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Indigenization of Indian Agriculture and Sustainable Rural Development: A Critical review of its need and Challenges

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ABSTRACT: India is predominantly an agricultural nation. Agriculture is the source of livelihood security for majority of the rural population. Indian agriculture has witnessed several transformations since the beginning of planned economic development. These technological shifts have induced our farmers to adopt new technologies which are not native to our system. Majority of these technologies are imported or indigenously developed on imported ideas. Although these new technologies did help in transforming food deficit nation into food surplus nation, it seems like Green Revolution has run its course. Our paper is a descriptive attempt to trace the development of Indian agriculture along with identifying inherent structural problems it has. The final objective of the paper is not necessarily to give wholistic solutions to the problems but to discuss the issues at hand in hope of creating a conducive environment in academia for finding better solution.

Keywords: Green Revolution, Sustainable Development, contemporary problems, wholistic approach

INTRODUCTION: Nearly a century before Bapuji remarked, that India lives in Villages. Nearly a century has passed, even now, when around 65 percent of Indian populace reside in villages, the statement made by Bapuji then, holds relevance even now. In this context, if India has to thrive and flourish, rural Bharat must be as much as empowered as urban India in terms of making choice and shaping their destiny. As majority of rural population depends on agriculture for their livelihood, agriculture must be made economical and sustainable. Whether we like it or not, service and Industry don't have the potential to accommodate and create employment opportunity for more than half of productive labor force of the country. As things stand, in foreseeable future, agriculture is going to continue to be the largest employer of labor force in India. On the other hand, as India is destined to be the most populated country in coming decades. This raises the question as to whether, is Indian Food Security strong enough to meet the upcoming challenge. Though Agriculture is not as glamorous as Industry or Service sector, its importance lies in the fact that, it is the food basket for the nation. Ignoring the problems faced by agricultural sector is akin to setting the nation in path of despair and doom. To address the core challenges faced by agricultural sector, tracing the development and transformation of Agricultural Sector becomes pertinent.

A brief overview of Agricultural Development in India since Independence: At the dawn of Independence, in terms of food security India was in a precarious condition. Although, during the period from 1956 to 1965, Agricultural sector was growing at a reasonable pace of 3 percent per annum, it couldn't keep up with population growth rate (Kurosaki, T.,1999), which was growing at a brisk pace of 2.2 percent per annum. The matters were made worse in light of frequent droughts and loss of well irrigated parts of Punjab and Bengal to Pakistan in the name of partition. Recognizing the importance of food security, the then Government under the Premiership of Pundit Jawaharlal Nehru appointed agrarian reforms committee under the chairmanship of J.C. Kumarappa (Tomer, et al.,2021). The committee sort to make an in-depth analysis of agrarian status prevailing in the country. The committee submitted its report in 1949. It recommended that all kind of intermediaries between state and the tillers must be eliminated, and land must belong to tiller subject to certain constraints. The groundwork laid by the recommendations of the committee to initiate land reforms was based on two highly relevant objectives: "The first objective was to remove such impediments to increase in agricultural production which has arisen from agriculture which was inherited from the past. The second objective of the land reforms was to eliminate all elements of exploitation and social injustice which was present within the agrarian system, so as to provide security for the tiller of the soil and assure equality of status and opportunity to all sections of the rural population" (Government of India,1961). To achieve the said objectives the first premier implemented land reforms with five-pronged approach, which are briefly summarized as under (Deininger, Klaus, et al.,2008):

Tenancy Regulation: Regulatory framework was established between landlords and peasants to secure the interests of both the parties, with a greater focus on providing security of tenure for the tenant. However, the regulatory framework met with limited success due to inherent unequal power dynamics which was present between the contracting parties.

Imposition of Ceiling on Land Holdings: The objective of this initiative was to impose a reasonable ceiling limit on landlords and to distribute their surplus land to landless peasants for the purpose of cultivation. This initiative had two inherent benefits. On one hand, it sought to address the inequality in wealth distribution among masses. On the other hand, by granting direct ownership of land for tenants, the policy aimed to increase the productivity in agriculture induced by inculcating a sense of ownership among previously landless peasants. As noble as the idea was, it was far ahead of its times. The then prevailing socio-economic political factors was not conducive for making such a radical idea successful.

Consolidation of land Holdings: At the dawn of independence, the total arable land of 310 million acres was held by 6.6 million households. On an average, the size of ownership of holdings among the rural areas was 4.72 acres. One of the major inhibitions in leveraging advanced technology to increase agricultural productivity has always been fragmented land holdings. In this context, consolidating land holdings to leverage advanced technology to increase agricultural production and productivity was the need of the hour. However, at that point of time, the nation had already been subject to unprecedented emotional turmoil and mutual distrust. Though the idea was feasible in economic terms, the national leadership under

the backdrop of prevailing socio economic and political backdrop lacked the political capital to make such a radical idea successful.

Though not successful in those times, the need for consolidation of landholdings has only increased in its importance as the time has progressed. One of the major inhibitions in leveraging advanced technology to increase agricultural productivity has always been fragmented land holdings. Due to law of inheritance the problem has become more so severe now, than it was then. Although India's total arable land has slightly increased to 394.6 million acres comprising 60.43 percent of land area (World Bank 2018), the average size of landholdings has declined to just around 2.84 acres from 4.72 acres. If anything, this reiterates the importance of consolidation of land holdings in contemporary times.

Encouragement of Cooperative Joint Farming: Though the initiative was highly relevant and need of the hour, it was too radical for its times. The then rural India, which was almost all of India, was divided in the lines of caste, creed, religion, and the like. In this context, implementing the foresaid reforms was met with very limited success.

In this backdrop, the then leadership of the nation, had realized that, at least for the short term they had to depend upon foreign aid for sustenance. Hence, India opted for PL-480 programme sponsored by United States (Blandford, et al.,1977) to meet its immediate food security deficit. However, the leaders were very wary of repercussions of the program. United States had started this programme with an ulterior objective of bringing the less developed countries under its sphere of influence, through aid. Under the prism of US foreign policy, sovereign actions of India to protect its territorial integrity against China and Pakistan in 1962 and 1965 were not viewed favorably. United States threatened to withdraw its aid to India. Indian leadership was faced with an unfortunate dilemma. If they opted for sovereignty, it would cost them food security. If they opted for food security, it would have costed them sovereignty. Fortunately for India, Norman Borlaug, heralded radical new initiative known as green revolution. Green Revolution focused on leveraging Agricultural research and technology to increase agricultural productivity in developing countries (Flachs, Andrew.,2016). The only reasonable way out of the quagmire for India was to implement green revolution in earnest.

To pursue the said objective, the government had one of two paths to pursue: on one hand, it could try to implement the radical new initiative nation wide or on the other hand, it could implement the program in the regions where it was conducive. Due to scarcity of resources, our national leadership chose to implement the green revolution technology in the regions of Punjab, Haryana, and western parts of Uttar Pradesh. Under the premiership of Srimati Indira Gandhi and able leadership of M.S. Swaminathan, Green revolution was implemented through high yielding variety of seeds. Although Green Revolution was mainly restricted to wheat and rice, it heralded subsequent prominent revolutions in agriculture and related domain. Some of such prominent revolution were: White Revolution: with the aim of increasing milk production, Pink Revolution: with the aim of increasing meat production, Grey Revolution: with the aim of increasing fertilizer production, operation Greens: With the aim of increasing the production of fruits and vegetables, with a particular focus on Tomato, Onion and Potato – TOP crops, Yellow Revolution: With a focus on oil seeds, Silver Revolution: with a focus on eggs, Golden

Revolution: With a great focus on bananas and mangoes, Brown Revolution: With a great focus on coffee, Golden Fibre Revolution: With a focus on enhancing Jute Production, Blue Revolution: With a focus on enhancing livelihood from aquaculture. All these revolutions at present have cumulatively transformed India into a food surplus nation. It is a matter of pride to state that, at present, India is the world's largest producer of pulses, millets and Jute. When it comes to rice, wheat, groundnut, sugar cane, fruits vegetables and cotton, India is the second largest producer. In the domain of livestock, plantation crops, fish poultry and spices, India is one of the leading producers in the world.

None can deny the fact that, India has transformed herself from food deficit nation to food surplus nation (Kesavan, et al.,2017), but the pertinent question that should come to our mind in this juncture is, has what has been achieved sufficient? Moreover, does quantity translate to quality? To answer the above questions in scientific temperament, it becomes pertinent to understand the nature of Green Revolution along with positive and negative externalities.

Nature of Green Technology

Green revolution technology encouraged the following agronomic practices

- HYV seeds responsive to chemical fertilizers. This has led to increase in the use of **chemical fertilizers**.
- HYV crops are more susceptible to pest and diseases. This has further increased the use of **pesticides**
- HYV crops are more vulnerable to drought and flood. This has increased the importance of irrigation which in turn has resulted in greater exploitation of ground water resources.
- HYV crops are short duration crops. This has enabled farmers to adopt multiple harvesting in a year. This has necessitated timely performance of agronomic practices resulting in increasing the need and demand for farm mechanization.

The Positive Externalities of Green Revolution are as follows:

- **Productivity driven production growth:** First and foremost, the most important aspect of green revolution is that it has transformed Indian Economy from a **food deficit nation to a food surplus nation**. This played a vital role in reducing our dependency on import of food grains
- **Reduced duration of crop:** has enabled the **multiple harvesting** and increased **job opportunities** in farm sector as well as **allied sectors** like fertilizer companies, seeds companies, pesticide companies, farm machines production companies their market distribution channels and so on
- **Incentivized initiation of subsequent Revolutions:** Green revolution laid the groundwork for initiation of several other important initiatives like White Revolution, Blue Revolution and the like which set the nation in the path of self-sufficiency.

Despite the prominent role played by the green revolution in empowering the nation, it did have its share of drawbacks which raises questions on its sustainability in the backdrop of Economic viability (Rahman, S.,2015). Some of the prominent issues are highlighted below:

Economic Viability of Green Revolution in the Backdrop of Sustainability

- New agriculture technology (NAT) inculcated in Green Revolution depends more on off-farm inputs like fertilizer, pesticides, purchased seeds, rented machineries and the like which has increased **the share of explicit cost** in production. This has made economically viable green revolution restricted to capital intensive farmers. For Small and Marginal farmers with less than two hectares of land accounting for nearly 86.2 percent of all farmers, such high costs pose a heavy burden.
- Increasing explicit cost, particularly for small and marginal farmers has invariably increased their **dependency on agriculture credit**.
- NAT not only **increased the mean value of agriculture production** but also has **increased the coefficient of variation**. Since HYV crops are more susceptible to pests, diseases, drought and flood – repaying debt has become more burdensome for farmers.
- Over the years the problem of indebtedness has introduced loan **wave-off culture**. Loan wave-offs inculcate willful **default** culture among farmers.
- **Negative Externalities on Environment and Health due to use of Chemical Fertilizers and Pesticides:** Use of chemical fertilizers, pesticides and herbicides not only adversely affect the soil fertility but also introduces poison residues in the food chain. This adverse effect on food chain persists for decades to come. In recent times, use of pesticide has witnessed a spike of 50 percent in a span of 5 years from 2009-10 to 2014-15.

Research shows that pesticides can contaminate soil, water, air and vegetation. In addition to those, heavy pesticides use can cause decline to beneficial microorganisms in earth. Ground water is also polluted by pesticides when they leach downwards. This paves a way for them to release heavy metals which gradually enter in to our food chain. In fact, Groundwater pollution caused by pesticides is a serious problem. It takes many years for the contamination to dissipate. Recent studies have shown that heavy metals can be extremely harmful to human health. They can cause damage to lungs, kidneys, livers and other vital organs. It can also lead to several muscular, physical and neurological degenerative diseases.

Repeated exposure to certain heavy metals has been related with harming reproductive system and eventually causing cancer. The negative externality caused by overuse of pesticides can be better illustrated by briefly reviewing Malwa region of Punjab (Kumar, et al., 2016).

Malwa, the Pesticide capital of Punjab, Punjab has been one of the corner stones of Green Revolution. Malwa region of Punjab consumes 75 percent of the total pesticides used by the state. A study (Kaur, et al.,2019) based on two villages of Malwa region: Arnetu and Wallipur was conducted with objectives of finding out the effect of frequency of pesticide use and its impact on environment and health of residents.

The study came up with very important observations (Kaur, et al.,2019) which is highly relevant for us to understand the negative externalities created by green revolution.

1. It was found that as high as 80 and 81 percent of respondents from Arnetu and Wallipur villages used pesticides in their agricultural fields.
2. It was found that farmers who cultivated wheat were spraying pesticides three times in whole crop season.
3. Rainy season caused extensive leaching of fertilizers and pesticides through soil into the ground water.
4. Vegetables grown in this region along the banks of river Ghaggar, were found to be highly contaminated with harmful heavy metals like copper, lead, cadmium, uranium, manganese, nickel and copper. The percentage of heavy metals found here were found to be higher in concentration than the recommendations set by World Health Organization (WHO), United Nations Environmental Protection Agency (UN EPA) and Bureau of Indian Standards guidelines.
5. Due to constant exposure to heavy metal in food chain, the prevalence of cancer and Hepatitis C was found to be very high in these villages. In addition to these, even cases of premature births and abortions were found to be very high in these villages. Most tragic outcome of this is that the incidence of stillbirths in this region is 5 times higher as compared to figures from other South Asian Countries.

Now, since we have understood the negative externalities of green revolution, it becomes pertinent for us to identify key issues which requires to be addressed to ensure food security of the nation in a sustainable manner.

First and foremost, limitation of food security as is present in India is that, it assures right to quantity at the cost of quality. Although due to advent of green revolution, we are able to harvest multiple times in a year, the harvest significantly falls short in terms of their potential to provide adequate nutrients, proteins, vitamins and the like to the general populace. This is reflected by blatant presence of malnutrition, stunting, wasting and diabetes prevalent in our populace.

According to UN report 2019, Indian population is expected to surpass that of China by as early as 2027. It brings in a set of new challenges in food security front. Even as the things stand, average land holdings among the farmers have deteriorated from 2.47 hectare to 1.15 hectare in present time, which is inhibiting in leveraging of new technology.

In addition to it, rapid development of infrastructure has resulted in shooting up of land values. Farmers, under pressure of fulfilling their short-term requirements don't mind disposing off their land for short term financial aid. This is resulting in decline of arable land. According to a survey conducted by United Nations, 40.76% of Country's population is expected to reside in urban areas by 2030. In other words, this just means that the availability of arable land which would be available for agriculture is going to be on decline.

Green revolution, as it stands based on the foundation of chemical fertilizers and pesticides cannot be sustained to meet the dynamic needs and challenges of the growing nation.

Possible Framework of Solution in the backdrop of Given Challenge: The challenge of food security which is being faced by our nation is no way a linear and a unidimensional issue. It is a nonlinear multidimensional challenge. The very nature of the challenge is such that to address the same, we require both short term measures and long-term measures which should

be worked out simultaneously to address various aspects of challenge which is threatening the food security of the nation.

In an ideal world, the solution must be Economically Viable, promote Social Equity and ensure Environmental Sustainability. Hence, some short term and long-term measures which could be taken to address the issue at hand in a sustainable manner are as follows:

Short Term Measures:

As productive as organic farming can be the quantum of production is not going to be sufficient to meet the food security challenges which is going to be unfolding in near future. To reduce the negative externalities created herein, on one hand, Government, should put measures in place to incentivize use of Integrated Pest Management (IPM) and Integrated Nuclear Management system (INM) in farming practice. However, we want to reiterate that, it is not going to be a zero-sum game. IPM or INM systems are not going to compensate for the negative externalities which are going to be created by use of chemical fertilizers and pesticides. However, with their aid, we would be able to reduce the quantum of negative externalities created to some extent.

Long Term Measures:

As the developed world are self-sufficient with their population growth stabilized, the issue of food security is not going to be an issue of great concern for them. Given that, India is going to be the most populated country in the world by 2027 and around 40 percent of Indian populace is going to reside in urban areas by 2040, some long-term measures are to be taken to address the issue in sustainable manner:

Ceiling a minimum limit on Arable Lands: As of now, arable land in India is around 309 million hectares. It is evident that the average size of land holdings shall be on declining trend as has been witnessed in the past. To meet the increasing demand for quantum of food produced in the nation in a sustainable manner, measures should be put in place to reserve at least this much land for the purpose of food security.

Incentivize Research In Contemporary Field: Next, the said amount of land in itself shall not be able to meet the quantum of production and productivity needed to ensure food security for the nation in near future. Although western premier educational research institutions would be able to rise to the challenge of finding a solution for the aforementioned problem, it will not be in their priority list, as it is not their problem. In this backdrop Indian Government must take measures to streamline research to address the challenges and needs of contemporary times, the most crucial of which being food security.

Put in place legislative framework to curb using land for speculative purpose: Hoarding of agricultural land for speculative purpose is a common incidence in Indian setting. Such lands are not used for any productive purpose except hoarding. This not only aggravates the problem of inequality, but also deprives agricultural land from productive use booth directly and indirectly by putting undue pressure in the system.

Conclusion: The purpose behind composition of our article was not to criticize green revolution. There can be no second opinion that, Green Revolution has transformed Indian Economy from food deficit nation to a food surplus nation. However, the success of green revolution has run its course. Green Revolution has created negative externalities. Radical new initiatives are to be undertaken to change the structure of Indian Agriculture. Only then will we be able to address the issue of food security in a sustainable manner. The probable solutions given by our paper is neither wholistic nor can be implemented easily. The purpose behind the paper was to bring into limelight the crucial issues which are going to pose significant challenges in near future so that academia can find feasible solutions. Hopefully we have done justice to our endeavor.

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