

BUILDING AGRICULTURE INNOVATION SYSTEM

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In the new National Agricultural Innovation System, we must look for total innovation, involving technological and institutional innovations throughout the production, marketing, policy research and enterprise domains. From transfer of technology, we must move to learning by using 'collective intelligence'. Farmer's role will no more be confined to learning, adopting and conforming. They must become co-creators of knowledge, process and innovation.

In India, we have daunting challenges. They range from substantial enhancement of our productivity to dealing with challenge of climate change to managing dry land farming to rapid elimination of poverty and malnourishment. They say that if you continue to do what you did in the past, you will get the same results that you always got. And we do not want that. This means we have to do things differently. This means we must resort to innovation.

More specifically, India needs to rapidly move towards 'innovation led agricultural growth'. This has to be achieved with speed, scale and sustainability.

We have benefited from our established 'Indian Agriculture Research System'. However, we need to understand that any National Agricultural Research System (NARS) is activity based. Agricultural Knowledge and Information Systems (AKIS) are

output based. National agricultural innovation systems (NAIS), however, are **outcome** based.

This new emphasis means that rather than just supporting research and research organizations, or supporting the generation of outputs, such as agricultural knowledge and information, emphasis has to be now placed on supporting **outcomes** that lead to sustainable development and growth.

This means that we have to do things differently than we have done in the past. For instance, in the classic National Agricultural Research System, the emphasis was on technology transfer. In the new National Agricultural Innovation System, we must move to 'total innovation', involving technological and institutional innovations throughout the production, marketing, policy research and enterprise domains. From transfer of technology we must

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move to learning by using 'collective intelligence'. Farmer's role no more will be confined to learning, adopting and conforming. They must become co-creators of knowledge, process and innovation. We must move from 'funding for research and research infrastructure' to 'strengthening' the systemic capability for 'total innovation', backed up by an enabling policy environment that fosters innovation.

Is it possible to draw any lessons from innovation in industry and manufacturing and agriculture especially from the new paradigms that were emerging? The answer is yes.

The author of this article and the late legendary thought leader C.K. Prahalad, wrote a paper titled 'Innovation's Holy Grail' in Harvard Business Review in the July-August 2010 issue. The paper discussed how the combination of scarcity and aspiration had helped India develop its own brand of innovation – getting more from less for more people – not just for more profit. This was called the MLM paradigm, i.e. 'More from Less for More'. Six months after the paper was published in HBR, the World Economic Forum had a special session on 'More from Less for More' on 16 November 2010. There are lessons from this paper that are valuable for the Indian agricultural innovation system too.

The challenge for the Indian Agriculture Innovation System will be also to get 'more from less for more'. This means getting more output or productivity by using less resource (land, water, money, inputs) to create benefits for more and more people, not just more and more profit.

The issue of going for 'more' is obvious. Indian demand for food grains would increase from 192 million tonnes in 2000 to 342 million tonnes in 2030. The challenge is that this 'more' has to be created with 'less'.

Let us deal with the challenge of dealing with 'less'. Take the land first. Diversion of arable lands for urbanization, industrialization and also for producing bio-fuels will mean less availability of land for agriculture. Availability of 'Less land' is also due to degradation caused by soil erosion, soil salinity and water-logging problems. Available estimates show that over 120 million hectares of land is degraded.

Furthermore, in India, agriculture is dominated by small farmers, with small landholdings. The

average size of the landholdings decreased from 2.30 ha (1970) to 1.32 ha (2000) and is likely to be reduced to 0.68 ha (2020) and then to 0.32 ha (2030).

Despite this 'less' land per capita, we have to get 'more' income for our farmers. This means developing technological innovations that suit less land holdings, or developing affordable implements (such as CSIR's 1 lakh Krishi Shakti tractor for small farmers) or involving these small land holders innovatively in agrisupply chain through institutional innovations.

First and the most powerful way of getting 'more from less' is by using the power of new technology, such as information and communication technology, nanotechnology, space technology, modern biotechnology, etc. However, a robust policy level innovation is a must to achieve this.

For instance, GM crops present a great opportunity of getting 'more from less' as is evident from the Indian success in Bt Cotton. With reference to GM crops, different nations have adopted different strategies. Some use 'preventive' policies. No matter what, do not allow GM crops. Others use 'permissive' policies. No matter what, within the next so many years, fifty percent of our crops will be GM crops. But the right policies are those that are 'promotional but precautionary'. While using the most rigorous scientific validation, we must be promotional too. And we must promote the use of new technology in multitude of ways. Here are some examples.

We could have innovation through technology-enabled supply chain through the use of RFID, advanced GIS/GPS, tracing and traceability systems. We could get 'more from less' by reducing wastage and ensuring quality throughout the supply chain.

Precision agriculture could be achieved with the use of advanced GIS/GPS and sensors can guide planting/irrigation, monitor yields, fine tune inputs and achieve 'more from less' by improving yields as well as reduce the use of water and fertilizer.

Moderately skilled agricultural workers with access to smart apps using smartphones or tablets can benefit from digital farm extension and advisory services.

Farmers can have real time market information by using mobile communications, voice based call centers and expert systems for real time price discovery, weather information and cultivation trends.

Again we can achieve 'more from less' by using leakage-free public distribution system, which uses computerized allocation of food grains, GPS/SMS monitoring, verifiable digital identify and web portal for public grievances.

Finally, we can have technology enabled crop insurance, where use of real time data from weather stations could be used to predict the rainfall and calculate the insurance payouts, which can be automatically transformed to the farmers through mobile banking. These seamless transections can

achieve 'more from less'.

The second powerful way of getting 'more from less' is to empower more and more farmers, with more and more knowledge. This can happen if the farmer understands the soil that he is sowing his seeds in (soil health card), he understands the why and how of the micro nutrient and pesticide addition that he makes and so on.

The third way of getting 'more from less' is by using the power of 'collective intelligence'. We must have more innovators becoming active players in the Indian agricultural innovation ecosystem going beyond our formal research and innovation systems. The author has been privileged to chair the National Innovation Foundation (NIF) inspired by the father of grassroots innovation movement in India, Prof. Anil Gupta. It was formed with the belief that 1.25 billion Indians do not represent 1.25 billion mouths but 1.25 billion minds. NIF recognises such grass roots innovators across India. The NIF website (www.nif.org.in) lists over 200,000 such grassroots innovations. Several of these are in the field of agriculture. And we have found that many of these are by ordinary farmers.

Let us see one typical example. Dadaji Khobragade from Nanded was one such as 'grassroots innovator'. NIF identified him and honored him. The improved paddy variety, HMT, developed by him has now diffused to several states covering more than one lakh acres. It has been included as a standard reference for thinness by Protection of Plant Variety and Farmer's Rights Variety (PPVFR) also! There must be thousands of Khobragades in the country. Our formal agricultural innovation systems (such as MPKV) must partner with such farmers to get 'more from less for more people in India'.

The fourth strategy is that more 'collective intelligence' of the innovators must be used in enhancing the productivity of the workers in agriculture, while reducing or

removing the drudgery in their fields. Let me give some examples.

Women comprise over fifty per cent of the total work force in tea gardens in India. Plucking of tea leaves manually involves a lot of drudgery. Can we not develop a tea leaf plucking device? Millions of women have to bend their backs for hours standing with feet in the water to transplant paddy in the fields. Can we not develop a manual paddy transplanter, which will eliminate this drudgery. We, at NIF, decided to challenge the Indian scientists and engineers to solve these problems.

In the Sixth National Grassroots Innovation Award Function of NIF on March 9, 2012, the Hon'ble President Smt. Pratibha Patil announced the Gandhian Inclusive Innovation Challenge Awards for such challenges causing the drudgery for the women. Three awards worth Rupees ten, five, two and half lakhs were announced. NIF received more than 500 entries. Fifty four entries were short listed by an expert committee for developing prototypes. But finally, none of the entries were found award worthy. NIF is going for a fresh round of challenges now.

Is it not strange that a country that is capable of doing the most challenging Mission to Mars in US \$74 million, ten times cheaper than other nations, and that too becoming the only nation to do it successfully the first time, is unable to solve these problems, which will remove the drudgery of our women in agriculture? We must get the best of minds in our research and innovation system involved in these so that the noble aim of 'more output with less drudgery' will be achieved with our 'collective intelligence'.

The Way Forward:

In this article, the Indian Agriculture Innovation System has been discussed. However, overall, how is India doing on innovation?

The decade of 2010-20 was declared as the Indian Decade of Innovation. We are almost at the end this decade – and where are we? Look at the world ranking of India in innovation based on the report published by Global Innovation Index. India's ranking among 143 nations has slipped from 62 (2011) to 64 (2012) to 66 (2013) to 76 (2014), 81 (2015). However, in the subsequent years, it has steadily improved, 66

(2016), 60 (2017) and 57 (2018). That means after halfway through the decade, India has slowly started moving up the ladder of the global index.

The very dictionary of innovation is changing due to the innovations done in India. These new terminologies in this dictionary now include phrases like frugal innovation, inclusive innovation, Gandhian innovation, nanovation (after the Tata Nano Car), reverse innovation and even 'Indovation'! And all these refer to India's ability to do 'more from less for more people'. That means India is creating its own imprint on the global innovation scenario. That means India is doing well. So what is the truth?

I believe there is both good news and bad news for India. Global Innovation Index is largely based on technological innovation. Other countries appear to be speeding faster than India in technological innovation. But India excels in non-technological innovations such as business model, system delivery, workflow, organizational, institutional innovations, etc. It also excels in grassroots innovation. The Global Innovation Index must be redesigned to account for all this.

We must build a robust Indian Agricultural Innovation System based on our great strengths. We must build it on the 'total innovation' concept with 'collective intelligence' of this great nation. We must have highly innovative pro-poor, pro-environment and pro-business policies.

We must build our own Indian Agriculture Innovation Index. It is important to do so, because what cannot be measured, cannot be monitored. And what cannot be monitored, cannot be improved. I have no doubt that if we do this with determination, then we will achieve the dream of moving rapidly from 'green revolution' to much needed 'evergreen revolution' and 'nutritional revolution'. We will then achieve our dream of 'food for all' with a smile on the face of a billion plus Indians, and not just some privileged few amongst us.

(The author is F. R. S., National Research Professor. He has received over fifty awards and forty honorary doctorates and is a member of numerous scientific bodies and committees. He has been conferred with India's top Civilian awards like Padma Vibhushan, Padma Bhushan, Padma shri.

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