

AGRICULTURAL ECONOMICS: THE FUTURE OF ECONOMIC GROWTH IN INDIA

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ABSTRACT: *Agricultural economics is the extensive study of the resources procured and utilized in production of commodities by farming. It co-notates the allocation, procurement, distribution and optimum utilization of the available resources used in production process. In the current scenario, Agricultural Economics include numerous other disciplines in it, while overlapping with the conventional economics with considerable amount. Significant contributions have been made till date by the Agricultural economists in order to do research and bring out innovations and up-gradations in economics, production economics, farm management, agribusiness management, food and nutrition, econometrics, agricultural law, rural sociology, development economics, environmental economics, policy, marketing and agricultural finance. Agricultural economics tend to affect food policy, PDS Policy (Public Distribution System) of the Government, agricultural policy and environmental policy. The fact that it entails several other disciplines makes it a field of very wider scope. Agricultural and Environmental Economics, Export and Import of various commodities represent the efficiency as well as effectiveness of Import Substitution and Export Promotion Strategy which will be discussed further in the paper. This research paper contains brief historical background regarding the emergence of Agricultural Economics, its major challenges and ingredients of its development and highlight the contributions made by the agricultural economists to the field by various models, namely:- Cobweb Model, Hedonic Regression Pricing Model, New Technology and Diffusion Model, Multi Factor Productivity (MFP) Model, Efficiency Theory and Measurement, Random Coefficients Regression.*

KeyWords: *Agricultural Economics, Environmental Economics, Production Economics, Farm Management, Food and Consumer Economics, Development Economics*

Introduction

Initially, Agricultural Economics started as a field of economics that particularly dealt with proper usage of land. Maximisation of the crop production was the main focus along with the maintenance of adequate soil ecosystem. The discipline enormously expanded throughout the 20th century and kept on expanding further as a ramification of which the contemporary horizon of the discipline is more extensive in scope. The term “Agricultural Economics” refers to the applied branch of economics associated with economic theory use and concepts in optimum utilization of available resources for the production and distribution of the most important means of subsistence and nourishment which includes eatables and meals; food and fibre. Environmental economics is the sub-discipline of economics, interdisciplinary in nature that uses the strategies, tools and methods of mainstream microeconomics and macroeconomics for the allocation of the environmental resources efficiently and effectively.

Literature Review

Agricultural Economics as the term denotes, represent the various issues prevalent in the agricultural micro and macroeconomics market which focuses mainly to deal with such problems and challenges faced by the farmers in maximizing productivity and minimizing the costs of production and providing the track for the Government support and assistance through effective and timely formulation and implementation of proper agricultural policies.

Snodgrass and Wallace (1980) related Agricultural Economics with the economics of social science which focuses on dealing with the agricultural challenges. Professor Gray (1925) calls it as the sub-discipline of applied economics which emphasizes the significance of Empiricism in the branch of Agricultural Economics. Observation and Experimentation theory becomes the life blood of applied

economics, especially agricultural economics. He has assigned the special weightage to the agricultural principles, methods, procedures and strategies to be applied to in the ground reality. Professor Hubbard (2004) has explained Agricultural Economics in terms of relationship between different activities of man relating to wealth earning and utilization. Lionel Robbins (1937) has emphasized on the problem of allocative efficiency of the resources involved in agricultural economics. His method provides us the farmers with various techniques for the analysis and evaluation of the different choices available for the allocation of resources that are scarce in order to get the maximum advantage out of it. Robbins has highlighted the significance of appropriate decision making process in selecting the proper combination of available factors of production in the ideal proportion so that it can act in the best interests of the agricultural community. Professor Taylor (1919) extended the concept of Lionel Robbins which focused on appropriate choice and selection of the resources i.e. man, machine, material, money, method and viewed it from the perspective of prices and cost of production involved. Taylor has particularly dealt with the concept of Farm management in the above context which makes it narrower in scope. Professor Jouzier (1920) calls for the synchronization of the relations between different components of agricultural economics which includes all the resources involved in the production and particularly human beings.

Professor Edgar Thomas (1968) deals with the link between different agricultural industries not only within the domestic territory but in the global dynamic world as well, while seeing the farming process from the perspective of business and viewing agriculture from the perspective of an industry. The activities involved in the Agricultural Economics include production (it deals with questions such as what to produce? When to produce? How to produce? How much to produce?), distribution (it deals with what to distribute? Where to distribute? price to distribute? whom to distribute? basis to distribute?) and consumption (it deals with what to consume? How much to consume?). Professor Holerow is concerned about the different policies relating to the production, distribution, marketing, consumption and general public in the agriculture.

Objectives

The objective of this research paper is to provide help to the department members, research personnel and under graduate, post graduate and other doctoral students to swiftly complete and share their research observations and conclusions with the professional associates and check their analysis at the pre-publication level. This paper is obligated to maintain the pedagogical freedom. The opinions, ideas, views and conclusions provided in the research paper are personal and those of the authors. In the light of this background description, the present study entails the following two main objectives: (a) To explain Agricultural Economics in terms of production, farming, development, food and consumer. (b) To explore the underlying principles of Environmental Economics and provide the basis for developing new hypothesis, while emphasizing on the following sub- objectives:

1. Highlight the contributions made by the agricultural economists by studying various models, namely:- Cobweb Model, Hedonic Regression Pricing Model, New Technology and Diffusion Model, Multi Factor Productivity (MFP) Model, Efficiency Theory and Measurement, Random Coefficients Regression.
2. To explain the Environmental Economics and various environmental challenges and strategies formulated by the environmental economists to deal with such challenges.
3. To explain the following terms :- Food and Consumer Economics, Production Economics and Farm Management, Development Economics.

Data

The data on Indian imports of agricultural commodities in the year 2018 has been taken from The World Factbook, Country Profiles, Central Investigation Agency and Trademap, International Trade Centre. The data on Indian exports of agricultural commodities in the year 2018 has been taken from World Economic Outlook Database, International Monetary Fund,. However, the complete data on imports and exports have not been taken. Instead, only data pertaining to Agricultural Economics and Environmental Economics have been taken into consideration in order to make the comparison possible.

Methodology

1. Comparison Method- has been adopted in order to compare and analyze the import and export of agricultural and environmental commodities in the year 2018 to that of 2017. It facilitated the comparison between the commodities of supreme importance and comparatively less significance of imports in 2018. The policy of import substitution has provided the mediocre results for agricultural products. It also facilitated the comparison between the commodities which have the potential to be

- produced with maximum quality while keeping in crux the cost minimization in order to be exported in the year 2018.
2. Observation Theory- has been followed in order to observe the rising and declining trends in the imports and exports of agricultural and environmental commodities.
 3. Verstehen Approach- has provided deeper understanding of the patterns and trends of imports and exports in India. Thus, providing a valid ground for the prediction of futuristic needs and further requirements of resources for farmers.

Analysis and Results

Economics is the optimum allocation and utilization of the available resources which are already running in scarcity. Agricultural Economics gained the notability and close attention at the end of 20th century, which dealt mainly with optimization of the decision-making process of farmers influenced by various non-negligible challenges. The practicability and application of agricultural economics can be observed mainly on the actual work field of land economics. One of the greatest contributions came from Henry Charles Taylor in the form of foundation of the Department of Agricultural Economics in 1909 at Wisconsin. In 1979, Theodore Schultz, who has won the reputed Nobel Economics Prize, examined development economics as an approach associated directly to the agriculture and problems involved in handling it. Schultz also established econometrics as an instrument in order to empirically use it in understanding and analyzing agricultural economics. His landmark 1956 article states: "Our analysis of the agricultural supply is deeply rooted in 'shifting sand' ". It simply implies that the agricultural operations in the country are not performed in a systematic and orderly manner till today's date.

Agricultural Economics is a very wide discipline that entails environmental economics as well which has continuously revealed its wider scope and application in various fields. Exports and Imports in agricultural and environmental commodities represent various aspects of an emerging country like India.

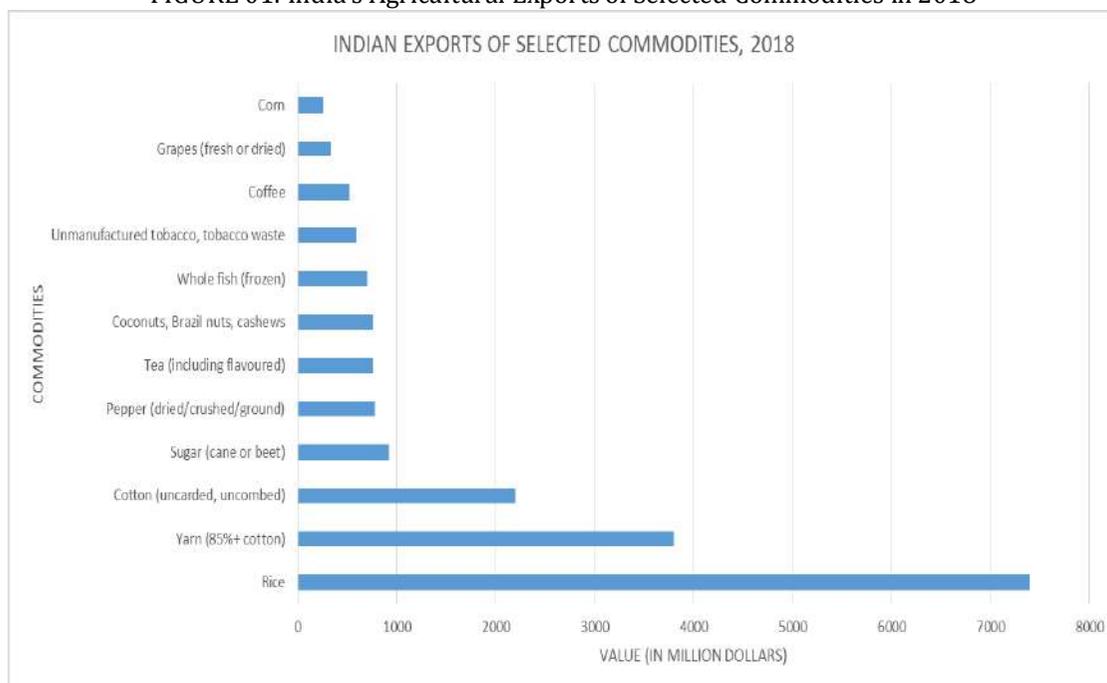
TABLE 01 : India's Agricultural Exports of Selected Commodities in 2018

Rank	India's Export Product	2018 Value (US\$)	Change
5	Rice	\$7.4 billion	+4.5%
8	Crustaceans (including lobsters)	\$4.5 billion	-6.3%
10	Yarn (85%+ cotton)	\$3.8 billion	+13.5%
13	Frozen beef	\$3.3 billion	-15.7%
14	Packaged insecticides/ fungicides/herbicides	\$3 billion	+21.7%
19	Cotton (uncarded, uncombed)	\$2.2 billion	+34.4%
59	Sugar (cane or beet)	\$919.2 million	-4.6%
75	Leather clothing, accessories	\$822 million	-6.3%
78	Pepper (dried/crushed/ground)	\$772.1 million	-13.8%
80	Mollusca	\$766.9 million	-5.5%
81	Tea (including flavoured)	\$763.2 million	-0.8%
82	Coconuts, Brazil nuts, cashews	\$758.5 million	-27.5%

Rank	India's Export Product	2018 Value (US\$)	Change
87	Whole fish (frozen)	\$700.1 million	-4.8%
99	Unmanufactured tobacco, tobacco waste	\$589.4 million	-3.7%
116	Fennel, coriander, caraway seeds	\$526.2 million	+17.2%
118	Coffee	\$520.2 million	-18.7%
148	Ginger, saffron, thyme, bay leaves, curry	\$417.6 million	+6.7%
166	Grapes (fresh or dried)	\$332.3 million	+8.8%
197	Corn	\$254.8 million	+62.1%

Source- IMF, World Economic Outlook Database

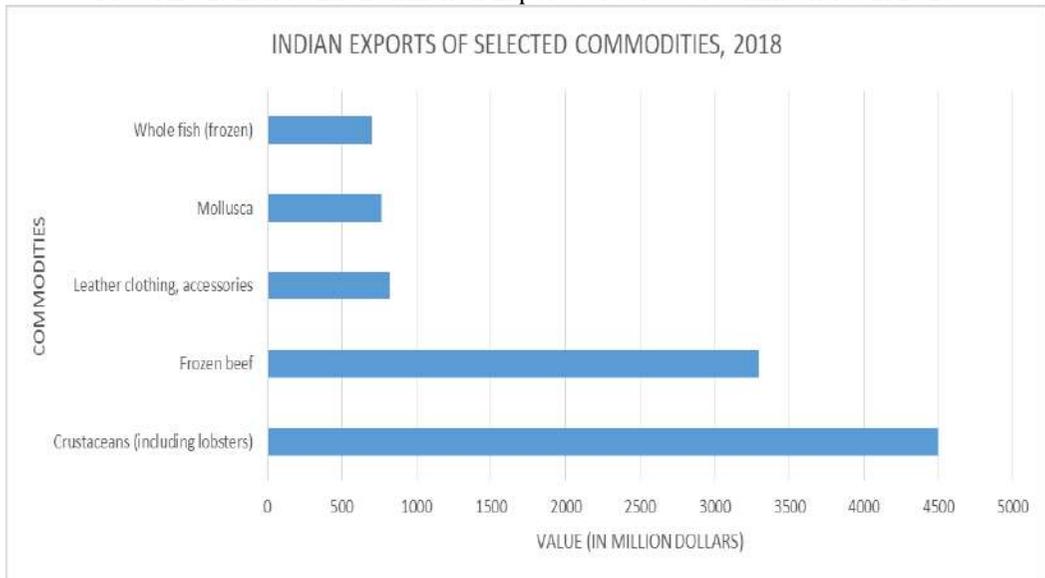
FIGURE 01: India's Agricultural Exports of Selected Commodities in 2018



Source- Author's Representation

Agricultural exports made by the country in 2018 reveal its efficiency in quality and quantity production of rice, cotton, grapes, corn and yarn (worth 7400, 2200, 332.3, 254.8 and 3800 million dollars) which depicts the increase of 4.5 %, 34.4 %, 8.8 %, 62.1 % and 13.5 % respectively, as compared to 2017. Exports of sugar, pepper, tea, nuts, tobacco and coffee was made worth 919.2, 772.1, 763.2, 758.5, 589.4 and 520.2 million dollars (4.6 %, 13.8 %, 0.8 %, 27.5 %, 3.7 % and 18.7 % less as compared to previous year representing inefficiency and under utilization of the existing capacity)

FIGURE 02: India’s Environmental Exports of Selected Commodities in 2018



Source- Author’s Representation

Environmental exports made by the country in 2018 reveals the reduction in the exports of crustaceans, beef, leather, mollusca and fish (worth 4500, 3300, 822, 766.9, 700.1 million dollars) which depicts the fall of 6.3 %, 15.7 %, 6.3 %, 5.5 %, and 4.8 % respectively, in comparison to 2017. It is the result of enactment and implementation of stringent environmental rules, laws and acts.

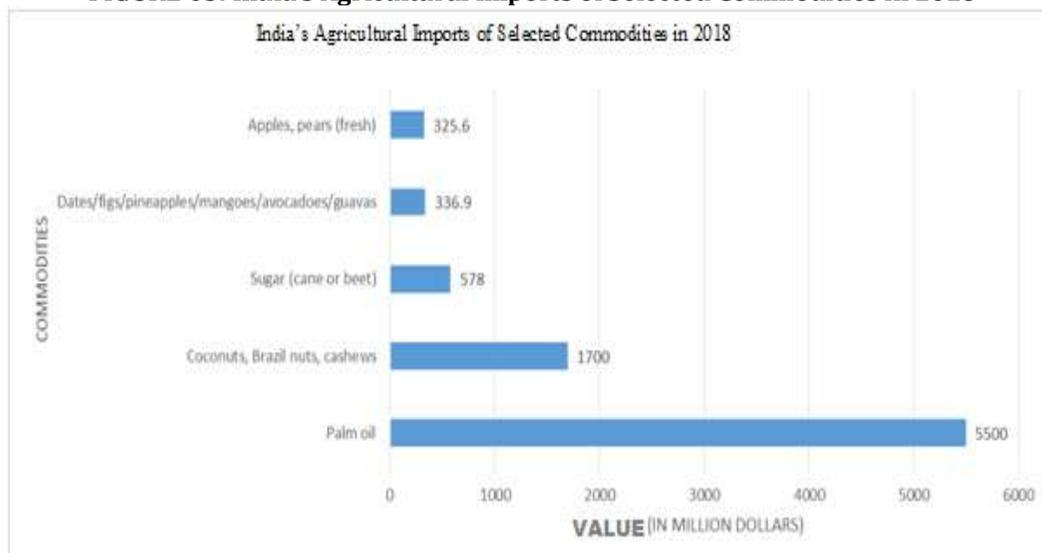
TABLE 02: India’s Agricultural Imports of Selected Commodities in 2018

Rank	India's Import Product	2018 Value (US\$)	Change
10	Palm oil	\$5.5 billion	-18.8%
16	Fertilizer mixes	\$3.1 billion	+78.5%
23	Soya-bean oil	\$2.3 billion	-17.3%
31	Sun/safflower/cotton-seed oil	\$1.9 billion	+2.8%
36	Coconuts, Brazil nuts, cashews	\$1.7 billion	+16.8%
43	Nitrogenous fertilizers	\$1.6 billion	+10.3%
52	Packaged insecticides/ fungicides/herbicides	\$1.3 billion	+7%
62	Potassic fertilizers	\$1.2 billion	+10.5%
68	Rough wood	\$1.1 billion	-7.6%
71	Miscellaneous nuts	\$1.1 billion	+2.8%
76	Dried shelled vegetables	\$1.1 billion	-73%

Rank	India's Import Product	2018 Value (US\$)	Change
85	Ammonia	\$910 million	+28.6%
127	Miscellaneous furniture	\$615.7 million	-0.1%
137	Sugar (cane or beet)	\$578 million	-45.2%
139	Chemical woodpulp (non-dissolving)	\$559.5 million	+15.6%
152	Chemical woodpulp (dissolving)	\$483.5 million	-9.4%
154	Miscellaneous animal feed preparations	\$476.4 million	+29.3%
167	Sawn wood	\$421.7 million	+14.7%
179	Essential oils	\$388.1 million	+42.6%
180	Miscellaneous engines, motors	\$384.2 million	+38%
197	Dates/figs/pineapples/mangoes/avocados/guavas	\$336.9 million	-2.2%
199	Apples, pears (fresh)	\$325.6 million	+0.2%

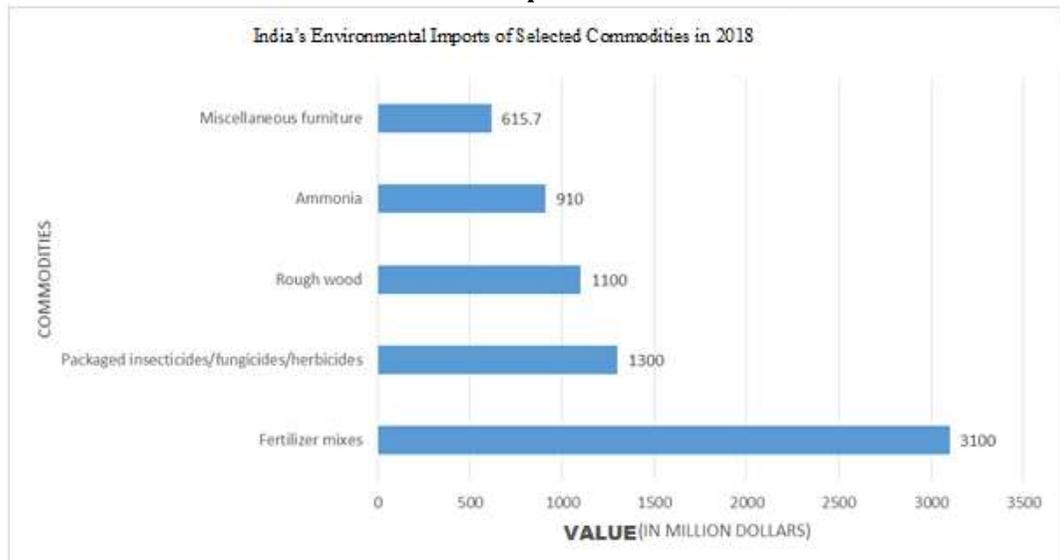
Source-Trademap, International Trade Centre

FIGURE 03: India's Agricultural Imports of Selected Commodities in 2018



Source- Author's Representation

Data on agricultural imports made by the country in 2018 says that India has imported apples and nuts worth 325.6 and 1700 million dollars which is 0.2 % and 16.8 % more than previous year. It simply indicates inefficiency of resource management in the country. Imports of sugar, dates and palm oil was made worth 578, 336.9 and 5500 billion dollars which is 45.2 %, 2.2 % and 18.8 % less than the previous year reflecting the progressive stage of Import Substitution Strategy.

FIGURE 04 India's Environmental Imports of Selected Commodities in 2018

Source- Author's Representation

Data on environmental imports made by the country in 2018 reveals that India has imported insecticides, fertilizers and ammonia worth 1300, 3100 and 910 million dollars which is 7 %, 78.5% and 28.6 % more than imports made in 2017. It indicates that the requirement of pesticides, fungicides, herbicides, fertilizers and ammonia for agricultural purposes is very large and vast proportion of these imports are availed by farmers on subsidised rates declared by the Government in order to promote agricultural activities. Imports of furniture and rough wood were made worth 615.7 and 1100 million dollars depicting the fall of 0.1 % and 7.6 % respectively as compared to last year.

Contributions by Agricultural Economists

Worth mentioning contributions have been made by the agricultural economists to the vast field and ever-evolving field of economics by formulating various models:-

Cobweb model explains the asymmetrical fluctuations in the cost and quantity that occurs in some market structures due to the expectations of prices. Hedonic Regression Pricing model is a revealed predisposition method commonly used in Consumer Price Index (CPI), real estate appraisal and real estate economics in order to estimate the demand or value. New Technology and Diffusion model is a theory which attempts to explain why, how in what manner as well as at what rate new, technologies and ideas spread. Its elements include creativity and innovation, channels of communication, time, human capital and social system. Multi factor productivity (MPF) or Total factor productivity (TFP) is a process of evaluating the economic performance by comparing the quantity of output produced to the amount of inputs used in producing the goods and services. Efficiency theory and measurement is a non- parametric revealed preference approach developed in special context with cost technology and cost- minimization while laying emphasis on efficiency as well as effectiveness of both constant and variable factors. Random coefficients regression technique is also called as multilevel or hierarchical modelling which is used to identify the relationship between response and time and is built on the presupposition that all individuals hail from the population having a single slope.

Agricultural and Economic Development

Agricultural and economic development is inversely related to each other. When country develops economically, then gradually the comparative importance of agriculture diminishes. This hypothesis was demonstrated by the German statistician named Ernst Engel in 19th century, who postulated that as income increases, the proportion of the income spent on food declines. In order to ensure the development, agriculture should produce the surplus quantity of food in order to feed and sustain the growing non-agricultural work force. Food is the utmost important physiological need for the survival than any of the services provided by traders or merchants. But if the food is unavailable for exchange or sale in adequate

quantities in order to support those who are engaged in such activities, then the economy simply cannot emphasize on promoting such productive activities. If the farm areas cannot supply its cities with food in exchange for the products or services of their factories, then a country will not progress due to the fact that the cities will then require procuring the food through international trade. Economic growth and development requires a growing labour force from urban as well as rural population. It means that agriculture should not only provide the towns with surplus food, but it should also be capable of producing the increased quantity of food with comparatively smaller labour force or by introducing technology intensive (labour saving) machinery. Agriculture in developing countries can be made more efficient and productive with adequate investment in the irrigation techniques, fertilizers, research and development, insecticides and herbicides.

In general, one can apprehend that when more than half of the country's population depend on agriculture for survival, then the per capita income of an individual will be low. It does not certainly imply that country is poverty- stricken because of the fact that large portion of its population is involved in agricultural activities; with some sort of affirmity it could be said that due to the poverty of a country, most of its people need to rely on agriculture for earning their livelihood.

Peasant agriculture

Peasant agriculture in India is mostly self-sufficient. Families of the farmers consume a major portion of their produce. Total production capacity is also very low due to high fragmentation of the land holdings. Due to the continuous cropping and adoption of the practices such as Jhuming Cultivation since decades, the fertility of land has been depleted. The available manures, fertilizers, organic pesticides are not sufficient and moreover, the farmers cannot afford them. Peasant agriculture is marked by high amount of risk and inertia. Peasant farmer is generally uneducated and reluctant to adopt the changes, try new methods, equipments and techniques. There exists a complex relationship between population, land, and farm production. In traditional agriculture, production is determined by quantity and quality of land available for cultivation and number of labour working on that land. Dependence of agriculture on land and human labour has gradually decreased due to Modernization which indicates the increased use of fertilizers, herbicides and insecticides. Animal and human power is now substituted by machinery and mechanical power.

Two major problems associated with the agricultural economics is the price instability and income instability. There could be several factors responsible for the instability of prices- unpredictable weather conditions and delayed monsoons in countries like India, Inelastic demand of the agricultural products, inelastic supply of the farmer's produce, Global market and liberalized policies for imports of farm products, etc. Net income of the farmers varies due to the instability of agricultural prices. The income of farmers in comparison to other workers is generally less. There exists two main reasons for this inequity. One is decline in the demand for farm labour which forces the rural people to migrate. The second is the lack of education which make farmers incapable of performing other jobs in the time period when there is no work on agricultural land.

Major topics in Agricultural Economics

Agricultural economics has fundamentally laid emphasis on seven main subjects from the very beginning : agricultural environment and natural resources (popularly known as Environmental Economics); risk and uncertainty factors; food and consumer economics; prices and incomes; market economy and structures; trade, commerce and development; technological change and resultant formation of human capital.

Agricultural environment and natural resources (Environmental Economics)

Environmental economics is that branch of economics which extends a helping hand in designing suitable environmental policies while laying emphasis on determining the theoretical, empirical and financial impact of such policies on the economy. The basic argument that arises in environmental economics is that there exists an environmental cost (negative externalities) of economic growth that generally goes unaccounted in the present market structure. These negative externalities (pollution, environmental degradation, ozone depletion) then results in the market failure. Due to this reason, the cost and benefit analysis of the environmental economic policies by the Environmental economists is of supreme importance. Strategies involved in the environmental economics in order to deal with the emerging issues in the field reflect the rigorous work done by the environmental economists in planning and formulating the suitable policies and procedures subject to the immediate implementation by the respective Governments and strict follow- up by the industrialists and citizens.

The government can place a forcible limit and quantity based taxes on carbon emissions from factories and industries. Government can also offer the tax credits to the companies using renewable and non-conventional energy resources for production in order to encourage and promote them. Government is also required to make the choice between perspectives or market based strategy. Prescriptive strategy is the one in which the Government controls the emission of carbon manually. Market based strategy is the one in which the Government sets the targets and goals to be achieved and on the other hand leaves the companies free to work accordingly to achieve those predetermined goals.

Environmental Economic Challenges

Dealing with challenges and problems of Environmental economics requires transnational approach. The task of environmental economists is to identify the negative externalities and bring to the notice of the concerned statutory body which in turn can pose the regulations. But the important fact which is to be highlighted here is the global character of such environmental issues which has led to formation of the International Panel on Climate Change (IPCC), which provides the platform for conducting the annual forums, conferences and attempts to discuss and negotiate the international environmental economic policies.

Environmental economics studies the impact that economic activities and policies have on the environment and surroundings in which we live. Production generates pollution through emissions from power stations which causes acid rain and ultimately leads to global warming. Consumption of households generate pollution which indicates more waste being sent to garbage dumps and polluting incinerators.

It requires decision- making by Central and State Governments to trade-off between cleaner environment or bearing high economic costs involved in the installation of pollution control devices :-

1. Complete tacklement of pollution or acceptance of it to certain level due to the high economic costs involved and other benefits associated with it.
2. Cost and benefit analysis of 'a clean environment' (however, environmental goods cannot be determined in terms of market prices) and 'pollution control equipments'.

Environmental economics is the sub-discipline of economics, interdisciplinary in nature that uses the strategies, tools and methods of mainstream microeconomics and macroeconomics for the allocation of environmental resources efficiently and effectively.

Valuing the Environment

Environmental Economists have attempted to determine the accurate value of environmental goods available in the society. Their efforts have led the formulation of various valuation techniques.

Contingent valuation also known as stated preferences method, it is an apparently simple method in which people are directly asked to assign the values to a particular environmental good.

This method of valuation seems to be simple in literature but actually contains a number of complexities-In information bias, the respondent has no accurate information or knowledge relating to the environmental product. In hypothetical bias, the respondent knowingly gives wrong answer in order to avoid the negative externality (harm done to the environment) and evade the payment for the harm done. In starting- point bias, the respondent strongly gets affected by the initial number of respondents presented as an example before them during the survey. In strategic bias, the respondent remains desirable of a specific outcome.

Another is the Revealed Preferences Method, which is also known as household production approach or hedonic approach, In this method of valuation, the value of environmental goods is determined by observing the buying behaviour of consumers while paying special attention to their buying motive.

For example- purchase of cloth bags, water purifiers, noise absorbing materials, eco- friendly products, etc.

Market failure

It refers to the economic situation in which the inefficient allocation of resources (including goods and services) takes place in the free market, often resulting in the net loss of social welfare.

Market failure is divided into two categories: - complete and partial market failure. Complete market failure, also known as missing markets, is when the market structure fails to supply the products and services for the society. Partial market failure represents that form of market structure in which the market functions inefficiently revealed by the production of wrong quantity of products being sold at wrong price.

INTERNATIONAL ENVIRONMENTAL TREATIES

These are the treaties and agreements signed by the different countries in order to facilitate working together to mitigate and tackle the environmental problems. Major environmental treaties and agreements include:-

Aarhus Convention, 1998-

Signed on 25th June, 1998 by 45 states in Aarhus, it is a multilateral agreement through which the access of citizens to the environmental information and justice is increased by promoting public participation in the decision making processes related to the local and national environment.

United Nations Framework Convention of Climate Change (UNFCCC), 1992-

Earth summit of Rio de Janeiro conducted from 3 to 14 June, 1992 gave birth to UNFCCC in order to stabilize the concentration of the greenhouse gases (GHGs) in the atmosphere and prevent the ever- increasing human interference with the climatic patterns.

Kyoto Protocol, 1997-

Based on the principle of “common but differentiated responsibilities”, It is international agreement which is linked to UNFCCC, which emphasizes on controlling the emission of following GHGs namely- Methane (CH₄), Carbon dioxide (CO₂), Nitrous oxide (N₂O) and Hydrofluoro carbons (HFCs).

Vienna Convention, 1985- An international treaty which was signed by 196 countries in order to protect ozone layer and minimize the amount of damage done.

Montreal Protocol, 1987-

It came into force from 1st January, 1989 which aims at phasing out production of those substances and products which are responsible for the depletion of ozone layer.

Basel Convention, 1989-

It is an international convention designed to ensure the structured waste management system in the developing countries.

Convention on Biological Diversity (CBD), 1993-

An international agreement signed for planning the strategies required for the conservation, preservation and for sustainable use of bio-diversity.

Ramsar Convention on Wetlands of International Importance, 1971-

It indicates the sustainable use of wetlands keeping in mind the ecological functions and economic, scientific and recreational importance of wetlands.

United Nations Convention to Combat Desertification (CCD), 1994-

Signed in 1994, it refers to the long- term plans and strategies strengthened by international partnership and cooperation agreements to combat the desertification.

Convention on International Trade in Endangered Species of Fauna and Flora (CITES)-

Signed in March 1973 In order to control and regulate the international trade in vulnerable and endangered wild life species. India is active member of CITES and participates in the conferences and meetings of the Plants and Animal Committees and Standing Committees from time to time through chosen representatives.

World Heritage Convention-

It is the convention under the sponsorship and support of United Nations Educational, Scientific and Cultural Organization (UNESCO) which is entrusted with the task of listing the World Heritage Sites, including both cultural and natural locations.

Convention on the Conservation of Migratory Species of Wild Animals (CMS) , 1979-

Also known as Bonn Convention, it aims to conserve migratory species of animals throughout their range of movement.

International Whaling Commission (IWC) , 1946-

It was set under the aegis of International Commission for the Regulation of Whaling to regulate conservation of whale species through conduct of whaling prescribed throughout the world.

Movement by Young Minds**Youth strike 4 climate and Fridays for Future**

The sixteen year old school girl, Greta Thunberg is adamant on bringing the positive change through the international movement of schools called student climate strike in order to prevent global warming and other climate imbalances. The movement has already gained support from thousands of schools and universities in United States, Belgium, Japan, Germany, Australia and a dozen other countries of the world while the placards criticizing the economists, policy makers and politicians read- ‘I will do my homework when you do yours’. Important point to be highlighted here is the back support that the students are receiving from 3000 scientists. Students are demanding a switch from fossil fuels to 100% renewable and non- conventional energy requiring an immediate political action on part of Government to stop the functioning of Adani Coalmine in Queensland. Students in Switzerland have put forth the demands in front of the government and leaders to immediately announce the emergency of climatic state, formulate zero-carbon policy by 2030 without giving much emphasis to geo- engineering and suggested the departure from

the prevailing economic system. Activists have laid emphasis on the systematic nature of the grave problem and also highlighted its collective significance of the choices rather than that of choices made by individual lifestyles. Serious criticism came on part of right- wing leaders and activists that forced the government to meet student commissions in order to take the few initial steps, for instance, restriction on the school trips that involve the transportation by flight.

Plastic- Bitumen Road Laying Technology: by ‘Plastic Man of India’

Plastic-bitumen road-laying technique which is the innovative idea given by a chemist, Dr. A. Vasudevan. While working in Thiagarajar College of Engineering (TCE), Madurai, he gave this innovative patented idea. Motive behind the innovative technique is not profit earning but the growing concern for environment and nature which is being continuously destructed by the ever- increasing plastic waste. The technology involves following steps :-

- a) collection of waste plastic material, which includes polythenes, polybags, saof and hard foams, disposal cups and plates, thermocol products, laminated plastics, etc.
- b) cleaning the collected waste material by washing.
- c) Shredding it to uniform shape.
- d) Melting waste plastic materials at the temperature of 165 degree Celsius.
- e) Blending the hot molten waste aggregate with the bitumen and using the mixture in laying the roads.

Every year on an average, about eight million tonnes of the plastic waste is directly dumped into oceans of the world. Whales and turtles mistakenly consume the floating bags of plastic, assuming them to be the jelly fishes. Brightly colored plastic packages attract sea birds and mammals that ingest them and die. Plastics dumped on land surface gets break down into tiny pieces and become microplastics which are gradually washed down by rainwater into rivers, lakes, ponds, seas and oceans. These microplastics are problematic because of the reason that they absorb other pollutants from the aquatic environment like legacy pesticides and carcinogenic hydrocarbons and assume the dangerous proportions. These microscopic toxic bombs are often mistaken for food and consumed by zooplanktons. Planktons are foundation structures of all aquatic food chain and plastics have contaminated that as well.

The “4 R Principle” formulated and implemented in this regard- Reuse, Reduce, Refuse and Recycle has not proven to be very successful and effective in reducing the plastic consumption. This eventually resulted in the discovery of such methods and techniques in which the plastics are used for the infrastructural development without causing much harm to the environment.

Dr. Vasudevan, popularly known as the ‘Plastic Man of India,’ who has been appraised by the Prime Minister of India, and awarded the Padma Shri. Dr. Vasudevan says that the roads which were constructed using the new formula of plastic material have not witnessed any blisters or potholes, since 2002. On revealing the proportions, he told that one tone of plastic waste is mixed with nine tones of bitumen in order to lay road of 1 km. This indicates the saving of a tonne of bitumen which costs approximately 50,000 rupees.

Performance appraisal by the Central Pollution Control Board (CPCB) states that the plastic roads didn’t develop very familiar defects such as potholes, rutting, raveling, blisters or flaw edge, even after 4 years of construction. Plastic- bitumen road making technology hasn’t proved to be very successful in India because of its poor adoption and follow- up. But there are few exceptions as well. The District Rural Development Agency was instructed by the late Chief Minister, Jayalalithaa to use plastic road making technology in Tamil Nadu. As a result of this, almost half of the roads in Tamil Nadu are made of waste plastic material. This technique has been adopted partially in states like Madhya Pradesh, Jharkhand, Himachal Pradesh and Meghalaya. According to the Director of Delhi- based CSIR (Council of Scientific and Industrial Research) – Central Road Research Institute, Satish Chandra –The plastic- bitumen road constructing technology is completely scalable but the lack of implementation by Municipal Corporations indicates that the enough shredded plastic is not available for this purpose. Moreover, it also requires the segregation, cleaning, cutting and processing of plastic in order to make it available as a raw product.

Food and Consumer Economics

It is a branch of Agricultural Economics concerned with the microeconomic analysis of the consumer behaviour that studies- effect of price and income on consumers, influence of information and quality parameters on consumer behaviour, consumer financial planning and consumer policy analysis. ‘Consumer’ is a broad term that includes families, individuals and groups as well. Food and Consumer Economics include- Consumption, Autonomous Consumption, Induced Consumption, Consumer Economy, Consumer Spending, Consumer Culture Theory and Consumer Debt. Consumer culture theory refers to the study of

consumer choice and behavior from the social and cultural perspective rather than the economic or psychological. Its purpose is to address and analyze the complex dynamic relationships formed between the consumer behavior, market structure and cultural orientations from both theoretical and pragmatic perspectives. A consumer economy is the one that depends heavily on the consumer behavior of buying and spending. It is an economy which is driven purely by the consumer spending which is expressed as a percentage of its Gross Domestic Product (GDP).

Production Economics

Production economics simply refers to the technique of applying the microeconomic principles in the production process. The fundamentals of production economics explain cost concepts, response of outputs to inputs, profit maximization, cost minimization, decision making process at the firm level, efficiency enhancement, institutional and technological changes and selection of best possible alternative from the available choices. The content or subject matter to be dealt with includes analysis of relationships formed between factors and factors of production; product and product; factors of production and resultant product, advantages of large scale production and returns to scale, evaluation of risk and uncertainty factors, etc, optimum allocation and utilization of available resources and marginal productivity analysis.

Farm Management

Farm management is a sub- division of agricultural economics, which deals with the allocation and distribution of scarce and limited resources in the farm activities while focusing on farmer's wealth earning and spending activities for gaining the maximum possible benefit. It seeks to give the answer of following questions to the farmer- What How and How much to produce, When to buy and sell. The subject matter of farm management includes the varieties of crops to be cultivated, the quantity of fertilizers and manures to be applied, the farm equipments to be used, the manner in which the farm functions are to be carried out, farm management research, training and development, evaluation of agricultural policies and practices being followed and development of appropriate models of mechanization and control.

Development Economics

Development economics is that field of study which focuses on the methods of improving economic growth and development in developing countries and fosters the way for improving the capacity for the masses of population. For example, by the way of healthcare and medical facilities, quality education, satisfactory working conditions, insurance schemes, infrastructural facilities, etc. Development economics aims at Improving quality of life of the individuals residing in developing and low- income countries, Improving their standard of living, improving the living conditions prevailing in such countries and improving the economic performance of such countries.

Conclusion

The concept of Agricultural Economics is not new to India, being an agrarian economy since origin. What is newer is the form and way of doing agriculture developed by various agriculturists and economists representing vast changes in the patterns of production and distribution both territorially and technologically. Entailing certain other disciplines in it (especially environmental economics) makes it a discipline of wider scope that not only deals with the farming related aspects related to exports but also focuses on various environmental concerns. This emphasis on the Environmental conservation is a result of entering into numerous environmental treaties and agreements with the various developed and developing nations of the world. Movement by young minds throughout the world highlights the need to work on the concept of Sustainable Development. Innovative eco friendly techniques of production being discovered now and then by the responsible citizens of the country expresses their willingness to bring about a change in the manner of dealing with the environment, for instance, Dr. A. Vasudevan of Madurai who formulated plastic- bitumen road laying technique.

Intervention of Central and State Government serves two major purposes from economic viewpoint- firstly, to provide the financial assistance to the small and marginalized farmers through various policies (such as declaration of Minimum Support Price) and concessional schemes (in order to provide them with fertilizers and pesticides at nominal rates). Secondly, to boost the agricultural production in the country in order to increase the amount of exports while focusing on optimum utilization of available resources (Export Promotion Strategy) and decrease the amount of imports (Import Substitution Strategy), which has achieved a mediocre success to a limited extent, indicating the more untapped potential of production in the country.

Agricultural economics is the extensive study of the resources procured and utilized in production of commodities by farming. It co-notates the allocation, procurement, distribution and optimum utilization of the available resources used in production process. Agricultural Economics include numerous other disciplines in it, while overlapping with the conventional economics with considerable amount. Significant contributions have been made till date by the Agricultural economists in order to do research and bring out innovations and upgradations in economics, production economics, farm management, agribusiness management, food and nutrition, econometrics, agricultural law, rural sociology, development economics, environmental economics, policy, marketing and agricultural finance. Agricultural economics tend to affect food policy, PDS Policy (Public Distribution System) of the Government, agricultural policy and environmental policy. The fact that it entails several other disciplines makes it a field of very wider scope. In short, given the structure of a developing country like India, with more than half of the population dependent on agriculture and the need to protect the environment and realise the importance of agricultural economics is same as the divinity of soul in a human body.

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