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Reimagining Agriculture for Poverty Alleviation and other Development Goals

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Abstract

Since the seminal work of Arthur Lewis (1954) on Dual Sector Economy, development economics literature has emphasised structural transformation of economy marked by decline in share of agriculture in economy's output and employment as an economy grows from low income towards middle and higher income. Based on this literature, policy emphasis for growth and development tilted towards non agriculture sectors especially manufacturing. In some cases this even led to overlooking the role of agriculture in development, which is qualitatively different than role of non agriculture in growth and development. Of late, there is a realization that the importance of agriculture for economy and society is much larger than what is revealed by its share in GDP. This implies that changes in share of agriculture in GDP is not a best guide for policies on growth and development. Everywhere, changes in occupation structure followed changes in structure of output with a long time gap. In some of the emerging economies the two shares i.e. share of agriculture in GDP and workforce are moving parallel instead of showing convergence. This has serious implications for employment and disparities in per worker income in agriculture and non agriculture, which is further related to poverty. Hunger at global level and in a large number of countries is showing increase after 2015 despite increase in per capita food output. More than 3 billion people are reported to be unable to afford healthy diets in 2020. Agriculture is also significant contributor to climate change and unsustainable use of natural resources. Such trends are threatening life of people and planet. There is a pressing need to reimagine agriculture and its role in nutrition and health and for inclusive and sustainable development.

JEL Codes: O13, Q01, J43



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Introduction

I am driven to talk about 'reimagining the role of agriculture in development and economic transformation' in the light of two biggest challenges faced by developing countries in particular and world in general. These are: the challenges of "employment and sustainability" which in turn are closely related to reduction in poverty and hunger and other development goals.

The role of agriculture in development is generally explained by linking it to the process of "structural transformation". The origin of literature on this theme is traced to the seminal work of Arthur Lewis (1954) "Economic development with unlimited supply of labour". Lewis described economic development as a growth process of relocating resources from agriculture, characterised by low productivity and traditional technology, to, modern industrial sector with higher productivity (the famous two sector model of development). This theory was then widely used by many developing countries to support industrialization. It assumes almost zero productivity of labour for agriculture and subsistence agriculture in early stage of development.

This theory assigns very passive role to agriculture in economic development. Even at that time, this theory was criticised for some of its assumptions like zero productivity of labour in agriculture. In the post green revolution period, some assumptions of Lewis model of development have come under serious question. First, the green revolution showed that technology can play a significant role in modernising agriculture and in generation of surplus. Regarding unlimited supply of labour in agriculture, this assumption holds no more. In fact, in many developing countries, agriculture now suffers due to low availability of labour. These changes have implications for economic transformation from agrarian economy to industrialised economy.

A few years after the classic work of Arthur Lewis, a new thinking emerged on role of agriculture in economic transformation led by Johnson and Mellor in 1961. According to this school, agriculture play a central role as a driver of growth, especially in the early stage of industrialisation. This was supported by experience of economic development in much of Asia. Leading development economists of the time like T W Schultz in 1964 and Hayami and Ruttan in 1971 also recognised leading role of agriculture and its potential to emerge as a modern sector and contribute to overall growth in a significant way.

A little later, economists identified growth linkage and multiplier effect of agriculture growth on non-agriculture sector. Much of this was result of modern agriculture technology which required use of modern industrial inputs like fertilizer, chemical, farm equipment and machinery. It seems Lewis and other thinkers at that time did not foresee technological change coming in agriculture, like industry, and thus enabling agriculture to play a different role in economic development than what was envisaged by Lewis. This also brings to the fore

power of technology in determining the nature of economic transformation. According to the proponents of growth linkages of agriculture, this sector contributes to economic development in multiple ways besides backward linkage through demand for inputs. The other linkage includes supply of new forms of raw material for industry and demand for industrial goods in rural areas. One can further add to this “agriculture – energy linkage” like ethanol and biodiesel from crops as a renewable and alternative source of energy.

It is interesting to point out that both the traditional and modern theories of economic development have a remarkable similarity in terms of conclusions on nature of economic transformation. All development economists arrived at a conclusion, that, as per capita income rises, shares of agriculture in GDP and in employment decline. This transition is finally set to bring equalisation in labour and capital productivity in agriculture with other sectors. These conclusions are often used to offer a simplistic solution for rural underemployment, low wages, low income per worker in agriculture and resulting poverty, that is: labour should be moved out of agriculture. Experience of last 3-4 decades in case of many emerging economies shows that the process of shifting labour force out of agriculture is not smooth and is very slow. According to Timmer (2009), the share of agriculture in GDP falls much faster than the share of agriculture labour in the overall labour force. As a result, growth in farm income starts falling behind income earned in rest of the economy. This has implications for income disparity between agriculture and non-agriculture which can lead to serious political problem. Economists like Bruce Gardner in 2002 observed that faster integration of farm labour into non-farm economy is the long term answer for convergence of farm and non-farm income but such integration takes a long time. According to Gardner, it was not fully achieved even in the USA until the 1980s. In the light of such experiences it is imperative to reimagine role of agriculture in offering employment and meeting goals of development. Similar concerns have been raised earlier in the Leonard Elmhirst Lecture at the 27th IAAE Triennial Conference, Beijing China, 16-22 August, 2009 by Alain de Janvry and subsequently articulated more sharply in his paper Janvry (2010).

Historical and Recent Experience

Empirical evidence from industrialised countries, emerging economies and developing economies provide strong evidence of faster decline in share of agriculture in GDP followed by much slower fall in share in employment even in recent period. This is demonstrated by data in case of select group of countries at different stages of economic transition and development presented in Table 1. The table shows structural changes in selected economies representing high income, upper middle income and lower middle income during the last three decades (1991 to 2020). The Table also provides per capita GDP at constant (2015 US \$) prices for the selected period.

Per capita GDP in China, Vietnam, India and Indonesia showed moderate to very high increase over each decade since 1991. The increase has been more than 10 times in China,

4.8 times in Vietnam, 3.4 times in India and 2.4 times in Indonesia over a period of three decades. However, this did not lead towards convergence in labour productivity (GVA per worker) in agriculture sector with non agriculture sector.

Table 1: Share of agriculture, forestry and fishing in income and employment and per capita income in select countries, 1991, 2000, 2010 and 2020.

Variable	Country	1991	2000	2010	2020	Ratio of income: agri worker/non agri
Income share %						
	China	24.03	14.68	9.33	7.70	0.270
	India	27.66	21.61	17.03	18.67	0.284
	Indonesia	19.66	15.68	13.93	13.70	0.378
	Viet Nam	40.49	24.53	15.38	12.66	0.299
	Kenya	24.32	28.72	17.57	22.70	0.580
	Mexico	6.50	3.16	3.09	3.71	0.254
	South Africa	3.74	2.61	2.11	2.58	0.097
	Brazil	6.84	4.75	4.12	5.71	0.590
	World	4.57	3.35	3.83	4.34	
Employment share %						
	China	59.70	50.00	36.70	23.60	
	India	63.41	59.64	51.06	44.68	
	Indonesia	46.94	45.28	39.13	29.57	
	Viet Nam	74.62	65.26	48.71	32.61	
	Kenya	47.99	45.51	39.71	33.63	
	Mexico	25.94	17.41	14.64	13.18	
	South Africa	23.56	21.02	16.57	21.42	
	Brazil	18.32	15.37	11.47	9.31	
	World	43.38	39.80	32.76	27.04	
GDP/capita US\$ 2015						Growth rate 2020/1991
	China	975	2194	5647	10358	8.49
	India	529	755	1238	1815	4.34
	Indonesia	1557	1845	2696	3780	3.11
	Viet Nam	698	1184	2029	3352	5.56
	Kenya	1291	1187	1343	1617	0.78
	Mexico	8303	9656	9480	9279	0.38
	South Africa	4480	4736	6018	5749	0.86
	Brazil	6043	6746	8674	8256	1.08
	World	6780	7875	9313	10548	1.54

Source of data: World Development Indicators, World Bank, available online.

In the set of these four emerging economies highest disparity in productivity or income is experienced in China which witnessed highest growth in PCI and output of manufacturing and total non agriculture sector in the last three decades. An agriculture worker in China generates only 27 per cent of the income generated by a non agricultural workers. India and Vietnam are close to China while Indonesia shows lower disparity.

It emerges from the recent experience in major developing and emerging economies that faster growth in non agriculture and so called modern industrial sector did not lead to commensurate shift in workforce from agriculture. As a result, share of agriculture in employment remained much higher than its share in output or income of the economy – almost three times in China, two and half times in India and more than two times in Vietnam and Indonesia. A serious consequence of such structural transformation is that income disparities did not follow decline with economy becoming more and more prosperous and non agricultural. In other words, structural change in composition of output did not address low income of agriculture – probably this requires action within agriculture.

Some other contradictions with model of structural transformation are also observed from the table. One, South Africa, at much higher level of PCI and development shows highest disparity in per worker income in the list of countries included in the Table. An agriculture worker there earns less than one tenth of non agriculture worker. Two, share of agriculture in total GDP shows increase in the recent period in some countries like Brazil and South Africa, especially after the global financial crisis that began around the year 2006-2007.

It is evident that structural transformation of economy towards manufacturing and other non agricultural activities does not adequately address disparities in productivity across sectors and low income (per worker) in agriculture. The underlying reason is that decline in share of agriculture in national income was not accompanied by similar decline in workforce engaged in agriculture. Modern day manufacturing requires specific skills and workforce from agriculture can't be absorbed in manufacturing without having such skills. Two, many jobs done by labour can be easily done by machinery. Manufacturers weigh cost of capital with cost of labour for doing the same task. Rising automation and cheap and easy capital availability also adversely affect growth of jobs in manufacturing. Recent spurt in deployment of robotics, AI, machine learning, IOT etc by manufacturing and services sectors are also emerging as serious challenge to jobs for humans. Thus, strong initiatives and policy measures are needed to make employment in agriculture more remunerative. This includes measures like increase in productivity of agriculture, increase in on farm value addition, harnessing consumer desires to pay for special attribute in food output, and producer- private sector partnership.

Poverty and other Development Goals

Eradication of poverty and hunger have remained most important goals for almost all developing countries and international community. United Nations and its various agencies and international institutions like World Bank have made series of attempts to achieve these goals along with other development goals. Two recent and most significant attempt made in this direction have been UN's Millenium Development Goals followed by Sustainable Development Goals. Out of 16 SDGs as many as 8 are directly dependent on developments in agriculture sector.

There are numerous studies that show that agriculture growth is central to poverty reduction and growth in developing countries (Fugilie et al 2020, Virmani 2008). Agricultural growth is found critical for poverty reduction both in an absolute as well as a relative sense in comparison to other sectors (Nomann 2004). Nomann suggest that to attack poverty head on we must have an explicit agricultural growth strategy in place and this focus on agricultural growth itself needs to be driven at least in some measure by labour productivity in order to produce better poverty reduction results.

A large number of studies in India used state level data to study the relationship between agriculture performance and poverty (Virmani 2008). The latest data on poverty in India is available for the year 2011-12. We used simple regression analysis to confirm the findings of earlier studies on impact of agriculture on poverty. This includes incidence of poverty HCR (%) in major states of India during 2011-12 as dependent variable and variables like per capita income, GVA (gross value added) per worker in agriculture, GVA per worker in non agriculture and GVA agriculture per hectare of agricultural land during the triennium ending with 2011-12, with different combinations, as independent variables. The results are presented in Table 2.

These results show that agriculture development measured by any indicators like land productivity or worker productivity has very strong impact on incidence of rural as well as total poverty. When both, per worker productivity in agriculture and in non agriculture sector are used in the same equation, former shows much stronger and significant impact while the effect of worker productivity in non agriculture sector turned out to be non significant.

Table 2: Estimates of effect of per capita income and land and labour productivity in agriculture and non agriculture sectors on rural and total poverty, in India

Particulars	Ln Rural poverty %				Ln Total poverty %			
	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4
Constant	16.75*	12.05*	11.65*	12.65*	17.34*	11.78*	12.76*	13.66*
	(2.27)	(2.30)	(1.96)	(3.52)	(2.13)	(2.41)	(1.80)	(3.46)
ln PCI (Rs)	-0.70*		-0.65*		-0.83*		-0.77*	
	(0.16)		(0.21)		(0.15)		(0.19)	
ln land productivity (Rs)	-0.53*	-0.56**			-0.47**	-0.53**		
	(0.17)	(0.21)			(0.16)	(0.22)		
ln agricultural worker productivity (Rs)		-0.23*	-0.15	-0.49*		-0.25*	-0.13	-0.52*
		(0.07)	(0.09)	(0.15)		(0.08)	(0.08)	(0.15)
ln non-agricultural worker productivity (Rs)				-0.32				-0.39
				(0.33)				(0.32)
F Statistics	19.56*	11.72*	13.26*	11.59*	26.01*	11.33*	19.28*	13.7*
R²	0.67	0.55	0.58	0.55	0.73	0.54	0.67	0.59
Number of states	22	22	22	22	22	22	22	22

Note : 1 * and ** shows that the coefficients are significant at 1 % and 5 % levels of significance.

2. Values in parenthesis are standard error of the respective coefficients.

The pathway to eradicate poverty and raise income of masses is through remunerative employment. However, employment is emerging as a most serious challenge of our time in developing as well as the developed countries. Technological innovations of various kind like robotics, machine learning, automation, AI etc. are favouring capital intensive production to the detriment of deployment of labour.

One may ask why a country doesn't encourage labour intensive production and discourage excessive capital intensity in industry through suitable incentive and policies. The difficulty of doing this follows from efficiency or competitiveness which cannot be ignored in a globalised world.

Given highly capital intensive nature of industry and fast emerging technological breakthroughs favouring labour displacing machines and methods, serious question arises, who will offer jobs to new entrants in labourforce that ought to move out of agriculture for better wages and income?

Sustainability and climate challenge are emerging as serious threat to survival of people and planet. Agriculture is major user of natural resources. Air, water and land are the three pillars of sustainability. According to official sources 80-90 per cent of total water used in India is used in agriculture sector. Global average is 70%. Still more than 50% area under cultivation is without irrigation. Because of common practice of flood irrigation, water use efficiency in the country is around 30-35%. Water intensive crops are being grown in low

rainfall areas and water intensive practices are spreading. As a consequence, groundwater resources are getting depleted in almost all the states in the country. Data from monitoring wells for groundwater level reported by Central Ground Water Board show a big decline in area with groundwater depth below 3 metres and 3-5 metres and a big increase in area with groundwater depth exceeding 10 metres below ground level between 1998 and 2018. Further, these changes are spread over all regions of the country though severity of change differs across regions.

Generally talked strategies of Rainwater harvesting in urban areas and recycling of urban water would be of little help in addressing future water demand. The real gain will come from efficient use of water in agriculture, and rain water harvesting and water conservation in agricultural land.

Almost half of the land in India is for agriculture uses (arable land). Therefore, the way agriculture is done, determines quality of soil and land resources. Very less area is available for ecological activities and functions. Meeting land requirement for non agricultural uses and addressing sustainable land use necessitate higher productivity in agriculture.

Green house gases emitted from agricultural activities are generally not visible. The emission results from application of organic and inorganic inputs to the soil for crop production, decomposition of biomass and dead plant residues, crop production, plant respiration, livestock rearing, uses of farm machinery, enteric fermentation in ruminants, manure handling, and burning of crop residues, land use changes. Agri share in global GHG emission is reported to be much higher than its share in global output and income. Three-fourth of this is due to methane produced from rice cultivation and livestock and the remaining 26% comes from nitrous oxide emitted from fertiliser.

It is evident from above that agriculture is central to climate change and clean air, and sustainable use of land and water. Agriculture is both part of the problem and part of the solution to climate change and sustainability. We must seize every opportunity to shift away from inefficient farm practices, towards long-term sustainability, efficiency and resilience. Among all sectors, agriculture offers the best hope for green growth that is environmentally sustainable.

Health and Nutrition

According to SOFI reports of Rome based UN Agencies the undernourishment, or hunger, in the world and in many countries has started showing increase after 2016-18. This is happening despite the fact that per capita food production has been moving on a rising trend in these years. The second issue raised recently by these agencies is that 42 per cent population of the world cannot afford healthy diets. The proportion exceeds 70% in large number of countries. This requires action at two levels. One, raise income of people, which

depends upon employment and wages. Two, lower cost of food especially healthy food through various kind of intervention in food system covering both cost of food production as well as cost of food marketing, transport, storage, distribution etc.

Consumers are increasingly becoming conscious about food quality and showing preference for food with specific attributes. The awareness about strong connect between food and health and immunity is spreading. This requires integrating demand with supply through well designed supply chains and direct linkages between producers and consumers. Similarly, food safety is also emerging as a major concern among consumers, with increasing reports of excessive and unsafe use of chemicals and hormones in crops, livestock and fish food and the presence of chemical residue in food. This requires the framing of rigorous regulations and their strict enforcement at both the production and post-harvest stages. New interest has emerged in the therapeutic values of food and its proper usage in order to maintain overall immunity and for good health. As a result, the demand for medicinal plants and varieties with specific attributes is on the rise. Some entrepreneurs are connecting consumers and producers through innovative value chains for the supply of such products. Large-scale supply of such products will require the creation of value chains with traceability and labelling. Overall, all these changes in food demand offers opportunity for new type of agriculture which can offer more attractive and more paying employment within agriculture.

Agri Focused Inclusive Development

Recent experience of a large number of emerging and fast growing economies clearly show that industry led structural changes in economy's output are inadequate to reduce disparity between per worker income in agriculture and non agriculture. Agriculture sector remain the largest employer of workforce despite fast increase in per capita income in transition and developing economies. This has serious implications for eradication of poverty and hunger, both of which are strongly affected by performance of agriculture sector.

The pathway to eradicate poverty and raise income of masses is through remunerative employment. However, technological innovations of various kind, like robotics, machine learning, automation, AI etc. etc. are favouring capital intensive production to the detriment of deployment of labour in industry and services sectors. Modern growth is dubbed as "jobless growth" by some experts as more and more machine and e-commerce are replacing human beings. There is also concern about shift in income and wealth share from bottom income classes to top income classes.

Given highly capital intensive nature of industry and fast emerging technological breakthroughs favouring labour displacing machines and methods, who will offer jobs to new entrants in labourforce and workforce that ought to move out of agriculture for better wages and income? Can we think of agriculture centric model of development and industrialisation,

which is more labour intensive, for future transformation of economies of developing countries. I think it is possible.

One way out is: think of two types of Industrialization, one for growth focusing on conventional industrial goods and second for employment, focusing on new activities in and around agriculture. This will require modernisation of agriculture from seed to sale and very close linkage between production and end use. On production side, this should include high tech, high productivity and knowledge and skill intensive farming. Further, there is tremendous scope for “on farm value addition”. Consumer preferences in food are shifting towards freshness, quality, safety, and attribute based products. Even in non food items, choices are shifting towards bios from synthetics and chemical products. A whole lot of farm level cottage industry can be developed to harness such opportunities.

The second route for agriculture led economic transformation may follow from Innovations in biotechnology. Advances in plant biotechnology are making it possible to produce customised products to meet health, pharmaceuticals and other needs and products with industrial, economic, pharmaceutical, nutritional and environmental importance. The counter to adverse effect of digital technology on jobs can come from plant biotechnology that lead to development of crops which will serve as factories for the synthesis of valuable metabolites and organic compounds.

To sum up: I feel the Context of Economic development has changed, as, employment, sustainability, environment services, poverty, nutrition and health have become the major concerns of our time. In this changed context, agriculture is seen to play much larger and different role, beyond serving as instrument for industrialisation. World Development Report 2008 has set the stage for new thinking on Prominent Role for Agriculture in the Development Agenda. This thinking was more clearly articulated in the 27th conference of ICAE as mentioned in the paper in journal Agricultural Economics by Prof Alain de Janvry:

“A new paradigm has started to emerge where agriculture is seen as having the capacity to help achieve several of the major dimensions of development, most particularly accelerating GDP growth at early stages of development, reducing poverty and vulnerability, narrowing rural-urban income disparities, releasing scarce resources such as water and land for use by other sectors, and delivering a multiplicity of environmental services”.

It is now for us to mainstream this new Paradigm under the title “Agriculture for Development” instead of “Agriculture for Industrialisation”.

Disclaimer

Views expressed in the paper are personal.

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