously and commercial cultivation of this plant is providing livelihood to a few farmers. The roots of vinca rosea are used to as anti-carcinogenic agent.

If this plant were to vanish by some reason, as it is happening to several medicinal plants of the Himalayas, option value would never have been estimated.

Vicarious value: is the value paid to preserve a resource for the benefit of others (eg. Benefit shows of worldwide fund for nature; Debt-for-nature swap programs of Green Peace, or Sierra Club in the USA, where in funds are raised from the US public, in order to pay the debts of south American countries to the world bank, in return for preservation of the Amazonian forests).

Bequest value : is the value paid to preserve a resource for the benefit of our future generation. People in their 'will' bequeath the natural resources or property to their children.

Existence value: is the value expressed by individuals which is not associated with present or future use of a resource. Example: High existence values can be seen in South Kodagu, where Kodagas have resisted encroachment of Devara Kadu (Sacred groves) and have preserved and maintained them exclusively for the purpose of their mere existence, may be for ecological or spiritual purposes which are not related present or future use. In North kodagu, existence value is not strong as there are encroachments in to the Devara kadu (sacred groves), and hence their existence value is relatively lower.

Intrinsic value: is the value totally unrelated to human use, and includes concern for rights and welfare of the non-human beings. For example, a rock which has no value for humans may have a large intrinsic value for a flying bird which may sit on it and relax.

### **Positive and negative externalities in agriculture with examples**

Positive externality refers to uncharged benefit enjoyed by one economic agent due to action of another economic agent. The sunflower farmer next to a apiculturist, derives the benefit of successful pollination in sunflower and thus increased output; the apiculturist on the other hand realizes increased output of honey due to good collection of nectar from sunflower. Both in fact are enjoying positive externality due to actions of each other.

Negative externality refers to unreimbursed costs due to action of one economic agent on the other. The mulberry silk worm rarer next to a cabbage farmer, suffers loss of cocoon yield by feeding the mulberry leaves, on which the pesticide spray deposits of the neighboring cabbage farmer are apparent due to drift of Plant protection chemical sprays.

### Illustration of the concept of transaction cost :

Transaction cost refers to the cost above the price of the commodity incurred in the process of extraction, processing, use or disposal of natural resource. For example, in the case of the cabbage farmer who is indiscriminately using plant protection chemicals and as the spray drifts on to the neighboring mulberry farmer, the transaction cost for the mulberry farmer is the loss due to poor cocoon yield due to feeding of chemical invested mulberry leaves to silk worms. The transaction cost is the difference between the marginal social cost of using plant protection chemicals and the marginal private social cost of using plant protection chemicals.

### Forest resources

India has 2 percent of world's forest area supporting 15 percent of world's population.

In the World, 30 percent of geographical area is under forests with a per capita forest area of 1 ha

In USA, 32 percent of geographical area is under forests with a percapita forest area of 1.3 ha;

Canada has 35 percent of geographical area is under forests with a percapita forest area of 14.2 ha;

In India 23 percent of geographical area is under forests with a percapita forest area of 0.11 ha .According to our forest policy, 33 percent of geographical area must be under forests.

In India, in 1991, the Forest Survey of India and the NRSA have both reconciled their data base and have arrived at a figure of 64 ml ha as area under forests. Considering the forest types in India, 52 ml ha are tropical forests, 6 ml ha are subtropical and 5 ml ha are temperate forests. Only 12 percent of this forest area has a crown density of 40 percent (called as closed forest). Our forests provide 41 ml cubic meters of fuelwood per year, but the annual demand for fuel wood is 240 ml cubic meters. About 25 percent of India's livestock graze on forest land . Considering the present rate of consumption of forest products in India, the per capita forest land should be 0.47 ha to meet the basic needs.

The actual total revenue from India's forests is Rs. 900 crores. Revenue from Non-Timber forest products is Rs. 300 crores.

Arunachal Pradesh has 62 percent of its geographical area under forests, with a percapita forest area of 8.26 hectares. Karnataka has 39.65 lakh ha of forest area which forms 20 percent of the State's geographical area with a per capita forest area of 0.11 ha.

#### Estimated value of environmental services provided by a tree in 50 years (Rs. Lakhs)

Production of Oxygen	=	2.5 (16 percent)
Conversion to animal Protein	=	0.2 (1 percent)
Soil conservation and maintenance of soil fertility	=	2.5 (16 percent)
Recycling of water and control of humidity	=	3.0 (19 percent)
Sheltering birds, squirrels, insects, plants	=	2.5 (16 percent)
Control of air pollution	=	5.0 (32 percent)
Total value of environmental services provided by a tree = Rs. 15.7 lakhs		

#### Estimated annual rental value of India's forests (in Rs. 000 Crores)

1. Timber and fire wood:	12.88
2. Minor Forest Produce:	1.09
3. Grazing :	2.20
4. Environmental services (other than recreation & biodiversity):	56.68
5. Bio diversity	6.60
6. Recreation	0.10

Total annual rental value of India's forests = Rs. 79,550 crores

Capitalized value of Indian forests = Net present value of Indian forests = Ann rental value/interest rate = Rs. 79,550 / 0.05 = Rs. 15,91,000 cores.

### **Important features of 1988 forest policy**

1. To bring 33 percent of geographical area under forests or tree cover
2. Total protection of tropical rain / moist forests (by Forest conservation Act of 1980 and ban on green felling in different States)
3. Control of introduction of exotic species
4. Extent of forest use for grazing and extraction will be determined by carrying capacity of forests
5. Tribals will be involved in protection, regeneration and development of forests
6. Forest based industries will have to raise their own requirements and the practice of supplying forest raw materials to industry at concessional prices will cease.

### **Major economic implications of the 1988 forest policy**

1. Due to ban on green felling, and the liberalization policy of the Government, timber imports have increased. At present around 60 to 70 percent of the value of timber in timber yards of major cities of India is imported timber (like Malaysian sal, Australian Honne etc). Timber imports are draining the foreign exchange
2. Even though timber imports have increased, even though substitutes for wood in the construction sector have increased, and even though technology of wood utilization has improved, resulting in less wastage, all resulting in reduced pressure on timber, the real prices of timber in the domestic market are still increasing . This shows that the demand pressure from domestic demand for wood will certainly is larger than the supply due to increased construction activity and cultural factors associated with timber use.

### **Resource scarcity**

Resource scarcity refers to rise in the real cost of extraction of natural resources. Considering renewable and exhaustible resources, the real cost of extraction of exhaustible resources should rise and that of renewable resource should at least not rise. Paradoxically, the real cost of extraction of exhaustible (or nonrenewable) resources is falling (that of copper, petroleum, minerals), while that of renewable resources (like timber) is rising, posing more challenges for resource economists to analyze.

## ENERGY

### Conventional and non conventional sources of energy used in agriculture

Conventional, commercial source of energy refers to use of electrical power, petrol, diesel in agriculture. In 1996, commercial energy equal to 4,50,287 000 tonnes of oil equivalent were used, which amounts to 476 kgs of oil equivalent per capita. Comparatively, the USA used commercial energy equal to 2,134,960,000 tonnes of oil equivalent, which amounts to 8,051 kgs of oil equivalent per capita.

During 1996, the use of electrical power is 347 kilo watt hours per capita in India, when compared with 11,796 kilo watt hours per capita in the USA. In India agricultural sector gets 31 percent of the total electrical power.

Conventional non-commercial source of energy refers to fuelwood, agricultural waste, cow dung. The total availability of fuelwood is estimated at 50 ml tonnes a year and this does not meet even half the demand. It is estimated that 80 ml tonnes out of the total 450 ml tonnes of agricultural waste and residue are used for cooking purposes.

Non conventional sources of energy refer to use of solar energy, wind energy, tidal power. At present these sources are not being put to use in significant quantities in agriculture.

#### The relative cost of conventional and non-conventional sources of energy in agriculture

Costwise, hydroelectrical power is the cheapest source of power and also pollution free when compared with other conventional sources. In one of our studies on the economics of borewell irrigation in Madhugiri, by installing an electrical meter for the irrigation pumpset on a coconut farm, and noting down the , we have estimated that to lift 1 acre inch of groundwater (or 22,611 gallons of groundwater) from a borewell, 42 Kilo Watt Hours of electricity are needed, which valued at 50 paise per kilo watt hour costs Rs. 21. However, to lift the same volume of water using diesel in oil engine pump set is more expensive.

#### **Green GNP**

The Green Revolution's success in fending off starvation even as Asia and Latin America's population doubled, from less than 2 billion to nearly 4 billion people, was a remarkable feat. Millions of human beings would not be able to survive today without the key innovations that launched the revolution. Foremost among these were advanced techniques of cross breeding that allowed development of rice, wheat and corn strains with increasingly higher yields per hectare. With sufficient access to irrigation water, fertilizers and pest controls, farmers could gain higher yields and, often, multiple crops in the same year, all with less labor.

Gross national product is the market value of final goods and services produced in an economy in a year.

Net national product is the GNP minus Depreciation of man made capital

Green NNP (also popularly called as green GNP, though it is green NNP) refers to

GNP minus (Depreciation of man made capital + Depreciation of Country's natural capital).

Depreciation of Country's natural capital = (Value of the extraction of exhaustible resources minus value of new discoveries of the quantity of exhaustible resources)

Plus

(Value of harvest of renewable resources minus value of renewable resources generated)

In the case of natural resources Price = marginal cost of extraction Plus the Opportunity cost. The opportunity cost of natural resource is called royalty or scarcity rent or user cost, which is the value of

natural resource. The opportunity cost of the natural resource is the cost imposed on the future generation due to the use of natural resource now. The value of natural resource is the quantity of natural resource multiplied by the royalty.  $\text{Royalty} = \text{Price} - \text{marginal cost of extraction}$ .

## Sustainability

Efficiency, in developmental connotation refers to the context of Myself and Today. As long as the single farm maximizes the profit for today, it is efficient, as it does not bother about the evil effects on its own environment or on the neighbor .

Equity refers to the context of Myself and Ourselves for Today: So Equity bothers about the effect of efficiency on the farm, on the neighboring farm but for today.

Sustainability refers to the context of Myself and Ourselves for Today and for Tomorrow: So sustainability gives due consideration to the efficiency today for the farm, for the society both for today and tomorrow.

### Commercialization and Specialization in agriculture

Commercialization refers to production of agricultural commodities in response to price signals in the market. This is reflected through increased share of marketed surplus, introduction of new crops/activities, growing commercial crops.

#### There are two types of commercialization

a. Product commercialization b. Factor commercialization

The prime measures of product commercialization are

- a. The share of commercial crops in the gross cropped area
- b. Share of non-food crops in GCA such as oilseeds, narcotics, beverages, spices etc
- c. The growth in the market surplus of crops serves as another measure of commercialization.

#### 3. Factor commercialization:

- a. Ratio of purchased inputs to total inputs; this has increased from 5.28% in 1950 to 70 % in 1998.
- b. Ratio of agril.inputs to gross value of output, this has increased from 8.7 % to 16 % correspondingly
- c. Ratio of purchased inputs to gross value of output; this has increased from 0.46 % to 12.11 %

Diversification: The element behind diversification is "not to put all the eggs in Single basket".

The concept of diversification at macrolevel: Move away from agril. to non-agril and services

Diversification within agril: Shift from one enterprise to another enterprise; addition of complementary enterprises to the main enterprise. Diversification could suggest one or all of the following situations.

- Shift from farm to non-farm activities ; -Shift from less profitable to more profitable enterprises
- Use of resources in diverse but complementary activities

#### Advantages/objectives

1. Income stabilization; 2. As a strategy against risk and uncertainty; 3. Increase in the income on smallholdings
4. Need for full employment in the farm household ; 5. Conservation and enhancement of natural resources

#### Determinants of diversification:

1. Market forces ; 2. Market infrastructure ; 3.Agronomical conditions ; 4.Availability of irrigation ; 5. Public interventions like price policy, credit policy, R&D policy

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(This class on Commercialization and Specialization in agriculture prepared for Ag Econ 101 by N Nagaraj, Professor of Agri Econ, Agri College, UAS, Mandya, July 2000)