

Achieving Sustainable Production and Consumption in the Agricultural Sector: An Indian Context

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Abstract

What affects a farmer's agricultural productivity, and in turn profits? This depends on the choices he is offered in terms of the type of crop, access to capital and technology, policy environment as well as natural conditions such as climate, topography, soil type, among others. A variety of constraints play into farmers' decisions, including availability of production technologies, biophysical or geophysical constraints, labor and input market constraints, financial and credit constraints, social norms, inter temporal trade-offs, policy constraints, and constraints to knowledge or skills. It is also important to note that productivity is not an absolute measure but is dependent on the proportion of inputs to outputs. Majority of the factors related to production have been directly impacted due to global warming. In India, the agricultural supply chain has been a major area of concern with regard to transparency and rampant corruption, wherein the presence of middlemen has largely affected the market supplies, in turn causing disruption in the food chain and consumption patterns. This paper talks about the interplay of various such factors that affect decisions on agricultural production and consumption, and how technology can be leveraged to reduce these inefficiencies and achieve the most efficient level of production and consumption. This will ensure that the farmer receives the most favorable price and the food security chain is sustained for the generations to come.

Keywords. Sustainable production and consumption, E-Commerce, Crowdfunding, Tradeoffs, Financing

1 Introduction

The agricultural sector globally has seen remarkable transformation, particularly since the end of World War II. This has been predominantly in case of use of new technology in farm equipment, shift from labor intensive farming to mechanized techniques, greater use of chemicals and fertilizers, favorable government policies, all resulting in an increase in productivity and yield per unit.

In the case of India, where 65% of the population is dependent on the agricultural sector for their livelihood needs, the benefit of modern agricultural technologies may not have percolated to the ground level, including to the small and marginal farmer. The agricultural sector in India is still a long way from being a sophisticated industry due to a large number of inefficiencies in various stages of the production cycle. This paper aims to identify the various factors affecting agricultural production, pertaining to the Indian scenario, and subsequently identify the areas of leakage or inefficiency. This will then help to derive a means of effective use of technology to minimize the inefficiencies and achieve the threshold level of production.

Consequently, sustainable agriculture can be understood as the most efficient management and use of available resources to meet the dynamic needs of the present generation without compromising the ability of the future generations to meet their needs, while maintaining or enhancing the quality of environment and conserving natural resources. This is of prime importance in the present times as we have started experiencing the repercussions of overexploitation of resources by previous generations and therefore there is increased awareness about the limited levels of depleting resources. Fundamental changes in the ways food is produced, processed, transported and consumed are indispensable for achieving sustainable development.

While sustainable agriculture addresses many environmental and social concerns, it also offers innovative and economically viable opportunities for farmers, laborers, consumers, policymakers and many others in the entire agro-ecosystem. It is important to tap this opportunity in order to achieve the most efficient level of production and consumption, where there is minimum wastage of resources and maximum profit, both in fiscal terms as well as yield.

Food wastage is a pressing concern for a country like India which is home to 194.6 million undernourished people or over 15% of the country's population. Often, these staggering statistics are not a result of lack of food (as India is one of the largest exporters of rice and wheat), but due to lack of access to sufficient nutritious food. A large part of the agricultural supply chain ecosystem is either in the public sector, or strongly linked to it, and there exist bottlenecks at various stages. Presence of too many intermediaries, information asymmetry, huge gap between agro-warehousing supply and demand and lack of collateral management options are some of the areas of grave concern.

2 Imbalance in cropping pattern

There is an existing imbalance in cropping patterns of food grains because a large proportion of area under food grains is occupied by cereals. While food grains occupied an area of 97.32 million hectare (mha) in 1950-51, this has increased to 126.74mha in 2011-12. Subsequently, the area under coarse cereals (Jowar, bajra, maize) has declined from 37.67mha to 26.62mha.

The reason could be attributed to steady rise in food grain prices while also remaining highly remunerative and productive under new technologies. Secondly, the change in consumption patterns has also been accountable for this. Thirdly, international demand has also been the reason behind this with supplies to Middle East and African nations and under some circumstances using it as a barter in exchange of importing other goods and services. The strategic objective of agricultural development in India has evolved with time. In 1960s, it was to maintain the prices of food grains at lower levels, with the government significantly supporting the growth of wheat and rice cultivation via its policy interventions, procurement and technology. From 1960s to 1980s, it was to maximize food production. From 1980s to 1990s, it was to go from a demand driven production pattern to reducing inputs in agricultural commodities. But now with the interference of global warming, the story has altogether changed.

2.1 Factors affecting Agricultural production

Natural and economic factors are the primary influencers of agricultural production. Social and political factors affect farm income by indirectly influencing economics factors (as depicted in the figure 1).

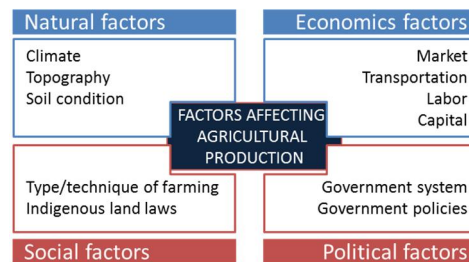


Fig. 1. Factors affecting agricultural production

2.1.1 Physical factors

- **Climate;** availability of adequate amount of heat and moisture: As India lies in the tropical region, agriculture thrives here. Due to increasing uncertainty of weather, as a consequence of global warming, this factor adds an element of vulnerability to the producer.
- **Soil;** fertility of the ground and presence of minerals. While fertility reduces by constant cultivation, this can be restored by leaving the land fallow and applying the right mix of fertilizers.
- **Irrigation;** as almost 55% of net sown area in India is dependent on rainfall, accessibility to irrigation facilities, at a reasonable cost is a pertinent factor.
- **Topography;** this plays a significant role as it determines the extent of soil erosion, method of cultivation and mode of transportation

2.1.2 Economics factors

- **Market;** distance from the place of sale determines the availability and cost of transportation. This is particularly important in case of perishable food items
- **Transport;** accessibility to the marketplace
- **Storage and warehousing;** inadequate storage facilities results in a huge amount of wastage of agricultural products
- **Capital;** with the use of mechanized agriculture comes huge capital investment. This is necessary for machinery, fertilizers and pesticides, high yielding seed variety
- **Labor;** this is a significant factor for a labor abundant country like India, and in case of crops which require intensive cultivation such as rice, tea, cotton etc.
- **Government policies;** Institutional factors such as availability of subsidies/ loans promote the cultivation of a particular crop
- **International trade;** demand and supply of agricultural products in the global market which in turn affects the prices

All these factors have an impact on the agricultural supply chain dynamics. While there has been a lot of emphasis on increasing agricultural productivity, reducing food supply chain inefficiencies remains a relatively unaddressed problem till recently.

2.2 Factors affecting Agricultural consumption

- Education level and awareness
- Unsustainable lifestyles
- Ethical practices
- Buyer power
- Socio-cultural factors

According to the Food and Agricultural Organization, United Nations, consumer choice plays a leading role in orienting production, as consumers select certain types of products according to the place of origin, production processes or producer. Consumers also exert strong influences through the ways they buy, transport, conserve, cook and consume their food. Food consumption is affected by a wide range of factors, including food availability, food accessibility and food choice, which may in turn be influenced by geography, demography, disposable income, socio-economic status, urbanization, globalization, religion, culture, marketing and consumer attitudes.

3 Role of ICT in Attaining a Sustainable Threshold Level of Production

One can envision a utopian state where the resources in agricultural production are utilized in the most efficient manner, i.e. minimum wastage while satisfying the dynamic needs of the consumers. The productivity at this threshold level will determine the ideal state ensuring sustainability.

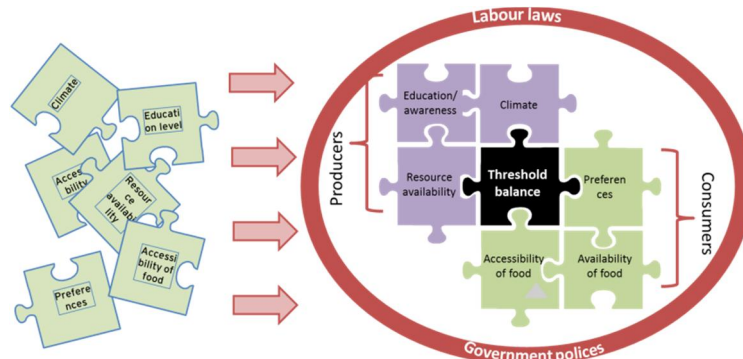


Fig. 2. Decoding the factors that impact the decision to produce and consume

Technology can play a significant role in moving as close to this threshold as possible. In various countries, evidence has established the increase in productivity caused by ICT interventions. For instance, a 2014 study suggests that ICT plays a significant role in enhancing agricultural production in Africa. At the same time, the results also suggest that certain socio-economic characteristics such as higher education levels and skills are prerequisites for effective improvements in agricultural production due to adoption and utilization of new technologies.

Some of other ways in which this medium can leveraged are presented below:

- 3.1 E-Commerce:** One way to do this is by supplying the farmer's produce directly to e-commerce grocery platforms. The e-commerce grocery platforms (marketing platforms) can help the farmers to avail the fair price (determined by the efficient market forces of demand and supply) for their produce, by eliminating the inefficiencies created by middlemen from the scenario. Perfect or monopolistic competition between various e-commerce players will ensure that the farmers receive the benefit of a higher price, instead of the middlemen. This higher payback can be used by the farmers to settle their loans, purchase high yielding variety of seeds, necessary equipment and fertilizers, among others. This would motivate them to pursue the sector as a need, rather than a curse and at the same time reduce their dependency on the government in order to get the right price for their products. The huge amount of produce supplied to e-commerce platforms would in turn generate greater employment avenues in semi-skilled and skilled labor force for management, storage and distribution.
- 3.2 Crowd-funding:** Due to the high level of turmoil in the economic markets, government budgets are facing a lot of pressure due to which the allocation and funding towards the agricultural sector often gets hampered till it reaches the actual beneficiaries at the ground level. Crowd-funding can be effectively leveraged to bring in the private sector to fill the large investment gap in the agricultural sector, by connecting middle-income individuals to the needs of the farming community. Irrigation can be one of the areas where various projects can get a boost through the crowd-funding platform.

Even though there is an expansive network of rivers and canals as well as groundwater, pumps and generators are required so that the water reaches the field. Only a small proportion of farmers have access to generators and pumps as they are available on rent for an exorbitant amount. Therefore, high level of distressed loans at the farmers' end and high level of dependence on monsoon to keep up with the productivity has caused a huge imbalance in the production and consumption pattern. In India, many examples of crowd-funding in agriculture can be seen that assist with irrigation requirements, especially as majority of the farmers in India are largely dependent on rainfall to meet their irrigation requirements. Various moderating agencies, such as One Acre Venture, eKutir, are providing a transparent route for small scale donations by a large amount of people to be channelized to substantial economic and social impact.

3.3 Research & Development: Due to global warming, the cropping patterns have noticed a significant shift with the increasingly unpredictable weather patterns. Such shifts in weather have drastically impacted the pressure, temperature and other key related components supporting production patterns. As a result, the farmer has started to focus on choosing the combination of crops awarding him with maximum profit. Therefore, the need of the hour is for the government to focus more on Research and Development of the currently existing patterns, as the traditional patterns are not in line with the current needs and requirements. Innovative means of solving these mushrooming problems are the immediate need, and thus, R&D in this space is essential to maintain food security for the future generations. The research should be condensed in a central database system where the information can be easily sent to the farmers and they can retrieve information from the central database probably via a speech recognition system (in order to tackle the problem of illiteracy). This may be available through mobile applications or any other feasible medium. This would certainly assist in building the farmers capacities.

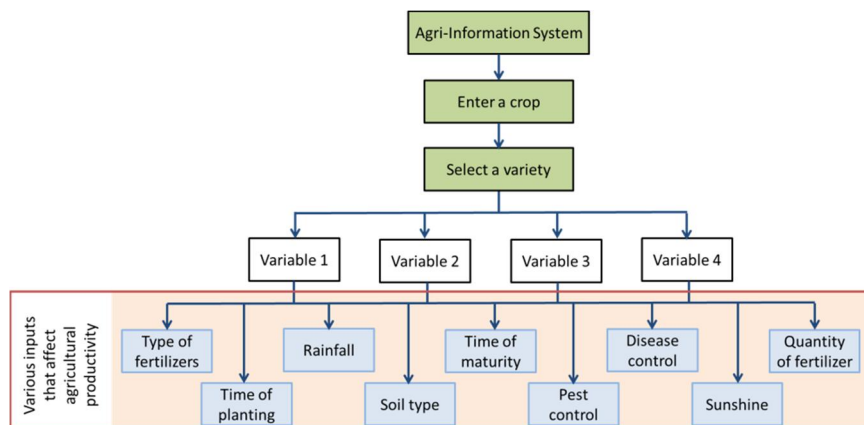


Fig. 3. Decoding the factors that impact the decision to produce and consume

3.4 Smartphone Application: One of the major revolutions in this segment can be brought through the use of neural network technology. This technology works on information gathering through the pixels of the image. The temperature, pressure, soil types, disease control measures and other likely important factors can be incorporated and assessed through the information feed of the smartphone application. An initiative by the University of California with Indian farmers is one such successful initiative, where the information feed via the smartphone application is assisting the farmers in taking informed decisions.

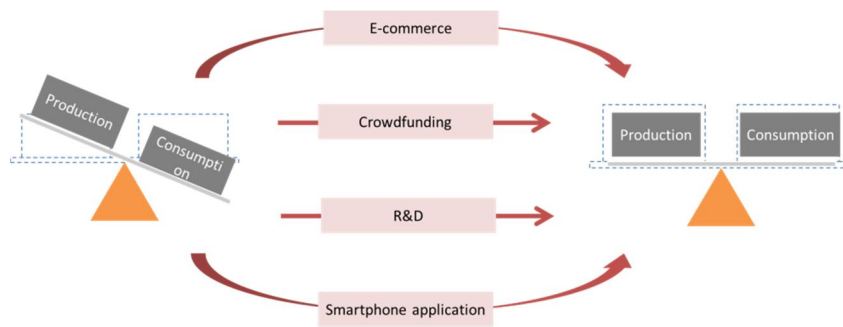


Fig. 4. Various mediums of technology to achieve the most efficient level of production and consumption

4 Conclusion and Way Forward

India, being an agricultural economy, is also responsible for feeding the world's second most populated nation. Over the years, the developed nations, through their continuous efforts towards identifying new research avenues for increased efficiencies in agricultural production have, to a greater extent, managed to attain a sustained production level. Unfortunately, India, in its efforts to match the global pace in the industrial economy, has continuously ignored the health and potential of its agriculture sector. The exponential growth in industrialization is continuously shrinking the agricultural lands in use. Furthermore, the draconian schemes and policies in place, without effective implementation have increased the burden on the sector.

Looking at the current situation, on one hand we have an urban India with massive growth rates, and on the other we have rural India struggling to meet the basic necessities of life, and unfortunately the gap between both these worlds is constantly increasing. The continued ignorance has resulted in an increase in suicide cases of farmers and a dearth of concrete action plans in place has further fuelled the problem. Adequate financing avenues that supplement continuous R&D have been responsible for achieving considerable balance in production and consumption patterns in developed nations. The effective implementation of technology possesses far reaching benefits in agriculture and a few of them have been discussed in this paper. Turning a blind eye to this sector can cause irreparable damage in the coming future. Thus, in

order to reach a balance among the various agricultural components, the innovative use of technological tools has to be incorporated.

It may be difficult to view agricultural development in silos, thus in order to achieve the efficient threshold level, interdisciplinary links have to be explored.

Future research work would focus on exploring avenues of financing for agricultural development with the effective role of technology. The potential for agricultural production is largely left unmet due to heavy reliance on monsoon as most of the farmers do not possess financial adequacy, thus various financial instruments equipped with ICT tools may help to raise the much needed support for irrigation projects/programs and assist with funds for carrying out impact research. The Sustainable Development Goals sit on the economic theory of production and consumption, and agricultural production and consumption is a major piece in this ecosystem.

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