Food and Agriculture Organization of the United Nations

MSSRF
Science for Sustainable Development

FAMILY FARMING

Meeting the Zero Hunger Challenge

FOOD AND AGRICULTURE ORGANIZATION (FAO)
M.S. SWAMIINATHAN RESEARCH FOUNDATION (MSSRF)

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L. Vedavalli has a PhD in anthropology and her research interests cover various dimensions of development: social aspects of agrobiodiversity/ethnobotany; the status and role of women in household food security; status of girl child; displacement related to repatriation; labour relations in plantations; impact of information technology on village society. She has been a part of research and community based projects at the MSSRF since 1993. Currently, she is a consultant for the Information, Education and Communication Programme Area of the Foundation at Chennai.

Foreword

For generating interest on specific globally important issues, the United Nations (UN) has been designating each year this decade. Thus, 2013 was the International Year of Quinoa and this led to a wider understanding of the importance of this Latin American crop to nutrition security and climate change adaptation. 2014 was the International Year of Family Farming in order to stress upon the importance of family farming, which is both a way of life and a means to sustainable livelihood. Family farming, in addition, helps to conserve and enlarge genetic variability resulting from cultural, culinary and curative diversity. 2015 is the International Year of the Soil, again to emphasise the need for soil health enhancement and amelioration. 2016 will be the International Year of Pulses to stress upon the need for the increased production and consumption of pulses: this can help to overcome protein hunger, now affecting large sections of the populations in South Asia and Sub-Saharan Africa.

To commemorate the International Year of Family Farming, the M.S. Swaminathan Research Foundation (MSSRF), Chennai and the Food and Agriculture Organization of the United Nations (FAO) Regional Office for Asia and the Pacific, Bangkok, organised an Asia-Pacific Regional Consultation at Chennai in August 2014. Several background papers were prepared for discussion at the conference. The present publication brings together these background papers, which are rich in data and content on issues relating to family farming.

Family farming has multiple advantages. It provides opportunities for year-round employment to all members of the family. It provides food security for the family. In recent years, MSSRF has been

engaged in converting family farms into nutri-farms by introducing biofortified crops—crops which are rich in specific micro-nutrients like vitamin A-rich sweet potato and quality protein maize—in the farming system.

In addition to strengthening household food, nutrition and livelihood security, family farming helps to conserve agro-biodiversity. Unlike corporate farming based on mono-crops, family farming promotes the cultivation of a wide range of crop varieties. Seed production and storage also become a part of family farming culture. Thus, in the interest of sustainable agriculture, it is important that our heritage in family farming is not only preserved but is enriched through the introduction of new technologies. The papers in this book bring out clearly the role family farming has so far played in the evolution of agriculture. They also highlight gender roles in family farming and methods of mainstreaming nutrition in the design of family farming. Further, they indicate approaches to achieve an ever-green revolution, which can help to increase productivity in perpetuity without ecological harm.

We are grateful to Dr Ajay Parida, Executive Director, MSSRF, Ms R.V. Bhavani, Project Manager LANSA, MSSRF, and Mr Gerard Sylvester, Knowledge & Information Management Officer, FAO, for bringing out this volume which stands testimony to the agricultural genius of farm families. We thank Ms Gita Gopalkrishnan for meticulously editing the papers.

The book helps to remind ourselves that we live on this planet as guests of green plants, sunlight and farmers. They have made it possible to ensure food security for all and forever.

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T. HAQUE

Sustainability of Small Family Farms in Asia-Pacific Countries

Challenges and Opportunities

Introduction

The Food and Agriculture Organization of the United Nation (FAO) has declared 2014 as the year of family farming with the objective of inviting focused global action for improving the productivity and incomes of family farms in different countries. Family farming is a form of agricultural organisation in which labour and managerial skills in farming come mainly from members of the farm family. Family farming exists in both developed and developing countries. While the average size of family farms is relatively large in the developed countries of the West, small size family farms dominate in the Asia-Pacific region. Despite the fact that agriculture is no longer a profitable occupation for most farmers in the developing countries and that they suffer from various technological, institutional, capital and market constraints, small farming dominates as there is not much choice or opportunities outside agriculture. Farmers in general do not possess either necessary skills for gainful non-agricultural employment nor capital to take up non-farm enterprises. The much talked about rural industrialisation and service sector growth has not taken off due to several constraints. Under this circumstance, small family farming will stay for some decades to come. However, the key question is how small farms can become viable and sustainable in the face of various odds.

The main objectives of this paper are to analyse the nature of the emerging agrarian structure in the Asia-Pacific countries where family farming comprising small and marginal farmers, tenants

and women plays a dominant role in the agricultural sector and to identify the key challenges and opportunities for the viability and sustainability of small family farms.

An Overview of the Agrarian Structure and the Role of Small Family Farms

In Europe and North America, rapid industrialisation has pulled a substantial number of the agricultural workforce out of the sector, thereby increasing the size of farms. But this has been consistent with the continued dominance of family farming over corporate management (USDA, 2003). In 2002, only 2.6 per cent of the United States (US) workforce was in agriculture, and most US farms used mainly family labour. In France, 75 per cent of farmers are own account farmers, whose primary occupation is farming their own family land. In fact, in Europe, most farms below 30 ha and almost all below 5 ha get most of their labour from the farm family. This is also the case with larger farms, with the additional help of combines, computers and other hireable capital intensive farm services (Lipton, 2005). China and India are the two largest agricultural economies that together account for nearly 61 per cent of the world's agricultural workforce (40% China and 21% India). In China, almost all farms are small family farms, while in India, about 85 per cent are small family farms.

Nearly 85 per cent of the operational holdings in India are less than 2 ha in size, covering about 44.4 per cent of area (GoI, 2012). The large farms above 10 ha account for only 0.73 per cent of the total operational holdings, cultivating 10.91 per cent of the total area. In Nepal, 92 per cent operational holdings are of less than 2 ha with 69 per cent of the total area. The operational holdings above 5 ha share only 0.75 per cent of the total number of operational holdings and 7.3 per cent of the area. In Pakistan, farms above 5 ha account for 14.3 per cent of the total operational holdings, with 56.5 per cent of area. In China, about 98 per cent operational holdings are of less than 2 ha. In the Philippines, 69 per cent holdings are of less than 2 ha, while medium and large farms above 5 ha account for only 8.4 per cent of total farms with 42 per cent of the total area. Nearly 89 per cent holdings in Indonesia and 95 per cent in Vietnam are of

less than 2 ha, while in Thailand, 63.5 per cent holdings are of less than 3 ha.

Thus, small farms are the dominant players in agriculture in developing countries. The average size of holding in India is about 1.16 ha, while in countries like Bangladesh, Nepal, Sri Lanka, China, Japan and Indonesia, it is less than 1 ha. However, it is 2.01 ha in the Philippines, 3.16 ha in Thailand and 1.01 ha in Malaysia (Table 1.1).

Table 1.1

Average Size of Holdings and Percentage Share of Small Farms in Total Number and Area of Operational Holdings

Country	*Size Class*	*Size of Holding (ha)*	*% Share in*	
			Number of Holdings	*Area*
India, 2010-11	Total	1.16		
	Less than 2 ha.	0.60	84.98	44.32
Bangladesh, 2005	Total	0.35	-	-
Pakistan, 2000	Total	3.09		
	Less than 2 ha.	0.84	57.63	15.64
Nepal, 2002	Total	0.79		
	Less than 2 ha.	0.59	92.44	68.72
Sri Lanka, 2002	Total	0.47		
	Small holdings	0.06	45.25	5.36
Myanmar, 2003	Total	2.52		
	Less than 2 ha.	0.84	56.92	19.03
China, 1997	Total	0.67		
	Less than 2 ha.	-	97.91	
Philippines, 2002	Total	2.01		
	Less than 2 ha.	0.74	69.06	25.47
Indonesia, 2003	Total	0.79	-	-
	Less than 2 ha.	-	88.73	
Malaysia, 2005	All persons	1.01	-	-
Vietnam, 2001	Total	0.71		
	Less than 2 ha.	-	94.81	
Thailand, 2003	Total	3.16	-	-
	Less than 3.2 ha.	-	64.50	
Laos, PDR 1998-99	Total	1.57		
	Less than 2 ha.	0.91	73.50	42.82

Source: 2000 World Census of Agriculture (1996-2005), FAO Statistical Development Series-12, 2010.

In recent years, the share of agriculture in GDP (gross domestic product) declined substantially in almost all the developing countries, while the share in total employment dropped only marginally and consequently, agricultural income per worker is very low. The value added per worker from agriculture has grown not only slowly, but it is also much lower than non-agriculture work. According to FAO, nearly two-third of the developing world's three billion rural people live in smallholder households, many of which are poor, food insecure and malnourished and with limited access to inputs and markets (FAO, 2010). About 70 per cent of the world's poor people live in rural areas and the majority of them are small and marginal farmers, tenants and landless workers.

As of 2009-10, the share of agriculture in GDP was 10-20 per cent in India, China, Indonesia, Malaysia, the Philippines, Thailand, Vietnam, Bangladesh, Bhutan and Sri Lanka, while it was 21-30 per cent in Pakistan and Afghanistan and 31-42 per cent in Nepal and Cambodia. In countries like the US (1.2%), Japan (1.2%), the Republic of Korea (2.5%), Maldives (3.1%), the Russian Federation (4.0%), France (1.8%), Germany (0.9%), Netherlands (2.0%), Switzerland (1.1%) and Australia (2.3%), the range was 0.9-4 per cent only. However, agriculture's share in the total workforce was still high at 72 per cent in Cambodia, 52 per cent in Vietnam, 65 per cent in Bhutan and 51 per cent in India. It was 41.5 per cent in Thailand, 48.1 per cent in Bangladesh, 44.7 per cent in Pakistan, 32.6 per cent in Sri Lanka. 39.6 per cent in China, and 38.3 per cent in Indonesia and 35.2 per cent in the Philippines. In Japan, only 3.7 per cent and in the Republic of Korea, 6.6 per cent of the total labour force is engaged in agriculture. Even in Malaysia, only 13.5 per cent and Maldives, only 11.5 per cent of the labour force is employed in agriculture. In the developed countries like the US (1.6%), France (2.9%), Germany (1.6%), Australia (3.3%) and Canada (2.4%), a relatively very small percentage of the workforce is employed in agriculture.

No doubt, small and marginal farmers in countries like the Republic of Korea, Japan, China and Malaysia have significantly improved their incomes in recent years to overcome the poverty trap, but in other countries, especially in South Asia, the problem of small

farmers' poverty and low level equilibrium trap remains a cause for concern. Table 1.2 shows that the incidence of poverty continues to be high in several countries, including Bangladesh, India, Laos PDR, Pakistan and the Philippines.

Table 1.2

Poverty Head Count Ratio in Select Countries

Country	*Year*	*Poverty Head Count Ratio at National Poverty Line (% of Population)*
Bangladesh	2008	31.51
Bhutan	2010	23.2
Cambodia	2007	30.1
China	2004	2.8
India	2011	21.9
Indonesia	2011	12.5
Laos PDR	2008	27.6
Malaysia	2009	3.8
Maldives	-	-
Nepal	2011	25.2
Pakistan	2006	22.3
Philippines	2009	26.5
Sri Lanka	2010	8.9
Thailand	2010	7.75
Vietnam	2010	14.2

Source: Data Bank 2013, World Bank.

It would be further seen from Figure 1.1 as well as Table 1.3 that the agricultural value added per worker has been very low in countries like Bangladesh, Bhutan, Cambodia, China, Indonesia, India, Laos PDR, Sri Lanka, Nepal and Vietnam.

The annual growth rate of agricultural income per worker from 2000 to 2012 was negative in Bhutan (-3.41%) and quite low in Maldives (0.68%), Sri Lanka (1.94%), India (1.89%), Nepal (0.21%), Pakistan (0.0%) and the Philippines (1.92%). Conversely, in the Republic of Korea, not only was the agricultural income per worker high, but it also grew at a much faster rate (6.13%).

Figure 1.1

Agriculture Value Added Per Worker 2012
(Constant 2005 US$)

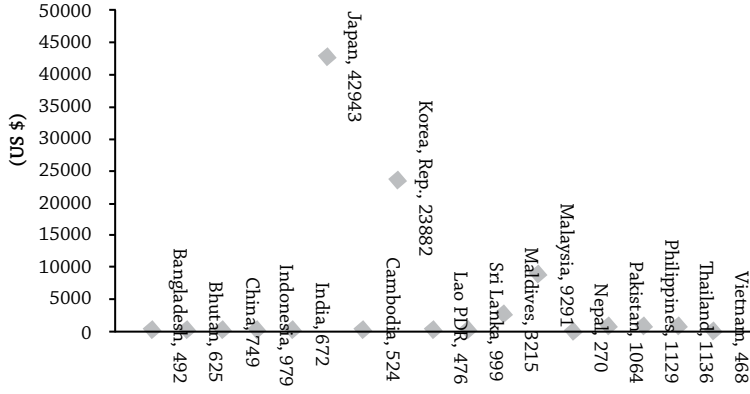

Table 1.3

Annual Growth Rate of Agriculture Value Added Per Worker
(Constant 2005 US$) (2000-2012)

Country	*2000*	*2012*	*CAGR (%)*
Bangladesh	324.2	491.9	3.26
Bhutan	947.3	624.9	-3.41
China	447.0	749.4	4.06
Indonesia	661.6	979.2	3.06
India	527.9	672.1	1.88
Japan	23812.9	42942.7	5.04
Cambodia	374.8	523.8	2.61
Republic Korea	11014.0	23882.3	6.13
Laos PDR	431.7	475.8	0.75
Sri Lanka	778.3	998.7	1.94
Maldives	2942.4	3215.3	0.68
Malaysia	5485.2	9290.5	4.14
Nepal	263.0	270.4	0.21
Pakistan	1063.7	1063.5	0.00
Philippines	881.9	1129.0	1.92
Thailand	802.8	1136.2	2.71
Vietnam	353.3	467.7	2.18
World	1065.6	1177.4	0.77

Source: National Account Files, World Bank.

It would be further seen from Table 1.4 that there is wide inter-country variation in crop yields per hectare. Countries like South Korea, Japan and China have comparatively much higher yields of crops than other countries, especially those in South Asia.

Table 1.4

Per Hectare Yields of Various Agricultural Food Commodities and Annual Growth Rates

Country	*Cereals*		*Pulses*		*Vegetables*		*Fruits*	
	Yield (kg/ha) 2012	*CAGR (2000-2012)*	*Yield (kg/ha) 2012*	*CAGR (2000-2012)*	*Yield (kg/ha) 2012*	*CAGR (2000-2012)*	*Yield (kg/ha) 2012*	*CAGR (2000-2012)*
Bangladesh	2980	1.29	1148	2.65	8012	2.88	801	1.31
Bhutan	2665	5.15	917	-2.24	2837	0.96	284	0.83
Cambodia	3178	4.22	1191	4.75	6542	-0.07	654	0.99
China	5839	1.70	1432	0.42	23348	1.44	2335	4.20
India	2954	2.04	642	0.00	14538	1.36	1454	0.31
Indonesia	5081	1.98	1154	2.33	9907	2.00	991	2.32
Japan	6134	2.06	2133	0.88	27940	-0.07	2794	-0.87
Laos PDR	4082	2.88	1023	-0.22	7499	0.65	750	3.63
Malaysia	3994	2.02	-	-	20423	2.73	2042	-3.66
Myanmar	3848	1.95	1408	5.78	14039	1.00	1404	1.28
Nepal	2719	1.40	956	1.22	13084	2.22	1308	0.65
Pakistan	2876	2.11	392	-1.28	12505	-0.62	1250	-0.45
Philippines	3493	2.40	811	0.50	8695	0.14	870	1.62
Republic of Korea	7271	1.23	1109	1.15	36176	2.57	3618	1.17
Sri Lanka	3843	1.18	1275	2.71	9998	3.19	1000	-1.19
Thailand	3097	0.65	960	1.29	7375	1.58	737	-0.89
Vietnam	5462	2.26	860	1.43	11128	-0.55	1113	2.31
Asia + (Total)	3865	1.92	827	0.64	20258	1.35	2026	2.08
World + (Total)	3619	1.63	900	0.60	19313	1.24	1931	1.47

Source: FAOSTAT, FAO.

In India, the share of family labour to total labour use has shown a mixed trend. In the case of rice which is a highly labour intensive crop, the share of family labour to total labour cost increased over time in the states of Bihar, Karnataka, Kerala and Tamil Nadu, while

it declined in Andhra Pradesh (AP), Assam, Chattisgarh, Haryana, Jharkhand, Madhya Pradesh (MP), Odisha, the Punjab and West Bengal. In physical terms, the use of labour per hectare from 2004-05 to 2010-11 showed declining trends in most of the Indian states, excepting Gujarat, Haryana, MP, Maharashtra and West Bengal. The annual growth rate in use of hired labour per hectare also declined in about 45 per cent of the states, while the growth rate of family labour use per hectare was negative in 15 out of 18 states for which data are available.

The key determinants of family labour use are availability of labour, wage rate, and the economic condition of farmers. The share

Table 1.5

Use of Family Labour as Percentage of Total Labour in Paddy Cultivation in India, 2010-11

States	*% Share of*	
	Labour Cost (per ha)	*Labour Hours Use (per ha)*
Andhra Pradesh	28.71	29.24
Assam	68.81	68.89
Bihar	43.64	41.72
Chhattisgarh	59.50	59.82
Gujarat	21.93	22.20
Haryana	35.91	35.66
Jharkhand	36.77	38.60
Karnataka	36.49	36.78
Kerala	15.54	13.27
Madhya Pradesh	47.50	47.32
Maharashtra	30.61	29.18
Odisha	44.10	45.33
The Punjab	31.24	30.54
Tamil Nadu	35.59	33.10
Uttar Pradesh	56.87	55.05
Uttarakhand	52.53	54.12
West Bengal	50.95	50.39

Source: Government of India, Directorate of Economics & Statistics, *Estimates of Cost of Cultivation/ Production & Related Data, 2011.*

of family labour to total operating cost ranged from 8.4 per cent in Kerala to 54.7 per cent in Himachal Pradesh (HP). It was above 20 per cent in West Bengal, Uttarakhand, Uttar Pradesh (UP), Odisha, MP, Jharkhand, Chhattisgarh, Assam, Bihar and HP. The share of family labour to total labour use was above 50 per cent in Assam, Chhattisgarh, UP and West Bengal (WB) and less than 30 per cent in AP, Gujarat, Maharashtra and Kerala (Table 1.5).

The data on cost of cultivation in a relatively underdeveloped region of Bihar show that both marginal and large farms use more family labour per hectare due to the availability of surplus family labour as well as high cost of hired labour, but in Punjab there is a clear inverse relationship between farm size and use of family labour. The marginal and small farms use more family labour per hectare as compared to medium and large farms.

Key Challenges

Overcoming Food Insecurity and Poverty

The average incomes of small family farms are lower than enterprises outside agriculture, due to the size, low crop yields, high input costs, low output prices and low access to off-farm and non-farm employment. Even though in some cases, land productivity of small family farms is higher than that of large commercial ones, the net farm incomes are lower as they are engaged mostly in the production of low-value subsistence crops. Many marginal and tenant farmers neither produce enough for home consumption nor earn enough to purchase food from the market. In India, those having less than 4 ha of land under average conditions do not earn enough to meet their consumption needs and overcome poverty (NSSO, 2003). In most cases, they are food insecure and caught in a poverty trap. Therefore, improving productivity and incomes and overcoming poverty by accessing appropriate technology, market, credit and other support services are challenges that require to be met with proper policy and governance systems in place.

Improving Market Orientation and Market Access

In most countries, the majority of small family farms produce mainly for self-consumption and sell only part of their produce. This helps them to ensure food security even in times of food price inflation. But they do not always produce enough of every food item to avoid dependence on the market. Also, farm income constitutes less than half of their total income. Small farmers' lack of market orientation and, in some cases, limited access to markets reduce the benefits that may arise from commercialisation. In fact, policies and strategies that link smallholders to markets or at least strengthen rural off-farm and non-farm employment opportunities are essential to take small farmers out of poverty and put them on the growth path. The existing agricultural marketing system in the developing countries suffers from several inadequacies and imperfections, such as an inadequate number of organised markets, poor facilities in markets and wide margins between what the farmers receive and what the consumers pay for most agri-products. In India, the government fixes minimum support prices for as many as 25 agricultural commodities, but, barring rice and wheat in some regions, there is no effective implementation of the support prices. The World Trade Organization (WTO) has also been questioning the market-distorting subsidy provided under the scheme. At the same time, alternative direct marketing or private markets for agri-products have not been adequately developed. Trade liberalisation in conjunction with urbanisation has no doubt resulted in increased private investment, both domestic and foreign, in food processing industries and has also vertically coordinated supply chains, involving explicit contracts between farmers and processors/traders. But small farmers face several constraints in this respect, as agro-food processing companies often prefer to enter into contractual arrangements with a few large farmers than with many small farmers for managerial efficiency. Tenant farmers' scope to benefit from contract farming is much more limited, as they do not have land in their names and also lack tenurial security in most cases. Besides, small farmers' participation in modern supermarkets requires greater managerial skills and an ability to ensure regular supply and to meet food safety and quality

standards. In some cases, small farmers operate in a group, which works better for both the farmers and the companies to enter into successful contractual arrangements. Moreover, farmers wishing to sell perishable products to export markets have to meet complex logistics as well as stringent food safety certification requirements. Such modern marketing systems impose a new range of conditions and challenges for small family farming. Quantity, quality and food safety requirements and timing conditions favour large-scale farms, which are able to meet these requirements. Besides, smallholders in remote areas fail to participate in markets due to high transportation costs. The private sector either does not source from them or requires high margins to cover its costs. Dispersed and inconsistent supply leads to high transaction costs for the processing farm, unless farmers aggregate their output by means of co-operatives, producer groups or even informal groups. Unless the scale of operations is large, the costs of transportation, marketing and also input purchases per unit of output for small family farms remain high. Further, when small farmers perceive that joining an agricultural value chain does not resolve pre-existing market risks or if it introduces new risks, they generally decline to participate.

In addition, small farmers' inadequate access to credit, storage, packing or processing facilities becomes a constraint to their market participation. Small farmers face difficulties in accessing credit as banks are often reluctant to lend due to poor collateral and lack of information. Small women farmers and tenant farmers face even greater disadvantages, as they have less access to land. Also, a minimum level of education and learning skills is crucial in complying with stringent requirements, such as meeting standards, obtaining certification and also in adopting modern technologies to improve quantity, quality and food safety, and reduce post-harvest losses. Besides, seasonal glut of food commodities in local markets leading to low prices and the high levels of post-harvest losses incapacitate smallholders, especially in the absence of rural food-processing enterprises. Processing of primary agricultural products can also offer livelihood opportunities for small farmers, provided market avenues are developed for the indigenous food commodities grown by them.

Moreover, providing timely and reliable market information to small family farms is essential for their market participation. The rapid expansion of cell phone usage in almost all developing countries by small farmers may be helpful in this regard.

Bridging the Yield Gaps

The gaps reflecting the difference between farmers' yields and technically potential yields are huge in most of the developing countries. In India, this is up to 200-300 per cent in some crops in some regions (Planning Commission, 2007). Even though in some cases, small family farms have significant advantages in terms of efficiency in the production of staple foods as well as vegetables that require transplanting multiple harvests by hand and for other products which require close attention, the production advantages get outweighed by diseconomies of scale in technology adoption and marketing. Bridging the yield gaps through appropriate extension, credit and other support services pose a challenge, as the public extension system has weakened in many places, while the private extension system has not developed. Besides, the public R&D (research and development) system has tended to concentrate on providing advice mainly on production issues, while the subjects of marketing, food safety, etc., have received low priority. This will require capacity building of extension staff and if necessary promotion of commercial extension services. The use of new technologies such as SRI, hybrid seeds, biotechnology, among others, can be expeditiously tapped through improvement in research extension linkages. Besides, genetic engineering holds enormous promise in developing crop varieties with a higher level of tolerance to pest and biotic as well as abiotic stresses and that can withstand drought, salinity, high temperatures, etc., along with improved nutritional quality by bio-fortification. But growing genetically modified crops is not yet a full proof technology in many developing countries, and there are some genuine concerns about their possible harmful effects on human and animal health and bio-safety, as well as with regard to their impact on the economic viability of small family farms. These need to be addressed through appropriate regulatory

and monitoring mechanisms. Also, there is no consensus among scientists about the possible beneficial as well as harmful effects of genetically modified crops.

Promoting Conservation Agriculture

The problem of soil degradation has engulfed a significant proportion of cropped area in many developing countries, causing a threat to sustainability of agriculture. Conservation agriculture which prevents soil degradation while increasing productivity offers a solution. But concerns have been raised as to the suitability of the technology for small farmers. Some of the concerns include the potential decline in yields because of poor adaptation of conservation agriculture, increased labour requirements when herbicides are not used, competing uses of crop residue as mulch for soil cover and livestock feed, and potential redistribution of farm labour, placing a higher demand on women's time (IFAD, 2011).

Lack of Quality Education and Skills Training for Farm Youth

Agriculture in developing countries remains no longer an attractive occupation for farm youth, as it requires hard labour without much income. At the same time, high-tech agriculture and agro-processing enterprises, which could be economically rewarding and attractive, require some level of education as well as skills training, which is largely absent among youth in most developing countries. This also disables them from trading in sophisticated chains and participation in markets.

Leveraging Greater Private Sector Participation in Value Chain Development

There is need for mechanisms that can promote the development of business activities by smallholders, reduce transaction costs and build trust between small farmers, traders and processors. Interventions may vary for different product chains, their level of development, the heterogeneity of small family farms and the constraints they face, as well as the capacity of the private sector to overcome these constraints. But currently, appropriate policy

framework is simply absent. Value chain development often implies identifying specific chains to support on the basis of likely benefits in terms of productivity, growth in marketable surplus, cash earnings, diversification and better labour market conditions. It is also necessary to develop smallholder capacity in domestic markets, as often the costs of compliance with standards for exports outweigh the benefits. Besides, some developing countries have shown hostile attitudes toward FDI (foreign direct investment), especially when it involves the acquisition of rights to land, water and other natural resources by foreign investors. In fact, there should be mechanisms to promote responsible FDI in agriculture to achieve higher productivity and sharing of benefits by all, including small and marginal farmers.

Improving Small Farmers' Access to Land

Access to adequate land is crucial for sustainable livelihoods of marginal and small farmers, as they fail to have adequate openings to non-farm employment opportunities for lack of education and skills. Leasing could be an option for improving their increased access to land. But this would require the lifting of legal restrictions on land leasing in many countries, including India. Also, legalisation of leasing along with security of tenure for the tenants would help improve their access to credit for investment in new technical inputs for productivity enhancement, apart from encouraging large farmers to lease out land and take up non-farm activities.

Providing Secure Land Rights to Women

Secure rights to land and property for women are fundamental to ensuring sustainable development. Agricultural production and food security increases when women are granted tenure security. According to FAO, if women had the same access to productive resources as men, they could increase yields on their farms by 20-30 per cent. These gains could lift some 100-150 million people out of hunger (FAO, 2011). However, there are legal as well as socio-cultural barriers to land and property rights of women, which have to be overcome through sustained awareness building and policy advocacy. The states of WB and Odisha in India have initiated schemes in

recent years for allocation of homestead plots in the name of either women only or jointly in the name of wife and husband. In WB, about 241,512 families have received land under the Micro Plot Distribution Scheme up to July 2014. The story of a woman beneficiary is briefly presented in Box 1.1.

Box 1.1

The Story of an Erstwhile Landless Woman in Kalna, Barddhaman District, West Bengal

Shubhankari Nag lived in a small rented shelter without any security, till recently. She received a 5 decimal plot of land under the Nijo-Griho Nijo-Bhumi (NGNB) Scheme of the Government of West Bengal on 27 March, 2012. She says: "I worked hard in the hope of enhancing my family's income, but options were few. Now after getting land and house from the government, things are changing. I have nurtured a small kitchen garden; fresh vegetables from my garden supplement our diet. I can even sell a portion to earn a little. I am also rearing cows. I now generate about ₹200 per month, which goes into supporting my children's education. I have never felt so happy before."

Source: Wings, Department of Land and Land Reforms, Government of West Bengal, 2012.

Organising Small Family Farms into Groups

Despite government and donor support, cooperatives and farmer associations have failed to play a significant role in linking their farmers to markets, although there are some positive experiences. There is need for professionally managed business organisations to improve the capacity of small farmers so as to participate in markets and organised supply chains. The government should act as a facilitator and can create forums for joint action. In India, the Kudambashree experience in Kerala in promoting joint liability groups to take up agricultural and non-agricultural enterprises on a viable basis with support from local self-government institutions and banks is an initiative on these lines.

Threat of Climate Change

Small family farms are presently ill equipped with knowledge and financial as well as human resources to meet the challenges of climate change. The support to agricultural practices that promote climate change adaptation would include designing financial mechanisms to offer incentives to small family farms for safeguarding ecosystem services such as watershed protection, carbon sequestration and the protection of biodiversity. The threats of climate change and degradation of natural resources that can alter the production system on which the livelihoods of small family farms depend are real. Adjustment to climate change may require new production patterns, adoption of new inputs with increased resilience to drought and floods and making wider use of intensive agro-ecology techniques such as conservation agriculture. Small family farms may be unable to adjust to the changed environment because of the lack of adequate human and financial resources as well as information. Therefore it would be essential to develop mechanisms to regulate and generate rewards for suitable agricultural practices, including payments to farmers for ecosystem services or higher prices for agricultural products that meet certification standards (Beddington et al., 2012).

Improving the Capital Base

Low value productivity as well as the low productive capital base of small family farms act as constraints to their viability. In the past few decades, there has been a decline in the provision of agricultural finance for small farmers by government, even though cooperatives, micro-finance institutions and contract farming arrangements have tried to fill the gaps to some extent. Therefore, a clear policy decision to improve smallholders' access to production finance by way of low rates of interest and simplification of borrowing procedures, including using savings as collateral of membership in farmers' groups as a guarantee, needs to be taken.

Promoting Diversified Rural Growth

Promotion of off-farm and non-farm rural employment opportunities is important for sustainable food security and poverty

alleviation of small family farms. At least one adult member of a farm family should be trained and supported to take up employment outside agriculture. Also, diversified agricultural growth is necessary to meet the growing demand for fruits, vegetables, milk, fish, meat, eggs and processed foods. However, this will require improvement in rural infrastructure, such as road and rail connectivity, development of physical markets, power, irrigation, storage and communication facilities, which will encourage private entrepreneurs to invest in off-farm and non-farm enterprises and the farmers to put money in new technical inputs for productivity growth.

Increasing Investment in Irrigation and Watershed Development

Rainfed areas constitute a substantial proportion of the total cultivated area in most of the developing countries. Also, the yield gaps between irrigated and rainfed areas are significant. Increasing investment in irrigation and watershed development would be necessary to improve crop productivity and quality of crop produce. As water resources are scarce in relation to demand, there is need for managing the available water resources optimally, in an efficient, equitable and sustainable manner. The objective should be to raise maximum output per unit of water rather than output per unit of land or to diversify in favour of low water consuming, high value crops. It may be necessary, too, to invest more in efficient irrigation technologies such as sprinkler and drip systems, especially for high value crops. Besides, shortening the length of the irrigation furrow could raise field level irrigation efficiencies by up to 10 per cent. Availability of water can be increased for both drinking and irrigation purposes through rainwater harvesting, check dams, renovation of ponds/tanks, de-siltation of rivers and also creation of new water retention structures.

Managing Yield and Price Risks through Insurance

Agricultural production in developing countries is associated with various types of risks, the major ones being variabilities in crop yields and incomes due to the erratic behaviour of the weather and prices. In most cases, the existing agricultural insurance schemes suffer

from several inadequacies and weaknesses. These schemes have to be redesigned to make them more small farmer friendly.

Opportunities

Huge Untapped Yield Potentials

In most of the developing countries, there are huge yield gaps, reflecting the difference between farmers' yields and technically potential yields. These are estimated to range from 11 per cent in East Asia to 76 per cent in sub-Saharan Africa (FAO, 2011). In the case of India, the yield gaps are as large as 200 per cent for sorghum in Karnataka and 300 per cent for maize in Assam (Planning Commission, 2007). Globally there are about 500 small family farms, 56 per cent of which are in China and India (Hazell et al., 2007). Reducing the yield gaps could offer high returns in terms of food security, nutrition and income gains. Further, closing the gender productivity gap on small family farms could raise output in developing countries by 2.5-4.0 per cent, leading to a reduction of 12-17.5 per cent in the number of undernourished globally (FAO, 2011). Closing the gender gap, however, would require improvement in rural women's access to land, credit technology and other resources.

Lower Labour-Related Transaction Costs

Small family farms generally have lower labour-related transaction costs, as they use more family labour which is motivated to work more and hired workers are also supervised more closely. Small farms have advantages in developing countries which have low capital and scarce land per worker, while large farms have advantages in developed countries with higher savings, capital and larger agricultural land per worker (Lipton, 2005).

Higher Production Efficiency

There is research evidence to suggest that output per unit of area is higher in small family farms, as compared to that in large farms (Fan and Chan-Kang, 2005). Small farms have significant advantages in terms of efficiency in the production of foodgrains as well as

vegetables which require more intensive use of labour. In India, small and marginal farmers contribute nearly 52 per cent of total cereal production, 70 per cent of the total production of vegetables and 55 per cent of fruits against their share of 44 per cent in land area (Birthal et al., 2011). This is because small family farms use land, labour and other inputs more intensively. What is needed is improvement in their market access and market orientation by way of farm producers' organisations, autonomous cooperatives, contract farming, etc.

Rising Private Investment in Agricultural Infrastructure

In countries like China and South Korea, private investment in agricultural infrastructure, including rural road connectivity, banks, markets, power, cold storages, godowns, etc., has helped to a great extent in modernising smallholder agriculture. The process has been slow in most other countries. Therefore, there is opportunity to benefit from private investment by way of creating enabling environments for the development of the overall agri-business. This will not only help improve agricultural productivity, but also increase farmers' access to off-farm and non-farm employment.

Role of Biotechnology

Biotechnology holds tremendous potential to improve farm productivity under varying agro-climatic situations. The term biotechnology is generally used to denote genetic modification. But there are other important aspects of it such as micro propagation, tissue culture, cloning, artificial insemination, embryo transfer and other technologies, the use of which can help revolutionise agricultural output. In India, Bt cotton has significantly improved the yields and incomes of cotton growers in almost all parts of the country, including that of small and marginal farmers. However, there are concerns of possible harmful effects of some GM (genetically modified) crops on human and animal health; hence, issues of bio-safety as well as economic viability of small and marginal farmers should be addressed through appropriate regulatory and monitoring mechanisms.

New Institutional Arrangements

In India as well as in other neighbouring countries, some institutional innovations in the recent past have helped improve productivity and incomes of small family farms. These include participatory or community management of irrigation water, establishment of small agricultural producers' organisations, establishment of supermarkets, value chains, etc., womens' collectives and contract farming. The community-managed Sustainable Agriculture Programme in Andhra Pradesh and Kudumbashree in Kerala are examples of how institutional innovations can help reduce poverty of women farmers and other workers, through self-help and other group approaches.

Globalisation

Trade liberalistion and globalisation have presented challenges as well as opportunities for small family farms in the developing countries. With proper market orientation and institutional innovations along with appropriate policy support, small farmers can benefit from global trade.

However, currently there is no level playing field. Agriculture is highly subsidised in the developed countries of the West and in countries like Japan and China, while the subsidy provided to agriculture in developing countries, including India, is negligible and also not WTO-compatible beyond a point. Therefore, subsidies that distort market economics and result in resource use inefficiency and environment degradation should be reduced so that more resources could be made available to support critical, albeit WTO-permissible services such as infrastructure development, agricultural insurance, research and extension, pest and disease control, and marketing and promotion services.

Second, in the post-Doha round discussions, in which there is currently not much progress, the developed countries' main concern is to have increased market access in developing countries through tariff reduction. It may be mentioned in this context that the Government of India has recently reduced the import duty levels of various agricultural commodities significantly. In most cases, it is

either zero or negligible. So the main fear is that in the next round of official WTO negotiations, these low import duty levels may be the bound rates which, if accepted, would open a floodgate of imports of agricultural commodities, thereby threatening the livelihood security of millions of farmers in the country. Therefore, it would be important to maintain import duties at reasonable levels.

Third, differential food safety standards followed in different countries and poor quality regimes in countries like India attract imports from abroad, while India's agricultural products may fail to access adequate export markets due to the sanitary and phytosanitary regulations laid down in other countries. Hence, it would be of utmost importance to create awareness among farmers and other stakeholders on various food safety standards.

Fourth, the Government of India, in consultation with various state governments should identify the products which are critical from the viewpoint of food and livelihood security, so that India may not be forced to resort to tariff cuts across the board for all agricultural commodities, as there would be flexibilities in terms of tariff cuts in case of such special products to developing countries. Besides, various policy flexibilities and safeguard provisions should be incorporated in all FTAs (free trade agreements) which have been signed or being considered.

Finally, India and other developing countries must give up makeshift decisions in agricultural export policy and should ensure that there is no frequent ban or restriction on the exports of those agricultural commodities which have export potential, based on sound economic logic. Adhoc decisions taken from time to time in recent years have in fact been counterproductive, from the point of view of farmers as well as overall economic development.

Conclusions

To conclude, there are numerous challenges and opportunities for small family farms in developing Asia-Pacific countries. However, many of these challenges can be converted into opportunities, provided there are appropriate policies to support small family farms in an integrated manner. These should be:

- To improve market orientation and market access of small and marginal farmers
- To increase crop and livestock productivity through appropriate technological and market interventions.
- To provide education and skills training to farm youth in high-tech and high value agriculture to incentivise private sector participation in value chain development.
- To organise small family farms into groups such as producer companies, autonomous co-operatives, etc.
- To improve small farmers' credit access.
- To ensure tenurial security for tenant farmers.
- To provide secure and effective land and property rights to women.
- To increase public and private investment in rural infrastructure.
- To promote diversified rural growth through integrated support for increasing overall incomes of small family farms.

Small family farms can help improve agricultural productivity and food security in a sustainable manner. However, they would require integrated policy support to become economically viable and ecologically more responsible.

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AMIT MITRA and NITYA RAO

Families, Farms and Changing Gender Relations in Asia

Introduction

The Food and Agriculture Organization of the United Nations (FAO) declared 2014 the International Year of Family Farming to raise the profile of family farming and smallholder farming by focusing world attention on its significant role in eradicating hunger and poverty, providing food security and nutrition, improving livelihoods, managing natural resources, protecting the environment, and achieving sustainable development, in particular in rural areas.

Such an explicit link is rarely made between smallholders or small-scale farming and family production, even when the agricultural policy focus is on subsistence production and/or household consumption. As a policy declaration, this bold move seeks to focus agricultural research and development on the people involved, to enhance their commitment to agriculture, food production and food security, and care of the environment.

This paper explores the implications of this move for women and men in the Asia-Pacific region. Lessons are sought to be derived from the existing literature and experiences of policies focused on farm families, their farming activities and their links with broader political and economic processes. Attempts are made to analyse the impacts of the changing political, economic and social contexts, alongside shifting policy regimes and priorities on the aspirations and practices of men and women in farm families across the region.

Understanding "Small" Family Farms

In the literature, small farms, also known as family farms, have been variously defined. The most common measure is farm size: small farms are defined as those with less than 2 ha of crop land (Thapa and Gaiha, 2011; World Bank, 2003). Others describe small farms as those depending on household members for most of the labour or those with a subsistence orientation, where the farm primarily produces the bulk of the household's staple food consumption (Hazell et al., 2007). Some define small farms as those with a low asset base and limited resource endowments, including land, capital, skills and labour (Dixon et al., 2003).

While all these characteristics prevail to some extent, depending on the context, a certain synonymy seems to exist, perhaps due to the classification according to the size of the holding, between plot size of the agricultural land and the idea of a 'farm'. This distinction is critical not only because of the implications for gender relationships, but also because some important issues are missed out. First, the way a farm is characterised seems to imply a consolidated and contiguous plot of cropland. In many parts of Asia, especially South Asia, farmers might hold several small plots that may or may not be contiguous or in the same village. Second, the homogenisation implicit in characterising farms according to size hides the fact of differential yields due to variations in agro-climatic settings, irrigation status, rainfall and temperature regimes, slope, soil conditions, and so on. Often variations are explained by differences in family size and inputs. However, the yield of a small farm in, say, a desert is different from wet-land paddy fields due to different agro-climatic settings that need to be considered.

Third, while a 'farm' is typically imagined as a mix of croplands and water bodies as well as grazing land and livestock—in fact, a 'farm' can be said to be a micro-ecosystem, a way of life contributing to livelihoods—this is not the reality for a majority of family farmers in Asia, given their small plot sizes. These small plots are, however, situated within the larger village ecosystem, including both community common property resources as well as people without operational landholdings, yet comprising an important part

of the rural economy and society. Conceptually then, rather than understanding a family farm as an individual holding with a discrete set of activities, it needs to be seen as part of a larger ecosystem with interdependent relationships.

Given both the individualisation of the farm and its association with crop production, a farmer is mostly viewed in the literature as an agriculturist who cultivates crops on land owned or leased from others. However, based on a more comprehensive view of agriculture, a holistic conceptualisation of a farmer would enable a better understanding of the role of small farmers in the Asia-Pacific region. The Indian National Policy for Farmers, 2007,[1] defines the term 'farmer' as:

> Any person actively engaged in the economic and/or livelihood activity of growing crops and producing other primary agricultural commodities and will include all agricultural operational holders, cultivators, agricultural labourers, sharecroppers, tenants, poultry and livestock rearers, fishers, beekeepers, gardeners, pastoralists, non-corporate planters and planting labourers, as well as persons engaged in various farming-related occupations such as sericulture, vermiculture, and agro-forestry.

The Women Farmers' Entitlement Bill, 2011,[2] extended this definition of 'farmer' to explicitly include any woman, irrespective of marital status or ownership of land, who lives in a rural area and is engaged in any agricultural activity, as defined above. As shall be discussed in subsequent sections, the definition of a farmer is crucial for better understanding of gender relations in agriculture in the region.

Prevalence of Small Holdings

Sixty (60) per cent of the world's population and 57 per cent of the poor live in Asia's 48 countries. They have only 30 per cent of

1. *http://agricoop.nic.in/npf/npff2007.pdf*
2. *https://kractivist.wordpress.com/2012/06/20/the-women-farmers-entitlements-bill-2011/*

the world's arable land.[3] Asia's agriculture is dominated by highly productive smallholder cultivators, an estimated 87 per cent of the world's 500 million small farms, from 81 per cent in India to 95 per cent in China and 96 per cent in Bangladesh. The average size of household landholdings is between 1-2 acres,[4] from only 0.5 ha in Bangladesh, to 0.8 ha in Nepal and Sri Lanka and 1.4 ha in India. Pakistan, with a relatively high concentration of large landholdings, is an exception.

Table 2.1

Changes in Farm Size for Selected Countries

Country	*Changes in farm size*	
China	0.56 ha in 1980	04 ha in 1990 (Fan and Chan-Kang, 2003)
Pakistan	5.3 ha in 1971-73	3.1 ha in 2000
Philippines	3.6 ha in 1971	2 ha in 1991 (Nagayets, 2005)
India	2.2 ha in 1950	1.33 in 2000 (GoI, 2008)
Bangladesh	1.4 ha in 1977	0.6 ha in 1996

Source: Thapa and Gaiha (2011).

The Gini coefficient in land distribution is declining in India, but increasing in Bangladesh, Pakistan and Thailand. In many Asian and the Pacific countries, unequal land access is perpetuated through social mechanisms that leave many households belonging to indigenous peoples or ethnic minorities without access to land or with plots too small for their needs (Thapa and Gaiha, 2011: 6).

3. India, China and Indonesia are all part of the E9 or most populous countries in the world, accounting for 40 per cent of the world's population *(http://www.internetworldstats.com/stats8.htm)*. South Asia accounts for 43.5 per cent of people living below the poverty line, and China and rest of Asia accounts for 57 per cent of the world's poor *(http://siteresources.worldbank.org/INTPOVERTY/Images/PovTrends_large4.gif)*.

4. China has an individual land allocation of 2-2.5 mu (one-third acre), 70 per cent of rural households in India are small or marginal farmers (1-2 ha), with an average area operated per holding in 2002-03 as 1.06 ha compared to 1.34 ha during 1991-92 and 1.67 ha in 1981-82 (NSSO, 2006). Some aspects of operational landholdings in India, 2002-03 *(http://www.mospi.gov.in/nss_press_note_492.htm)*. In Indonesia, the average size of landholding is 1.05 ha, with 50 per cent of farm households operating in less than half a hectare *(http://www.agnet.org/library/eb/344c/)/*

Highlighting the important role of agriculture in the development of Asian economies, Briones and Felipe (2013: 1) identified five aspects of agriculture and structural transformation in Asia:

a. Agriculture's output share is declining faster than that of employment. Agriculture is the largest employer in developing Asia but not the largest sector in any Asian country by GDP (gross domestic product). This mismatch contributes to higher poverty levels amongst the agriculture-dependent populations.
b. Asian agricultural labour productivity has grown faster than in other developing regions.
c. Land productivity in Asia has grown faster than in other developing regions.
d. Technological changes in agriculture since the 1960s have significantly improved traditional crop yields.
e. The composition of agricultural output of developing Asia has shifted from traditional to high-value products.

Within these overall changes, there are major inter-regional and inter-country variations. Aided by technological changes, both land and labour productivity in agriculture have improved. The past two decades have, however, witnessed declining terms of trade for agricultural commodities, negatively affecting prices and earnings. Industry and services have done better in comparison to agriculture. Hence despite reasonable productivity, surpluses are low and poverty levels remain high in agriculture. *The World Development Report 2008* (World Bank 2007: 5, Table 1) presents a rural poverty rate of 51 per cent in agriculture-based countries *versus* 13 per cent in urbanised countries in 2002. Households in Asia are therefore diversifying into non-farm work in order to improve the quality of their lives. Agriculture, in turn, is increasingly being viewed as a subsistence sector, 'feminised' and devalued.

These transformations have been accompanied by significant socio-economic changes, including in gender relations and family structures. The region faces major challenges that have a bearing on small holder agriculture. Some of these are discussed below.

Challenges Confronting Family Farms in Asia

Urbanisation

Asian cities are growing rapidly. In 2012, the Asian Development Bank (ADB) predicted "another 1.1 billion people will live in the region's cities in the next 20 years. By 2030, more than 55 per cent of the population of Asia will be urban."[5]

Rapid growth of the urban population is undoubtedly one of the key processes affecting Asian development in the 21st century (Kundu, 2011). In 2010, the Asia-Pacific region's urban population was 754 million, more than the combined population of the United States of America (USA) and the European Union (EU). However, dimensions, characteristics and significance of the urban population growth vary across countries. While the Pacific has more than 70 per cent urban population (mainly driven by Australia and New Zealand with urbanisation rates above 85%), in South and Southwest Asia only 34 per cent of the population live in urban areas. Seven of the 10 most populous cities of the world are in this region.[6] Internal migration from the rural areas is the main factor behind this urban growth (ESCAP, 2013). Such migration is driven by multiple factors, including climate change, growing operational costs in agriculture, dwindling market prices of farm products, lack of non-agricultural employment opportunities as well as higher aspirations of the youth (Thapa et al., 2010), all though once again causalities vary by country, location, state priorities and cultures.

The expansion of urban areas inevitably covers some productive agricultural land. Changes in land prices and land markets around cities, or what are called the peri-urban areas, often lead to land being left fallow as the owners anticipate the gains they will make from selling or using it for non-agricultural purposes (Satterthwaite et al., 2010). In most urban areas of low and middle income countries,

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5. (*http://www.adb.org/features/12-things-know-2012-urbanization-asia*)

6. These are Tokyo, Delhi, Shanghai, Mumbai, Beijing, Dhaka and Kolkata. (*http://www.adb.org/features/12-things-know-2012-urbanization-asia*)

including those of Asia, the absence of any land use plan or strategic planning framework to guide land use changes leads to haphazard urban expansion. This expansion is determined by where different households, enterprises and public sector activities locate and build, legally or illegally. In most instances, there is little effective control over land-use conversions from agriculture to non-agricultural uses (Satterthwaite et al., 2010). Regulations to limit these are bypassed or simply ignored by politicians, real estate interests and land-sharks (Hardoy et al., 2001; Mitra et al., 2015).

This unregulated physical expansion brings many serious consequences. These include the segregation of low-income groups in illegal settlements on the worst located and the most hazardous sites (they would not be permitted to settle on better located and safer sites), and a patchwork of high and low-density land uses to which it is both expensive and difficult to provide infrastructure and services (Satterthwaite et al., 2010; Mitra et al., 2015). Further, crucial waterbodies are destroyed, often due to dumping of urban solid wastes and sewage, adversely impacting people's health and reducing water availability for both irrigation and domestic use. Fish and other aquatic animals that provide protein to the people dwindle in supply. Additionally, the common property lands that provide fuel as well as grazing grounds for livestock are often usurped for urban construction, impacting agriculture and rural livelihoods (Mitra, 2010; Mitra et al., 2015; Marshall et al., 2009; Narain, 2010). Needless to say, the end result is disastrous for both agriculture and the communities involved.

Climate Change

According to the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report, the severest climate impacts in terms of number of people and volume of economic assets affected will be felt in Asia and the Pacific. These include significant temperature increases, changing rainfall patterns, greater monsoon variability, sealevel rise, floods, and more intense tropical cyclones (Cruz et al., 2007).

The Asia-Pacific region is particularly vulnerable because of its already high degree of exposure to environmental risks, high population density (particularly along the coasts), and high vulnerability of particular social or economic groups (ADB, 2011: 2). Large numbers of people are displaced annually by floods, droughts, soil degradation, typhoons and cyclones. Poor people suffer a disproportionate share of deaths and displacement and damage associated with such events. Forced by poverty to inhabit the low-lying coastal deltas, river banks, flood plains, steep slopes, and degraded urban environments where the impact is most severe, they often cannot rebuild their lives when their homes and communities are battered by extreme weather (ADB, 2011: 2). Climate change will further accentuate the vulnerability of the poor.

Within Asia and the Pacific, climate change is expected to take the heaviest toll on the Pacific, South Asia and Southeast Asia. The 2011 Vulnerability Index of the risk advisory firm Maplecroft shows that Asian and Pacific countries represent 6 out of the 10 most vulnerable countries worldwide, all ranked as countries at extreme risk. Bangladesh tops the list, followed by India (2nd), Nepal (4th), the Philippines (6th), Afghanistan (8th) and Myanmar (10th). More than 60 per cent of the region's population work in agriculture, fisheries, and forestry—the sectors most at risk from climate change. Climate change will cut agricultural crop yields and hike food prices—every 10 per cent rise will push another 64 million Asians into poverty.[7]

Migration

About 80 million of the estimated 200 million international migrants worldwide live in Asia and the Pacific. The Chinese diaspora globally is estimated at 40-50 million, while 20 million Indians live outside India (Wihtol de Wenden, 2009). Important migration flows with the rest of the world and increasing mobility between Asian countries co-exist in the region.

Within Asia, Indonesia, the Philippines and Sri Lanka are the main countries of origin for migrants, while Brunei Darussalam,

7. *(http://www.adb.org/themes/climate-change/facts-figures)*

Japan, Republic of Korea, Singapore, Taipei, China and Thailand are key destinations. While there are no official figures, it appears that internal migration, especially from rural to urban areas, has been increasing (ADB, 2011: 2). A substantial part of the growing rural-urban migration in the Asian countries is due to the loss of profitability of the "otherwise crowded and non-viable agriculture as well as the non-availability of employment opportunities in rural areas" (Thapa and Gaiha, 2011).

Migration behaviours are likely to be influenced by a wide variety of transformations, ranging from climate change to cheaper travel and public policies that encourage migration. According to the ADB, in 2009, 13.2 million people were displaced by sudden onset of climate-related and extreme weather events in Asia. The corresponding figures in 2010 and 2011 were 31. 8 million and 10.7 million people, respectively (ADB, 2011: 2-3).

Decline of Ecosystems and Ecosystem Services

Agricultural production and rural livelihoods are deeply embedded in ecosystems and the services they provide. According to the Millennium Assessment (MA), these include:

- *Supporting services*: 'that are necessary for the production of all other ecosystem services', such as nutrient dispersal and cycling, seed dispersal, and primary production;
- *Provisioning services*: 'products obtained from the ecosystems' such as food, fuel and water, fodder, fibres, genetic resources, medicines, health care, energy, and ornamental products;
- *Regulating services*: 'benefits obtained from the regulation of ecosystem processes' such as carbon sequestration and climate regulation, waste decomposition and detoxification, water and air purification, natural hazard mitigation, pest and disease control, and erosion control; and
- *Cultural services*: 'non-material benefits people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation, and aesthetic experiences' (Millenium Ecosystem Assessment, 2005: 40).

These ecosystem services also potentially build resilience to climate change (Mitra et al., 2015). Not only do these services ensure the well-being of people, they also ensure that they do not migrate in hordes to the city/other rural areas as "foot-loose" labour (Breman, 1996).

> Human well-being has multiple constituents: including the basic material for a good life, such as secure and adequate livelihoods, enough food at all times, shelter, clothing, and access to goods; health, including feeling well and having a healthy physical environment, such as clean air and access to clean water; good social relations, including social cohesion, mutual respect, and the ability to help others and provide for children; security, including secure access to natural and other resources, personal safety, and security from natural and human-made disasters; and freedom of choice and action, including the opportunity to achieve what an individual values doing and being (MA, 2005: v).

People are an integral part of ecosystems. A dynamic interaction exists between them and other parts of ecosystems, with the changing human condition both directly and indirectly driving changes in ecosystems and thereby causing changes in human well-being (see MA, 2005: Figure B). Alongside natural forces, several social, economic, and cultural factors unrelated to ecosystems also alter the human condition (MA, 2005).

The rapid changes in Asia (land and water degradation, loss of biodiversity, high urbanisation, migration and climate change) are fast destroying the ecosystems, leading to the breakdown of ecosystem services, impacting adversely the landless, small and marginal farmers, and women more than men. This is because in the absence of rights to land, women in particular depend vitally on the ecosystem services for survival. It is only when people are rooted in their original habitat, but with access to their development rights as well as basic needs, that they are able to preserve the ecosystem, so vital to their own well-being as well as that of the ecosystem (Mitra et al., 2015).

Gendered Impact of the Challenges Confronting Asian Agriculture

The rapid migration from rural to urban areas, induced by multiple factors including urbanisation, industrialisation and growth of the service sector, as also climate change as well as declining share of agriculture in the GDP, have led to two major trends in agricultural employment in Asia. First, there is a growing feminisation in several countries. Thus, South and Central Asia are witnessing widespread male migration, often as climate refugees to urban centres or just in search of non-farm employment, leaving behind women in the rural areas. In South Asia, 60 per cent of all economically active women are engaged in agriculture (FAO, 2011: 106). Second, in Southeast Asia, there is increasing female migration for domestic work and provision of other services, leading to an overall decline in interest in smallholder production. While women's share in the labour force has remained stable at 41 per cent, the proportion of women engaged in agriculture declined from 64 per cent to 48.5 per cent between 1980 and 2010 (FAO, 2011: 106). Land here is increasingly being taken over by capitalist investors for large-scale, mono-cropped, commercial production.

Such changes in patterns of employment have led to a growing share of the elderly in the farming population. For instance in China, all young people are moving to urban areas, leaving many rural sites with households consisting of grandparents and grandchildren (Murphy, 2008). In Malaysia, the state tried to entice young women to stay in the rural areas, offering them a larger share of land; yet, given the devaluation of agriculture and farming within state policies, young women prefer to work in modern "factory" jobs (Stivens et al., 1994). This is a serious "demographic dilemma" confronting Asian agriculture.

With such increases in female-headed or old-people-headed households in rural areas, not only is the notion of the family itself changing (including staying together in one locale), but labour and market relations as well as agrarian enterprises are getting transformed. Crop choices and mixes, rights and access to resources are changing. Under these circumstances, a fresh paradigm to analyse

gender relations becomes crucial in sustaining agriculture and family farms.

Globalisation, integrated value chains, rapid technological and institutional innovations, as also environmental constraints have rapidly changed the role of agriculture in the development process. As Byerlee et al. (2009) argue, it is time to move out of treating agriculture as the handmaiden of industrialisation. The sheer size of the agricultural sector with an estimated 2.5 billion persons dependent on this activity, with three-quarter of all poor people living in rural areas, and with agriculture as the largest user of natural resources, the realisation of the global development agenda will not be possible without explicitly focusing on the role of agriculture for development, rather than in industrialisation.

Taking a cue from the above, we argue that it is time to focus on gender equality and the centrality of women in agriculture within a context of changing rural livelihoods. Universally, patriarchy has thrived by undervaluing, undermining and invisibilising women's labour, manifested in the differential returns, both material and symbolic, for the work performed by men and women. Women's reproductive economy is not recognised. What is needed now is to contextualise gender relations within agrarian livelihoods resulting from different climatic and agro-ecological conditions on the one hand and the specific socio-cultural context on the other. It is also important to capture changes over time—for an individual through the life-course, and for the community as a whole. This would require a new understanding of agency, moving beyond notions of resistance to creative strategies for managing and maintaining the household across time and space, including recognising women's managerial and entrepreneurial roles in smallholder agriculture across Asia.

Methodology and Structure

This paper is based on a review of key literature from the Asia-Pacific region. Given the diversity of the region and the inter-disciplinarity of the subject, various search engines on the internet were used to search for relevant papers using keywords such as agricultural, agrarian, gender, nutrition, women's work and so on.

At a second stage, in order to enhance depth, detailed searches were conducted for 10 countries, from different sub-regions of Asia and the Pacific. While enhancing insight into the processes at work, this has contributed to a robust analysis.

Having set out the conceptual understanding of family farms and the challenges they confront in the present context, the next section explores in greater depth the nature and processes of structural change taking place in the region. This includes changes in the agrarian structure, in state policies, and in market and price mechanisms. It brings to light the diversity of transformations in the Asia-Pacific region, along with the nature of agricultural workforce, mechanisation and trade liberalisation having different consequences on differently-positioned people across diverse agro-ecological contexts.

The third section focuses particularly on social institutions of the household, community, markets and the state, and how the rules and norms in each of these institutions interact to shape gendered outcomes. Women's lack of access to land often becomes a barrier to recognising their contributions toward labour, knowledge and the management of resources. Constraints are sometimes imposed by social institutions, rather than emerging from women's gendered location. Intra-household relations are fluid, and geared towards shared interests, not only conflicts. This is particularly the case in a context of uncertainty and insecurity. While consumption priorities have largely been controlled by men, the position is shifting: women in Southeast Asia have always been managers of household finances, and even in South Asia, women's control over certain domains of decision-making, such as education and health of the children, is relatively strong, and consultation is the norm rather than unilateral decision-making.

Nutrition remains a difficult area. Given women's role in food preparation and feeding, the responsibility for nutrition is handed over to them. Yet faced with heavy burdens of work, differential wages and unequal access to resources, nutritional outcomes cannot be improved without the cooperation of men, who also pride themselves as food providers in most of Asia. More attention needs

to be paid to the energy costs of particular activities, to food cultures, and to the particularity of individuals and groups to address the nutritional problem.

The final section presents the conclusions and recommendations.

STRUCTURES AND TRANSITIONS

In the last section, we set out our key conceptual understanding of family farms as located within complex micro-ecosystems, with a host of activities performed both independently and jointly by different members of the household and community—men and women—that is a way of life, and not just an economic enterprise. We explored the current challenges family farms face from rapid urbanisation, climate change and migration.

In this section, we specifically look at the key changes in: a) agrarian structure, b) state policies, and c) market forces, over the past 20 years or so in selected countries/sub-regions of Asia and the Pacific, and examine the implications of each of these for gender relations in the particular contexts. Are these changes leading to increasing time poverty for women, with varying levels of recognition of their contributions by the state, the community and the household, or are they giving them a more visible role in production, and hence in both the economy and society? In cases of feminisation, as in South Asia, is farming seen as an extension of household work, a secondary contributor to household livelihoods, and hence devalued? Is an expanded role in agricultural decision-making a mark of improved status or indeed constrained choice, as is the perception in China or Malaysia?

Changes in Agrarian Structure

The overarching context of the agrarian transitions relating to family farms is globalisation in its multidimensional economic, political, technological and cultural aspects. Overtly, it has meant liberalisation of national economies, privatisation of key infrastructure and services required for agriculture such as irrigation, agricultural technologies, inputs and services, and the withdrawal of the state, including in welfare provisioning. Commercialisation,

including that by transnationals and commodification, is on the rise. The outcomes are hotly debated. Given the context of smallholder production and low yield gaps, Deininger (2011) strongly recommends contract farming as a strategy for combining investors' assets with those of local people to raise production and reduce poverty.[8] Li (2011) points to the inequitable power relations embedded in the relationship between investors and smallholders.[9] What becomes important to recognise is the co-existence of contradictory trends, shaped as these are by the nature of the policy environment, the strength of social support networks, the presence/absence of civil society resistance and voice, and gendered norms and expectations on the ground. So, along with growing inequalities among nations and people, the rise of transnational corporations and the loss of sovereign decision-making, as also a homogenisation of cultures, there is a simultaneous creation of global knowledge systems powered by advances in communication technologies and fora through which local innovations can impact on global developments (see also Tsikata, 2010). Yet, these trends take different forms across countries. For example, even though China has rapidly opened up to global trade and industry, it has still continued to provide pre- and post-production services to its farms, thereby protecting them from the vagaries of price volatility in the global market. It has also expanded township and village enterprises to ensure productive work with reasonable returns to people whose labour is surplus to household agriculture (personal communication with M.S. Swaminathan, 24 May 2014).

Assessing the gendered impact of liberalisation policies on rural livelihoods is not easy since various agro-ecological and social processes jointly influence the changes that take place on the ground

8. With little surplus land available for expansion of cultivation, yields can only be further improved through innovations in the use of capital, technology and information, and organisational forms for processing and market access.

9. Data on large-scale land acquisitions from the colonial period point to the import of labour based on cash advances and the creation of the narrative of the 'lazy native' because they did not provide labour cheaply or consistently. Independent Indonesia continued an incentive package for investors by maintaining an impoverished labour reserve through its transmigration program (Li, 2011).

(Jackson and Rao, 2004). However, in agriculture, three general trends are visible that have direct and indirect impacts on gender relations. These are the rise of corporate (and contract) farming, opportunities/constraints for the diversification of livelihood strategies (non-farm activities and migration) and the increased casualisation of agricultural labour. It has to be reiterated that climate change and usurpation of rural spaces including the commons (both land-based and water bodies), due to increased urbanisation, heighten the vulnerability of smallholders. The reliance of the rural poor, especially landless households, on ecosystem services to meet important survival needs gets threatened as the ecosystems get damaged, often irreversibly (Mitra et al., 2015). We briefly examine the implications of these three trends on gender relations.

Corporate and Contract Farming

Changes in land-tenure systems act as one of the major indicators of the impact of globalisation and liberalisation on family farms, the most important ones resulting from the corporatisation of agriculture and the development of commercial farming. The global food crisis of 2007-08 raised the urgency of enhancing food production. This has led to a rush to acquire land by domestic and foreign investors, a phenomena now termed as 'land grab'. Two-third of the land acquired has been in Africa, followed by Southeast Asia, especially Indonesia and Malaysia, the investment here mainly being in oil palm (Li, 2011).

Corporate farms are usually large-scale farms that produce high-value agricultural products, including horticultural produce, as well as inputs for industry such as rubber and oil palm. In Punjab, India, contract farming started in 1989 with Pepsi Foods Ltd (Pepsico) setting up a tomato processing plant in Hoshiarpur district. To make this viable, they soon wanted greater control over the yields and quality of tomato production, leading to typical contract farming agreements. Within a decade, more than 90,000 acres were under contract farming in Punjab. Farmers however resent this control by corporations, as there are growing incidents of pre-determined prices being reduced on the pretext of inferior quality. In terms of

employment, vegetable production has led to a boom, especially for women workers. Gill (2001) found that female labour accounted for 60 per cent of total labour used. However, women's wages were only between 60-75 per cent of male wages. While opening up new sources of employment and opportunities for earning incomes, these farms have highly gender-segregated occupational systems, with implications for working conditions (long hours, lack of safety, little scope for advancement), seasonality of work and wage gaps (Jackson and Rao, 2004).

This has also been the experience in Bangladesh, where rice land has been converted to prawn farming. Only those with some land and assets can undertake prawn farming, so over time the small and marginal farmers have leased out their lands to the better-off farmers. While jobs in prawn farming *per se* are limited, several related jobs have emerged, such as guarding the farms, repairing the nets and harvesting the prawns. Women's post-harvest jobs have been replaced by snail-shelling, an intensive and hazardous, low-paid activity. These tasks are largely taken up by Hindu women. While they do earn some cash, they have lost control over rice stocks, which they could formerly barter in small quantities for other products. They earn cash incomes but women's overall autonomy might have declined (Ito, 2002).

Despite experiencing limited tenure, labour-intensive work, sexual harassment and health and safety hazards, being able to migrate and earn money changes women's bargaining power as well as the family structure. There appears to be a rise in female-headed households (women leaving their husbands and women workers collectively living together); however, there is little information on the implications for the quality of life and well-being of these women workers and their households. The gender pay-gap persists, not only on these farms but even in agro-processing industries that are growing in the region. Thus in Bangladesh, female shrimp fry catchers are paid about 64 per cent of what male fry catchers are paid (World Bank, 2007), raising questions about the degree of financial autonomy that such opportunities indeed provide women (see also Rao, 2012a).

In Andhra Pradesh (AP) in India, contract farming has led to a virtual alienation of the lands of small and marginal farmers as they no longer have any say or control on how the lands are to be used. Access to by-products from supplementary crops and livestock too is thus restricted. Here, the spread of contract farming has led to a growing casualisation of labour as well as the greater use of female and child labour.[10] A study by Venkateshwarlu and Da Corta (2001) of hybrid cotton seed production in three districts of AP found the large-scale use of the labour of young girls extending over long periods of time. Men were withdrawing from work and there was growing responsibility on women and girls to earn incomes. Hard work coupled with lower wages was leading to health problems and girls were being withdrawn from schools. Ota (2002: 229) found in her study on child labour in AP that, in several poor households, men were increasingly unable to contribute much to household income due to ill-health or unwillingness to work, and it was the women, with help from the children, who were earning for survival. Her analysis of secondary data reveals that child participation rates were positively linked to female labour participation.

One of the few studies to examine the gendered effects of commercial farming on smallholders relates to the expansion of oil palm in West Kalimantan, Indonesia (Julia and White, 2012). Granting of concessions/land use rights through leases to large companies permanently abolished customary rights (including use rights) on that land, which would eventually revert to the state rather than the community. Women did not have access to communal formal politics, but they did have customary rights to both private and forest land. Under the oil palm plantation administration, this land, divided among smallholders, was registered in the names of "male family heads" or the plantation owner, leading to the dispossession of a majority of women. With the loss of forests, women lost key resources that brought them additional incomes, such as rattan used

10. Sukhpal Singh (2003) notes that in 1999-2000, Andhra Pradesh had the highest incidence of child labour in the country (25% as compared to 9% for India), higher rates of casualisation (47% of rural employment as against 36% for rural India) and higher rates of casual employment for female labour at 53 per cent compared with 43 per cent for male labour.

for the production of baskets and handicrafts. To ensure survival, they illegally collected and sold oil palm fruit, risking being caught and fined as thieves by the plantation authorities.[11]

Secondly, the plantations employed men as drivers, security guards, foremen and checkers. Women were employed as casual wage labourers, often in hazardous roles like spraying pesticides and applying fertilisers—with no protective gear—making their work insecure and secondary. Where some land was retained, women continued rice cultivation, earlier a joint activity. Under the Dayak custom, it is taboo to sell rice, it is mainly for consumption; hence gradually all work that didn't bring cash, whether rice cultivation or voluntary mutual contributions of labour in the community, came to be seen as women's work and their wage labour as supplementary earnings. While women do view the household cash incomes positively, as helping meet food, education and health expenses, they also recognise the malpractices and insecurity therein—the problems of pollution and clean water, the growth of "cafes" and prostitution where men spend their earnings. The need for land as a form of security therefore remains (Julia and White, 2012).

Clearly, such forms of corporate farming do provide alternate sources of livelihood to women and men, a potentially higher level of cash earnings, leading to greater autonomy and flexibility in terms of consumption patterns. The outcomes are not all positive or negative, but shaped by local power relations between the investors, the state, community leaders and men and women in households. While more research is needed to understand these changes over time, available evidence seems to suggest two negative effects: a) women losing control over customarily recognised assets, and b) women's labour contributions becoming increasingly marginal and invisible. We illustrate these trends with two examples.

In the case of Sarawak, Malaysia, Sim (2011) demonstrates the consequences of logging, development of oil palm plantations, resettlement due to the construction of hydro-electric dams, and

11. Sarin (1997) too documents the branding of rural women in India as thieves when they entered protected forests to collect fuel wood for cooking.

greater integration into markets as a result of infrastructural development, on altering the rural landscape and, in turn, gender relations. Displaced communities either received 1 ha of alternate land or share certificates in compensation, but these were disbursed to heads of households, presumed to be men. Between 1970 and 2001, the population self-sufficient in rice reduced from nearly 100 per cent to about 30 per cent. From smallholders diversifying their crops to include export-based cash crops such as cocoa, rubber and pepper, this evolved into the large-scale cultivation of oil palm and the decline of smallholding agricultural systems. A crisis in rural household incomes followed when the price of cash crops fell. Men migrated to earn cash incomes, creating a shortage of labour and incomes in the hands of women, to ensure investment in pepper. In the absence of men, women could not take up off-farm work. In analysing the gendered implications of these changes, the author notes several trends: women became vulnerable to sexual abuse by loggers; they lost access to fertile lands and forest produce, both sources of income, in the process of displacement and rehabilitation, apart from the share certificates or land titles being issued in the names of their men; and at times engaged in casual sex work. Younger women migrated to work in factories in the urban centres, engaging in trade and other services in order to ensure financial autonomy and in turn a voice in negotiating household relations. More importantly, rather than staying behind to manage the family farms and the production of "sacred paddy", adult women themselves decided to move to towns with their husbands, despite loss of their inheritance.

Similar stories are playing out in India and China over the last decade, with rural agricultural and common lands being acquired by the state for development by private capital of liberalised economic enclaves—enjoying minimal tariffs, taxes and regulations.[12] In India, fodder and fuel are often no longer available, household water

12. In India, profits have been made through rent-seeking activities such as money lending, further land speculation and petty mercantile activities, with disastrous effects on the poor, in particular women (Levien, 2011). In China, over 4 million ha of farmland have been acquired and more than 50 million rural people displaced. Land has been undervalued and poorly compensated with the rural dispossessed receiving less than 10 per cent of the government's profit (Xiubin, 2011).

has to be purchased from tankers, women have lost all means of production, and their labour has been marginalised (Levien, 2011).[13] Expenditures are made on consumer goods that reflect male status, rather than easing women's work burdens (Chowdhry, 1999). In China too, a third of women received no personal compensation, as eligibility criteria included residential registration and women's marital movement went against this.[14] Women therefore have repeatedly petitioned the state to get a roll out of social insurance provision for all expropriated villagers, rather than compensation to the "head of household"—a measure which will reduce gender disparities in compensation distribution (Sargeson, 2008).

Diversification and Migration: Gendered Opportunities and Constraints

While much of the literature on farming and livelihoods is not gendered, it typically constructs women as a disadvantaged group, coping with a host of constraints including responsibilities for household maintenance and child care, unequal access to land, capital and education, alongside cultural expectations of being a virtuous woman, a good wife and mother. It is only in the last decade that a growing number of studies have examined the gendered impact of different diversification strategies (UNRISD, 2005). Does diversification (i.e., taking up non-farm employment, formal employment in corporate agricultural farms, migration) offer more effective routes out of poverty? In other words, does non-farm income have an impact on increasing well-being, or indeed on re-investing in family farms? What types of opportunities are there for women in terms of non-farm employment and what are the implications for gender relations?

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13. This is reflected in the decline in female work participation rates for the first time in 2007-08 (Rao, 2011).

14. Daughter registration got erased when they 'married out', and while in-marrying brides were supposed to be registered and compensated, those married to urban migrants lost out as they couldn't transfer their rural residential registration to their husband's location. Following the passage of the Rural Land Contracting Law in 2003, women effectively lost their entitlement to land after marriage even in rural locations, and this de facto landlessness has been used to justify their exclusion from compensation distribution.

Several interesting insights emerge from Kabeer and Van Anh's (2002) research in Vietnam. First, diversification of income, especially through off-farm work, is the most important predictor of household well-being (as measured by savings, housing, diet diversity, food security and consumer durables). Women-maintained households were generally worse off, as apart from having access to a lower asset base such as land, credit and other productive assets, they were unable to diversify in the absence of adult men. Second, strong interdependencies existed between different household activities: for instance, the garden, fishpond, livestock and rice farms were dependent on each other, making it hard to clearly identify male and female contributions to household farming. Third, gender divisions of labour were not rigidly imposed, but varied by location and in response to the opportunities available to different household members. Women do take over men's traditional responsibilities —irrigating and managing water for the fields, spraying pesticides and applying fertilisers—in absence of males (Paris et al., 2009); in South Asia, they carry out some of these tasks with the help of hired labour rather than do it themselves (Rao, 2012b). Finally, and quite significantly, Kabeer and van Anh (2002) found that household income was generally pooled, and in 62 per cent of the cases, managed by women. Evidence from Indonesia too suggests that in 70 per cent of the households interviewed, the woman was the main financial manager and decision maker (Papanek and Schwede, 1988).

Diversification is a household risk-reduction and consumption-smoothing strategy to meet seasonal food shortages. In poorer societies, it is increasingly driven—in particular, distress migration—by the vulnerability of smallholders due to agricultural liberalisation. Studies show that in rigid forms of patriarchies (South Asia and the Middle East), opportunities for diversification and benefits therefrom are disproportionately in favour of men (UNRISD, 2005; Jackson and Rao, 2004). Men migrate first, for longer periods and to further destinations. This is because their mobility is higher (not constrained by reproductive and care tasks), and they have more options regarding non-farm employment in construction and services in urban areas, both nationally and transnationally, partly due to higher levels of

education. The uncertainties and poor living conditions in the urban slums also deter women from migrating (Mitra and Singh, 2011). This has not just increased female presence in the agricultural sector, it has also added to the workload of women without providing the sought stimulus to production and technological change (UNRISD, 2005). Though not sufficiently researched, in peri-urban areas, older women unable to cultivate their small plots of land appear to be leasing them out on a fixed cash basis to younger women, who cultivate vegetables to sell in the urban markets.

Women in these contexts do migrate to urban areas for work in manufacturing industries, yet it is mostly younger, unmarried women who are able to access such jobs. While this does enhance their agency, especially in relation to their own marriages, the earnings are often inadequate for re-investing into the household's farm (UNRISD, 2005). Women's strategies remain survival-driven and they save less as they earn less, which means they make fewer investments. However, migration, both seasonal and longer-term, has led to shifts in household structures and mechanisms for both cooperation and control (Nazneen, 2010; Rao, 2012a).

Southeast Asia is more diverse, with men often migrating internally for industrial and service sector jobs, and women transnationally in the growing domestic service sector. Roughly 45 per cent of economically active women are engaged in agriculture. Though not title-holders, they maintain control through their farm work—an expression of economic partnership—and also provide a safety net for men's more risky ventures, in keeping with the national discourse of the family and their customary practices of inheritance. This of course varies with the particular context as illustrated by Paris et al. (2009) in their study in Vietnam, distinguishing between irrigated and rainfed villages in terms of their diversification strategies. Migration, they find, is the highest in the rainfed south. What is interesting is the age profile of the migrants: these are mainly daughters and sons from the south, while in the north it is the father/adult male or son. Who migrates has implications for gender relations. Where adult men migrate, women not only assume more workload, but also greater supervisory roles and managerial

responsibilities (Rao, 2012b). In the Philippines, women taking care of the farms in the absence of their migrant husbands, alongside their roles as mothers and household labourers, increasingly depend on both hired help and extended kin (Lukasiewicz, 2011).

Where daughters migrate, they seem to prefer to send their remittances to their mothers in the village. This is an area not adequately studied, but it appears that daughters either do not trust their fathers with the money, or indeed see their remittance as reducing their mother's dependence on their fathers. Farming here has also become geriatrified (Sim, 2011). An added dimension of daughter migration from Vietnam relates to their marriage to Taiwanese men, who are disadvantaged in their own community, but are much better off than the Vietnamese brides they marry. A big motivation for the girls is that they could contribute to improving their natal family's economic situation through regular remittances (Wang, 2010). The framework here is not one of victimisation of women by men, the state, or capitalist market pressures, nor does it highlight 'moments of dramatic resistance'; rather, it places attention on how power relations are negotiated through the 'gendered rhythms of work and exchange' (Li, 1998: 676) and the multiple ways through which agency can be expressed.

Feminisation and Casualisation of Agricultural Labour

Unpacking Feminisation

In the contemporary development discourse, it is held that as countries develop, the relative weight of the agricultural sector, whether it is measured as its contribution to the total GDP or as the proportion of the workforce that it employs, reduces (Lobao and Meyer, 2001; de Schutter, 2013). This process of agrarian transition is deeply gendered, particularly in the developing countries, with women slower in moving out of the agricultural sector to non-agricultural work.

This leads to what is referred to in the literature as "feminisation" of agriculture. Feminisation however does not imply an increase in the number of women workers *per se,* nor in their ownership and

control over land. Rather, "feminisation" refers to the rise in the proportion of female agricultural workers in the female workforce, and a rise in the share of female to male agricultural workers (Duvvury, 1989). Effectively implying the increased importance of women's role in agriculture, it is measurable as the ratio between women and men in this sector or the increasing proportion of women whose main employment is in agriculture.

Though the share of women in agriculture has remained stable in recent years, at between 40 and 50 per cent of the total agricultural workforce, the "feminisation" process shows important regional variations. Women's participation in agriculture has declined in Malaysia and the Philippines, increased in China (presently at about 48%, all though mainly of elderly women), Pakistan (at 30%, it is triple the percentage of 30 years ago) and Bangladesh (where it is above 50%) (FAO, 2011: 9; de Schutter 2013). International Labor Organization (ILO) data shows declining male and female employment in agriculture between 2000 and 2011, but the decline for men is faster than for women in South Asia. The scenario is mixed in East Asia and Southeast Asia (see Table 2.2).

Table 2.2

Changing Patterns of Employment in Agriculture by Gender and Sub-region

Region	*Male Employment (%)*		*Female Employment (%)*	
	2000	2011	2000	2011
East Asia	41.0	32.2	55.8	39.3
Southeast Asia	48.6	42.5	51.2	43.9
South Asia	53.4	44.4	74.9	68.8

Source: Computed from de Schutter 2013: 4.

However, the strong inter-country differences constrain the utility of regional comparisons. For instance, while the agricultural sector is an important source of employment for women in many South Asian countries, agricultural employment represented 46 per cent of total female employment in India for 2003-2005; this figure was 60 per cent for Bangladesh and about 40 per cent in Sri Lanka (de Schutter, 2013: 4; FAO-IFAD-ILO, 2010).

Secondly, women are treated as a homogenous group in such statistics: no differences are made by age, class, marital status, caste or ethnicity, or indeed the nature of their engagement with the farm —whether as owner-cultivators, household workers, wage labourers or migrant workers. There is considerable evidence to demonstrate the ways in which opportunities and constraints are shaped by women's social positioning in particular contexts. The interests of a migrant woman worker or a landless agricultural labourer are likely to be distinct from that of a land-owning woman farmer or an educated middle-class woman.

Thirdly, macro-level data also needs to be treated with caution due to the lack of a harmonised methodology to identify the numbers recorded (de Schutter, 2013). Thus, it is likely that in many countries, the family members (whether men or women) working on the family farm to produce for their own consumption, rather than for the market, would not even enter official statistics: such statistics measure the contribution to the country's GDP, and only take into account that part of the economic activity that enters into the cash economy (de Schutter, 2013). This under-reporting of women's activity in agriculture due to the fact that women's work in subsistence agriculture forms part of the non-cash "household" economy may explain, for instance, why scholars have sometimes disagreed as to the extent of the feminisation of agriculture in China (see de Brauw et al., 2008 expressing doubts about the reality of feminisation of agriculture in China, while Chang et al. (2011) and Mu and van de Walle (2011) recognise that such feminisation has been developing since 1997). In India, after much feminist mobilisation since the early 1990s, women's work on family farms is recorded as employment, yet labelled as "unpaid household help" and thus socially undervalued.

Fourthly, such aggregating of gendered work participation does not consider that women and men's employment in agriculture varies from crop to crop, from activity to activity (planting, for instance, is more frequently practised by women, whereas ploughing is an activity generally performed by men), and across age groups: the younger female cohorts, for example, join off-farm employment in greater

numbers, whereas relatively older women (beyond the age of 35) tend to remain in the rural communities even as rural-to-urban migratory patterns develop (Pang et al., 2004; Zhang et al., 2004). In Malaysia and Sri Lanka, young women tend to out-migrate to urban centres to work in transnational production sites or free trade zones, in a shift that creates well-documented tensions between the traditional values of the peasant society from which they originate and that of the industrial sites where they work (Ong, 1987).

Young women from Cambodia, China, Sri Lanka and the Philippines, as well as other Asia-Pacific nations such as Indonesia and Vietnam, increasingly migrate to other countries to serve as domestic workers (particularly in the Middle East), or sometimes as sex workers (especially in Thailand and Malaysia) (Adams and Dickey, 2000; Brochmann, 1993; Momsen, 1999; Mason, 1999). Female migrants formed, respectively, three-quarter of those migrating from Sri Lanka and over half of those migrating from the Philippines in recent years (UNRISD, 2005), often to become part of a heavily segmented employment market (Parrenas 2001). Although precise figures are missing, due to the often clandestine nature of prostitution and the associated trafficking and exploitation, it is estimated that 'by 2002 there were at least 1.3 million foreign women working in the seven major labour importing countries: Singapore, Malaysia, Thailand, Taiwan Province of China, Hong Kong (SAR China), Republic of Korea and Japan', constituting a high proportion of the total immigrant labour force in some of these countries (UNRISD, 2005: 115). These women make a generally undervalued contribution to meeting household/family needs through remittances (Gunewardena and Kingsolver, 2007), which often expands in times of economic crisis (Li, 1998). Sweeping generalisations to the "feminisation of agriculture" mask such critical exceptions to the general pattern (de Schutter, 2013). It needs to be pointed out here that there is hardly any literature on the "masculinisation of agriculture" or how men in situations where the women migrate cope with both agriculture and the care tasks (Quisumbing et al., 2004).

Finally, while drawing attention to the fact of women's participation in agriculture, such data conceal more than they reveal

about the exact locale-specific underlying causes, circumstances and drivers of feminisation, rendering policy formulation difficult, and sometimes inappropriate if not inadequate. Is "feminisation" a result of the lack of state investment in agriculture, low productivity of farms, or indeed lower social valuation of the rural, agricultural sector? Chen (1996) notes in the case of China that women's increased decision-making power in farm management—caused by the absence of their men who had moved to the non-farm sector—in fact reflected women's unequal access to opportunities outside agriculture rather than gender equality.

There are at least three different modalities through which this process of "feminisation" can be understood. Feminisation can occur when male adult members of the family find employment outside the family farm, which often implies migrating to cities. The women left behind shoulder the burden of production work on the family plot of land. They meet the bulk of household food security needs, in addition to their involvement in reproductive and care work, as the children and the elderly remain with them. This corresponds to the scenario in which so-called "subsistence" agriculture is improving in the hands of women, despite the significant constraints they face. The women in this situation may be supported by the receipt of remittances, which can serve to buy inputs or to hire labour for the performance of the more heavy tasks, such as land preparation, that are not generally seen as suitable for women. This appears to be quite common in Southeast Asia, where the productivity of land could be maintained due to such remittances (Paris et al., 2009). But women often have little legal protection or rights to property ownership, and they face cultural and social norms that are obstacles to their ability to improve productivity as much as they could in the absence of such barriers. Such constraints led to concerns, more than a decade ago, about the impact of feminisation of agriculture on local food security if, due to the obstacles faced, women are less productive than men (UNDP, 2003).

A second variation on the process of feminisation of agriculture occurs when women take over agricultural production from men on the family plot of land, more to produce for the market and not just

the household's consumption. The constraints the women face are especially significant: production for the market generally requires larger volumes of output, necessitating the use of external inputs (whereas more diversified forms of farming, if well practised, may require less of such inputs); and it requires interactions with buyers, who are generally men; or that the woman-farmer has to travel the distance that separates her from the market. Both the acquisition of inputs (which generally means access to credit) and entry into supply chains (especially when it takes the form of contract farming) require that the woman be recognised as the legitimate owner of the land, whereas in most cases the land will have been registered in the name of the man. And the various travels that commercial farming implies, whether to fetch the inputs and carry them to the field or to market the agricultural produce, may conflict with the mobility constraints women face, ranging from the extreme case of imposed seclusion (as under the customary *purdah*) still common in some South Asian societies, to the more likely situation where they find that they cannot be absent from the home except, at best, between the preparation of the morning and evening meals. The more women seek to practise certain types of commercial farming that require moving outside the home, the more they may find it difficult to reconcile their role of producers for the market with their responsibilities in the household, an obstacle male agricultural producers do not face.

A third variant of feminisation of agriculture occurs when women take up waged employment on large plantations, sometimes located at some distance from the home or even requiring them to migrate for long periods: it is then linked, not to the small-scale family farm sector, but to the shift to more capitalised forms of agriculture, and often to an increase in land concentration. Access to waged agricultural employment can bring about important benefits to women, who often have a considerable say in how their wages are spent. But a number of problems remain. Women are over-represented among the 'peripheral' segment of the agricultural workforce, made of unskilled workers, often recruited at certain points of the year only and often without a formal contract of employment. There is also ample evidence of discrimination and

violence against women in the waged agricultural sector. Where the remuneration is calculated on a piece-rate basis, based on how much of the task has been accomplished, it tends to disfavour women, since the pay is calculated on the basis of male productivity standards. And women may face specific difficulties in reconciling their responsibilities in the care economy—particularly as regards the minding and educating of children of pre-school age—and their work on farms. These various disadvantages that women farmworkers face raises the following question: does the co-optation of women in the agricultural workforce to replace men who have migrated to other sectors, although contributing to their economic independence, not also perpetuate the pattern of exploitation and domination on which the low-cost food economy is based? Does feminisation also imply, then, devaluation of the contributions, both of women and of farms, to household livelihoods?

Crucially, all these forms of "feminisation of agriculture" will show up in statistics as increases in the female agricultural workforce (in proportion to the employment of men or even, though less frequently, in comparison to female employment in other sectors). However, each will result in a very different set of gender relationships, and each will correspond to a very different type of agrarian transition (de Schutter, 2013).

Thus these differential types of "feminisation of agriculture" necessitate separate and distinct policy approaches that distinguish between women as small-scale, independent food producers and women as wageworkers (both on-farm and off-farm), with the caveat that in many cases women combine both roles. A major dilemma is that while it is important to identify and address the major kinds of discrimination women face in agriculture, not all the constraints women face can be removed at once, particularly when those constraints relate to existing gender roles. However, recognising such constraints, and organising the support given to women farmers to take such constraints into account by relieving them from some of the burdens that they shoulder, may simultaneously lead to confirm existing gender roles, making them even more difficult to challenge (de Schutter, 2013: 6-7).

As will be discussed in the section on policies below, recognition and relief needs to be combined with the redistribution of gender roles.

Casualisation of Work

One element of inequality that may have improved with the process of liberalisation is the nature of labour contracts, which have shifted from attached and bonded labour contracts to more casual ones. Brass (1999) is critical of the permanent or attached labour contracts, as, though meant to be materially reciprocal exchange relationships, they tend to provide poorly-paid employment. The casualisation of labour is a long-standing pattern in rural India, and Pal (1997) uses ICRISAT data 1980-1984 and resurvey 1992 in order to show that economic development in India goes hand-in-hand with expansion of alternative employment opportunities for agricultural labour and also an expanded access to credit, both of which lead to a decline in regular (i.e., attached) labour contracts and a gradual casualisation of agricultural labour. This trend has continued, although several qualitative studies suggest that casual labour hiring is also embedded within debt relations as well as networks of political and caste patronage based often on the mediation and distribution of resources flowing into the locality (Coppard, 2004). Thus there seems to be some ambiguity among labourers in terms of relative benefits, as, while earnings from regular contracts are usually lower than from daily casual labour, they are seen to provide comparative security. The diversification of opportunities, however, has also contributed to a desire for greater economic independence amongst labourers, hence a preference often for casual contracts (Heyer, 2010). Further, with more cultivators taking on labouring, they tend to prioritise their own cultivation before engaging in wage labour.

Casualisation *per se* then is not a problem, although poverty data for India reveal that those having the principal employment status of casual labour have the highest ratio of poverty in 1999-2000 (around 42%) (Dev, 2004). Others point out that in agriculture, "casual" is considerably better paid than "regular" labour. For women, being at the lowest end of casual employment, both on-farm and off-farm,

their relative access to cash incomes may be declining, but it is the days of labour and gender pay gaps which are most significant here. While recent studies on intra-household control over income and expenditure are few (see Rao, 2012b; 2014; older studies include those by Mencher, 1988, among others), what they do demonstrate is that women's contribution to total household income is declining. While in the 1990s, following Sen's intra-household bargaining model, there was evidence of declining control over household expenditures by women, as seen in the de-prioritisation of their needs that is indicated in patterns of consumption (as in Haryana) (Chowdhry 1999), widening nutritional gaps (NNMB, 2002) as well as producing a new segregation in fee-paying services, especially education and health (Ramachandran, 2004), this situation seems to be changing. With a rapid fertility transition and upward class mobility, women's reproductive work in bringing up and educating the children is valued and investments are made therein (Rao, 2014). While women's unpaid, reproductive work is recognised in expenditure patterns, it however, once again, reaffirms women's roles as reproducers rather than equal partners (see also Nazneen, 2010: 45-46).

Having examined key changes in agrarian structures, namely, commercial and corporate farming, diversification and migration, as well as the casualisation and feminisation of agricultural work, we turn to an exploration of state policies, and how they have contributed to shaping emerging gender relations.

State Policies

Investments in Agriculture

Mogues et al. (2012), drawing on public expenditure data from IFPRI's Statistics on Public Expenditure for Economic Development (SPEED) database, analyse the situation of public spending on agriculture in 70 developing and transition countries, 17 of them from the Asia and Pacific region. They show that the 'agriculture expenditure intensity'—a percentage of agricultural expenditure to agricultural GDP which measures government spending on agriculture relative to the size of the sector—is extremely low in

developing countries in general. Whereas developed countries have an intensity of more than 20 per cent, agricultural expenditure intensity was only 8.7 per cent in Asia in 2007.

While the above analysis does not consider the gender impacts of agricultural investments, their data demonstrate the effects of enhancing public investment in agriculture on health and nutrition, critical for millions of women, children and men in Asia, who are not only below the poverty line but are malnourished. Small and marginal farmers form the majority of these populations. This can happen through at least three pathways: by increasing production for self-consumption, in the case of subsistence farmers; by reducing prices for net buyers of food (IFPRI, 2011a); and by increasing marketable output for agricultural producers who sell all or part of their output, thus increasing their incomes (Mogues et al., 2012). This is particularly crucial for rainfed areas, which are subject to precarious weather conditions compared to irrigated lands. As Jha (2007) notes in the case of India, the combination of rising subsidies in real terms and stagnant investment implies that altghough there are resources for operational purposes (irrigation, seeds, fertilisers), resources for augmenting the productive capacity of agriculture are dwindling.

Not all agricultural investments are equally successful in bringing about such gains in productivity, consumption, income and health. A vast literature on the returns to public investments in agricultural RDE (research, development and extension) finds that annual IRR (internal rates of return) are substantial (Mogues et al., 2012: 18). Recent attention to the cost-effectiveness of fortification programmes reveals the strong impact of these interventions. Biofortification, or the development and dissemination of micronutrient-enhanced staple crop varieties, is an innovative nutrition intervention designed to reach the rural poor (Meenakshi et al., 2010). Although biofortification involves high start-up costs (such as costs for development and dissemination), once biofortified staples are integrated into the food chain, they continue to provide micronutrient intervention with little additional input (Stein et al., 2008). In addition, biofortification is especially designed to reach the rural poor as the staple crops targeted for micronutrient

biofortification are those that are grown and consumed by the same, often making up a significant part of their daily diets (IFPRI, 2011b; Mogues et al., 2012: 18-19).

Empirical justification of the claims for success of the biofortification programme comes from the use of the concept of disability-adjusted life years (DALYs); that is, the sum of years of life lost due to premature mortality and years lost due to disability (WHO 2011). Stein et al. (2007) found that costs per DALY averted of zinc biofortification of rice are from $0.40 under optimistic scenarios to $3.90 under pessimistic scenarios. Costs per DALY averted of zinc biofortification of wheat are from $1.98 (optimistic) to $39.45 (pessimistic). The authors also estimated IRRs to zinc biofortification of these two crops over a 30-year period (assuming 1 DALY is valued at US$1,000). The result is high IRRs for rice, 173 per cent (optimistic) and 66 per cent (pessimistic), and somewhat less so for wheat.

Through a gender lens, such public investment in agricultural research and development has multiple potential benefits. First, women have control over food crops in general, given their responsibility for food preparation and feeding other members of the household. Nutrient-enriched crops, therefore, can contribute to improving diets without the need for purchase from the market. Integrated into existing farming systems, they are unlikely to create additional demands on labour or input investments requiring a re-negotiation of labour and resources at the household level, although of course this is an area that needs to be studied. Further, an improvement in nutritional status by improving the overall health status of household members will not just enhance the ability to work, but also reduce the need for care—part of women's reproductive roles.

Introduction of New Technologies

Commercialisation of agriculture or shifts from subsistence to greater market orientation is generally accompanied by the introduction of new technologies. These include mechanisation, introduction of new crop varieties, inputs such as fertilisers and

pesticides, and techniques for post-harvest storage and processing (Ullenberg, 2009). The effects of technological change are gendered even within the same socio-economic class, due to differences in the divisions of labour involved in agricultural and non-agricultural work (especially domestic work and childcare), and also due to differences in the symbolic meanings attached to different crops and activities (Ahmed, 1985). It is shaped too by the extent of control over productive resources, especially land (Behrman et al., 2011), and the patterns of distribution of household earnings and expenditures deriving from different crops. Since the diffusion of agricultural innovations is a long-term process, the effects of technology adoption cannot often be discerned in the short run. The longer-term adjustment effects may involve the movement of labour from agriculture to non-agriculture. Such employment effects of new technologies are important factors determining changes in incomes and welfare.

Whether or not the introduction of new technologies has a positive effect on local women and men is a subject of debate. FAO (2009) cautions that local populations will not benefit if technology transfer occurs in a system where advanced agriculture and smallholder agriculture continue to exist side by side with limited spillover from one domain to the other. Cotula (2010) points out that investors often put limitations on the use of technology and related knowledge, particularly when it comes to application outside of the project. It is however conceivable that labour-saving technology might make production more efficient for the small producer, so there are surpluses for sale in the markets without necessarily increasing labour inputs (Behrman et al., 2011).

In a review paper on gender and technology adoption, Quisumbing (1998) asserts that for new technology to increase employment opportunities for women, there must be a concurrent increase in demand for women's labour. In contexts where there is a growing supply of landless women labour, women will benefit only if productivity increases are accompanied by greater labour demand or if productivity increases allow women time for leisure, self-care, or other more remunerative tasks. Early studies of the gendered

impacts of new agricultural technologies, particularly the package of fertiliser-responsive, high-yielding varieties of rice and wheat that led to unprecedented increments in the production of foodgrains in Asia, pointed to the ways in which women were negatively affected by technological and subsequent socio-economic changes (Palmer, 1975; Cain, 1981; Begum 1985; Sajogyo, 1985).

More nuanced accounts, however, point to the class-differentiated impacts on women. While some landless women lost jobs and income-earning opportunities because of the adoption of direct seeding, introduction of threshers, commercial mills and other kinds of technology, work burdens increased for the wives of farmers' adopting these new technologies (Agarwal, 1985). Innovations in drudgery-reduction technologies and appropriate mechanisation can address these issues. It is important then to find ways of providing work opportunities, and also achieving greater productivity per working hour through the use of drudgery-reducing technologies (White, 1984). This will depend on women's position as landowners, wives of landowners, members of landless households, or, indeed, single women. However, little research has explicitly reviewed the conditions under which specific technologies can help or hurt farm women (Paris, 1998).

There are a number of important environmental dimensions to the introduction of new technologies. For example, the discharge of pollutants that accompanies the use of inorganic fertilisers, pesticides or other agrochemicals may damage the quality of local soil and water used for productive purposes. Furthermore, the quantity of water needed to sustain large-scale agricultural production for staple crops or biofuels will likely compete with water needed for food production, livestock and domestic consumption (Rossi and Lambrou, 2008). Women are typically charged with collection of water and fuel and with preparation of food. In a review of 19 developing countries in Africa and Asia, researchers found that biomass fuels managed by women—including wood, charcoal and agricultural residues—made up a large percentage of the country's energy supply (Karlsson, 2008). Thus, women stand to be particularly disadvantaged if they are forced to seek out new and more distant sources of water and fuel.

In addition, the use of new technologies, such as pesticides, may have serious potential health effects on the local community. These health effects may differentially affect men and women, as there is evidence that women workers in plantations often receive less training and instruction than their male counterparts, do repetitive work that can result in health problems, and face reproductive difficulties as a result of exposure to agrochemicals (Loewenson, 2000). For example, in Malaysia and Indonesia, women plantation workers are often recruited as sprayers of chemical pesticides and herbicides and are not given proper training and safety equipment (Oxfam, 2007; Behrman et al., 2011; Julia and White, 2012).

Mechanisation of Agriculture

One of the most contested issues in agriculture relates to mechanisation and its impact on people, especially those who work as wage labourers. Needless to say, this is highly gendered, but at the same time substantially under-researched. *Apriori,* a position cannot be taken whether such mechanisation is good or bad: there are important contextual considerations that need to be made and trade-offs to be considered. Moreover, such absolute positions impair finding solutions and turning challenges into opportunities.

Major concerns were raised in the 1980s on the displacement of agriculture-dependent labour post-mechanisation (Agarwal, 1985; Basant, 1987, for a summary of the debate). Although the debate was not gendered in the sense that men and women were not considered separately, some important lessons can be drawn that remain relevant. Most of it was related to Asian countries, especially India, and claimed that the Green Revolution had widened the income disparity between large- and small-scale farmers, landlords and tenants, farmer-cultivators and landless families (Rao, 1975; Griffin and Ghose, 1979).

It was observed that the most important factors involved with labour use/absorption in agriculture were soil-climatic conditions, changes in net sown area, cropping intensity/changes in gross cropped area, irrigation, technology (seeds, chemical fertilisers and mechanisation), institutional factors such as tenancy, and the

agricultural wage rate (Reddy and Venkatanarayana, 2013). When agriculture output growth occurs due to expansion of net sown area, it increases labour absorption. Output growth due to increase in gross cropped area, consequent upon increasing crop intensity, would also augment labour use in agriculture, as would irrigation that heightens cropping intensity, stabilises crop production and increases the yield (Bardhan, 1978; Ishikawa, 1978). Technology involving modern varieties of seeds and biochemical inputs increase yield rates, while mechanisation potentially displaces labour (Rao 1975; Barker and Cordova, 1978: Binswanger, 1978). Thus, different dimensions of technology in agriculture have different impacts on labour use (for review see Basant, 1987).

Specifically, many studies reported the displacement impact of mechanisation on labour use (see Rao, 1975; Binswanger, 1978). However, mechanisation combined with other factors can reduce or even nullify the displacement effects. Thus it was shown that the displacement of labour by tractors was roughly compensated by the positive employment effect of the changes in cropping pattern and intensity associated with tractor use (Rao, 1975; Krishna 1975; Basant, 1987). More recently, Pandey et al. (2010) showed that the use of combine harvesters in eastern India reduced demands on family labour in both harvest and post-harvest work, while there was no reduction in the demands for hired labour.

In the ultimate analysis, a simple answer to the issue of mechanisation is not possible. As Reddy and Venkatanarayana (2013) have shown, labour shortages, caused by various factors including migration or the demand for a higher wage rate, often lead to mechanisation. In the case of single-woman-headed households, such mechanisation, including the use of tractors and fossil-fuel- or electricity-based irrigation, often becomes a necessity as it enables them to conduct agricultural operations smoothly. They have to negotiate with fewer men (Mitra's personal observations in West Bengal's rural areas). Similarly, in western Uttar Pradesh, Jat landowners, including women, prefer to use machines instead of the local Dalit labour due to: a) the organisation and increased awareness of the Dalits who refuse to accept their social subordination, and b)

the emerging market in crop residues (especially sugarcane), leading the landowners to engage migrant annual farm workers so as to deny the Dalits the traditional share of residues as wages. The Dalits attaining education has helped many to migrate to the cities and leave agricultural wage work (Rao and Mitra, 2013).

But again, the impact is specific to the context, including the position of women in the local social and political hierarchies. In a study of SC (scheduled caste) women agricultural labourers from Salem district in Tamil Nadu, Padmavathi and Ramamohan (1999) have shown how agricultural mechanisation and inflation have contributed towards the pauperisation of female agricultural labourers. Due to modernisation and technological transfer, this particular caste group was forced to migrate to the cities in search of employment. Before migration, they sold, their lands to the big farmers with whom they were unable to compete because of changes in the economy. The "pull" factor for these migrants to Tirupati in Andhra Pradesh has been quarry mining. The quarry contractors employ migrants by paying them lower wages. These women worked for more than 15 hours a day, had no permanency of work, shelter or perks. Working in the quarries also poses many health hazards, pushing them further down the occupational hierarchy.

It is important to reduce the drudgery of women, but at the same time the implications of labour displacement has to be kept in mind, the potential displaced women identified and adequate compensatory measures put in place. However, such 'audits' would need a lot more research. This would have to be ecosystem-based and would have to consider the issue of women's labour utilisation according to: a) crop; b) specific operations in its cultivation (soil preparation, seed preparation, seeding/transplanting, weeding and pest management, harvesting and post-harvesting, irrigation and so on); c) the distribution of women's time according to labouring in agriculture, reproductive work and leisure; and d) women's positionality according to age, marital status, class and caste. A very important factor relates to the ownership of equipment, its costs—including operational and maintenance costs—and the terms and conditions of its use, especially when such machinery is hired. In this context, it must be

pointed out that efforts to reduce the domestic drudgery of women are also critically important. Simple devices like pulleys to draw water from wells, push carts to fetch water or fuel efficient stoves go a long way to reduce the drudgery and time poverty of women.

Information and Skills

Central to the adoption and use of new technologies are information and skills. Traditionally, extension services have been the main source of information on new technologies and for imparting the skills necessary for their adoption. Studies on access to technical inputs (seed varieties, fertilisers) and natural resources (such as water and soil fertility) have largely focused on sub-Saharan Africa, but most of these find that there is no significant difference in resource use and technology adoption between male and female farmers, once land, education and labour are controlled (Peterman et al., 2010). A study in Ethiopia (Tiruneh et al., 2001, quoted in Peterman et al., 2010) on gender differentials in agricultural production and decision-making highlights this point further: while farm size and extension service contact positively affect adoption in male-headed households, farm size and asset ownership are critical in female-headed households. The lack of land titles and the smaller size of holdings are then likely to disadvantage women in Asia as well. The agricultural census (2006-07) of India, for instance, reveals that 28 per cent of marginal farmers had access to certified seeds in comparison to 37-40 per cent medium and large farmers (Rao, 2012*c*). Input use and technology adoption then depend on both access to land and security of tenure (Doss, 2001).

A second element in improving production is the access to information and extension services. A World Bank and IFPRI (2010) study of 676 households in Karnataka on access to extension services found that 20 per cent of female-headed households and a slightly higher 27 per cent of male-headed households reported extension visits in the previous year. Here too, asset/wealth variables seem to be more important than gender variables, a result confirmed by Rao's (2005) micro-study of agricultural extension in one district of Jharkhand, where the better-off groups benefitted much more than

the poorest STs (scheduled tribe), who owned land (though remote and marginal) but lacked access to other resources, both financial and social, critical for accessing information around new technologies.[15] Lack of land titles however does exclude women from membership of, and decision-making within, farmers' organisations, irrigation societies and other development projects. It is possible that in some parts of India, such as Uttar Pradesh, the gender of the extension agents, primarily male, could influence the degree of interaction with female farmers and consequently their access to information.[16] Almost all over Asia, with the exception perhaps of China, women agricultural extension workers rarely exist. And this applies even more to the seed and fertiliser agents of companies, more and more responsible also for information provision.

ICTs are increasingly becoming an important tool for information dissemination: women in South Asia are 37 per cent less likely to own a mobile phone compared to their male counterparts (GSMA Development Fund, quoted in Peterman et al., 2010). The Government of India's announcement in 2012 to provide mobile phones to all BPL (below poverty line) households can potentially have a transformatory effect on access to information for the poorest households, including women,[17] provided adequate attention is given to gender relations in the distribution of these phones (*http://telecomtalk.info/india-govt-to-give-mobile-phone-free-bpl-family-200-minutes-talk-time/98114/8th August 2012*). While the progress in terms of state subsidy is not clear, 64 per cent of the population (792 million) now have access to mobile phones, close to 40 per cent of

15. Padmaja et al. (2006), in a case study from Maharashtra, point out that women have stronger bonds with kin and family, while men have cross-cutting ties with farmers, friends and acquaintances, expanding their sources of information considerably.

16. In Karnataka, none of the 41 extension agents were female, 1 or 41 junior engineers and 4 of 40 veterinary assistants (World Bank and IFPRI, 2010).

17. Lee (2009) cites evidence that not only points to the improvement in agricultural and fish markets through better market information, but also the beneficial effects of mobile phones on reducing domestic violence and improving women's mobility and economic independence. It does not however improve women's autonomy or decision-making within the household. The results are similar to Jensen and Oster's (2009) study of cable TV use in India, which attributes shifts in social norms to exposure to such media.

them are women. Of course, here too, there is a bias in favour of the better-off (DEF, 2012).

Market Forces

The understanding of the role of subsidies in promoting the interests of small farmers in developing countries, especially women, necessitates linking agriculture with contemporary trade liberalisation regimes. Under the WTO, agricultural trade was opened up under the Agreement on Agriculture (AoA), 1994, that involves providing market access to WTO member states by "capping" import duties, laying down uniformly applicable (to all WTO members) standards and processes, and reducing or eliminating trade-distorting export and domestic subsidies given mainly by the developed countries. While the developed countries have hardly done so, there is pressure on the developing world to comply with these regulations, making it impossible for governments, especially in large countries, to provide food subsidies for poor consumers and price support for small farmers (Sengupta, 2013). Trade liberalisation has not been able to control speculation (further boosted by the crisis in financial markets and concentration in global food markets); the consequent volatility in international prices has been hurting both poor farmers and consumers, and has threatened food security across developing countries (Sengupta, 2013).

In the Asian socio-cultural set-up, where domestic and social compulsions tie women to their homes, restricting their access primarily to local markets, it becomes very difficult, if not impossible, for women farmers to survive and compete in a free-trade world. In recent years, many small and marginal farmers, particularly women farmers, have sold their land and become casual labourers. Based on their Indian village studies, Garikipati and Pfaffenzeller (2012) note that cost of production increased with the removal of subsidies. Male farm owners had to cut down on hired labour, leading to the increase in the use of unpaid household female labour. They themselves had often to migrate or engage in wage work to earn money for investments in the land. If at all additional labour was required, the preference was for female agricultural labourers, linked both to their

lower wages, and also to their assumed steady work discipline and ability to multitask. In Bangladesh, due to *purdah* as well as domestic obligations, while women have been increasingly brought into work on family farms, they still do not participate in the hired labour market (Rahman, 2010).

With the WTO's limits on subsidy levels in developing countries, the farming communities in these countries are constrained by increased prices of inputs such as fertiliser, water and electricity. This pushes up the production costs for farmers. To make the situation more complex, removal of import restrictions opens the floodgates to imports of agricultural commodities. Even when there is no actual import, low world prices will drive domestic prices downwards—so much so, despite cases of crop failures, domestic prices may not necessarily increase. Many small and medium farmers are finding it difficult to cope with this dual problem of increasing production costs and low domestic prices. For women in particular, apart from controlling small fragmented plots of land, usually of poor quality, and with lower access to institutional credit and public support programmes, as well as to the public sphere in general, problems are likely to multiply rather than be resolved by processes of trade liberalisation (Prugl et al., 2012; Chandra et al., 2010). Post-WTO, many farms are engaged in export-oriented cultivation. Commercialisation encourages consolidation of landholdings as well as mechanisation, reducing employment opportunities in this sector (Shivpuri, 2010).

Clearly structural changes—be it in terms of the nature of farming, the structure of the agricultural workforce, mechanisation or trade liberalisation—have different consequences on differently-positioned men and women across agro-ecological contexts in the Asia-Pacific countries. The diversity of the region makes it difficult to make any generalised conclusions or recommendations. But this itself is an important policy lesson: to have an impact, policies need to be responsive to particular contexts, both social and ecological. A one-size fits-all solution will not work.

In the next section, we examine how these changes have impacted on shifting gender roles, responsibilities and relations across the

Asia-Pacific region. Equally, we will comment on the implications for poverty and inequality, as stubborn poverty levels may point to more equitable gender relations within households, pushed as they are by survival needs, yet may not contribute to improved levels of well-being or an improved quality of life.

SOCIAL INSTITUTIONS

Laws, Customs and Practices

Social institutions comprising the state, markets, communities and households are not mutually exclusive; rather they constitute each other (Moore, 1986; Rao, 2007), shaping and being shaped by changing norms, rules and aspirations. This is particularly pertinent to a discussion of women's rights, especially to productive assets. While countries across Asia have ratified CEDAW (Convention on the Elimination of All forms of Discrimination against Women), 1979—Articles 14, 15 and 16 of which call for ensuring equal access to agricultural credit and loans, marketing facilities, appropriate technology and equal treatment in land and agrarian reform and land resettlement schemes—and the Beijing Declaration and Platform for Action, 1995, with a similar set of commitments, these rights have been hard to enforce and difficult to realise in practice.

A gender-just legal framework is an essential starting point; the first step in the realisation of rights by women is establishing their legitimacy, both legally and socially. That is, a woman's rights, whether to land or any other asset or service, should be recognised by law, custom, her family and the community. This would enable her to overcome resistance from elite power and patriarchal control, and to claim her rights, whether through state or community mechanisms. Often women themselves do not want to recognise that they have legitimate rights to land because of the overwhelming structures of patriarchy that dictate them to be self-effacing and sacrifice their rights for their men: fathers, brothers, husbands and sons (Rao, 2008).

A few recent studies have explicitly examined the impact of the Hindu Succession Act (HSA) Amendment (2005) on women's land

claims in the five Indian states that had brought in amendments earlier, recognising the time lag between legal reform and normative change. In her study in two districts of Andhra Pradesh, Brule found that, in the absence of information and mobilisation, the HSA Amendment itself had little impact on women's land claims, irrespective of educational levels. A UN Women and RDI (2012) study in two other districts of Andhra Pradesh confirmed not just the low awareness of the law among women, but also greater support for wives inheriting land from their husbands, rather than their parents. Despite the HSA (Andhra Pradesh) Amendment 1986 and the State policy on joint tilling of land since the 1990s, women's names appeared in less than 10 per cent of the documents. Only 60 per cent of the plots surveyed had any sort of formal documentation in the first place (UN Women and RDI, 2012) due to the tedium of registering land and gaining title documents. While not necessarily leading to enhanced claims or registrations of land titles in the names of women, the law does seem to have influenced women's autonomy in their marital families (Roy, 2008) and negotiations with husbands on the distribution of their wealth to their children (Brule, 2010).

Across Asia, women are disadvantaged as landholders; their share ranging from 10-15 per cent (FAO, 2011). Kabeer and van Anh (2002) in their Vietnam research have tried to disentangle different forms of "constraints" that women face. These include gender-specific ones such as responsibility for reproductive work; gender-intensified ones such as differential investments in education and health, which lead to differential opportunities for work and earning; and imposed gender constraints including those imposed by markets and state institutions such as differential wage rates or allocation of compensation money or land to heads of households, typically constructed as male. Such an analysis illustrates well how social institutions, embedded in a culture of male bias, intensify the constraints faced by women, and therefore, why women may prefer "bargaining with patriarchy" (Kandiyoti, 1988) to an assertion of their rights.

Several important points emerge. First, women are not autonomous entities in relation to family farms; but are subject at the

same time to rules of the family, kinship and community networks, to rules set by religion, or by formal state and market organisations (Rao, 2007: 303). A recent study of marriage practices in the context of smallholder capitalism involving cottonseed production in Andhra Pradesh, India, reveals adeptness at cottonseed production, alongside willingness to contribute labour to joint household production as key criteria in the selection of a bride (Ramamurthy, 2014). The line between legal rights, kinship norms and household welfare is not distinct there.

Second, the multiplicity of activities undertaken in an agrarian household requires cooperation and mutuality between the different members. This is because the family's survival needs are met not just from the plots of land they may operate, but from the ecosystem they are situated in. For instance, they may grow food crops, but get fuelwood and leaf litter (to be used as manure) from the surrounding forest, fish from the river, and graze their cattle on common pastures. It has to be emphasised that the household is more a site for shared interests than just conflicts.

Finally, women too are not a homogenous category, but differentiated by age, class, marital status, caste/ethnicity/race—hence, they don't necessarily share common interests, or, indeed, common constraints. The interests of a migrant woman worker or a landless agricultural labourer are likely to be distinct from that of a land-owning woman farmer or an educated middle-class woman. Their interests originate from their particular social position and location at a point in time and hence their struggles too are centred around these interests (Molyneux, 1985). In the case of land claims, for instance, brothers' wives are likely to support their husband (and sons) rather than another woman, his sister (Rao, 2005).

Instead of considering women and men as holders of individual rights in relation to family farms, it is more important to understand how, in adapting to fast-changing local contexts, they negotiate different rules and norms to construct a new code of practice. Processes of male migration and the feminisation of agricultural work pose many contradictions and trade-offs for gender equality: between higher incomes earned from non-farm *versus* farm work (Walker and

Ryan, 1990; Quisumbing et al., 2004; Hare 1999), autonomy versus hard work to fulfil household responsibilities (Karlekar, 1995), or effectiveness in negotiating the conjugal partnership and seeking personal security (Elmhirst, 2011; Sargeson, 2008; Rao, 2011). There are gains and losses. Women in Sarawak, Malaysia, are, for instance, now prepared to give up their inheritance and move to towns with their husbands, given the loss of income alongside the increased threat of sexual violence (see also Sim, 2011).

The question that arises is: how far does a state acknowledge the power differences between various social actors and seek collaboration to ensure fairness in social interactions through implementation of its laws and policies? Women's central role in food production and ensuring food security, and consequently a realisation that they need to be supported in this role through strengthening their rights and entitlements, is now recognised at the global level. Apart from China, which provides an environment where women farmers can succeed (de Brauw et al., 2013), state institutions in most Asian countries, especially credit and service providers, have yet to adjust their policies.

India, through its 2010 budget, launched a Women Farmers' Empowerment Programme (Mahila Kisan Sashaktikaran Pariyojana) precisely for this purpose, but it is now restricted to a small initiative implemented through NGOs (non-governmental organisations). An effort to legislate on Women Farmers' Entitlements was not successful. This Bill sought a wider definition of a woman farmer, as noted in the Introduction, and sought to bypass the need for a land title as a prior requirement to accessing other inputs and services for agricultural production. As per the provisions of the draft Bill, every woman shall have equal ownership and inheritance rights over agricultural land in her husband's family, along with rights to water, access to credit and insurance, technology and other essential agricultural inputs, recognition of her intellectual property, as well as access to a separate fund created to provide support services such as crèches and daycare centres, and water and sanitation facilities.

Given the importance of land, we discuss next the implications of land titles for gender relations.

Women's Rights to Land and Other Productive Assets in a Context of Change

Land ownership and distribution patterns vary greatly in Asia, but it is primarily accessed through inheritance systems. There are four major types of inheritance and land management systems relevant to women's rights to land. These include: a) the largely patrilineal South Asia, with land as a private asset owned and acquired mainly through inheritance down the male line; b) bilateral and matrilineal Southeast Asia, where too land is a private asset acquired through customary inheritance systems; c) the communist/socialist states like China and Vietnam, where land is vested in the state but households are granted use rights by the local village committees; and d) the Central Asian states marked by conflicts between centralised state institutions and private, clan-based land management systems.

Despite inadequate and faulty data, available evidence suggests that women are less likely to own and operate land in South Asia (roughly 10-15% of total land) (FAO, 2011; Rao, 2006), and when they do, the size and value of holdings are lower than those of men.[18] This is further shaped by caste and class disparities in asset ownership,[19] though often with contradictory gender effects. In Southeast Asia, the gap in landownership is not as stark as South Asia (FAO 2011). There is a greater equalisation of rights, shaped by the gender division of labour and work opportunities, to provide proper incentives to both men and women (Quisumbing et al., 2004; Li, 1998). Chinese women who worked on farms had almost equal access to land and credit as men, due to the provision of pre- and

18. A recent household asset survey in Karnataka state, India, covering 4110 households, found that in rural areas, while 71 per cent of all plots were owned individually by men, this was only 14 per cent for women. While 20 per cent of women were agricultural land owners (both individual and joint), only 12 per cent of the value of total agricultural land accrued to them, pointing to smaller holdings (Swaminathan et al. 2011). Rao (2008) too found in her Santal village studies that while women owned 11-13 per cent of the total village land, they constituted about 30 per cent of the landowners (both individual and joint).

19. The National Sample Survey's Indebtedness Report that calculates the value of total assets per social group (land, livestock, buildings, equipment, household durables and financial assets) confirms this in revealing that the SCs and STs own about half the value of assets of the OBCs and about a third that of Others (Rao 2006b: 91; Heyer 2010; Harriss-White 2003; Deininger et al. 2010).

post-production services by the village government (Croll, 1987), although Vietnam's women-headed households had much lower access to assets (Belanger and Li, 2009).

Land rights have not remained static over time. There have been historical events and changes, at times exogenous changes in technology (Quisumbing et al., 2004), law or state priorities (Stivens et al., 1994)[20] that have pushed for equality. The pressure for diversification has enhanced male migration and feminisation of the agricultural sector across South Asia and China, as discussed earlier (FAO, 2011). The implications of male migration vary across the region. In India, without land titles and with restrictions on public engagement, women are unable to access markets, technologies, inputs and institutional credit, especially due to their continued classification by the state as unpaid family helpers rather than independent cultivators and decision makers (Rao, 2012b; Neetha, 2010), and get restricted to lower paid casual and informal work (Kapadia, 2000). Most Chinese women do not face production-related difficulties, with the exception of widowed or divorced women, whose shares and interests are often not recognised by the village regulations and councils (Davin, 1999; Yunxian, 2010).

Land is seen as the key productive asset in the context of farming communities. Women's access to, and control over, land can potentially lead to gender equality, alongside addressing material deprivation, as land is not just a productive asset and a source of material wealth, but equally a source of security, status and recognition too. But this is perhaps also why there is often strong resistance to women's claims. There are four levels of institutional barriers to the recognition of women's rights. These include the strongly entrenched notion of the male head of household across Asia, community and kinship norms that resist women's inheritance of natal property (especially in South Asia), commercialisation and globalisation processes that commoditise land, and shifts in state

20. Stivens et al. (1994) note in Malaysia the process of feminisation of land due to the ideological construction of women as 'conservers of nature'. Yet it was seen as a backward sector, there was little state investment in agriculture, and growth was seen to lie in the urban, industrial areas.

priorities and policies in favour of private capital. Imbibing these institutional barriers are the so-called "Asian values" (of peace, service, sacrifice), whether driven by Confucian, Hindu, Islamic, Christian or Buddhist religious practices—all strongly patriarchal in nature. Pressures on land add to the complexities mediating women's access such as its location (natal/marital), mode of acquisition (inheritance, markets, state), the type and extent of rights (legal, use), and the larger religious and political economy context that shapes state policies and priorities within which claims are negotiated.

Except in Latin America which recognises "dual heads of household", globally, including in Asia, families remain strongly patriarchal, with the man recognised as the "head of household" by both state and market institutions across these very diverse contexts.[21] Land and other asset entitlements are generally issued to the head of the household; the social identity of farmer then linked to masculinity (Jacobs, 2014). Despite women's work in the fields, caring for livestock and agricultural labour, their farm-work too, like housework, is hidden and undervalued; or at best, seen as an extension of their housework (Rao, 2012b). Women, constructed socially as dependent wives and mothers, are expected to obey and service men and the family through their lifecycle, and as long as they perform this role, their rights are protected. Divorced and separated women are most vulnerable, as lacking in male protection and supervision, they are seen as deviants and denied their rights. Chinese families are disinclined to give daughters their share following marriage. Women find it difficult to legally prove and claim their marital share in the courts, especially in the event of marital breakdown, given the perception that agricultural land "belongs" to the male's side of the family (Yunxian, 2010). Widows in India are an exception, as this is perhaps the only stage in the lifecycle when women's rights do get legal recognition, albeit subject to conditions around residence and remarriage (Agarwal, 1998; Rao 2008).

21. The 1990 national census in Indonesia classified women as housewives and registered land in the names of the husband as 'head of household' (Li, 1998; Elmhirst, 2011). Agarwal (1994) and Sargeson (2008) report similar findings in South Asia and China respectively.

The contexts of growing diversification and migration, and the commercialisation and commoditisation of land and agricultural production, have been discussed earlier in this paper. Women are increasingly being driven into insecure positions, both within marriages and outside. They have lost access to customary lands, to income, and are pushed more and more into "housewife" roles with pressure to bear and rear children (Jacobs, 2014). In the absence of independent resources, especially houseplots, women experience much higher levels of violence (Panda and Agarwal, 2005; ICRW, 2006; Bhattacharya et al., 2011; Sargeson, 2008; Belanger and Li, 2009).

What needs to be emphasised is that women's claims to productive resources are often dismissed as being of the socio-cultural domain. Recognising women as productive workers/farmers is essential to give legitimacy to their claims to resources. This has however been a fundamental tension within development policy: the construction of women as either workers or mothers and wives —the separation of the productive and reproductive, rather than a holistic attention to women's needs and claims as "persons", engaging equally with the productive and reproductive domains. Recognition of their entitlements as farmers by different institutions would affirm women's social status in the household, community and wider society. By enhancing their value as equal members of the economy and society, it could help challenge deep-seated son preference in some parts of Asia such as India, Pakistan and China. Without such a paradigmatic shift in recognising women's value and contributions, substantive equality will be hard to achieve.

Gendered Knowledge

Most studies point to the differential access to assets by men and women, particularly land. What are rarely researched are the differences in the details of men's and women's knowledge about soils, seeds, crops, etc., and application to ensure optimal and efficient use of limited resources, including labour. Thus, in villages in eastern India, while both men and women spoke of the importance of soil health, the methods they used to achieve these ends were

different. Women collected and mixed leaf litter and dung, and applied it in small quantities at frequent intervals, comparing this operation to birds feeding their chicks, while men followed practices suggested by the agents of fertiliser companies. Women were also able to multitask—opening or closing water channels, collecting fallen twigs or edible plants, on their way to and from the fields (personal observations of the authors). In the case of Maharashtra, Kelkar (2007) further distinguishes between the knowledge of women of different caste groups, given their varying responsibilities *vis-à-vis* land. Women small operators knew much more about soil health management than women landless labourers.

Parks et al. (2014) in their study in Mindanao, the Philippines, note that men are seen as farmers, and women seen to "multitask" including farming. While men therefore had extensive knowledge of the terrain, of soils and plants, the pastureland, and cash crops, women too had considerable knowledge of plants, mainly subsistence crops, but also of marketing and business strategies. They used different indicators of soil health. Hence, they note that if men alone are invited to training sessions, only partial knowledge can be gained.

Intra-Household Relations

In most land-based economies, labour contributions of different members of the household are valued not just in market-based or monetary terms, but also a social value is attached to these contributions—they have value in reaffirming or renegotiating particular social relations. Karl Polanyi (1944) described this as the social embeddedness of economies. However, what is important to note is that rather than seeing social and economic relations as distinct, they are still understood in many contexts as mutually constitutive, where economic transactions reflect the nature of social relations, dependence, obligations and so on. While conjugal contracts may not be explicit, the cultural emphasis in Asia is on complementarity between partners rather than narrow self-interest, so even when people work separately, they are expected to "eat together" or contribute to joint household well-being (Li, 1998).

Using the example of oilpalm growers and settlers in the province of West New Britain in Papua New Guinea, Curry and Koczberski (2012) demonstrate how labour relations sit within wider relations of reciprocity and obligations within households and kingroups. While male "heads of household" are responsible for organising harvest labour, payments reflect age, gender, kinship status, and perceived need of the individual rather than only the labour provided. These notions of value however are contested and they change, so growing market pressures (with contract farming and export crops) have seen more individualised patterns of harvesting coming into play. The implication has been declining cooperation between and within households and a consequent decline in productivity, given the difficulty of accessing adequate labour to complete harvesting within the short window of three days available for this purpose.

Women gradually withdrew their labour from oilpalm work as the companies paid cash to their husbands, who made inadequate contributions to the upkeep of the family (Koczberski, 2007). They preferred to grow vegetables or engage in alternative income-earning activities. They saw men as failing to meet the "implicit contracts" (Netting, 1993) in terms of upkeep of the household, paying school fees, raising bride prices for sons' marriages and other indigenous obligations.

Companies found that 60 per cent of the loose fruit collected by women was lost. Technical solutions were attempted, but failed, as the problem lay in the lack of recognition of women's labour. Once the companies realised this, they changed the system of payment to directly reimburse women for the loose fruit they collected. This recognition was not opposed by men; rather they supported it. The men themselves added oilpalm fruit to women's collection, as their share of contribution to the household. Cash was a signifier of male prestige, so multiple demands were placed on it from multiple sources, making contributions to wives increasingly limited.

Two lessons can be drawn from this experience. First, all assets have a gendered meaning, be it land, labour, cash or particular crops. Second, and importantly for policy, intra-household disputes over labour and income distribution can be resolved by institutional

mechanisms, which recognise the different meanings of different assets and resources, and find ways to equitably redistribute them in contexts of resource constraints and social change.

Much has been written about pigs and the construction of "Big Men" in New Guinea. What is interesting is the joint ownership and rights of men and women in the pigs, even though they are publicly transacted for prestige by men. Rather than being exploitative of women's labour, checks and balances are in place to ensure complementarity, where women are compensated both materially and symbolically for their contributions. Before transacting a pig publicly, private negotiations are held and claims settled, as disputes affect the reputation of men. The logic of pig maintenance and killing does not follow demographic or nutritional reasoning, but reflects transactions that affect social standing, respected status and political association (Sillitoe, 2001). Gendered cooperation is activated to produce both fertility and wealth (Stewart and Strathern, 1999).

Conflict and Changing Meanings

Contexts of conflict can however change the meanings of different assets and activities. Rwanda is an example of women taking leadership roles across different domains of life in the absence of men who were at war—the Rwandan Parliament is constituted of 64 per cent women, the highest in the world. In South Asia, despite control over women's mobility and choice, it is Afghanistan that has the highest number of women in Parliament.

Following its collapse in 1991, most of the states comprising the Soviet Union witnessed a sharp economic downturn, and some in Central Asia like Tajikistan were confronted with many years of civil war and ethnic conflict (1991-1997). Poverty increased sharply post-1991, and a majority of the people (67% of the population) continued to depend on agriculture, especially subsistence production, despite its share in GDP declining by close to 28 per cent over the 1990s (Rowe, 2010; Robinson and Guenther, 2007). Following Independence, there was a move from collective farms to farm labourer cooperatives in order to incentivise production. Changes however remained cosmetic, as bureaucrats and leaders did not want

land use to shift away from cotton production, the major income earner of the Tajik nation, contributing over 20 per cent to its GDP. Profits from cotton went to them, rather than to the farm labourers.

Cotton, however, needs irrigation and depends on effective water management. Following privatisation into cooperatives, this became a problem, as the state was no longer willing or able to invest in maintaining canals, provide oil for running pumpsets, or, indeed, pay attention to drainage. With payments from labouring on cotton farms increasingly unpredictable, and the long distances to these farms in the absence of transportation facilities, families gradually opted out (Rowe, 2010). Diversification became important for survival. A large number of households saw male migration to Russia, and those with some resources tried to set up businesses—the two key predictors of improved incomes (Robinson and Guenther, 2007).

Interestingly, 23 per cent of the agricultural land is currently classified as 'kitchen gardens'. Small plots of land close to the homestead were used during the Soviet period to augment diets through the cultivation of vegetables and fruits, and maintenance of small livestock. In the face of the civil war, drought and the decline in infrastructure and services, kitchen gardens have however become a major source of income. Fruit trees are grown alongside wheat/barley in the first crop season and rice or vegetables thereafter. Onions and herbs are also cultivated in the spring, as they constitute an essential part of the local diet. Livestock however has drastically reduced following the collapse of irrigation and access to water, and consequently, dietary diversity (Rowe, 2009).

The gender implications are interesting and somewhat unexpected. Earlier 40 per cent of the women were employed as teachers, local clerks and workers in cotton farms, and the rest were engaged in kitchen gardens and livestock rearing. With the cooperatives not paying regularly, both men and women are now working in the kitchen gardens. Apart from finding more men in the fields, it is interesting that women, in particular older women, are increasingly taking on the task of marketing of surplus produce in the local bazaars. Women's domination in the bazaars has resulted not just from earning income, but also because the local militia

which extort money and products from men tend to leave older women alone; the women are able to strategically use kinship and age hierarchies to establish connections with these young men and not rely on bravado (Rowe, 2009: 700).

Secondly, families continue to be multi-generational; hence even if an older male migrates, it is unlikely that only a single woman with children would be left behind. The presence of other adult women in the family greatly affects women's time availability and use, as with the collapse of infrastructure and services, sharing of tasks becomes essential. This varies with position in the household (Harris, 2004), with older women more likely to perform agricultural and market-related work, daughters more in non-care reproductive work such as fetching fuel and water for cooking, cleaning and subsistence production, and daughters-in-law more engaged with care work, especially those with young children. As Meurs and Slavchevska (2014) point out, the implication is that rural women are already stretched for time, even though this varies with their subject position.

Consumption Priorities and Patterns

Farming households too, like others, have aspirations for a better life. In the first instance, they seek to ensure food security and basic needs such as safe housing. Thereafter, they invest in assets—whether education of the children, irrigation and farm equipment or other status markers. What is increasingly clear across Asia is that engagement with non-farm employment and migration contributes surpluses for such investments and is central to upward mobility (Djurfeldt et al., 2008; Kabeer and van Anh, 2002; Paris et al., 2009; Rao, 2013).

This raises the question of the relationship between women's contributions to the household, be it food or cash, and the degree of control they have over decisions relating to consumption priorities. Across Southeast Asia, as mentioned earlier, women are tasked with household financial management, and are often the final decision makers on household consumption priorities (Kabeer and van Anh, 2002; Papanek and Schwede, 1988).

Studies from India such as that of Garikipati (2009: 537) in Andhra Pradesh indicate that women's work participation does not necessarily enable them to bargain for better household outcomes, including more personal spending money or sharing of household chores. Based on an analysis of expenditure patterns, Harriss-White (2004: 171) demonstrates that female work participation or income-earning production is not sufficient for enhancing women's power, but requires conscious struggle in the domestic arena to challenge the predominantly male control over resources and decisions. Household expenditure on "male items" is several times (13-20) more than female private expenditure. Other studies note that decision-making was usually a consultative process, irrespective of women's asset ownership or work participation status. This is one area where socio-cultural norms matter (Swaminathan et al., 2011; Rao, 2014). For instance, women in Tamil Nadu have considerable voice in decisions in the "reproductive" domain, such as education and health of the children.

Impacts on Household Nutrition

Swaminathan (2014) in his editorial in Science entitled "Zero Hunger" notes that:

> Commercial farming tends to promote market-driven monoculture of food crops, in which prioritising nutrient need is generally absent. Family farming is characterised by diversified crops and hence can be harnessed to support nutrition-sensitive agriculture.

Evidence related is the so-called South Asian enigma, where despite increase in food production and high levels of foodgrain stocks, malnutrition remains widespread. Current evidence appears inconclusive on whether women's employment, and engagement with agriculture in particular, has positive implications for child nutrition (Vepa et al., 2015 forthcoming). New analysis on the pathways between agriculture and nutrition and how they are mediated by social institutions including gender is largely absent, and is an important area of future research. Imperative here is to move beyond the material, and to recognise the significance of social relations and

cultural norms in shaping responsibilities for food provisioning and feeding practices. A few examples illustrate this.

Amongst the Gogodala in the Western Province of Papua New Guinea, food and sago are clearly linked to women's work, way of life and identity. Their knowledge of nourishing and maintaining families as also their physical capabilities are recognised and appreciated within the village and kin relations. Migration to urban areas is now rising, and women are mainly mothers and wives at the destination —they don't engage with paid work and are largely domesticated. To retain their identities as equals and workers, women struggle to maintain the metaphor of sago, at least in gifts and consumption (Dundon, 2005).

In a reverse case, Hill (2011) finds a contraction in men's employment opportunities in the Philippines post-1990, with rapid conversion of farm land to other uses, while women's have increased in range and financial significance, partly through better access to skills and credit. Yet the prevalent discourse remains one of male responsibility for bread-winning, despite the problems encountered through disruptions in irrigation and debts for machinery and inputs. Given the tenuous masculinities at stake, women supported male discourse as providers and devalued their own contributions. They represented their work, both reproductive and income-earning as "responsible motherhood". Given men's increasingly aggressive behaviour, taking to drinking, etc., because of frustrated masculinities, women recognised the need to foster harmony within the household and beyond. By downplaying their income contributions, they could make claims on their husbands' labour and time, and also demand that they fulfil their financial responsibilities.

There is similar evidence from India, where confronted by few opportunities for employment, in contrast to their women who received both skills and credit, men either took to drinking and violence, or at best withdrew from work and allowed women to single-handedly manage the household (Deshmukh-Ranadive, 2003). It was to retain male contributions and a degree of household reciprocity that Santhal women refused to take up ploughing, even though this sometimes delayed cultivation and reduced production

(Rao, 2008). What Hill (2011) for the Philippines and Rao (2006) in the case of India demonstrate is not only the role of state discourses and policies targeting women in increasing women's workloads and responsibilities, but also pitting women against men, or, worse, alienating men from the process of ensuring food and nutrition security.

Joint contributions and reciprocity are particularly crucial for ensuring household nutrition, given the differential meanings attached to different assets. While women are tasked with food preparation and distribution within the household, cash incomes are often controlled by men. Even if they are able to cultivate the basic staple and some supplementary food items in their "home gardens", confronted by capitalist mono-culture, declining water tables and lack of cash for cultivating vegetables and other crops, it is impossible to ensure a balanced diet in the absence of male cash contributions. Men too take pride in their role as household providers, and rather than undermining this sense of responsibility by shifting it entirely to women, policy needs to enable support and cooperation within a more egalitarian framework. The interconnections between different institutional levels in shaping gender relations, and how sometimes official discourses themselves may lead to performances by women of an alternative, albeit subordinating, role for the sake of household peace and harmony, need to be highlighted.

While it is assumed that women's work in agriculture and responsibility for household care and food provision influence nutritional outcomes, existing research finds these links to be somewhat tenuous. As Gillespie et al. (2012) demonstrate in the case of India, while female employment can improve nutrition through control over earnings, it can also have a reverse effect due to the reduced time available for care and feeding. Further, double burdens of work lead to higher energy consumption and possible undernutrition of the women themselves. This raises several questions in relation to women's work and nutrition.

First, one needs to consider the energy costs and arduousness of particular activities; time allocation alone is insufficient for assessing the differences in burdens of work by gender (Palmer-Jones and

Jackson, 1997). In both India and Bangladesh, male mortality is higher among men in the age group of 40-50, especially those who have been engaged in hard manual labour, often migrant, over a period of time. Appropriate technology can definitely reduce effort intensity, but then work may be labelled as heavy/light, skilled/unskilled depending as much on the gender identity of the worker as the character of the work itself, with likely impacts on earnings.

Second, to understand potential gender bias in intra-household nutrition outcomes, it becomes necessary to disaggregate households by class, location, family size, age, landholding size, and additionally take account of seasonality. New research is pointing to the role of grandmothers, in particular maternal grandmothers, in the care and well-being of grandchildren (Strassmann and Garrard, 2011). Harriss-White (1997) in her review of key studies in India points to the difficulties of making individual estimations of "need" and "adequacy", given the simultaneous occurrence of different biases by gender and age across different social and income groups. Miller (1997), in fact, finds that son bias was stronger among the higher status, literate groups in South Asia, rather than the poor, where the entire family may have lower access to adequate food, but gender discrimination was not overt.

Third, what is crucial in societies, but often ignored, are the cultures of food consumption. Food commodities have symbolic value and ritual status, be it pigs among the Guinean highlanders or rice among the Dayaks. Belief systems about eating and feeding practices—such as notions of the sacred, ritual taboos, or practices such as fasting—can reinforce social and gender boundaries (Mintz and du Bois, 2002). Such cultural knowledge is an important source of information, strongly influencing dietary practices. While imparting scientific knowledge, we need to first recognise indigenous understandings of the different meanings of food and its properties, of rituals and taboos, but equally how these are overcome through strategies such as snacking or planting larger gardens (Bentley et al., 1999). Food cultures also constitute notions of beauty and the body. As Unnithan-Kumar (2011) demonstrates, fatness may be an

expression of beauty for women in Ghana, but would reflect laziness in rural Rajasthan.

Clearly, then, improving nutritional outcomes is not just about giving women land and information about nutrient-rich crops; it is equally about intra-household negotiations around work, responsibilities, reciprocity and peace. Labour processes are inseparable from social relations and life processes of the domestic unit, both across gender and generations. While research on crop choices and crop diversity are lacking in Asia, evidence from Africa reveals the importance of crop rights in mediating household labour allocations (Carney, 1988). A recent study on the adoption of biofortified crops (orange sweet potato) in Uganda found that this depended on joint decisions by husbands and wives, even though women may take primary responsibility. A key implication is to include men in the dissemination of information on biofortified crop varieties (Gilligan et al., 2013).

Collective Action for Change

While women do find and use everyday forms of negotiation and bargaining, there are limits to this in a context where women face considerable institutional/structural barriers, be they from market mechanisms, state policy or social norms. Advocacy for changing policy and social practices requires collective action. Agarwal (2010) emphasises that collectives improve incomes and production, enhance women's self-confidence and self-esteem, and develop leadership capacities that can be exercised in other settings. Collective action is of various types and can function at different levels: to demand the implementation of existing legislation and policies; to advocate for policy change, including seeking representation for women in key decision-making bodies; to address constraints of resource access as well as scale in production and marketing; or to gain social recognition and visibility for women as farmers and equal citizens.

Collective action, however, often requires conscious mobilisation. In rural Andhra Pradesh, mobilisation by the gender thematic group of the Society for Elimination of Rural Poverty (SERP), a body linked to the Department of Rural Development of the Government of

Andhra Pradesh, did make a difference in terms of women's awareness of their rights, especially to land. Struggles, both individual and collective at different institutional levels, initiated by women themselves or by progressive NGOs, are key strategies in the process of gaining legitimacy for their rights. This requires, at the very minimum, mechanisms that can ensure transparency, accountability and, most importantly, give women a voice within systems of governance. In this process of forging their identities and gaining rights, women draw on both customary and contemporary legal frameworks and developmental policies, as well as on community mobilisation and negotiations within the household.

Collectives can take different forms—from self-help groups (SHGs) to women's federations, cooperatives, grass-roots movements and political organisations (e.g., elected local governments). These are nevertheless bounded institutional spaces, circumscribed by specific agendas and ideologies, which tend to often both include and exclude the poorest who lack the time and resources to contribute equally to the collective enterprise (Rao, 2010). Women are not a unified category, but have different subject positions, family circumstances and interests, depending on their own social positioning at a particular point in time. So, in speaking of women's engagement with collectives, it is important to consider who sets the agenda, who participates in negotiations, as also the mechanisms through which different voices are heard or represented (Fraser, 2009). NGOs often select educated and slightly better-off women as group leaders, but clearly the issues they prioritise draw on their own lived experiences. Apart from matters of rights and recognition, the question of representation then becomes crucial.

Over the last decade, women's SHGs have become synonymous with collective action. Yet, in analysing rural women's engagement with institutions (ranging from the household to the community, state and markets), the levels, spaces and forms of power entailed, separately and as inter-related dimensions, need examination (Gaventa, 2006). Spaces for struggle and negotiation can be formal—accessed by right (e.g., *panchayats*) or by invitation (e.g., land reform committees)—and informal—claimed or created outside mainstream

institutions. They can take forms that are either permanent/ongoing in nature (e.g., SHGs or federations organised by NGOs) or involve transitory action (e.g., land marches). Power relations within and between these different spaces may be visible in observable decision-making, hidden in the ability to set the political agenda or invisible in silently shaping meanings of what is acceptable.

Despite a lack of documentation, some examples from South Asia described here illustrate good/innovative practices, from the perspective of both goals and processes (Rao, 2013).

Implementation of Existing Policies

The Deccan Development Society in Andhra Pradesh has since the mid-1980s organised over 3000 low caste (Dalit) women in 32 villages to develop, take decisions and establish de facto control over low quality fallow lands with financial support from the state government and organisational support from NGOs. Apart from instituting their own public distribution system for food and nutritional security, and meeting needs of fuel and fodder, women have leased and bought land (Rao, 2010; Agarwal, 2003). Organisations like the M.V. Foundation in Andhra Pradesh seek to facilitate the convergent implementation of a range of schemes, policies and entitlements (Swaminathan and Jeyaranjan, 2008). In Kerala, power exercised through the Kudumbashree programme has put pressure on the local government to promote collective farming by women on land leased from the state.

Social Recognition and Visibility

Social mobilisation is crucial for visibility and recognition of women's agricultural contributions in public fora. Nepalese women organised a massive land march in early 2011 for a supportive legislation and its implementation on the ground. A major objective of such social mobilisation is to enhance awareness of existing laws and entitlements, identify mechanisms for operationalising them through sensitising men, village leaders and state functionaries, and shift attitudes and values across different patriarchal institutional domains (J. Basnet personal communication).

Policy Advocacy and Change

a. *Claiming legitimate decision-making spaces*: Ekta Parishad in India secured the formation of a Land Reform Committee under the Ministry for Rural Development after a land march by 25,000 people (40% women). This recommended the setting up of multi-stakeholder Land Reforms Councils to oversee the process of land distribution. The Councils would provide a legitimate space at the local level to poor men and women to participate in decisions regarding land distribution. Unfortunately, this is yet to be implemented, and with the change of government in May 2014, now unlikely to happen.
b. *Changing attitudes of the bureaucracy*: The Working Group for Women and Land Ownership (WGWLO) in Gujarat has adopted a dual approach of simultaneously mobilising and enhancing the capabilities of women and sensitising the local male bureaucracy. Alongside building women's sub-committees and federations on land, they have been invited to conduct training programmes for the local revenue functionaries (Vasavada, 2004).
c. *Institutionalising the state-society interface to make programme implementation gender-sensitive:* ANANDI, a WGWLO member, has set up gender justice centres at the block level run by local *sangathan* (collective) leaders, women elected to *panchayats* (local government bodies) and NGO representatives to facilitate the interface with government implementation bodies. As a result, women have been able to secure *kisan* (farmer) credit cards, widow benefits, ration cards, bank accounts, as also inclusion of local grains within the PDS (public distribution system).
d. *Highlighting the rights of single women as subjects, not deviants:* The Ekal Nari Shakti Sangathan, a network of single women (never married, abandoned, divorced, separated, widowed) in India, is demanding from the state separate official registration, separate ration cards and two acres of surplus government land on a 30-year lease. In Himachal Pradesh,

the first two demands were accepted in 2009, important as markers of identity and enabling access to pensions and jobs. The demand for land has not yet been acceded to.[22]

Control Over the Production Process

Cooperatives have been an attractive institutional form, demonstrating alternative pathways for production and marketing. While the nature of private, household-based landholding has made cooperative agriculture largely unsuccessful, the Chinese example demonstrates the benefits of providing pre- and post-production services through village cooperatives. In India, this has been successful in the dairy sector, exemplified by the Amul brand, led by the Kheda District Co-operative Milk Producers' Union in Gujarat. Although women constitute a majority of livestock managers, nevertheless they comprise a minority 18 per cent of registered membership.

Political Leadership

The 73rd and 74th Constitutional Amendments in India, which provided for one-third reservation of seats for women at all levels of local government, have contributed to a process of positive change. Despite critiques, women now do influence agendas and decisions locally, including on resource distribution, and not just serve as "proxies" for their husbands. Most South Asian countries have implemented affirmative action for women in local councils.

CONCLUSIONS AND FUTURE DIRECTIONS

Summary of Key Insights

Asia's economy has witnessed rapid changes over the past three decades. Globalisation has led to a shift in emphasis from agriculture to manufacturing and services. Agriculture is seen as the handmaiden

22. Rather than seeking land from the natal family, which would imply a reconstitution of gendered kin positions of sisters and brothers and a loss of security and support in the short run, the transformations sought relate to the recognition of the validity of different subject positions and subjectivities, alongside shifting ideologies and consciousness (Berry, 2011).

of industry, in an industry-led economic growth model. While a large part of the population remains dependent on the agrarian sector, it is viewed—especially by the youth—as a 'backward' sector, influenced by the state equating manufacturing, services and urbanisation with modernity. Lack of investments in agriculture, both domestic and through development assistance, has created a view of it being 'unskilled', and negative terms of trade have led to an undervaluation of its contribution. This, accompanied by climate change and declining ecosystem services, has created an impetus for diversifying incomes through a range of strategies including migration, engagement with non-farm and off-farm work, and commercialisation of agricultural production.

This has transformed the very concept of the farm, the family and agriculture itself. A farm is increasingly viewed as an independent, individualised plot of land, rather than embedded in an ecosystem, providing a host of interdependent ecosystem services. Asian families were never nucleated in the strict sense of the term, but considered part of the wider community living in a specific locale and bound through strong kinship ties. Contemporary policy assumptions of the nuclear family (typically a unit consisting of husband, wife and children) seem to be misplaced, as there is increasing evidence of 'global householding': members of a family living and earning in distant locations to support each other, multi-generational or skipped generation families, alongside female-headed and female-only households.

For agriculture, this conceptual atomisation of both land plots and families, seeing them as individual units and not part of larger ecosystems or communities, has meant the non-acceptance of heterogeneity and contextual variations in policy formulation. Such reduction of complex realities to simplistic unilinear farm models has led to a situation where a shift from diversified family farms to commercial mono-cropping is perceived as an efficient use of land, not recognising the challenges to livelihood, food and nutrition security. This lack of reflexivity has led to losses in biodiversity, soil and water conservation, crop mixes, declining nutritional standards and indigenous knowledge.

As such, there are critical implications for both the gender divisions of labour and the gendered access to resources. To begin with, the discourse on feminisation of agriculture reflects the attribution of 'feminine' to the nature of work itself—low paid, invisible, insecure and not requiring special skills. Patterns of employment vary in practice, with a majority of women workers engaged in agriculture in South Asia, a possible masculinisation in some parts of Southeast Asia, and geriatrification in China and East Asia. But in all these cases, agricultural employment is the least preferred choice, taken up by those with no other options. The adverse terms of trade and rising costs of production that family farms are facing lead to women increasingly providing unpaid family labour in cultivation and allied activities, adding to their work burdens, alongside the systemic undervaluation of the work itself. Despite this, the rural agricultural sector continues to subsidise the urban manufacturing and services sectors by ensuring basic food security to households dependent otherwise on insecure and low-waged jobs. Women's managerial and entrepreneurial roles in these processes are however not recognised.

Parallel to the debates around feminisation of agriculture, there is recognition in the policy domain of the need for gendered access to resources. However, by confining this perception primarily to land ownership, and not to other key resources including natural resources (such as forests, pastures, water), economic resources (such as credit, markets, technologies) and social resources (including support networks and collectives for both productive and reproductive activities), the gendered meanings of, and dependencies on, different resources are ignored (Jackson, 2003). Further, it leaves out all those who don't have land and therefore may not directly be engaging with cultivation, though still involved with the agricultural enterprise.

For example, contemporary policy discourses emphasise cash transfers, conditional or unconditional, for meeting the goals of food security, education and health. Such thinking ignores the 'maleness' of cash as an asset. There are multiple demands on cash in any household. While it can be used potentially for diversifying and improving diets, given the gender inequalities within households,

there is a big risk that instead of improving nutrition, the men corner the money and spend it on consumer goods to enhance their status and on leisure activities. Food, as is consumed daily, on the contrary, remains under female control. In such a context, it is imperative to recognise and understand the local meanings and values attached to different assets and resources and their gendered nature, instead of imposing external, market-driven, economic ones only.

Given their roles in reproduction and care, the responsibility for food and nutrition security too has been placed on women. Yet increasingly their access to resources, both household and communal (ecosystem services) are threatened, labour availability uncertain and returns unpredictable in contexts of price and market volatility. State withdrawal has additionally meant the decline in public investments in agriculture—whether irrigation, credit or extension—making it even harder to survive. Across Asia, the evidence suggests that rural women are already stretched for time, even though this varies with their subject position. It is essential to recognise women's heavy burdens of unpaid work involving intense drudgery—long hours of subsistence production, livestock maintenance, domestic and care work. Without the cooperation of men, who pride themselves as household 'providers', nutritional outcomes cannot be improved.

Collective agency by women (with support from men) becomes crucial for negotiating and challenging the social norms that tend to undervalue and invisibilise women's contributions. As noted by the UN Special Rapporteur on Unpaid Work, the first step to achieving gender equality is to recognise women's work and contributions, both paid and unpaid. Only then can strategies be put in place to reduce and redistribute tasks through the provision of private and public services.

Policies, which focus on particular fragmented sectors rather than people, have largely failed to acknowledge changes in household relations (inter and intra) due to diversification and migration. Women continue to be treated as a homogenous group, not distinguished by age, class, marital status, caste or ethnicity, or indeed the nature of their engagement with the farm, whether as owner-cultivators, household workers, wage labourers or migrant

workers. There is considerable evidence to demonstrate the ways in which opportunities and constraints are shaped by women's social positioning in particular contexts. Men are largely left out of the question.

Marriage and belonging to a family is important in the lives of both men and women and should be recognised as an equal partnership, both legally and socially, rather than a relationship based on male authority and female subordination, as is currently the practice of most state and market institutions. Rather than contract farming or capitalist investment in land, the need is to support smallholders in their enterprise through the provision of both pre- and post-production services, as in China. It is only through such holistic support can one ensure not just a sustainable livelihood based on the small farm, but equally both food and nutrition security in the future.

While there is polarisation between the urban and rural, and even within the rural between capitalist farmers and landless labourers, this is not inevitable. Small family farmers have confronted this challenge by diversifying their livelihoods through non-farm incomes and migrant remittances (Rigg, 2006), while also maintaining production on their farms. They have been supported in this by state land reform policies, along with appropriate support for commercial production, as in the case of rubber (recognition of tenure rights, extension services, low cost loans) in some countries in Southeast Asia (Fox and Castella, 2013).

Ideally, every farm has to be a sustainable farm—ecologically, economically and socially. This necessitates, especially in the economic domain, that small farms unite, a task that cannot be achieved without explicitly recognising the contributions of men and women. This implies attention at multiple levels: from the individual plots to the larger community and village ecosystems in which these are embedded.

Further, rather than a generic model, crop choices and agronomic practices have to respond to local specificities: to agro-climatic and ecological conditions, to market preferences and demands, and equally to the traditional knowledge that shapes land and labour

management policies. Women are central to this process; and cannot be patronised by being offered only credit and technology. Attention has to be paid to reducing the drudgery of work, increasing productivity gains per hour of work, and adding value, so work burdens are reduced without loss of income. Not only have their skills and wisdom to be acknowledged, but women need to be seriously taken on board at the level of implementation—that is, they have to be recognised as farmers and not just as unpaid household helpers. This can happen only when we accept that family farming is an economic and social partnership between men and women, which has to be based on the principles of equality and mutual respect.

Recommendations

There is a critical need for a paradigm shift in the policy domain that sees agriculture as a driver of development and growth. This would entail context-sensitive (ecosystem and socio-cultural) strategies that strengthen family farms and contribute towards enhancing household livelihood and nutrition security, promoting job-led economic growth and equitable and sustainable development. Women have to be seen as central actors in this process, as farmers in their own right, alongside men.

Governments

a. Remove discriminatory provisions in law, make women equal partners in land inheritance (with attention to marital property) and ownership of resources, and ensure effective monitoring and implementation through sensitisation of land officials and adjustment of forms and procedures.
b. Ensure convergence in accessing entitlements to other related resources such as credit, inputs, tools, membership of service and marketing agencies, irrespective of land title.
c. Improve infrastructure and services, such as the provision of water, cooking fuel and electricity that can contribute substantially to reducing time required for unpaid household and care work and also improve welfare (not just agricultural training or market-related interventions).

d. Recognise the reality of diversification in local economies and changing aspirations of young men and women, and provide appropriate support such as upgrading facilities at local markets, devolving extension and knowledge-sharing roles, providing local transport.

UN

a. Take forward the 'Gender Equality' clause in FAO's Voluntary Guidelines on the responsible governance of tenure of land, fisheries and forests in the context of national food security, and initiate a comprehensive UN Convention on ensuring equal entitlements to men and women family farmers, along with other UN agencies. This could combine principles from the Draft Women Farmer's Entitlement Bill, 2011, of India and the Report of the UN Special Rapporteur on Extreme Poverty and Human Rights on Unpaid Care Work and Women's Human Rights.
b. Support context-specific research to deepen understanding of institutional constraints faced by women in securing equal rights, recognition and representation.

Other Actors/Researchers

a. Conduct high quality and rigorous research, both quantitative and qualitative, to sharpen understanding of the changes in gendered work and life processes in different agro-ecosystems in the context of global macro-economic changes and its implications for gender equality.
b. Specifically locate gender studies in order to identify particular intersectionalities (of age, ethnicity, marital status, education) and factors (natural, social and economic) that constitute the framework of informal institutions influencing the social recognition/denial of women as equals.
c. Undertake information-sharing and capacity-building of a range of stakeholders—women, men, village and community leaders, local bureaucracy and policymakers.

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3

AJAY PARIDA

Sustaining and Enhancing Small Farm Productivity in an Era of Emerging Challenges

Agriculture, particularly involving the small farm sector, is at the heart of the economies of many developing countries. Agriculture contributes to a large share of GDP (gross domestic product), employs a large labour force, represents a major source of foreign exchange, meets the bulk of basic food requirements, and provides subsistence and other income for large sections of the population in these countries. Through forward and backward linkages with other sectors of the economy, agriculture provides significant stimulus for growth and income generation. Without a vibrant agriculture system with concurrent attention to human potential and productive capacity, significant progress in promoting growth, reducing poverty and enhancing food security cannot be achieved. A strong and effective food and agricultural sector, therefore, has to be the primary pillar in the strategy of overall economic growth and development for many developing nations, including many countries in the Asia-Pacific region.

Agriculture has played a dominant role in the growth of economy in countries of the Asia-Pacific region. Comprising 39 countries, this region is characterised by huge diversity in size, population, agricultural and economic development (Beintema and Stads, 2008). The majority of Asia's rural population remains highly dependent on agriculture, forestry, fisheries and allied sectors, both directly and indirectly. Rosegrant and Hazell (2000) observe that the region and especially South Asia, is also seeing increasing population pressure, agricultural intensification, and inappropriate farming practices that seriously threaten the rural environment. Despite having a wide range of natural endowments in terms of agro-ecology/agro-climate,

rich bio-resources, coupled with diversified agriculture, the area today faces major challenges of food insecurity, and high rates of poverty and malnutrition.

Smallholder farmers generally face marginalisation, in terms of access to resources, information, technology, capital and assets (Murphy, 2010). Small farmers in India as well as in many other countries of Asia-Pacific have several common features. Seasonal production, lack of scale in production, undifferentiated functions such as consumption, investment, work and social activities are characteristic features of small farmers in the Asia and Pacific region (APO, 2004). Small farmers, especially in rainfed areas—a dominant feature of the agricultural landscape of the region—encounter constraints in the production process, in access to inputs and credit, marketing and value addition. Their production level is limited by the small size of their holdings, weaknesses in the land tenure system and unequal access to irrigation water. They often experience difficulty in procurement and application of modern technologies because of the high costs and greater risks involved.

In India, for example, the agriculture and allied sector is the largest one, contributing to around 14 per cent of the GDP and engaging 55 per cent of the workforce (GoI, 2014); it is the prime contributor to the living standards of nearly 70 per cent of India's population living in rural areas. The Green Revolution of the 1970s pushed productivity growth and enabled the transition of the country to a food-secure nation. However, in recent years, growth in agriculture has stagnated relative to other sectors. In 2010, the agricultural sector grew at a rate of 2.7 per cent, relative to about 10 per cent growth in both the service and industry sectors. Agricultural incomes are lower and the rate of growth is slower than incomes in other sectors. This has resulted in the persistence of unacceptable levels of hunger, poverty and malnutrition among large sections of India's population.

In most of the Asia-Pacific region, during the second half of the last century, there has been substantial investment in irrigation, infrastructure and institutions (although a declining trend in such investments has been noticed during the last two decades). This

has enabled many food-insecure, import-dependent developing countries, including India, become food self-sufficient. The adoption of advanced technologies aiding agriculture—farm, agricultural, management and mechanical—coupled with the traditional wisdom and knowledge of the farm-dependent communities, has led to enhanced productivity of major crops in the region. Agriculture has undergone notable transformation during the last four decades resulting from the phenomenal success of the Green Revolution. According to Food and Agriculture Organization of the United nations (FAO) (2006), Asian cereal production registered more than a 260 per cent increase from 386 million tonnes in 1965 to 1,009 thousand tonnes in 2004, with similar trends for other agricultural commodities. Furthermore, the region's average yield of rice doubled from 2.0 t/ha in 1965 to 4.1 t/ha in 2004, while that of wheat more or less tripled from 0.97 t/ha to 2.87 t/ha. Some countries also showed notable progress in non-cereals. For example, India, besides achieving a near-tripling of foodgrain production, also witnessed a fourfold increase in production of fruits and vegetables during the period 1966-67 to 2011-12. Similarly, it also recorded an increase (6-10 times) in the production of animal food products during this period, sixfold increase in milk production, 12-fold increase in egg production and eightfold increase in aquaculture production. These production and productivity gains need to be sustained in the coming days as it is projected that by 2030, India will require a minimum of 304 million tonnes of foodgrains, 175 million tonnes of vegetables, 96 million tonnes of fruits, 170 million tonnes of milk and 21 million tonnes of meat, eggs and fish (Joshi and Kumar, 2011). This calls for concerted action to focus on resource-conserving agricultural technologies and enabling policy support for meeting the emerging challenges.

Despite the progress, there has been a plateau in yield levels of different produce in the Asia-Pacific region. The yield growth for many crops declined in the 1990s. This has been primarily due to the inadequate emphasis given to addressing the specific needs of rainfed areas, which account for over 60 per cent of the cultivated area in the region. Growing crop bias with major focus on rice and wheat has

been noticed in the region. Lack of focused attention to emerging challenges, particularly in the area of post-harvest, marketing and environmental conservation, has also contributed to this factor. At the research level, there has been less emphasis on multidisciplinary research as well as weak interaction among researchers, extension workers and farmers and the private sector.

The overall challenge in the Asia-Pacific region, therefore, is to enhance agricultural production during the next 25-50 years to meet the increased food demand based on projected demographic and economic changes. Significant effort needs to be placed on reducing post-harvest losses, with about 30-35 per cent getting wasted along the value chain. Agricultural production systems focusing on small farmers are not only required to be productive and profitable, they also need to ensure that the produce is nutritious, affordable and safe. There is also need to ensure that these are produced in an environmentally and socially sustainable manner. Increased competition for water and land, availability of less labour, rural to urban migration, loss of biodiversity at the genetic, species and ecosystem levels, and changes in climate such as temperature, precipitation, sea level, extreme weather events such as floods, droughts and heat waves coupled with loosely interlinked institutional support systems, limit our options for enhancing productivity and profitability of farming systems. Appropriate technology interventions therefore need to be developed, demonstrated and practised in the region. Technology applications are needed in an integrated way, addressing different sectors of agriculture—crops, forests, livestock and fisheries.

Investing in Technology

Agricultural productivity is a function of a range of factors and services. Land- and water-related factors, including the nature and size of farms, their location and ecology, quality of land, source, quality and quantity of water, require to be taken into account while developing strategies for productivity increase. Climatic factors such as rainfall, temperature, precipitation, heat, cold and frost significantly affect small farm holdings, contributing to uncertainties

in farm production. Agronomic factors such as quality, quantity and timing of input applications (seed, fertilisers, weedicides, etc.) need to be given adequate attention. At the same time, socio-economic factors such as farmers' education level and experience in farming, farm size, tenancy terms, availability of credit, etc., need to be integrated in developing suitable plans for addressing agrarian reforms in the region. Farm management factors like adoption of modern production technologies, farm planning and management practices, etc., are of crucial importance in developing and adopting technologies.

Several studies have indicated that improved agricultural technology can help reduce poverty through both direct and indirect effects. de Janvry and Sadoulet (2002) detail direct effects as those derived from increased production for home consumption, higher gross revenues from sales and lower production costs. Indirect effects are through the price of food for consumers, employment and wage outcomes in agriculture; employment, wage, and income effects in other sectors of economic activity through production, consumption, and savings linkages with agriculture; lower costs of agricultural raw materials; lower nominal wages for employees (as a consequence of lower food prices); and foreign exchange contributions of agriculture to overall economic growth (Haggblade et al., 1991).

It is well established that there has been uneven diffusion of technology across the world. While some countries are at the cutting edge of the network age, others lag behind. UNDP's 2001 Human Development Report (UNDP 2001) indicates that the prime explanations for the success of advanced industrialised countries and the economic transformation of recently industrialised countries in the developing world lie in their history of innovation. The 2004 Report on Implementation of the United Nations Millennium Declaration (UN, 2004) indicates four broad categories of countries according to their technology adaptation capacity: a) scientifically advanced countries, b) scientifically proficient countries, c) scientifically developing countries, and d) scientifically lagging countries. Most of the countries in the Asia-Pacific region fall under

the third and fourth categories, with the exception of India and China.

The Asia-Pacific region is highly diverse in terms of geography, population distribution, economic development, and cultural, political and historical backgrounds. With over 30 countries, the region comprises about 60 per cent of the world's population, including more than half of the world's poor. This high level of diversity is also reflected in the region's agricultural R&D (research and development) efforts. According to Beintema and Stads (2008), the Asia-Pacific region as a whole spent $9.6 billion on agricultural R&D in 2002. The distribution of spending among countries was noticed to be very uneven, with China, Japan and India accounting for a combined total of about 70 per cent. Regional investments as a whole grew by 3.0 per cent per year during 1981-2002. With China and India in particular accelerating their expenditure on agricultural research, most of this growth has taken place in the last decade. While some of the smaller countries like Malaysia, South Korea and Vietnam also realised impressive growth in agricultural R&D spending in recent years, in countries like Pakistan, Indonesia, and Laos, the research outlay in agriculture has been quite negligible (and in some cases negative), for a variety of reasons.

Investment in agriculture is a complex issue that requires multiple interventions that are important and crucial. Estimates of the rates of return on agricultural R&D suggest a very high social value of such investment. Alston (2010) estimated that annual internal rates of return on investment on agricultural R&D range between 20-80 per cent. In developing countries, the dollar-for-dollar impact of R&D investments on the value of agricultural production is generally within the range of 6-12 per cent across countries (Fan, 2008; Fan and Zhang, 2008; FAO, 2011). It has been pointed out those countries that have heavily invested in R&D while simultaneously investing in extension have shown strongest productivity growth (Fuglie, 2012). These investments have resulted in many countries enhancing productivity of the farming system and in turn income of the small farmers.

Rising productivity increases rural incomes and lowers food prices, making food more accessible to the poor. Other investments, such as improved irrigation and appropriate varieties of crops, reduce price and income variability (World Bank, 2007). Productivity gains are key to food security. Singh et al. (2002) pointed out that agricultural technologies are 'scale neutral' but not 'resource neutral'. Smallholder-oriented research and extension should focus on cost reduction measures that do not compromise the yield per unit area. Thapa and Gaiha (2011) therefore argue that new technological innovations are needed and these should include low external input and sustainable agriculture approaches based on ecological principles that will enable enhancing farm income for small-scale farming communities. The need for such technological interventions is inevitable in future as it is estimated that by the year 2050, the projected world population will be about 9.1 billion. Coupled with the need for food production that will increase by 70 per cent, 90 per cent of this additional food requirement has to be met through increases in yields in the areas with intensive agriculture. Specifically in the Asia-Pacific region, where the scope for net increase in arable land is greatly limited and availability of fresh water resources for food production is declining fast, utmost attention should be paid to the sustainability of natural resources used in the intensification of agriculture.

Managing Natural Resources

Conservation of natural resources is an important issue for sustainability of food security and farming systems. The major challenge in achieving increased productivity would essentially depend on our ability to ensure proper and judicious utilisation of natural resources that contribute to increased production of food and other agricultural crops in a sustainable manner.

In 2008, FAO introduced the concept of Conservation Agriculture (CA) as a resource-efficient agricultural crop-production system based on an integrated management of soil, water and biological resources combined with external inputs. Conservation agriculture is a farming approach that fosters natural ecological processes to

increase agricultural yields and sustainability by minimising soil disturbance, maintaining permanent soil cover, and diversifying crop rotations. CA also encompasses natural resource management both at farm and landscape levels so as to increase the synergies between food production and the conservation and use of ecosystem services. Conservation agriculture includes integration of diverse practices that are promoted by small-scale farming communities in livestock and fodder management, improved use of fallow lands, introduction of agroforestry systems and community management of watershed and protected areas.

In a review of the CA practices adopted in sub-Saharan Africa, Milder et al. (2011) point out that CA is a timely strategy for agriculture and rural development and conservation in Africa, a continent that faces multiple challenges associated with land degradation, rapid population growth and climate change. The study observed that CA resulted in increasing household and community level resilience to climate change by increasing crop yields, improving moisture retention, enhancing soil fertility, and bolstering the knowledge and capacity of farmers to respond to novel circumstances or threats.

By adopting a similar approach in addressing the declining productivity growth of the rice-wheat farming system in the Indo-Gangetic plain, zero tillage has been promoted by the Rice-Wheat Consortium, a partnership of the Consultative Group on International Agricultural Research (CGIAR) centres and the national agricultural research and extension system with the support of the International Fund for Agricultural Development (IFAD) and other development partners (Box 3.1). This technology involves planting wheat immediately after rice, without tillage, where residual soil moisture from the previous rice crop facilitates seedling germination. This practice has been reported to have many advantages over conventional tillage in the rice-wheat system. This intervention results in reduced use of labour, fertiliser and energy. It minimises planting delays between crops, contributes to soil conservation and reduces irrigation water needs. It also increases tolerance to drought, and reduces greenhouse gas emissions (Erenstein et al., 2007).

Box 3.1

Leaving the Plow Behind

Zero-Tillage Rice: Wheat Cultivation in the Indo-Gangetic Plains

Key period: 1995-present

Geographic region: India, Pakistan

The intervention: An estimated 620,000 wheat farmers in northern India have benefitted significantly from the introduction of crop management techniques known as zero-tillage cultivation. In this practice, the seeds are planted in unplowed fields in order to conserve soil fertility, economise on scarce water, reduce land degradation, and lower production costs. Varying forms of the technique have been adopted over an estimated 1.76 million hectares of wheat, particularly in the Indian states of Haryana and Punjab, with average income gains amounting to US$180-340 per household.

Source: Highlights from *Millions Fed: Proven Successes in Agricultural Development, 2009*. International Food Policy Research Institute.

The evidence from several other countries shows that CA practices are suitable for existing major cropping systems. Various studies indicate that CA is not a single or uniform technology that can be immediately applied anywhere in a standard manner. Rather, it represents a set of principles that encourage adoption of locally adapted practices, approaches and methods. These principles are tested, evaluated and then adopted in participation with the local communities, taking into account the various biophysical and socio-economic conditions prevailing in the location. Although several reports have indicated successful adoption of CA practices, further research is necessary, for instance, to study its impact and effect on crop rotation, weed, nutrient, pest and water management, and fertiliser and irrigation rates as well as on livelihoods and environmental conditions. Adoption of CA principles in existing farming systems in the Asia-Pacific region, therefore, provides a unique opportunity for enhancing productivity and profitability

of diverse agriculture systems for small farmers. CA practices are gaining importance in the countries around the globe and, according to Friedrich et al. (2012), such practices have been adopted in about 124 million ha of farm land, thereby suggesting scope for wider replication (Table 3.1).

Table 3.1

Extent of Adoption of CA Worldwide

Country	*CA Area (ha)*	*Country*	*CA Area (ha)*
USA	26,500,000	South Africa	368,000
Argentina	25,553,000	Venezuela	300,000
Brazil	25,502,000	France	200,000
Australia	17,000,000	Zambia	200,000
Canada	13,481,000	Chile	180,000
Russia	4,500,000	New Zealand	162,000
China	3,100,000	Finland	160,000
Paraguay	2,400,000	Mozambique	152,000
Kazakhstan	1,600,000	United Kingdom	150,000
Bolivia	706,00	Zimbabwe	139,000
Uruguay	655,100	Colombia	127,000
Spain	655,000	Others	409,440
Ukraine	600,000		
Total			124,794,840

Source: Friedrich et al., 2012.

Integrating Agricultural Enterprises

According to Rotz et al. (2007), the integrated farming system model combines many biological and physical processes in a farm production system. At present, farmers concentrate mainly on crop production and this is subjected to a high degree of uncertainty in income and employment due to various factors like the weather and markets Integration of various agricultural enterprises like cropping, animal husbandry, fishery, forestry, etc., has great potential in the agricultural economy (Box 3.2). These measures supplement the income of farmers, and help in increasing employment and

involvement of family labour. The integrated farming system approach primarily focuses on farming practices that maximise production in the cropping system and take care of optimal utilisation of resources. A judicious mix of agricultural enterprises like dairy, poultry, piggery, fishery, sericulture, etc., suited to the given agro-climatic conditions, are incorporated so as to contribute towards enhanced income and prosperity for small farmers.

Box 3.2

Story of a Farmer Practising IFS

P. Kottaisamy, belonging to Kutchanur village in Uthamapalayamtaluk of Theni district in Tamil Nadu, has 6 ha of arable land with adequate supply of irrigation; he cultivates banana, cotton, coconut and groundnut by using heavy doses of fertilisers and pesticides. In 2000, he adopted Integrated Farming Systems (IFS) under the technical guidance of K.V.K. Theni. He integrated his farm with horticultural crops, cereals and livestock, and mainly used organic inputs. For this purpose, he established infrastructure including production capacity of 15,000 kg cattle manure (50 cows), 3,000 kg dried farmyard manure (FYM), 500 kg enriched FYM, 20 t vermicompost, 6 t cattle feed mill (20 hp service motor), 25 t chaffed fodder (2 chaff cutters), and 1,500 hr use of mechanical weeders per month. He opted for consultancy programmeson IFS in various places inside and outside the State. He has provided employment opportunity to 15 women and 5 men who continue to work in his farm. There are about 200 farmers, farm women, rural youth and students from various parts of India who have come and visited his farm and undergone training programmes, varying from one day to one week, on the preparation of various organic inputs.IFS has thus been a successful initiative since 2000 because of its sustainability.

Source: Tamil Nadu Agricultural University. TNAU Agritech Portal. Coimbatore: July 2012.

The declining trend in size of landholding in the region poses a serious challenge to the stability, sustainability, productivity and profitability of farming systems. For example, there is a decline in per capita availability of land in India from 0.5 ha in 1950-51 to 0.15 ha

in 2000-01, and this is projected to further decline to less than 0.1 ha by 2020. This calls for strategies and agricultural technologies that enable adequate employment and income generation, specifically for the small and marginal farmers who constitute more than 80 per cent of the farming community in the region. It is absolutely essential that we shift from research based on crops and cropping systems to one based on farming systems carried out in a holistic manner for the sound management of available resources by small farmers. It is necessary to integrate land-based enterprises like fishery, poultry, duckery, apiary, field and horticultural crops, etc., within the bio-physical and socio-economic environment of farmers to make farming more profitable and dependable (Box 3.3). No single farm enterprise is likely to be able to sustain small and marginal farmers without resorting to integrated farming systems for the generation of adequate income and gainful employment year round. Integrated farming systems is a valuable approach for addressing the problem of ensuring sustainable economic growth for farming communities in countries like India.

The farming system mode involving factors such as in situ recycling of organic residues, including farm wastes generated at the farm, to reduce dependency on external inputs; decrease in cost of cultivation through enhanced input use efficiency as well as engagement of family workforce; effective forward and backward linkages within the farm components; upgrading soil and water quality and increased crop diversity in the fields; effective water management and productivity; and nutritional security through the soil-plant-animal-human chain, offers unique opportunities for improving productivity of the system. Such a farming system provides a vast canvas of livelihood enterprises, a better risk coping strategy, and continuous flow of income and employment throughout the year for small landholders. It interacts with the environment without affecting the ecological and socio-economic balance.

Integration of various agricultural enterprises, *viz.,* crop, animal husbandry, fishery, forestry, etc., in the farming system has great potential in an agricultural economy. These enterprises not only supplement the income of the farmers, but also help in increasing

employment of family labour throughout the year (Jayanthi et al., 2000; Singh et al., 1997).

Channabasavanna et al. (2009) report that IFS consumed 36 per cent higher water than the conventional system of rice-rice, but the water use efficiency was 71 per cent higher in IFS compared to the conventional system. Jayanthi et al. (2000) indicate that integrated farming requires less water per unit of production than mono-cropping systems. Channabasavanna et al. (2009) also report that IFS requires only 1,247 mm of water per acre and, on the other hand, the conventional farming system requires 2,370 mm of water.

Box 3.3

Farm Pond-based Agricultural Diversification Model for Rainfed Areas

Application: In rainfed medium and low land.

Description: Rainwater harvesting system was designed and agricultural diversification model with harvested rainwater was developed for small and marginal farmers through multiple use of water.

Inputs needed: Land, seeds of field crops, vegetables and short duration fruits (papaya, banana, drumstick), fertilisers, necessary agro-inputs, fish seed.

Output: Additional income: ₹ 25,000-30,000/ha.

Specific benefits: This model, implemented in Bahasuni watershed of Dhenkanal, Odisha, increased cropping intensity by about 200 per cent. Due to harvesting of spring water and rainwater, irrigated areas of two villages of the watershed increased from 3.2 ha to 26.5 ha, and 55 tribal families were benefitted. Production potential, potential gross income generation per year, and potential man-days generation due to asset created have been computed, and technology has been included under National Rural Employment Guarantee Act (NREGA) for implementing in watersheds of eastern Indian states.

Unit Cost: ₹ 40/m^3.

Source: Indian Council of Agriculture Research, Government of India.

Based on the principle of enhancing natural biological processes above and below the ground, the integrated farming system: a) reduces erosion; b) increases crop yields, soil biological activity and nutrient recycling; c) intensifies land use and improves profits; and d) can therefore help reduce poverty and malnutrition, and strengthen environmental sustainability. Therefore, well-designed integrated intensive farming systems centred on traditional agriculture practices that are specific to particular agro-ecosystems need to be developed, based on marketing opportunities for the products of small farms. This system will also provide opportunities for the involvement and engagement of family labour and home consumption of a diversified agricultural basket.

Investing in Seed

Quality seeds and planting material constitute the first step in agricultural practices, and are the most basic agricultural inputs that contribute to improved agricultural productivity responding to farmers' needs and crop use practices. Small-scale farmers are increasingly challenged with agricultural systems being affected by both biotic and abiotic stresses. Seed systems in several countries have progressively improved over the years, through efforts of both the public and private sectors. Improvements in seed quality aided by plant breeding efforts have provided enormous contribution to global agriculture (yield, resistance to biotic stresses, tolerance to abiotic stresses, greater harvest and quality traits including nutritional value, etc.). In recent years, many initiatives at global and regional level on varietal improvements in major crops have therefore focused on factors that affect the productivity of small farmer agriculture.

Both formal and informal seed systems have played a major role in access to and use of quality seeds for small farm agriculture,thereby enhancing productivity (Bishaw and van Gastel, 2009). The formal seed system that exists in many developing countries is characterised by: a) variety development, evaluation, registration and release; b) seed production, processing and storage; c) seed marketing and distribution; and d) seed quality testing. The informal sector is mostly dependent on farmers' knowledge in seed selection, management

and distribution and is based on local diffusion mechanisms. The importance of informal seed systems in guaranteeing access to genetic resources for use at local levels in developing countries is well documented by many researchers (Bishaw and van Gastel, 2009; Lipper et al., 2010). In many countries, informal seed systems remain a key element in the maintenance of crop diversity on farms and can account for up to 90 per cent of seed movement. Small farmers, in general, prefer varieties adaptable to local conditions, with cooking and culinary qualities and acceptable seed quality that can be easily produced and propagated (Louwaars and Visser, 2006).

It is essential and crucial that quality seeds of preferred varieties are readily accessible to resource-poor farmers. This requires a systematic pathway, combining a set of activities that starts with identification of preferred genotypes with quality traits. It is well established that crop-breeding patterns and seed system management practices do influence seed availability and accessibility. To make seed systems more effective and efficient, a holistic approach is required, combining renewal of cultivated biodiversity, taking into account the diversity and the complex relationships between species, ecosystems and associated agrarian, social and cultural systems. Participatory varietal development programmes involving researchers and farmers need to be in place for developing varieties with adaptation to the local climatic and cultural systems. These initiatives must also include agrarian, economic and social systems which influence, or are influenced by, cultivation. In recent years, micro propagation and tissue culture methods have been successfully utilised for many horticultural crops for accessing disease-free planting material and seeds, which has contributed to enhanced income for the small farmers (Box 3.4).

Genetic improvement of crops for enhanced productivity and quality has often been regarded as a product of random selection by farming communities, ever since agriculture has been in practice. Plant breeding in itself has become a deliberate and predictable activity, with the result that tailor-made and mostly uniform crops are under cultivation in major and high input-oriented farming

systems. Breeding efforts, both traditional and advanced, have led to creation of remarkable diversity among various crop species.

Box 3.4

Record Harvest of Banana through Tissue Culture

R. Arivanantham: A farmer earns ₹19 lakh profit in a year from 4.5 acres.

Hosur: A farmer produced a record harvest of banana through tissue culture in Onnalvadi near Hosur. B. Venkatasamy was attracted towards banana cultivation through tissue culture. Mr Venkatasamy told a group of journalists who visited his banana farm on Thursday that he cultivated Grand Naine banana through tissue culture technology provided by the Horticulture Department using the drip irrigation system. He got subsidy from the government under the National Horticulture Mission. Horticulture Department provided organic inputs such as vermicompost, neem cake and biofertilisers along with the technical know-how. Water soluble fertilisers were supplied through fertigation at weekly intervals, helping the crop grow fast and vigorous. Although in early stages a soft rot Ervinia was noticed in the field, it was controlled by the Bagallol, and the leaf spot disease was managed by spraying Tilt and Bavistin. Furadan was applied at early stage to control nematodes. Mr Venkatasamy said that he invested ₹75 a plant on 4.5 acres at Onnalvadi. After eleven-and-a-half months, they were ready for harvest. The total profit earned through his 4.5 acres planting was around ₹19 lakh. This is the highest return ever he got in his 25 years of banana cultivation.

Source: *The Hindu* (13 November 2009)

However, recent trends in crop productivity indicate that traditional methods alone will not be able to keep pace with the growing demand for food, fibre and fuel. Much of the early increase in grain production resulted from a growth in area under cultivation, irrigation, better agronomic practices and improved cultivars. In the 1970s, a quantum jump in yield was achieved in wheat and rice by modifying the plant architecture. Productivity gains in future will have to be achieved through better natural resource management and crop improvement. Productivity gains are essential for long-

term economic growth, but in the short-term, these are even more important for maintaining adequate food supplies for the growing world population.

Promoting Biodiversity

Biodiversity is the feedstock for agriculture and food security as it provides genetic material needed for crop cultivation, breeding and improvement. The 20th century saw a great loss of biodiversity through habitat destruction, mainly due to deforestation. Maintenance of biodiversity is important for sustainability and resilience of farming systems that have capacity to function in changing circumstances. The challenge is to maximise contribution of agricultural biodiversity while minimising the negative impacts of agriculture on biodiversity. The key element to ensure sustainability in production is based on effective use of agricultural biodiversity, both in its conventional use in breeding and ensuring its direct use by farmers and communities for livelihoods, and other multiple benefits. Agricultural biodiversity has been, and continues to be, a foundational source of varietal improvement traits, thereby contributing to enhanced productivity in small farms.

Frison et al. (2006) summarise evidence that agricultural biodiversity contributes to sustainable production and that it has potential to make an even greater contribution. In his report to the UN Secretary General, de Schutter (2010) notes that agro-ecological approaches to food security involve the maintenance or introduction of agricultural biodiversity (diversity of crops, livestock, agroforestry species, fish, pollinators, insects, soil biota and other components that occur in and around production systems) so as to achieve sustainability and productivity of farming systems. Agricultural biodiversity therefore, contributes both to sustainability and resilience, and to a more diverse production base.

Agricultural biodiversity has various dimensions or scales: gene level, species or population level, inter-specific or ecosystem level, and landscape level. The contribution of increased diversity of crops and increased crop production, particularly through genetic diversity, to improve resistance to biotic and abiotic stress, and to

improve ecosystem regulating and supporting services are reported in Østergård et al. (2009) and Hajjar et al. (2008). The role of diversity of soil biota and the maintenance of all components of the soil food web and of diversity within different levels for supporting agricultural systems is described by Beed et al. (2011), Gliessman (2007) and Mäder et al. (2002).

The major challenge is to integrate conservation of biodiversity and its utilisation for enhancing productivity and profitability in the small-scale agriculture landscape. A successful initiative that is being promoted by the M.S. Swaminathan Research Foundation (MSSRF) is the 4C approach that aims at linking conservation, cultivation, consumption and commerce in an integrated way with active partnership and involvement of the custodian family farmers (Box 3.5). The components of the 4C system are:

a) Conservation, which includes enhancement and sustainable use of biodiversity and comprises in situ, on-farm and ex situ conservation involving seed banks, cryogenic community gene banks, and in vitro cultures in the case of vegetatively propagated species.
b) Cultivation that promotes low external input, sustainable agriculture.
c) Consumption that covers food security and nutrition, revitalisation of traditional food habits including the use of underutilised crops and tubers, survey of prevailing macro- and micro- nutritional deficiencies.
d) Commerce that creates an economic stake in conservation by concurrently addressing the cause of conservation and livelihood security through SHGs (self-help groups).

The introduction of trees into agricultural environments to improve ecosystem function and to provide marketable products and realise the full potential of agroforestry systems is essential. The value of pollination services and the relation between pollinator diversity *versus* density is reported in Gallai et al. (2009).

Agricultural biodiversity, through dietary diversity, can contribute to nutritional health gains and in moderating problems related to micronutrient deficiencies (Johns and Eyzaguirre, 2006). Dietary

diversity is a vital part of diet quality. There is evidence of the beneficial effects of dietary diversity (as opposed to specific dietary components) on disease, morbidity and mortality (Frison et al., 2006). Thus, a wide range of local plants and minor crops and varieties are key contributors to accessing essential micronutrients and health-promoting factors for nutrition security. Research has demonstrated a strong association between dietary diversity and diet quality, and nutritional status of children (Arimond and Ruel, 2004; Sawadogo et al., 2006).

Box 3.5

Custodian Farmer: Ms Chinnakkal, Age: 55

Village: Thiruppuli Oorpuram, Koli Hills, Tamil Nadu, India.

Number of Family Members: 4.

Occupation: (a) *Primary*: farmer. (b) *Secondary*: labour.

Type of cultivation: Mixed crop, Mono crop.

Method of sowing: Line sowing and broadcasting .

Type of millet crop: Finger Millet and Little Millet.

Variety of millet crops: Perunkelvaragu, Sataikelvaragu, Surataikelvaragu, Sundangikelvaragu, Thirikulas, Maliyasamai, Katavetisamai.

Type of storage system use: Mann Pannai.

Recipes prepared and consumed: Kaali, Roti, Soru.

Need for improving profitability: Improved seed supply for little and Italian millets; processing mill for little millet.

A major bottleneck for the effective use of the diversity for crop improvement and productivity growth is the lack of easy access to information on the characteristics of materials to potential users. In this regard, the development of a global information system that provides users with direct access to information on the wealth of material conserved ex situ may well be the single most important contribution that could be made to increasing the efficiency of crop improvement.

A key issue in agriculture in many developing countries, particularly relevant in the case of smallholder farms, is the low

importance given to traditional farmer seed systems. The concept of farmers' rights, adopted in the International Treaty on Plant Genetic Resources for Food and Agriculture (PGRFA), prescribes involvement of farmers in the development of policy and gives farmers the right to save, use, exchange and sell farm-saved seed. This has been in practice in a few countries, including India that has legislation on protection of plant varieties and farmers' rights. The Protection of Plant Varieties and Farmers' Rights Authority (PPVFRA) has, through established mechanisms, systems in place for recognising and rewarding community conservers, thereby creating an economic stake in conservation. Other countries of the region also need to develop similar systems taking into account national needs and priorities, while also respecting international obligations concerning IPR (intellectual property rights) protection, including with respect to the Trade-Related Aspects of Intellectual Property Rights (TRIPS) Agreement.

Ensuring Water Use Efficiency

Agriculture is the largest consumer of water in the world, accounting for about 70 per cent of total withdrawal. The quantity of water available for agriculture in the Asia-Pacific region is likely to be affected by dwindling of groundwater resources in many areas. Widespread and largely unregulated groundwater withdrawals have resulted in depletion and degradation of some of the world's most accessible and high-quality aquifers such as those in the Punjab, North China Plain and the Souss basin in Morocco, where annual rates of decline of up to 2 metres since 1980 have been recorded (Garduno and Foster, 2011). Due to demand of water for industrial and drinking purposes, the share of available water resources in the agriculture sector is severely affected too. Agriculture is also a major source of water pollution, from nutrients, pesticides, soils and other contaminants, leading to significant social, economic and environmental costs. It also damages the wider environment through the emission of greenhouse gases.

Improving agricultural water management will be critical to help reduce pressure on water resources as well as to enhance

the quality of water. The productivity of small farms is strongly dependent on effective and efficient management of water resources (Box 3.6). Harvesting, conserving and recycling available water for agricultural use holds the key for addressing growing inter-sectoral competition for water use. Investment in infrastructure to address water resource and quality concerns, including fostering more efficient farming practices and farming systems, needs to be given much greater attention. Efforts on crop breeding for water-stress tolerant genotypes, which can yield significantly larger water conservation benefits than direct interventions in irrigation systems, need to be intensified. In the regions of greater water stress, expanded water storage capacity at farm level through farm ponds or following a watershed model will pay rich dividends. Improved water management in agriculture can be promoted involving governments, farmers, water managers, the agri-food chain and other stakeholders. Strengthening institutions and governance to support efforts are required for enhancing food and water security. Building resilience, developing and implementing agricultural adaptation and mitigation options will also enable farming communities to meet the challenges of addressing depleting water availability in their farms.

A successful initiative undertaken by MSSRF is the concept of a bio-industrial watershed, where issues of ecology, economics, employment and equity are dealt with in a holistic manner. The approach builds on the conventional system of watershed management through value addition and new markets, with appropriate socio-economic and institutional support systems owned and managed by the community. This programme has enabled organically evolved grass-root institutions to help overcome constraints faced by small and marginal farmers and integrate them in value chains and in non-market interventions. The watershed communities have demonstrated that both employment and income security can be enhanced through the adoption of scientific methods of climate-smart agricultural practices, water harvesting and sharing (MSSRF, 2013a).

Managing Climate Change

Global communities will have to seriously address issues of climate change that affect millions of small farmers. There is growing evidence of the negative effects of climate change on agriculture and widespread agreement that agriculture, particularly in developing countries, will be negatively affected (IPCC, 2007; Lobell et al., 2008; Nelson et al., 2010; Wassmann et al., 2010; Müller et al., 2011). Burney et al. (2010) have projected that climate variability and extreme weather shocks are likely to increase, negatively affecting all regions in term of yield growth and food security, particularly in sub-Saharan Africa and South Asia in the period up to 2030.

Climate change is expected to disproportionately affect smallholder farmers by further increasing the risks that they face. Recent studies using regional and global simulation models indicate that even moderate increases in temperatures will have negative impacts on rice, maize and wheat, which are the main cereal crops of smallholder farmers in the global agricultural system (Morton, 2007). Climate change is also expected to alter pest and disease outbreaks, increase the frequency and severity of droughts and floods, and increase the likelihood of poor yields, crop failure and livestock mortality (Kevan, 1999). Tropical countries with large populations of poor smallholder farmers will be hit the hardest by climate change (Hertel and Rosch, 2010). There is an urgent need for the global community to focus its attention on identifying adaptation measures that can help these farmers reduce their vulnerability to climate change and cope with adverse consequences.

Adaptation through learning to live with the new environment (e.g., time of planting, changing varieties, new cropping systems, etc.) and mitigation through offsetting the causative factors, such as reducing the net emission of greenhouse gases, are two strategies being advocated for coping with global climate change. Intensifying the search for genes for stress tolerance, employing modern technologies and developing genotypes for disease, pest, salinity, drought, heat and cold are among the adaptation strategies where focused efforts are essential. Ongoing research initiatives for transforming C3 plants to the C4 system, if successful, will

Box 3.6

Jain Drip Kit: More Crop per Drop®

Jain Irrigation's journey of "working with farmers" continues with a focus on small farmers. Among the small farmers too, the majority are without an independent water source, and their landholding is less than 1 acre. Such tiny holdings are also fragmented and located in more than one place; independent water source and electricity is also not available to these farmers. Jain Drip Kit can address all these constraints and empower small farmers with a scientific, durable and simple-to-operate irrigation system.

- Mainly suitable for cultivation of vegetables.
- Can be used for cereals, pulses, cotton and other closely-spaced crops
- Can be used for irrigation in open fields, greenhouses/net houses and nurseries
- Suitable for kitchen gardens and also Himalayan/hilly terrains where landholding is very small
- Useful as a survival irrigation tool in rainfed area or water scarcity region, or when there is a prolonged gap between rains and electricity is not available.

contribute immensely to crop productivity enhancement. Land use systems need to be developed based on the history of traditional practices, for bringing about a change in the shift or modification of cropping patterns and cropping zones. Critical appraisal of agronomic strategies as well as evolving new agronomy for climate change scenarios is needed. Exploring opportunities for maintenance/restoration/enhancement of soil properties and use of multi-purpose-adapted livestock species and breeds in cropping systems will help in coping with climatic uncertainties. However, more research efforts are required to generate information on the carbon sequestration potential of different land use systems, including opportunities offered by conservation agriculture and agroforestry.

Empowering Women

The proportion of women in agricultural production and post-harvest activities ranges from 20-70 per cent (IAASTD 2009). With the development of export-oriented irrigated farming, which is associated with a growing demand for female labour, including migrant workers, the involvement of women is growing in many developing countries. Increasing women's access to land, livestock, education, financial services, extension, technology and rural employment have been suggested as effective measures that will contribute to agricultural production, food security, economic growth and social welfare. FAO's 2011 report on the *State of Food and Agriculture* indicates that gender gaps exist for many assets, inputs and services, including land, livestock, labour, education, extension and financial services and technology, all of which impose costs not only on women themselves, but also on the agriculture sector, the broader economy and society as a whole. It argues that closing the gender gap in agriculture would generate significant gains for the agriculture sector and for society, and if women had the same access to productive resources as men, they could increase yields on their farms by 20-30 per cent, and could possibly raise total agricultural output in developing countries by 2.5-4.0 per cent (FAO, 2011).

Priority areas for technology and infrastructure investment with focus on women include access to water and water management (both for farming and for household consumption), access to energy (cooking fuel and on- and off-grid electricity, in particular), and access to tools and implements well suited to women's physical requirements and cultural preferences (Carr and Hartl, 2010; World Bank, 2007).

Leakey et al. (2009) point out that despite progress made in national and international policies since the first World Conference on Women in 1975, urgent action is still necessary to implement gender and social equity. Agricultural Knowledge Science and Technology (AKST) policies and practices are required to address gender issues as an integral component to agricultural development processes. These should include strengthening the capacity of public institutions and NGOs (non-governmental organisations) to improve

the knowledge of women's changing forms of involvement in farm and other activities in AKST (IAASTD, 2009). Women's access to education, information, science and technology, and extension services will in turn enable improving their access, ownership and control of economic and natural resources. Appropriate credit schemes, support for women's income-generating activities and the reinforcement of women's organisations and networks are also needed to be given priority attention. Strengthening women farmers' ability to benefit from market-based opportunities requires giving explicit importance to their getting engaged and involved in value chains. Giving primacy to technological development policies focusing on rural and farm women's needs and recognising their knowledge, skills and experience in the production of food and the conservation of biodiversity, as well as assessing the negative effects and risks of farming practices and technology, including pesticides, on women's health, and taking measures to reduce their use and exposure, are some of the areas that require immediate attention (IAASTD, 2009).

New Technology Options

Recent developments in the field of molecular biology and biotechnology offer uncommon opportunities to aid and improve classical plant breeding programmes. Using modern approaches, it is now possible to analyse both the phenotype and the genotype of new/existing varieties and predict the performance of specific new traits. The marker-assisted breeding approach enables successful transfer of several genes of interest as well as quantitative trait loci involved in polygenic traits in many crop plants. The availability of molecular data, linked to pedigrees and phenotypic evaluation, now makes breeding analysis much easier. Development of genomics and associated DNA technologies is greatly increasing molecular understanding of important plant-breeding traits. Advanced marker technologies, such as single nucleotide polymorphisms or second-generation massive parallel DNA sequencing technologies, offer new ways to improve efficiency and effectiveness of many breeding programmes.

The research focus in the field of genetic modification now aims at transfer of desired genetic combinations across sexual barriers. The impact of GM (genetically modified) crops has been well documented and has contributed to commercial cultivation of varieties of herbicide and insect-resistant crops in many countries around the globe. Now, more than half of the areas planted with corn, soybean and cotton in the USA utilise transgenic varieties, and there is widespread use too in South America, the Indian subcontinent and Australia. GM crops provide promising solutions for addressing problems in agricultural production. Only a few GM traits have been successfully developed, and these mainly replace or reduce chemical inputs such as herbicides or insecticides. Agronomic traits such as abiotic stress tolerance and output traits such as yield or quality improvements have not yet emerged from the research phase, while there are several reports of promising leads in the development of transgenic varieties whose field performances are yet to be established.

Plant biotechnology offers opportunities to improve the production and composition of crops with benefits to both the environment and consumers. Application of molecular plant breeding is now focusing on discovery of new genes, and their functions are opening new avenues for basic plant biology research. For example, the work of the MSSRF (Prashanth et al., 2008; Parida, 2012) has demonstrated that genetic characters from across sexual barriers can be mobilised to generate transgenic materials free from IPR. The work on identifying and isolating genes from mangrove species and transferring them into locally cultivated rice varieties has been successful in developing rice cultivars with tolerance to salinity, drought and quality enhancement. This and other ongoing work in both the public and private sectors in some countries of the Asia-Pacific region have opened up new avenues for enhancing agricultural productivity of major crops. When carefully deployed, modern biotechnology will become an integral supplement to conventional plant breeding and its enormous potential should be harnessed to the best advantage, keeping in mind issues of social and economic conditions in which small farmers are engaged in their agriculture practices.

The proprietary nature of the technology, however, limits the options for addressing the needs of the farmer, especially in low productivity regions where smallholder farmers are faced with a challenging environment in which to grow their crops.

The potential benefits of biotechnology should not divert our attention from the real concerns about application of the new science. In the countries of the region, there is an urgent need to invest on developing adequate scientific infrastructure and human resources for biotechnology research, product development and, more specifically, in the area of safety assessment and safety management both at pre- and post-deployment stages. Capacity building and skill enhancement on issues of bioethics and biosafety and IPR will be required particularly for the developing countries. Adequate and effective ways of public education and capacity building of stakeholders is the key for instilling the confidence of people in the technology.

Use of genetically modified varieties in most of the countries will depend on the development of appropriate regulatory capacity by the public sector to address food safety and environmental issues. Investment in technology appropriate for small farmers and the establishment of effective, science-based regulatory capacity in the countries are essential for safe and judicious use of advanced biotechnology. Regional cooperation in intellectual property and biosafety has great potential for technology access and agricultural trade.

Transforming Smallholder Farming

Designing appropriate farm- and community-level innovations focusing on small farm agriculture will enable intensification of sustainable agricultural systems. This will address the issues of trade-offs between individual productivity and increased collective initiatives of smallholders with regard to emerging issues of market conditions.

The challenge is to develop and scale up the approaches that take into account the gains for individual producers and ensure profitability in the agricultural systems. Sustainable agricultural

growth requires the designing of market-based mechanisms that provide smallholders with incentives to invest in sustainability. At the same time, strengthening agricultural practices of the smallholders in the area of their own supply chains (agricultural inputs, feed and drip irrigation) will contribute to sustainability in the production systems.

Investing in the modernisation of extension services is essential, including approaches such as farmer field schools (Halwart and Settle, 2008) and the use of rural radios and other mobile telecommunication methods (Munyua, 2000; Bhavnani et al., 2008). An efficient extension system can reach smallholders with targeted, adapted advices that are location-specific and demand-driven. These must take into account local environmental conditions, production practices and access to markets so that small farmers can be involved in decision-making processes and follow risk reduction strategies. Extension service systems need to be adapted to local needs and must build on farmer knowledge by facilitating lateral exchange of practices and learning. At the country level, stronger in-country research/extension linkages need to be built. This will increase the efficiency and effectiveness of both public and private extension services.

Existing extension systems in many countries are top-down in their approach with little participation by the farmers. It is necessary to take corrective steps to make the extension systems responsive to the needs of communities and small farmers. In the absence of an effective system of extension, resource-poor farmers are becoming the victims of exploitation by unscrupulous traders and moneylenders interested in selling inputs such as seeds, fertilisers and pesticides. Therefore, there is an immediate need for reforming and revitalising the existing agricultural extension system. Such a system should include active involvement of farmers through user groups/associations, participation by the private sector and NGOs, increasing use of media and information technology to disseminate knowledge on new agricultural practices and information on output and input prices as well as those related to climate uncertainties. The returns to investment on research and extension will be much higher on agricultural growth as compared to other investments.

Agricultural extension systems must also address environmental considerations in developing practices and processes. Agricultural training facilities and academia should integrate sustainable approaches into their curricula. Additional research is also needed on identifying the drivers of change that influence smallholder practices both negatively and positively. Innovative agricultural extension systems need to operate on a landscape management approach involving smallholders. The essential component is to implement environmental conservation strategies in consultation with stakeholders, which does not compromise food production or livelihoods. This can be done through facilitating sustainable, autonomous, smallholder livelihoods adapted to local conditions. This requires a collective effort involving ecologists, agronomists and social scientists as well as policymakers.

Sustainable productivity growth in agriculture is a knowledge-intensive undertaking. Development of the capabilities of actors involved in the process is of crucial importance. Fostering and developing the ability of farmers to innovate and to solve new problems as they emerge in a volatile environment would require involvement and engagement of other stakeholders, from researchers and policymakers to retail buyers. In many countries, agricultural education and training has been neglected. Low levels of general education in the farming population of developing countries have been an obstacle to adaptation to changing conditions.

These are crucial for undertaking and implementing any knowledge-intensive innovation and translating technical know-how to practical do-hows. There is a felt need for reforming curricula and teaching methods to match small farm needs and building capacities. Stakeholder partnerships for technical education and training are also an utmost priority.

Information and Skill Empowerment

The importance of access to knowledge as a measure of human development has been clearly argued by many development experts. UNDP's *2006 Human Development Report* lists three essential elements for human development: long and healthy life, knowledge

and a decent standard of living (UNDP, 2006). Access to knowledge is critical for the benefits of economic growth to reach a majority of the rural population for its sustenance. Knowledge and technology empowerment for enhancing rural livelihoods and standards of living of the agricultural communities are being addressed at several levels. This includes initiatives taken up at governmental, non-governmental, private enterprise and scientific/research levels. For example, there are several innovative ICT (information and communication technologies) initiatives underway in rural India, some of which are sponsored by governmental agencies while others are run by NGOs. Some of them focus on the technological aspects and some on accessibility and informational issues. The projects also use different approaches or models, with some focusing on sustainability through social entrepreneurship (Common Service Centres, e-Seva), some on a corporate model (ITC Gyan Choupals) that is aimed at providing channels and easier access to markets for farmers, and others focusing purely on community development through information dissemination (Village Knowledge Centres [VKCs] of MSSRF). The last model (Box 3.7) aims to make rural communities more knowledge-aware. ICT offers a unique opportunity to obtain easy access to information on agricultural technologies, inputs, weather, markets, prices, etc. Several studies have shown that access to information *via* telephones, mobile phones and internet reduces costs associated with information search significantly and helps farmers obtain higher yields, reduce risks and realise better prices for their produce (Jensen, 2007; Mittal et al., 2010; Ali, 2012; MSSRF, 2013b).

The declining costs of ICTs are giving small farmers much greater access to information. Mobile phone coverage in Asia is expanding in a significant way. Computers are now being connected through mobile phone networks to greatly expand the scope of information access. By linking communication technologies to market issues, even small farmers can overcome the enormous informational asymmetries that limit their participation and bargaining power in traditional supply chains. The revolution in mobile phones is helping small farmers get information about crop prices and input prices and other related information on agriculture.

Box 3.7

MSSRF ICT Programme

The MSSRF ICT programme is motivated by, and built upon, principles of participatory development and social justice. The VKC is set up in a participatory manner, emphasising partnerships with local CBOs (community based organisations) and all sections of communities. No VKC is established unless there is consensus amongst the community, and the Centres are always located in spaces accessible to Dalits and women, which are often not in the centre of the village. ICTs are thus regarded as part of the community infrastructure. Financial viability underpins the dominant conceptualisation of ICT projects that adhere to the market paradigm. MSSRF, on the other hand, understands sustainability in the vocabulary of community acceptance, integration and ownership.

Source: Excerpt from *Village Knowledge Centres: An Initiative of MSSRF.* Case Study, 2008. Bengaluru: IT for Change.

Policy and Institutional Innovations

The productivity of small farms in the region can be improved only when economies of scale are realised. The adoption of more technically and technologically efficient production systems by smallholder farmers is essential for achieving productivity growth. Sustaining and ensuring long-term productivity growth in agriculture will require continuous technological progress, with concurrent attention to social innovations and new business models. These innovations must improve the efficiency with which inputs are turned into outputs, as well as take into account the conservation of scarce natural resources and reduction of waste.

The policies and priorities followed by many governments in the region during the last few years have contributed to productivity improvements with lower levels of variable and judicious input use, thereby addressing the issues of sustainability in farming systems. These have taken into account local level demands and views and suggestions from users, policymakers and international development partners. Some of the investments in the region promoted by the

governments include no-till farming, insect-resistant crops, more efficient irrigation, water management systems, sensors for nutrient status in crops, remote sensing and GIS (Geographic Information Systems) to improve and monitor land use and advisory services to farmers.

Promotion, capacity building and linking of marginal and small farmers' groups to financial institutions is an essential step towards needed credit flow to these farmers. Motivating and enabling marginal and small farmers to acquire skills by establishing Community Resource Centres and promoting marginal and small farmer activities at the village, cluster and block levels will require institutional support and advocacy. Supporting and linking farm and non-farm interests of smallholder agriculturists will contribute to enhanced income for those who are otherwise in constant struggle to meet their basic needs.

Based on a regional consultation in 2009, the Asia-Pacific Association of Agricultural Research Institutions (APAARI) recommended institutional and policy support for linking farmers with markets, strengthening post-harvest management, agro-processing, value addition, enhancing food availability for the poor through market, trade and distribution reforms, safety nets and integrated on-farm/off-farm/non-farm employment and income; strengthening bio-security towards safe and green agriculture; and facilitating international trade. It has also called for increased investment in agriculture and agricultural R&D, participatory (involving public, private, NGO, CSO sectors and farmers) research, extension and education, input-output pricing, and minimisation of distortions of crop-animal-soil-water cycles. Regulatory measures and standards, gender sensitivity, and retention of youth in agriculture are some of the priority areas where institutional and policy support is of crucial importance (APAARI, 2009).

Conclusion

It is difficult to differentiate between smallholders and family farmers as there is no common typology of attributes or components; the productive and social structures of the small farming communities

do not follow any rigid patterns. Smallholders and family farms vary in terms of the activities they engage in and the assets and resources available to them. Several factors such as land area and quality, availability and ownership of water resources, animal stock, infrastructure and machinery, financial assets, etc., as well as access to these productive resources, should be taken into consideration for assessing the problems and prospects of family farming.

Irrespective of the terminology and descriptions used, family farmers operate in small farm holdings in the region and elsewhere, sharing concerns of decreasing agricultural growth and falling productivity levels. The National Commission on Farmers summarised the major issues affecting small farm agriculture in India in its final report:

> A technology fatigue has further aggravated farmers' problems, since the smaller the farm the greater the need for sustained marketable surplus, in order to have cash income. Linkages between the laboratory and the field have weakened and extension services have often little to extend by way of specific information and advice on the basis of location, time and farming system. Good quality seeds at affordable prices are in short supply and spurious pesticides and biofertilisers are being sold in the absence of effective quality control systems. Input supply is in disarray, particularly in dry farming areas. Micronutrient deficiencies in the soil as well as problems relating to soil physics are crying for attention. Farmers have no way of getting proactive advice on land use, based on meteorological and marketing factors....The prevailing gap between potential and actual yields, even with technologies currently on the shelf, is very wide (GoI, 2006).

These issues still prevail in India and in a majority of countries in the region, affecting small farm production. They require priority attention from all stakeholders.

Family farming in itself is a means of maintaining social status, cultural heritage and landscapes, as it includes several economic, social, cultural and environmental functions. The motivations of family farmers, therefore, go beyond maximising economic profit and encompass other social, cultural and ecological goods (Wolfenson, 2013). Agriculture is a critical foundation for family

farmer livelihoods. Agriculture plays an important role in providing income and employment, food supply and a direct household basic consumption source. Smallholders and family farmers more often diversify their activities to complement incomes by participating in non-farm activities. Moreover, temporary migration in the search for additional income in the off-season has been reported in rural areas of many countries. The challenge is to ensure that small farmers enhance their productivity in perpetuity, without negatively contributing to social and ecological security. The need for adopting the methods of an evergreen revolution, therefore, has become very urgent now (Swaminathan, 2011). The pathway to an evergreen revolution is green agriculture that promotes ecologically sound practices like conservation farming, integrated pest management, integrated nutrient supply and natural resources conservation. Green agriculture techniques could also include the cultivation of crop varieties bred through use of recombinant DNA technology, if they are good at resisting biotic and abiotic stresses or have other attributes like improving nutritive quality.

Given the magnitude of challenges that small and marginal farmers are facing in the region, holistic, sustainable and equitable development of farm families and communities need to be based on conservation and enhancement of individual and common property resources, together with efforts to improve the productivity and profitability of small farms and generation of new opportunities for market-driven non-farm livelihoods. Based on these principles, MSSRF for the last 20 years has been promoting biovillages as an initiative for ensuring prosperity and human-centric development (MSSRF, 2013b). This is a pathway for ensuring a job-led economic growth leading to an era of bio-happiness and needs to be replicated and expanded in the region.

Family farming is a means of organising agricultural production, which is managed and operated by a family and predominantly reliant on family labour. The family and the farm are linked, and they co-evolve and combine economic, environmental, social and cultural functions. Small-scale farms and family farms are the dominant mode of farm organisation around the world, especially

in the Asia-Pacific region. Family farms are essential for the sustainability of agricultural and allied systems. They hold the key to achieving food security not only for themselves, but also for the increasingly large number of families that have left the farm sector for employment in other occupations. Concerted effort in ensuring stability and sustainability of smallholder family farms will in turn translate into productivity gains of the farms and profitability of the communities. This approach has to be guided by identification of relevant technologies in enhancing the skill and capacity of marginal and resource-poor farming communities to take on the emerging challenges.

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4

VIKAS RAWAL

Economics of Family Farming

A Study of Returns from Crop Production in India

Introduction

Family farming—if broadly defined as agricultural production on household operational holdings—is the predominant form of agricultural production in Asia. As shown in Table 4.1, in all the Asian countries for which data are available from the World Agricultural Census, over 99 per cent of holdings are managed by households.[1]

Family farms are extremely heterogeneous in terms of scale of production, technology, level of investment and the nature of labour deployment. Given these dissimilarities as well as regional variations in agro-ecological conditions in a large country such as India, there are considerable differences in costs incurred and returns obtained by different types of family farms. Evidence presented in this paper shows that a vast majority of family farmers in India obtain very small incomes from crop production. While there is a considerable amount of empirical literature on cost of cultivation and returns from crop production in India, both as part of scholarly work as well as in official reports, most of this evidence deals with average returns. This paper shows, for the first time using macro-level official statistics, that a large proportion of cultivators incur losses in crop production in any given year. In contrast, a small minority of rural

1. Agricultural censuses of very few countries report the share of operated area that is held by individuals or households. Given that institutional holdings (including corporate, cooperative and public farms) tend to be larger than average household holdings, the share of household holdings in total operated area tends to be somewhat smaller than their share in total number of household holdings.

rich, with large landholdings, access to irrigation and other resources, obtain substantial returns from crop production.

This paper focuses on India. It primarily relies on two sources of data on costs and returns from farming. Official statistics on cost of cultivation are collected in India through large-scale surveys conducted under the Comprehensive Scheme for Studying the Cost of Cultivation of Principal Crops in India (CCPC) of the Directorate of Economics and Statistics of the Ministry of Agriculture. A major limitation of statistics from CCPC surveys is that these provide information on costs and returns only for individual crops and not for cultivating households as a whole. The paper also uses data from the Project on Agrarian Relations in India of the Foundation for Agrarian Studies (*http://agrarianstudies.org/pages.asp?menuid=16*). Although limited to selected villages, data from the Project on Agrarian Relations in India (PARI) are unique for providing rigorous estimates, using the same methodology as in CCPC data, of costs and returns for cultivating households as a whole.

There is no accepted definition of what constitutes family farming. Countries that use family farms as a category define them on the basis of one or more of the following three dimensions: agricultural production that is under management of a single household/family; agricultural production that is predominantly based on family labour; and agricultural production managed by a household and below a specified size (Lowder, Skoet and Singh, 2014). In this paper, I stick to a broad definition and include all crop production on operational holdings of households as family farming. Evidently, such a definition results in inclusion of a widely heterogeneous set of farmers in terms of size of land operated, scale of production, level of capital deployment, and the extent of use of family and hired labour. As shown in the paper, this heterogeneity has an important bearing on the incomes of family farmers.

The paper examines three issues. First, it looks at levels and disparities in household incomes from crop production (Section 3). Second, the paper analyses variations in per hectare returns and points out that policymaking based on average returns can be extremely problematic as a very large proportion of cultivators has

returns below average. Even more importantly, the analysis shows that a substantial proportion of family farmers in India incur losses in crop production in any given year (Section 4). Third, it studies the relationship between net returns and scale of production (Section 5).

Table 4.1

Number of Holdings and Area Operated, Household and Total Holdings, Selected Countries: Asia

Country	*Year*	*Percentage of Household Holdings*	*Total Number of Holdings ('000)*	*Percentage of Area Operated by Households*	*Total Operated Area ('000 ha)*
Afghanistan	2002/03		3045		
Bangladesh	2005		28192		9782
Bhutan	2000				106
China	1997	99.8	193446		
India	2000/01	99.8	119894	98.9	159394
Indonesia	2003		24869		19673
Iran	2003	99.1	4332		
Japan	2000		3120		3734
Myanmar	2003	99.7	3465		8721
Republic of Korea	2000		3270		
Laos PDR	1998/99	100.0	668		1048
Lebanon	1998/99	100.0	195	84.6	248
Libyan Arab Jamahiriya	2001	100.0	177		1810
Malaysia	2005	100.0	526	100.0	534
Mongolia	2000		250		
Nepal	2002	100.0	3364		2654
Pakistan	2000	100.0	6620	99.8	20438
Philippines	2002	99.2	4823	96.4	9671
Sri Lanka	2002		3265		1531
Thailand	2003	99.9	5793		18314
Vietnam	2001		10690		7634

Source: Based on data from the World Agricultural Census, 2000 Round (1996–2005).

Statistics on Returns from Cultivation

As mentioned earlier, official statistics on cost of cultivation and returns from farming are collected under the Comprehensive Scheme for Studying the CCPC in India of the Directorate of Economics and Statistics of the Ministry of Agriculture. CCPC statistics are among the most elaborate cost of cultivation statistics collected in any developing country.

A major limitation of the CCPC statistics is that, although these are collected for all crops cultivated by sample cultivators at the stage of processing, the data are separated crop-wise, and are validated only for selected crops. These are then released separately for each of these crops. This is a serious limitation since most cultivators grow multiple crops on their operational holdings in a season as well as grow crops in more than one season in a given agricultural year. Given that CCPC statistics are only released separately for individual crops, it is not possible to use these to study economics of farming households as units.

In reality, duration and seasons in which crops are grown vary. Often, seasons for crops cultivated in different plots in the operational holding of a household—and, sometimes, on the same plot of land—overlap. There are also periods in an agricultural year in which different parts of the holding remain fallow. As a result of these complexities, crop and technological choices are made, and by implication, the profitability of crop production is determined for alternative crop mixes and crop sequences rather than individual crops. In some cases (for example, for perennial crops and crops that have ratoons), cropping pattern choices may even have long-term implications. CCPC statistics, which are provided only for individual and selected crops, do not allow us to look at farm households as production units and analyse the economics of these units.

Until recently, farm-by-farm CCPC data were not available for the country as a whole and reports of the Commission for Agricultural Costs and Prices (CACP) were the main source of public data on cost of cultivation. These reports provided only state-wise averages of

per hectare output and per hectare expenditure. As a result, until recently, it was not possible to analyse distribution of incomes from CCPC data.[2]

The Directorate of Economics and Statistics have recently made available farm-by-farm data, albeit separately for individual crops, from CCPC surveys. These allow considerably more detailed analysis of returns from cultivation of different crops than has been possible thus far from published state-level averages, from reports of the Commission for Agricultural Costs and Prices.

In contrast with the data available from CCPC, data from the Project on Agrarian Relations in India, although only for selected few villages, are available for individual crops as well as for households as a whole. Table 4.2 provides details of villages from PARI surveys for which cost of cultivation statistics are used in this paper.

Table 4.2

Location of PARI Villages

Village	*District*	*Region*	*State*	*Reference year*
Ananthavaram	Guntur	South coastal	Andhra Pradesh	2005-06
Bukkacherla	Ananthapur	Rayalaseema	Andhra Pradesh	2005-06
Kothapalle	Karimnagar	Northern Telengana	Andhra Pradesh	2005-06
Harevli	Bijnor	Western	Uttar Pradesh	2005-06
Mahatwar	Ballia	Eastern	Uttar Pradesh	2005-06
Warwat Khanderao	Buldhana	Vidharbha	Maharashtra	2006-07
Nimshirgaon	Kolhapur	Southern	Maharashtra	2006-07
25F Gulabewala	Sriganganagar	North-western plain	Rajasthan	2006-07
Rewasi	Sikar	Semi-arid region	Rajasthan	2009-10
Gharsondi	Gwalior	Gird region	Madhya Pradesh	2007-08

2. Data from CACP reports have been used by many scholars to examine different aspects of cost of production and returns from crops. The most detailed analysis is by A. Sen and Bhatia (2004). Other noteworthy studies are Surjit (2008); Raghavan (2008); George (1988); Kahlon and Kurien (1984); Vishandass (2013); Dev and Rao (2010); Narayanamoorthy (2013).

PARI estimates use the CCPC methodology for estimation of cost of cultivation adopted for that of incomes from crop production. Estimates of income from crop production in the PARI dataset refer to net income over what is known as cost A2. Cost A2, a concept taken from the CCPC methodology of estimation of cost of cultivation, broadly refers to paid-out cost (POC) incurred by a cultivator. Importantly, in estimation of cost A2, no value is imputed for the cost of family labour or for the implicit rent of owned capital (including land).

Levels and Disparities in Incomes of Households from Crop Production

Since official CCPC statistics do not provide net returns from cultivation of all crops cultivated by a farm household, it is not possible to analyse levels and disparities in household-level crop incomes using CCPC data.

PARI data on incomes from crop production show that a vast majority of family farmers in India obtain very low incomes from farming. Table 4.3 shows median income from crop production in each village at 2005-06 prices. It shows that the average annual income was only ₹1,290 per household in Mahatwar, a village where agriculture was primarily rainfed. Even in Ananthavaram, where about 79 per cent of the gross cropped area was irrigated, annual income was only ₹2,654 per household. In Warwat Khanderao, a cotton-growing village in Vidarbha region, median income from crop production was only ₹14,577 per household. In Nimshirgaon, where sugarcane was the most important crop, the median income from crop production was only ₹9,853 per household.

Figure 4.1 presents Lorenz curves of income from crop production for cultivator households. A remarkable aspect of the distribution of income from crop production is seen here. It shows that in Ananthavaram (Guntur), total income from crop production of the bottom 84 per cent cultivator households was zero. In Bukkacherla (Ananthapur), total income of the bottom 80 per cent cultivating

households was zero. The corresponding proportion was 70 per cent in Rewasi (Sikar), 59 per cent in Gharsondi (Gwalior) and 54 per cent in Mahatwar (Ballia). The Gini coefficient in most villages was more than 0.6 and, in three villages, it was above 0.8.

Table 4.3

Income from Crop Production, Median, Average of Top 5 Households and Highest Income, by Village (Rupees per Household, 2005-06 Prices)

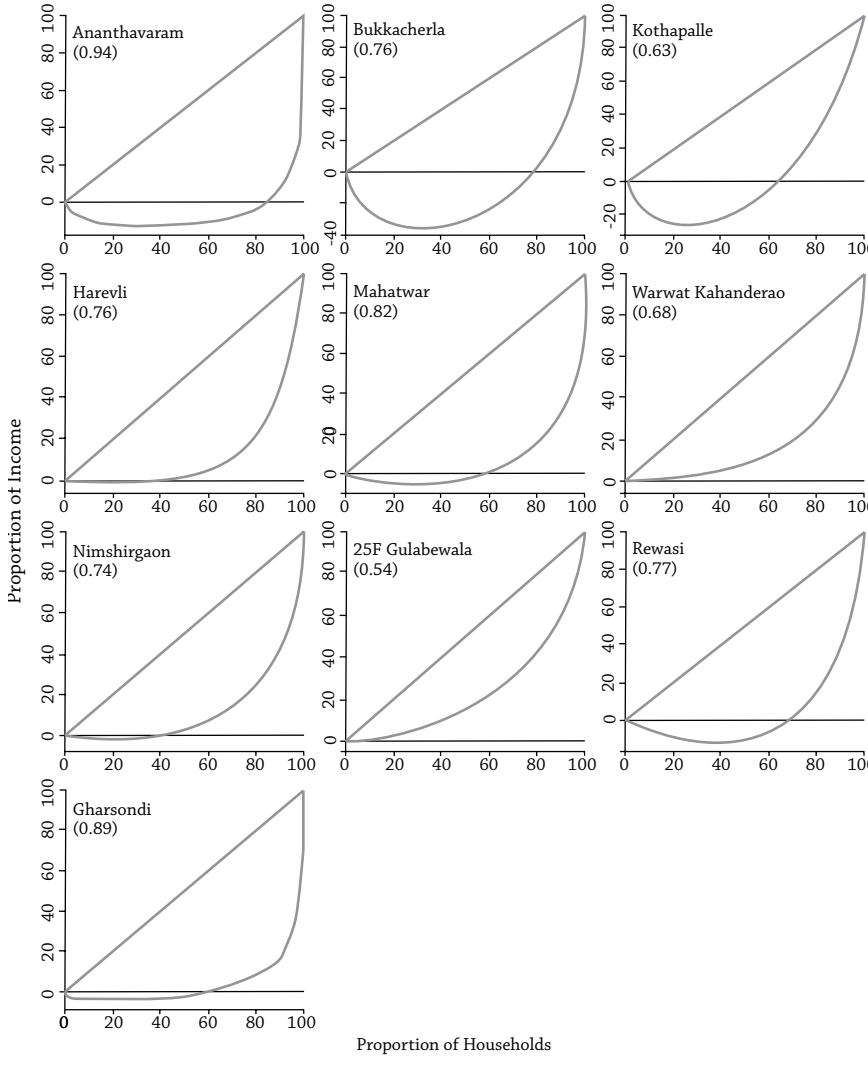
Village	*Median*	*Average of Top 5 Households*	*Max*
Ananthavaram	2654	402266	1385903
Bukkacherla	6477	89228	136962
Kothapalle	5869	32239	47650
Harevli	8812	316289	516723
Mahatwar	1290	60956	126841
Warwat Khanderao	14577	354008	816382
Nimshirgaon	9853	740759	1876043
25F Gulabewala	175001	1169556	1494138
Rewasi	2361	96709	103632
Gharsondi	9145	1258859	2796476

Source: Estimated from PARI survey data.

The third most important aspect of distribution of incomes from crop production is that, while a majority of cultivating households obtained meagre incomes from crop production, there were small sections of households in most villages that derived substantial incomes. Table 4.3 shows that, at 2005-06 prices, the topmost household in Gharsondi had an income of over ₹27 lakh from crop production alone. Similarly, income from crop production for the topmost household was ₹18.7 lakh in Nimshirgaon, ₹14.9 lakh in 25F Gulabewala and ₹13.8 lakh in Ananthavaram.

Figure 4.1

Lorenz Curves of Income from Crop Production, Cultivating Households, by Village



Note: Following Chen, Tsaur and rhai (1982), these adjusted Gini coefficients account for negative incomes. The value of the adjusted coefficient lies between 0 and 1.

Source: Estimated from PARI survey data.

Variations in Per Hectare Returns and Losses in Crop Production

A striking finding of the PARI studies has been that in most study villages, a substantial proportion of cultivator households incurred a loss over POC in the given reference year. That is, even when value of their own labour or rental value of their own land and other productive assets was not accounted for in the costs, a significant proportion of cultivators were unable to recover the expenses incurred in the process of cultivation. Based on the PARI data, Table 4.4 shows the proportion of cultivating households that incurred a loss in crop production. As can be seen, the proportion of cultivating households that incurred a loss in crop production was highest in Rewasi in Rajasthan (42%) and in Bukkacherla in Andhra Pradesh (35%). In eight out of 10 villages for which data are presented in the Table 4.4, more than 15 per cent of cultivators incurred a loss in crop production in the reference year of the survey.

Table 4.4

Proportion of Households with Negative Incomes from Crop Production, by Village (%)

Village	*Proportion of Households with Negative Incomes*
Ananthavaram	30
Bukkacherla	35
Kothapalle	27
Harevli	12
Mahatwar	19
Warwat Khanderao	5
Nimshirgaon	20
25F Gulabewala	0
Rewasi	42
Gharsondi	20

Source: Estimated from PARI survey data.

Reports of the CACP provide summary statistics on average output, costs and returns from crops at the level of states. Until

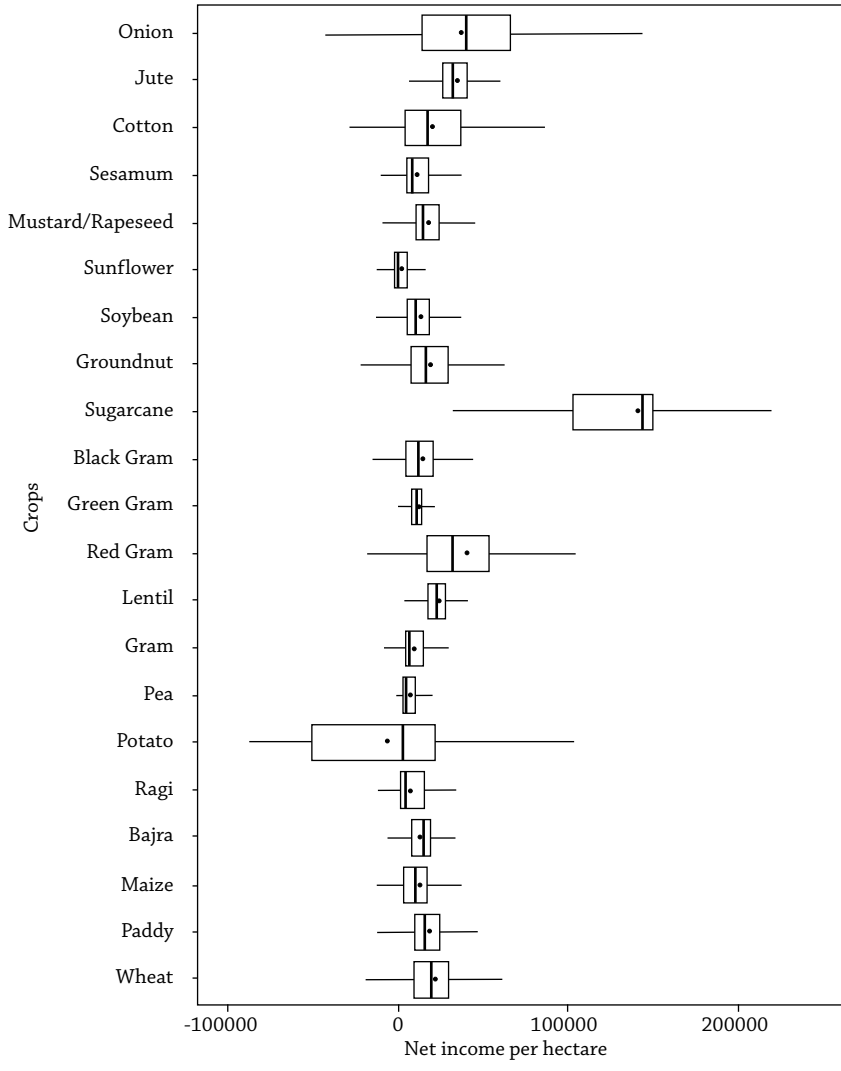
recently, these reports were the primary source of data on cost of cultivation and net returns. However, since they provided no information on the distribution of costs and returns, no information has been available on how many cultivators actually got less than average levels of returns and how many actually incurred losses.

With availability of farm-by-farm data from CCPC surveys, an analysis of distribution of per hectare returns has become possible. Figure 4.2 presents boxplots of net returns per hectare for different crops. It shows that there is a large variability in returns for each crop. Table 4.5 presents estimates of proportion of cultivators who obtained less than state-level average returns. It is, of course, expected that a substantial proportion of cultivators would have less than average returns. However, these have important implications because distributions of costs and returns have never been taken into account for formulation of price policies. It is also particularly noteworthy because in some cases this proportion is staggering. For example, in 2009-10, 88 per cent of paddy cultivators in Karnataka had less than average returns. Similarly, 86 per cent of wheat producers in Jharkhand, 79 per cent of cotton producers in Tamil Nadu, 71 per cent of cotton producers in Karnataka, and 62 per cent of wheat producers in Chhattisgarh had less than average returns.

While CCPC data do not allow us to estimate proportion of farm households that obtained negative net income from all crops cultivated in a given year, the farm-by-farm crop-wise CCPC data can be used to estimate the probability of incurring losses in cultivation of a particular crop.

Figure 4.2

Distribution of Net Returns (Over Cost A2) Per Hectare, by Crop, All States, 2009-10 (₹ Per Hectare)



Notes: The mean values have been marked as a point.

Extreme values have been removed since some of these may be outliers.

Source: Estimated from farm-level CCPC data.

Table 4.5

Proportion of Cultivators with Below Average Returns from Cultivation of Selected Crops, by State, 2009-10

State	*Wheat*	*Paddy*	*Bajra*	*Green gram*	*Sunflower*	*Cotton*
All States	42	45	53	55	59	52
Andhra Pradesh		51		53	46	49
Assam		38				
Bihar		40				
Chhattisgarh	62	55				
Gujarat	54	58	42			54
Haryana	39	48	55			40
Himachal Pradesh	42	22				
Jharkhand	86	56				
Karnataka		88	55	29	56	71
Kerala		37				
Madhya Pradesh	58	65				37
Maharashtra	36	67	55	61	68	54
Odisha		35		50		43
Punjab	46	40				37
Rajasthan	46		58	62		53
Tamil Nadu		45				79
Uttar Pradesh	38	31	38			
Uttarakhand	45	50				
West Bengal	54	50				

Source: Estimated from farm-level CCPC data.

Based on farm-by-farm CCPC data, Table 4.6 shows the proportion of family farmers who incurred losses in growing different crops between 2001-02 and 2010-11. It brings out some important findings.

These estimates clearly show that, in any given year, a substantial proportion of cultivators incur losses in almost every crop. It may be noted that CCPC data underestimate the proportion of households that incurred losses because CCPC excludes, at the stage of data validation, all entries where there has been a complete crop failure and the production is reported as zero. Even with this clear source of

underestimation, a substantial proportion of households are found to incur losses.

Table 4.6

Proportion of Cultivators with Negative Returns, by Crop, All States, 2001-02 to 2010-11 (%)

Crop	*2001-02*	*2002-03*	*2003-04*	*2004-05*	*2005-06*	*2006-07*	*2007-08*	*2008-09*	*2009-10*	*2010-11*
Wheat	5.4	7.0	1.1	3.2	4.2	0.5	1.1	1.7	2.7	1.0
Paddy	6.6	15.1	6.8	8.3	9.0	11.1	5.4	7.7	7.4	5.8
Maize	24.8	11.3	14.9	9.0	11.8	14.5	9.0	16.7	23.2	5.5
Bajra	21.5	11.8	19.1	5.5	12.4	17.1	5.1	16.8	6.1	8.0
Ragi	48.4	40.7	22.6	30.2	54.4	83.5	67.3	53.6	15.0	20.3
Potato	4.8	37.8	10.5	7.0	1.3	3.7	21.4	4.1	29.0	7.1
Pea		13.9		9.0	11.8	0.0	0.0	8.3	7.3	14.6
Gram	13.3	4.8	4.8	10.5	7.1	7.8	5.2	8.4	9.4	8.8
Lentil	8.4	8.3	8.0	17.7	3.9	0.0	0.0	0.0	2.4	2.7
Red gram	7.8	8.2	6.6	14.0	11.6	15.1	12.8	15.7	1.8	11.6
Green gram	13.2	30.4	22.2	20.3	24.4	15.2	23.7	10.7	6.0	6.9
Black gram	9.0	12.9	24.2	25.1	25.2	13.5	11.1	15.4	19.2	4.5
Sugarcane	6.6	9.3	7.3	2.5	4.3	3.2	16.2	0.4	6.6	1.7
Groundnut	30.9	44.7	34.4	30.4	24.1	42.9	22.2	48.1	12.7	12.3
Soybean	11.3	22.3	3.6	7.8	13.3	9.6	5.8	15.1	9.1	10.9
Sunflower	29.3	12.4	58.1	38.8	32.3	35.8	33.4	38.8	36.0	10.1
Mustard/ Rapeseed	8.7	12.0	9.9	8.0	9.5	4.0	2.5	2.8	2.0	1.5
Sesamum	3.6	4.8	0.9	4.1	6.1	6.1	8.1	4.5	0.7	1.8
Cotton	24.5	27.6	13.4	28.0	22.6	20.2	10.6	15.2	12.6	8.1
Jute	3.7	7.7	7.5	1.9	2.1	4.5	7.1	0.9	1.4	1.1
Onion	44.3	13.3	6.0	23.1	14.0	0.4	3.3	10.3	6.9	5.0

Source: Estimated from farm-level CCPC data.

Of all crops, the proportion of cultivators who incurred losses is highest among cultivators of *ragi*. In 2006-07, about 84 per cent of cultivators who cultivated *ragi* incurred losses. In seven out of 10 years over the last decade, more than a third of cultivators growing *ragi* incurred losses in each year.

A comparison of cereal crops shows that a significantly higher proportion of cultivators growing millets, maize and paddy incur losses than those growing wheat.

The proportion of cultivators incurring losses from cultivation of pulses increased considerably in the 1990s. In case of green gram and black gram, the proportion was close to a quarter in the first half of the 2000s. In case of red gram, more than 10 per cent of cultivators in most years in the second half of the 2000s incurred losses.

Among cultivators of oilseeds, the proportion who incurred losses was highest in the case of groundnut and sunflower. In 2008-09, 48 per cent of groundnut cultivators incurred losses over POC. In the same year, about 39 per cent of sunflower and about 15 per cent of soybean growers incurred losses.

Between 1994-95 and 2004-05, there was a distinct and considerable rise in the proportion of cotton producers who incurred losses. In 2001-02, 2002-03, 2003–04, 2004-05, 2005-06 and 2006-2007, over 20 per cent of cotton farmers incurred losses. This was the period in which incidents of suicides among cotton producers peaked. There has been a decline in proportion of cultivators incurring losses since 2006-07, even though the proportion remains substantial.

The trend in case of potato and onion is marked by large fluctuations and intermittent spikes in the proportion of cultivators who incurred losses. In 2009-10, about 29 per cent of potato producers incurred losses. Among onion producers, 44 per cent incurred losses in 2001-02, 23 per cent in 2004-05 and about 10 per cent in 2008-09.

Sugarcane is among the most profitable crops in India. PARI data show that there are systematic variations in costs and returns of planted and ratoon crops of sugarcane. However, since CCPC statistics on sugarcane are not released separately for planted and ratoon crops, we can look at returns from sugarcane only for planted and ratoon crops together. As per CCPC statistics, sugarcane is among the crops with the lowest probability of cultivators incurring a loss. The proportion of sugarcane cultivators who incurred losses has been below 10 per cent every year, except in 2007-08, when this rose to about 16 per cent.

There is considerable disparity across states in terms of the proportion of cultivators who incur losses in cultivation of a particular crop. For illustration, Tables 4.7-4.10 show state-wise estimates of the proportion of cultivators who incurred losses in cultivation of different crops in 2009-10. The proportion of cultivators incurring losses in wheat cultivation is relatively low. Across all states, only about 3 per cent of wheat cultivators incurred losses in 2009-10. However, the proportion of wheat cultivators who incurred losses in the same year was 55 per cent in Chhattisgarh and about 27 per cent in West Bengal. Among paddy cultivators, the

Table 4.7

Proportion of Cultivators with Negative Returns from Cultivation of Cereals, by State, 2009-10

State	*Wheat*	*Paddy*	*Maize*	*Bajra*	*Ragi*
All States	2.7	7.4	23.2	6.1	15.0
Andhra Pradesh		5.8	17.8		0.0
Assam		6.5			
Bihar		4.8			
Chhattisgarh	55.3	1.2	0.0		
Gujarat	0.0	0.3	15.2	6.4	
Haryana	0.1	0.2		3.0	
Himachal Pradesh	7.6	0.1	1.4		
Jharkhand	1.4	42.7			
Karnataka		2.2	3.2	39.9	14.9
Kerala		8.6			
Madhya Pradesh	0.0	0.9	16.7		
Maharashtra	6.5	37.1		15.2	18.2
Odisha		0.6			
Punjab	0.1	1.3			
Rajasthan	0.0		24.0	0.8	
Tamil Nadu		4.5	10.1		0.6
Uttar Pradesh	1.1	4.2	39.3	1.0	
Uttarakhand	0.0	0.0			
West Bengal	26.9	7.5			

Source: Estimated from farm-level CCPC data.

proportion of cultivators who incurred losses was about 43 per cent in Jharkhand and 37 per cent in Maharashtra, while the proportion for all states together was 7 per cent. Across different crops and states, there are cases of very high incidence of losses. In 2009-10, for example, 39 per cent of *bajra* cultivators in Karnataka, 39 per cent of maize cultivators in Uttar Pradesh, 45 per cent of gram cultivators in Karnataka, 47 per cent of red gram cultivators in Tamil Nadu, 24 per cent of red gram cultivators in Andhra Pradesh, 48 per cent of black gram cultivators in Maharashtra, 40 per cent of groundnut cultivators in Karnataka, 30 per cent of groundnut cultivators in Andhra Pradesh, 50 per cent of cotton cultivators in Karnataka, and 63 per cent of potato growers in West Bengal incurred losses.

Table 4.8

Proportion of Cultivators with Negative Returns from Cultivation of Pulses, by State, 2009-10

State	*Pea*	*Gram*	*Lentil*	*Red Gram*	*Green Gram*	*Black Gram*
All States	7.3	9.4	2.4	1.8	6.0	19.2
Andhra Pradesh		8.6		24.1	3.0	2.0
Bihar		0.7	0.0	0.0		
Chhattisgarh		0.0				5.1
Gujarat				16.1		
Haryana		8.5				
Jharkhand		0.0	0.0			
Karnataka		44.7		6.4	3.0	
Madhya Pradesh	0.0	0.4	0.0	0.0		3.4
Maharashtra		21.1		1.5	21.6	47.8
Odisha				0.0	0.4	0.0
Rajasthan		9.2			1.3	8.0
Tamil Nadu				47.4		0.2
Uttar Pradesh	7.9	2.1	3.3	0.7		14.4
West Bengal			0.0			

Source: Estimated from farm-level CCPC data.

Table 4.9

Proportion of Cultivators with Negative Returns from Cultivation of Oilseeds, by State, 2009-10

State	*Groundnut*	*Soybean*	*Sunflower*	*Mustard and Rapeseed*	*Sesamum*
All States	12.7	9.1	36.0	2.0	0.7
Andhra Pradesh	30.8		6.2		
Assam				17.7	
Bihar				0.3	
Gujarat	20.7			0.0	12.3
Haryana				0.0	
Karnataka	39.5		46.7		
Madhya Pradesh		0.0		0.0	
Maharashtra	10.3	18.9	6.2		
Odisha	0.5				0.0
Rajasthan		2.7		0.9	1.2
Tamil Nadu	10.4				0.3
Uttar Pradesh				0.6	
West Bengal				3.1	0.4

Source: Estimated from farm-level CCPC data.

A detailed examination of the causes for farmers incurring losses requires analysis of costs and prices, weather shocks, and production and marketing relations. Although it may be possible to analyse the impact of prices and weather shocks using large-scale data, CCPC data do not provide much information on production and marketing relations of individual cultivators.

An examination of PARI data brings out two common proximate causes for losses in crop production. In villages that were primarily rainfed—for example, Rewasi (Sikar), Gharsondi (Gwalior), Bukkacherla (Ananthapur), Kothapalle (Karimnagar) and Mahatwar (Ballia)—losses in crop production were incurred on account of lack of access to irrigation and crop failures. Interestingly, losses were also incurred by a substantial proportion of cultivators in irrigated villages like Ananthavaram (Guntur) and Harevli (Bijnor). This was on account of specific forms of tenancy relations, which compelled

poor households to enter into loss-making tenancy contracts that were interlocked with other economic activities (most importantly, animal-keeping or wage labour).[3]

Table 4.10

Proportion of Cultivators with Negative Returns from Cultivation of Cotton, Sugarcane, Potato and Onion, by State, 2009-10

State	*Cotton*	*Sugarcane*	*Potato*	*Onion*
All States	12.6	6.6	29.0	6.9
Andhra Pradesh	1.0	0.0		4.2
Bihar			10.0	
Gujarat	8.1			2.7
Haryana	0.5	0.0		
Himachal Pradesh			14.6	
Karnataka	50.7	0.0		
Madhya Pradesh	0.0			
Maharashtra	15.4	0.1		6.9
Odisha	0.0			
Punjab	0.0			
Rajasthan	1.5			
Tamil Nadu	7.5	0.0		
Uttar Pradesh		7.8	14.9	
Uttarakhand		0.0		
West Bengal			63.0	

Source: Estimated from farm-level CCPC data.

Relationship between Scale and Net Returns

The well-known debate on the relationship between farm size and productivity in post-independent India was started by Sen (1962; 1964), who found that there was an inverse relationship between the two. Over the last five decades, numerous contributions have been made to this debate. These include some that tried to explain the negative relationship on the basis of differences in the productivity potential of land and input use, and others that analysed policy

3. See Ramachandran, Rawal and Swaminathan (2010); Rawal (2013; 2014).

implications of the negative relationship, as well as those that questioned universality of negative relationship and contributions that argued that the negative relationship may have weakened with technological changes in agriculture.[4]

There are two limitations in using CCPC data to explore relationship of gross output or net returns with scale of production.

First, using CCPC data, one can only examine this relationship for individual crops. Such an analysis cannot take into account differences in the extent of multiple cropping or variations in cropping patterns between different classes of cultivators. Households with access to better land, water and other resources are not only able to obtain better returns from a given crop, but are also able to choose a more profitable crop mix. Analyses of returns to scale at the level of individual crops miss this crucial determinant of variation in returns.

Second, the findings of studies on the relationship between productivity and scale in Indian agriculture have been questioned because most of these used physical extent of land as a measure of scale. It has been argued in the literature that physical extent of land is a poor measure of scale of production. Use of physical extent of land as a measure of scale of production overlooks variations in fertility of soil, access to irrigation and drainage facilities, investments made on land, and the terms of contract through which land is operated (Ramachandran, 1980).[5]

A unique feature of the PARI dataset is that it allows us to analyse variations in income from crop production per acre of household operational holding across economic classes, defined on the basis of the nature of labour deployment on the farm and the extent of

4. While it is not possible to list all writings on this issue, some of the well-known contributions that examine relationship between physical extent of land holdings and productivity include Saini (1971); Sen (1964); Sen (1962); Rani (1971); Patnaik (1972); Patnaik (1971); Bardhan (1973); Bharadwaj (1974); Berry and Cline (1979); Deolalikar (1981); Sen (1981); Carter (1984); Shenggen and Chan-Kang (2005); Bhalla and Roy (1988); Chattopadhyay and Sengupta (1997); Reddy (1993); and Lipton (2009). Byres (2000) looks at the historical evidence on the inverse relationship.

5. See, for example, Patnaik (1972); Patnaik (1971); Bhalla and Roy (1988); Ramachandran (1990); Ramachandran (1980); Patnaik (1987), and various contributions to the mode of production debate (in Patnaik, 1990).

ownership of means of production by cultivators. PARI data also allow for evaluation of variations in returns across different caste groups and cropping systems. In the analysis that follows, cultivators are grouped into five categories using data on ownership of means of production, on levels and composition of household incomes, and on the pattern of labour deployment. The five categories are: Landlords/ Big Capitalist Farmers, Peasant 1 (rich), Peasant 2 (middle), Peasant 3 (poor), and Hired Manual Workers. The last category refers to a section of hired manual worker households who also operated some land. Households that did not operate land have been excluded from the analysis.

Table 4.12 presents data on median gross value of output per acre across different socio-economic classes in PARI villages. Table 4.13 shows median net income per acre across different socio-economic classes.[6] Table 4.12 shows that there is no negative relationship between gross value of output per acre and scale of production. In some villages—for example Ananthavaram, Warwat Khanderao, Nimshirgaon, Rewasi and Gharsondi—there is a positive relationship between the two variables. In other villages—Bukkacherla, Kothapalle, Mahatwar—there is no clear relationship between scale and gross value of output.

The relationship comes out more clearly when one looks at scale effects in net returns. Table 4.13 shows that in most villages, average net income per acre declines as one goes from rich peasants to middle peasants and then to poor peasants. Take, for example, the case of Mahatwar (Ballia district, Uttar Pradesh). Median net income per acre was ₹6,957 for rich peasants, ₹2,656 for middle peasants, and ₹952 for poor peasants. In Rewasi (Sikar district, Rajasthan), median net income per acre was ₹3,299 for rich peasants, ₹469 for middle

6. A note of caution is due here. As has been pointed out, the number of classes and their character varies across PARI villages. For the purpose of a limited comparison, in these tables, lower-middle peasants and upper-middle peasants in Ananthavaram, Bukkacherla, Kothapalle, Harevli and Mahatwar were combined into a single category of middle peasants. Warwat Khanderao and Gharsondi had two categories of hired manual workers each. These were combined into a single category of hired manual workers in both these villages.

peasants, and ₹517 for poor peasants. The extent of disparities across the three classes, of course, varies across villages.[7]

The positive relationship between scale and net returns over cost A2 may be driven by rental payments on leased land, which is usually expected to be higher for poor peasants than for rich and middle peasants. To check this, let us look at the net returns over cost A1, which, unlike cost A2, does not include rent for leased land. Estimates of median income over cost A1, presented in Table 4.14, show that, although incomes of poor peasants in some villages (for example, Ananthavaram and Harevli) are significantly higher when computed over cost A1 rather than over cost A2, the overall positive relationship between scale and net returns remains unchanged.

It may also be pointed out that the positive relationship between scale and returns over cost A1 and A2 is seen, despite the fact that both of these cost concepts do not account for greater use of family labour by poor peasants than by middle and rich peasants.

Table 4.11

Median Gross Value of Output and Net Income Per Acre of Operational Holding, by Village

(Rupees Per Acre, 2005-06 Prices)

Village	*Gross Value of Output Per Acre*	*Net Income Per Acre*
Ananthavaram	23160	1740
Bukkacherla	4689	918
Kothapalle	8600	2848
Harevli	17204	4517
Mahatwar	9194	1871
Warwat Khanderao	8501	4748
Nimshirgaon	15633	6714
25F Gulabewala	11797	5565
Rewasi	4295	469
Gharsondi	7894	3116

Source: Estimated from PARI survey data.

7. The trend is distinctly different in the case of Kothapalle, where median net income rises as one goes from rich peasants to middle peasants, and then to poor peasants. The pattern is not so clear in the case of median gross value of output per acre.

Table 4.12

Median Gross Value of Output Per Acre of Operational Holding, by Class

(Rupees Per Acre, 2005-06 Prices)

Village	*Landlord*	*Peasant: 1 (rich)*	*Peasant: 2 (middle)*	*Peasant: 3 (poor)*	*Hired manual Workers*
Ananthavaram	14500	32465	24892	20492	19595
Bukkacherla	7408	4611	7087	3387	5136
Kothapalle	8997	7703	10138	18083	6065
Harevli	19380	17496	20438	15164	11875
Mahatwar	9234	13849	9595	9371	9557
Warwat Khanderao	15288	11577	10250	9140	6133
Nimshirgaon	37225	29172	20904	13597	4083
25F Gulabewala	13058	12216	11287	nil	nil
Rewasi	6528	7403	3622	5123	581
Gharsondi	13923	11161	8469	7694	4923

Source: Estimated from PARI survey data.

Table 4.13

Median Net Income from Crop Production Per Acre of Operational Holding by Class

(2005-06 Prices)

Village	*Landlord*	*Peasant: 1 (rich)*	*Peasant: 2 (middle)*	*Peasant: 3 (poor)*	*Hired Manual Workers*
Ananthavaram	7534	15022	3238	485	993
Bukkacherla	-274	1134	894	207	2159
Kothapalle	4839	2210	3188	3523	2039
Harevli	6636	8627	6640	2134	1634
Mahatwar	3458	6957	2656	952	1745
Warwat Khanderao	9576	7594	5515	5660	1358
Nimshirgaon	16231	13001	9449	5888	-58
25F Gulabewala	7077	6004	5890	nil	nil
Rewasi	3304	3299	469	517	-572
Gharsondi	7031	5634	3924	3035	1258

Source: Estimated from PARI survey data.

Table 4.14

Median Net Income over Cost A1 from Crop Production Per Acre of Operational Holding by Class

(Rupees Per Acre, 2005-06 Prices)

Village	*Landlord*	*Peasant: 1 (rich)*	*Peasant: 2 (middle)*	*Peasant: 3 (poor)*	*Hired Manual Workers*
Ananthavaram	7534	15481	9698	7285	3642
Bukkacherla	754	1134	1726	1019	2159
Kothapalle	4839	3304	3678	6033	2039
Harevli	6636	9133	8281	7987	8791
Mahatwar	3458	6957	2945	2497	1745
Warwat Khanderao	9576	7594	5515	5660	1683
Nimshirgaon	16231	13001	9449	5989	-58
25F Gulabewala	7077	6502	6536	nil	nil
Rewasi	3611	3299	594	517	-572
Gharsondi	7497	5810	4235	3196	1258

Source: Estimated from PARI survey data.

What are the factors that contribute to different levels of returns obtained by different categories of cultivators? I have analysed detailed data on economy of crop production from seven PARI villages to examine the sources of positive relationship between scale and net returns (Rawal, 2013). While it is not possible to include the detailed analysis for each village in this paper, it will be useful to present the conclusions of this analysis for each village in order to illustrate how different categories of cultivators obtain different levels of returns, and why the relationship between scale and net returns tends to be positive in most cases.

Harevli (Canal-Irrigated Village, Najibabad District, Western Uttar Pradesh)

Cultivation of sugarcane, the most important crop in Harevli, required considerable investment and was associated with complex agronomic practices. In particular, large producers operated complex crop cycles to evenly spread investment and demand for labour. Very high inequality in ownership of land, irrigation equipment

and other means of production across classes and castes resulted in considerable variations in returns from land obtained by the different classes. In particular, the poorest cultivators—landless Dalit tenants who cultivated paddy on seasonal contracts—obtained very low returns from cultivation.

Nimshirgaon (Groundwater-Irrigated Village, Kolhapur District, Southern Maharashtra)

In Nimshirgaon, the scale of production had a very clear positive relationship with both the gross value of output and net returns. This relationship was obtained as a result of better command of landlords and rich peasants over access to irrigation, credit and investible resources, as well as access to technical knowledge. These allowed landlord and rich peasant households to grow more profitable crops on a greater proportion of land. On the other hand, poor peasant and hired manual worker households had poorer access to investible funds, credit and technical knowledge. Cultivation of horticultural crops and flowers not only required high investment, but also specialised knowledge. Only a few persons, mainly from among landlord and rich peasant households, had the technical know-how for cultivation of such crops. Also, given smaller landholdings, poor peasant and manual worker households were required to use a greater proportion of their land for cultivation of subsistence crops like sorghum. Land cultivated with sorghum in the *rabi* season had to be planted with soybean and groundnut in the *kharif* season, and cultivation of long-term/annual horticultural crops like sugarcane and grapes could not be done on such land.

25F Gulabewala (Canal-Irrigated Village, Sri Ganganagar District, Rajasthan)

Among all the PARI villages, 25F Gulabewala stands out as one with the highest levels of economic differentiation. Agrarian structure in 25F Gulabewala comprised capitalist Jat Sikh farmers (with a relatively low degree of disparity among them) and a large proportion of Dalit agricultural workers with no land. While the overall levels of inequality were exceptionally high in this village, this

was on account of a large gap between land-owning Jat Sikh farmers and landless Dalit households. Economic disparities within Jat Sikh farmers were relatively low. A strikingly different pattern in terms of returns from cultivation must be seen in the light of this. Average returns in 25F Gulabewala did not have any clear relationship with the scale of production. Except for the top two households, who cultivated sugarcane and got high returns from it, data do not show any systematic variations in per acre returns from crop production. No clear relationship between net income and scale of production is seen for individual crops either.

Gharsondi (Canal and Groundwater-Irrigated Village, Gwalior District, Madhya Pradesh)

Gharsondi was surveyed in a year that saw severe shortage of water on account of diversion of water from Harsi dam and less than normal rainfall. Problems were compounded by the widespread pest attack on soybean in the *kharif* season. PARI data from Gharsondi clearly show that the impact of such stress is distinctly differentiated across classes. Landlords, capitalist farmers and rich peasants were able to partially cope with these constraints because they owned tubewells for supplementary irrigation. On the other hand, middle and small peasants incurred substantial net losses in the *kharif* season, and had very low levels of production and income in the *rabi* season.

Warwat Khanderao (Primarily Rainfed Village, Buldhana District, Vidarbha, Maharashtra)

In Warwat Khanderao, landlords and richer sections of peasantry obtained higher returns than middle and poor peasants on account of several factors. First, there was a positive relationship between scale and returns in cotton cultivation. Landlords and rich peasants made higher investment in cotton cultivation—in particular, on seeds and fertiliser—to obtain higher output. Second, given larger landholdings, landlords and rich peasants were able to use a higher proportion of land for cotton cultivation. Middle and poor peasants cultivated millets and pulses on a larger share of their operational holdings. Returns from cultivation of millets and pulses were

considerably lower than that from cotton. Third, given their newly-acquired access to electric pumps for irrigation, landlords and rich peasants were able to cultivate profitable irrigated crops, albeit on a small share of their land, in the *rabi* season.

Mahatwar (Primarily Rainfed Village, Ballia District, Eastern Uttar Pradesh)

Given the inadequate availability of irrigation, crop production in Mahatwar was characterised by low levels of investment and poor yields. Peasants, in particular poor peasants, spent little on modern inputs like chemical fertilisers. On the other hand, cost of irrigation was high, particularly for lower-middle peasants, poor peasants and cultivators among hired manual workers. These households at best obtained meagre returns from crop production and often incurred losses.

Rewasi (Primarily Rain-Fed Village, Sikar District, Rajasthan)

In Rewasi, because of sandy soils and high summer temperatures, *kharif* cultivation was limited mainly to an unirrigated crop of pearl millet. On single-cropped land, this was the only crop cultivated in the year. In the *rabi* season, when wheat and rapeseed were the main crops, cultivation was done only on sprinkler-irrigated land. In 2009-10, the pearl millet crop was completely abandoned because of deficient rainfall. While poor and middle peasants incurred losses, landlords and rich peasant households were able to use their tubewells to save fodder crops on as much land as they could to support their livestock holdings. The extent to which losses in the *kharif* season could be covered by irrigated agriculture in the *rabi* season was directly dependent on the extent of ownership of tubewells. With better access to tubewell irrigation, landlords and rich peasants cultivated *rabi* crops on a greater proportion of their holdings and also obtained higher per acre returns.

Conclusions

This paper presents an analysis of returns from cultivation on operational holdings of cultivator households in India. The paper

uses crop-wise farm-by-farm data from CCPC surveys and household-level data from village surveys conducted under the Project on Agrarian Relations in India of the Foundation for Agrarian Studies. Data from the CCPC surveys are available separately for individual crops and do not allow an analysis of economy of crop production at the level of cultivating households. Data from PARI surveys are unique in this respect. Although only for a few selected villages, these provide methodologically consistent estimates not only separately for all crops cultivated by survey households, but also at the level of individual households.

The paper shows that a vast majority of cultivating households in India obtain meagre incomes from crop production. Among PARI villages, leaving aside 25F Gulabewala which was exceptional in terms of levels of income differentiation and capital deployment, median annual household incomes from crop production at 2005-06 prices varied between ₹1,290 per household in Mahatwar to ₹14,577 in Warwat Khanderao.

Studies based on PARI data have shown that a substantial proportion of households in most villages incurred a loss in crop production in any given year. This paper uses official CCPC data to show that, at the national level, a substantial proportion of cultivators incur a loss over paid-out costs. Estimates based on farm-by-farm data from CCPC surveys show that, in most years, the proportion of cultivators incurring losses is very high among cultivators who grow millets. For example, in 2006-07, 84 per cent of *ragi* cultivators incurred losses. The proportion of cultivators of pulses who incurred losses increased considerably in the 1990s and has remained high since then. Among cultivators of oilseeds, the probability of incurring losses was particularly high among groundnut, sunflower and soybean cultivators. In 2008-09, 48 per cent of groundnut cultivators, 39 per cent of sunflower cultivators and 15 per cent of soybean cultivators incurred losses. The proportion of cotton farmers incurring losses peaked between 1994-95 and 2004-05. In 2004-05, 28 per cent of cotton farmers incurred losses. Although this has declined since 2004-05, it continues to remain substantial. The trends for potato and onion, although usually very profitable crops, show intermittent

spikes in the proportion of cultivators who incur losses. These are likely to be related to sudden drops in farmgate prices.

Analysis of farm-by-farm CCPC data presented in this paper shows that there are considerable variations in per hectare costs and returns in each crop. This is important because the recommendations of the CAPC and Prices regarding minimum support prices normally take into account only average costs and returns, and not the distribution of costs and returns. As shown here, a substantial proportion of cultivators, and in some cases substantially more than half of the cultivators, have below average returns.

Evidence from PARI surveys shows that, in most villages, there was a positive relationship between scale of production and net returns from cultivation. PARI surveys are unique in two ways. First, data from PARI surveys allow analysis of relationship between scale and returns from cultivation at the level of cultivating households. This is extremely important since net returns of cultivating households depend not only on costs and production of individual crops, but also on the crop mix that a household cultivates. Second, PARI surveys allow a more nuanced measurement of scale by incorporating information on ownership of means of production, levels and composition of incomes and the pattern of labour deployment on land. In contrast, measurement of scale only on the basis of physical extent of land cultivated, as is often done in studies on the relationship between size of farm and productivity, can be extremely problematic.

The positive relationship between scale and net returns is seen clearly, irrespective of whether income is measured over cost A2 or over cost A1 (which does not include rental payments). Data show that, in most villages, landlords, big capitalist farmers and rich peasants had the highest per acre incomes, and these declined progressively as one moved to middle peasants, and then to poor peasants and cultivators among hired manual workers.

The evidence from PARI surveys shows that disparities across economic classes in ownership of land and other means of production result in differential outcomes in terms of incomes from crop production, and capacity to cope with agronomic and economic

constraints. While most households either incurred losses or obtained meagre incomes from crop production, households with large amounts of land and with dominant control over water and other means of production realised substantial incomes not only because of large holdings, but also because of higher per hectare returns that they were able to get on their holdings.

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5

J.V. MEENAKSHI

Nutri-Farms

A Review of the Evidence on Nutritional Impact of Agriculture in India

Agriculture is the primary source of livelihood of a majority of countries in the Asia-Pacific region. Many of these countries are also grappling with the problem of a large percentage of their population being malnourished.

This paper outlines some of the pathways by which agriculture affects nutrition, and the points at which there may occur what has been termed an agriculture-nutrition disconnect. It then presents some empirical evidence on the nutritional impact of agriculture, focusing in particular on diet quality. It also briefly reviews the trends in production of horticulture, poultry, milk and meat products in India, and provides some evidence disaggregated by land holding class, given the focus on family farms. Although the empirical review focuses primarily on India, its lessons are likely to be relevant for much of the Asia-Pacific region as well.

The Relationship between Agriculture and Nutrition

It has long been recognised that agriculture and nutrition are inextricably linked. As early as 1968, Nobel laureate Gunnar Myrdal noted:

> The main cause of undernourishment and malnutrition in South Asia is, of course, poverty and, in particular, the low productivity of man and land in agriculture. The remedy is development, but the way will not be easy, partly because the dietary deficiencies themselves have reduced people's ability to work. On the other hand...nutritional deficiencies...themselves constitute one of the obstacles standing in the way of development, particularly in agriculture (as cited by Bliss and Stern, 1978).

There is a rich and equally old literature in economics on the instrumentality of health and energy (calorie) intakes in increasing productivity in agriculture: for example, through the efficiency wage hypothesis, which suggests that higher (than market clearing) wages enable higher food consumption, which in turn fosters higher labour productivity (see Strauss and Thomas, 1998, for a review). There is an analogous nutrition literature which looks at the impact of energy and micronutrient deficiencies on work capacity and cognitive outcomes (see, for example, Martorell and Arroyave, 1998).

It is only more recently that greater attention has begun to be paid to the impact of agricultural performance on nutritional outcomes. Headey et al. (2011), Hoddinott (2012), and Fan and Brezska (2012), among others, outline a multiplicity of pathways by which agriculture may be expected to influence nutritional outcomes. These include but are not limited to the following. First, improved agricultural production may translate into improved income, which in turn enables households to buy more food, and possibly better quality food. The savings that higher incomes engender may be invested in health or human capital. Second, independent of this income effect, higher agricultural output may be associated with the better availability of food locally, which can be important where marketing infrastructure is poor. Third, changes in agricultural production patterns (mechanisation, for example) may imply less demands are placed for physical labour and therefore for calories. However, these changes could also imply an increase in the use of child labour in agriculture, implying worse nutritional outcomes. Fourth, the pattern of agricultural growth may free up—or take more of—parents' time toward/away from the care of young children, thus impinging directly on observed nutritional outcomes. The TANDI (Tackling the Agriculture-Nutrition Disconnect in India) initiative identified seven core pathways between agriculture and nutrition (Gillespie et al., 2012), adding two more from the gender perspective to the five identified by the World Bank (2007). The recent employment surveys in India are indicative of an increasing feminisation of agriculture, and, since women are often the primary caregivers of children, this may impact negatively on nutritional outcomes. The composition

of agricultural growth also matters: energy intakes (and poverty reduction) appear more responsive to increased acreage under staple food crops than in other (non-food) crops. Fifth, cropping patterns can change in favour of more diversity in production patterns. If this diversity translates into increased shares of area under fruits and vegetables, for example, it could in turn translate into better diet quality, if on-farm production is also consumed. Sixth, technical change through bio-fortification, which focuses on improving the micronutrient content of staple foods, could directly increase the quality of a cereal-based diet.

These impacts are mediated by a whole host of factors. For example, Fan and Brzeska (2012) and Dev (2012) suggest that the status of women, as also inequalities in access to resources both within and outside the household, can mediate the impact of agricultural growth on nutritional outcomes. Women's education and the degree to which they have a say within the family have an independent effect on nutrient intakes and outcomes. Also, inclusive growth in agriculture can enhance nutritional impact: unequal land or income distribution may imply that any gains in productivity are experienced disproportionately by those who are better off, so that agricultural growth does not translate into improvements in nutritional outcomes. The macro-economic environment also matters: food price inflation can erode any nutritional gains (Dev, 2012). In addition, relative price changes may make a diverse diet, rich in proteins and micronutrients, an elusive goal to reach. The last is further elaborated in the subsequent sections.

It is clear then that *a priori* there is no reason for improved agricultural production to translate automatically into improved nutritional outcomes, and that there are a multiplicity of points where a disconnect can occur.

Of course, several factors outside of agriculture have an effect on nutritional outcomes. Child nutritional outcomes may be impacted by an unhygienic living environment, which renders young children prone to repeated infections that can lead to undernutrition. This also becomes a vicious cycle because undernourished children are more prone to falling prey to infections than their better-nourished

siblings. Public health and nutrition interventions (such as India's Integrated Child Development Services [ICDS] programme) may directly lead to improved nutritional outcomes. While important, these are not the focus of this paper and are mentioned only for the sake of completeness.

Given this, it is perhaps no surprise that the empirical evidence on the role of agriculture in improving nutrition, at least in India, is mixed. Headey et al. (2011) find that for nine states, growth in agriculture has been accompanied by improved nutrition (Andhra Pradesh, Tamil Nadu and Maharashtra fall in this category). But there are several other states where there appears to be a disconnect, with good agricultural performance but little improvement in nutritional indicators (Gujarat and Madhya Pradesh best exemplify this). There are also states where agricultural performance has been below par, but nutritional improvements have occurred nonetheless (as, for instance, in Uttar Pradesh, West Bengal, Odisha and Karnataka). In contrast, in an analysis of state-level data for India, Gulati et al. (2012) find that the level of (rather than change in) agricultural production is a strong predictor of adult and child nutritional outcomes, although they also highlight women's literacy and access to sanitation to be other important determinants. Bhagowalia et al. (2012) note that key entry points for improving nutrition are irrigation, crop diversification and livestock development.

Headey et al. (2011) examine the relationships between agricultural employment,maternal status and child nutrition. Although labour-force participation rates for women are in general low, agriculture accounts for the lion's share of those who do work. They cite literature indicating, for example, that in one state 40 per cent of infant deaths occur during the peak agricultural months of July-October. Using data from the National Family Health Survey (NFHS), they find that women who work in agriculture have significantly lower BMI (body mass index) than others, even after controlling for other covariates such as income and education. However, they find no evidence that women working in agriculture spend less time with their children as compared to others, nor that child nutritional outcomes are worse for women who care for their

own children as compared to children who are cared for by others (older siblings, other women in the household).

Agriculture and Diet Quality

An agricultural impact pathway that has received relatively limited attention in the literature is dietary quality. The Green Revolution that was initiated by Prof Swaminathan nearly 50 years ago was also a nutrition revolution in the sense that it increased the availability of calories, thereby freeing India from the spectre of chronic hunger. But mainstreaming the nutrition dimension in agriculture requires much more. While energy intakes (calories) are important, they are only the first step: a balanced diet, with adequate amounts of proteins and micronutrients is key to improving nutritional outcomes. And although the magnitude of hunger in India has come down, the prevalence of anaemia (a significant proportion of which is a reflection of low dietary iron intakes) is high and has been less susceptible to reduction. Similarly, while severe clinical manifestations of several micronutrient deficiencies have decreased (see Gopalan 2013), the subclinical problem remains and is implicated in the relatively high prevalence of childhood stunting and underweight in the country. Thus, interventions that enable diets rich in micronutrients are necessary. Among these are home/kitchen gardens and biofortification.

There have been several systematic reviews which attempt to synthesise the available evidence on the impact of interventions that aim to increase the quantity or quality of agricultural/livestock production at the household level on food and nutrient intakes, as well as nutritional outcomes such as stunting and underweight among children. These reviews typically exclude agricultural interventions such as irrigation since these don't have a specific nutritional target, but do include interventions to encourage home gardens or horticulture, as also raising poultry and other livestock. The more recent of these include Girard et al. (2012) who focus on studies conducted after 1990 in low and lower-middle income countries, which reported nutrition outcomes on young children or on women. Another recent systematic review is by Masset et

al. (2012) who further limit their focus to studies that included a counterfactual analysis and also accounted for selection bias. The main findings of these and earlier reviews (see, for example, Berti et al., 2004 and Leroy and Frongillo, 2007) may be summarised as follows:

First, interventions to promote vegetables or livestock do result in an increased consumption of these commodities, and do usually improve intake of micronutrient-rich foods by women and young children. But Masset et al. (2012) also note that many studies do not account for substitution effects: it is not clear if this increase comes at the expense of other foods. Second, the impact on food intakes is greater when the intervention includes either nutrition education or a gender component, or both. But, as Berti et al. (2004) note, "those projects that invested in ...nutrition education and consideration of gender issues...had a greater likelihood of effecting positive nutritional change, but such investment is neither sufficient nor always necessary to effect change." Also, to the extent these interventions have multiple components, attribution of impact to a specific intervention is not always possible. Third, there appears to be no evidence of impact on child nutritional outcomes, including stunting and underweight.

However, the studies also caution that the lack of evidence on impact should not be interpreted as evidence of lack of impact, since many of these studies suffer from methodological shortcomings. Masset et al. (2012) in particular draw attention to the small sample sizes on which these studies are based, thereby being underpowered to detect impact. For this reason, and due to presence of other sources of heterogeneity in these studies, these systematic reviews do not conduct a formal meta-analysis—with the exception of serum retinol (vitamin A) concentrations considered by Masset et al. (2012). The small number of studies are driven in large part by the exclusion of several studies from the systematic review on grounds of methodological shortcomings. For example, Masset et al. consider only 23 of 307 studies reviewed for potential inclusion and Girard et al. (2012) include 36 of the 138 studies identified. Girard et al. (2012) conclude that "future research that utilizes robust randomized or

quasi-experimental designs...and includes appropriate assessment and control for confounding...is still needed".

It is in this context that an intervention such as biofortification, which seeks to improve the micronutrient content of staple foods (including rice, wheat and coarse grains) through plant breeding, assumes significance. Biofortification translates into diets with higher micronutrient intakes, but relies on staple foods which are the mainstay of rural diets to achieve this. It also avoids the potential calorie-micronutrient trade-off which is implicit, if greater dietary diversity is to be achieved through increased area under cultivation of fruits and vegetables, which in turn could come at the expense of lesser area under cereals (assuming there is no yield-augmenting technical change, and given a fixed area under cultivation). It has the added advantage that because the diet quality is embodied in staple foods, it is not perishable in the way that vegetables, milk and meat are. Biofortication has also been shown to be a cost-effective intervention. Pearl millet varieties enriched with iron are currently being disseminated in India, and high-zinc wheat and rice are under development. The Government of India (GoI) announced a nutri-farm scheme in 2013-14, providing for the establishment of nutri-farms in districts with a high burden of malnourishment. The initiative includes demonstration and promotion of biofortified crops. Rice, wheat, maize, finger millet, pearl millet among cereals, as well as horticulture crops such as moringa and sweet potato, were identified for promotion under the pilot scheme to be launched across 100 districts.[1]

Changes in Food Prices

The success of interventions to promote diet quality depends on the macroeconomic environment as well. One strand of literature examines how changes in food prices impact nutrient intakes and nutritional outcomes. Galab and Reddy (2013) analyse data from the Young Lives study for Andhra Pradesh and find that dietary diversity is positively related to child height, and that food price

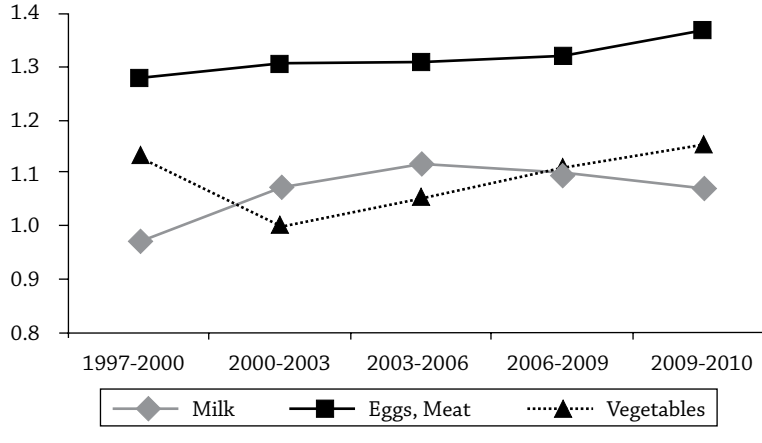
1. *www.nfsm.gov.in/Guidelines/NutriFarms.pdf*

inflation can have a significant adverse bearing on stunting, especially as consumers protect calorie consumption at the expense of dietary diversity. Their analysis suggests that households' ability to cope is limited when food price inflation exceeds 15 per cent, although better educated mothers as also public interventions do help mitigate adverse impact. Heady et al. (2011) find that given the highly price-elastic nature of consumption, changing relative prices of food between 1983 and 1999-2000 were highly correlated with consumption changes in India.

Figure 5.1 presents more recent trends in wholesale prices (Bouis, personal communication), where three-year averages have been taken to better distinguish secular trends (as distinct from short-term fluctuations). Prices of vegetables, meat and eggs are increasing relative to those of cereals, which implies that consumers (especially those who are poor) are not as likely to switch to foods that afford dietary diversity. The only exception to the overall secular increase in the relative price of non-cereal foods is found in milk. Once again, to the extent that biofortification uses cereals (and other staple foods) to deliver micronutrients to consumers, it is not as affected by increases in the relative prices of other foods that are rich in micronutrients.

Figure 5.1

Trends in Wholesale Prices of Milk, Vegetables, Eggs and Meat, Relative to the Wholesale Price of Cereals, 1999-2000 to 2009-10



Source: Data provided by Howarth Bouis, personal communication.

Agricultural and Dietary Diversification in India

Going by the National Accounts Statistics, Indian agriculture has already achieved a high degree of diversification. Cereals account for a little less than 30 per cent of the gross value of output in the farm sector, a magnitude nearly matched by the share of vegetables and fruits. However, pulses account for a mere 5 per cent of the gross value of output, and kitchen gardens, less than 1 per cent (GoI, 2013). The gross value of output from the livestock sector (of which milk constitutes nearly two-thirds) similarly exceeds that from cereals.

These figures are however largely a reflection of the higher unit prices of vegetables and fruits relative to that of cereals. The 2011 Agricultural Census data suggest that the share of fruits and vegetables in the total area devoted to food crops is about 5 per cent, and the share in total cultivated area is smaller still. In contrast, cereals and pulses account for nearly 90 per cent of the area under food crops. Despite this, over the last 10 years, fruits and vegetables, milk and eggs have seen impressive increments in production, with meat registering more modest increases. Annexure Figure A-5.1 demonstrates this by presenting per capita trends in these commodities. It is clear that the growth in production of fruits and vegetables, and of milk, has been in excess of population growth, while the per capita production of cereals, pulses and meat has stayed the same in the last 10 years. From the perspective of dietary diversity though, back-of-the-envelope calculations suggest that a per capita production of 290 g of milk translates into approximately 12 mg of protein and less than 1 mg of iron. Similarly, a per capita production of 55 eggs per year translates (assuming 70 g per egg) into 1 mg of protein and 0.2 mg of iron per day. At the aggregate level, the contribution of meat is lower still. These are far less than the recommendations for nutritional adequacy. Cereals continue to be the most important sources of protein and iron in the Indian diet because of the sheer quantities consumed, although they are poor sources of these nutrients (see also Sharma and Meenakshi, 2004).

The other notable feature of the expansion in the production of fruits and vegetables is that this increase has come about primarily

due to area shifts. Productivity of fruits has not increased, and has remained at about 11–12 tonnes per hectare over the period 2001-02 to 2011-12. Vegetables saw some increase in productivity, from 14-17 tonnes per hectare over the same period (GoI, 2014b). Thus, much of the hike seen has come about through expansion in area and not so much from rise in productivity. In the context of a land-scarce economy, this implies that there was reduction of area under cultivation elsewhere. In the absence of significant yield improvements, and unchanged area under non-food crops, this in turn could imply a trade-off between the cultivation of energy-dense cereals and micronutrient-dense vegetables and fruits. Productivity increases for milk over the same period also appear to be modest—for example, milk yielded by buffalos increased from about 4.1 to 4.6 kg per animal over 10 years, while that from cross-bred cows increased from 6.4 to 7 kg per animal (GoI, 2014d).

Given the focus on family farms, it is instructive to examine some of these statistics by size of landholding. By way of example, as demonstrated in Annexure Figure A-5.2, marginal farmers devote higher shares of their area to fruits and vegetables than do larger farmers. But over the five-year period, 2005/6 to 2010/11, there has been a small decrease in the share of area devoted to fruits and vegetables on marginal holdings and a corresponding increase in this share on large holdings. Also, there appears to be an area shift away from vegetables and into fruits. Dev (2012) and Gaiha et al. (2012) use these differences to recommend that interventions such as the National Horticulture Mission can provide opportunities to ensure convergence between agricultural growth and nutrition.

Gaiha et al. (2012) use the 59th Round of the National Sample Survey Organisaton's (NSSO) Situation Assessment Survey of Farmers to note that small farmers cultivating less than 2 ha account for approximately 60 per cent of all the calories and protein produced from foodgrains in the country, and about 43 per cent of calories and protein produced from pulses. This implies that small farmers are extremely efficient in producing calories, since such small farmers account for less than 40 per cent of the cultivated area (GoI, 2012). However, small farmers also account for 80 per cent of all farm

holdings, which suggests that from an energy intake perspective, they do not have an advantage. Small farmers also account for the bulk of calories and protein produced from milk, meat and poultry, lending support to a call for a smallholder or family farm focus to policy interventions that attempt to increase agricultural productivity.

Differences by size of landholding matter because there is evidence to suggest that nutritional outcomes are inversely related to landholding size. Data from the third (the most recent available) round of the NFHS (2005-06) suggest that BMI for adult women, heights of adult women, height-for-age for children, weight-for-age for children, all increase with the size of land holding, and the prevalence of anaemia among adult women decreases with the size of landholding.[2]

Household-level Evidence from India's Semi-Arid Tropics

The analysis of trends above is based on aggregate data.The recently-compiled dataset on Village Dynamics in South Asia (VDSA) provides a unique opportunity to study some of these issues at a disaggregated level, since production and consumption expenditure information is canvassed for each household. Sample households from India's semi-arid tropics have similar magnitudes of the share of area under cultivation of fruits and vegetables, and the production of eggs and milk per capita—foods that are important in terms of dietary diversity—as the all-India magnitudes.[3]

Even at the household level, there appears to be a disconnect between the production and consumption of fruits and vegetables As noted in Table 5.1, all of the sample households report having consumed some fruits and vegetables; however, less than 20 per cent of households report producing any fruits and vegetables. And in contrast to the area shares, the percentage of households reporting positive production increases with size of holding, from 6 per cent of marginal households producing vegetables and fruits to 35 per

2. As calculated from unit record data of the third round of the survey. The NFHS classification is based on land owned, and not land operated, which is the basis for the rest of the paper, and is therefore not directly comparable, but the comparison is suggestive nonetheless.

3. Unfortunately, data on production on homestead or kitchen gardens is not included.

cent of medium and large households. Similarly, 60 per cent of all households report positive consumption of eggs; yet only 15 per cent of the households report producing them. There is a U-shaped relationship across land-size categories: with one-fifth of landless and the medium and large households producing eggs, the percentages being lower for marginal, small and semi-medium households. In either case, this suggests that consumption is sourced either from the local market or from other farmers. It is only in the case of milk that once again virtually all households reported consuming fluid milk, and the percentage of households reporting production is also high across all land categories.

Table 5.1

Production and Consumption of Non-cereal Foods, Disaggregated by Size of Landholding

	Percentage of Households Reporting Positive Production or Consumption of					
	Fruits and Vegetables		*Eggs*		*Milk*	
	Production	*Consumption*	*Production*	*Consumption*	*Production*	*Consumption*
All (867)	20	100	14	60	71	99
Landless (193)	0	100	20	62	61	98
Marginal (200)	6	100	10	57	75	98
Small (191)	19	100	14	56	80	100
Semi (173)	26	100	12	70	77	99
Medium and Large (110)	35	100	19	61	87	100

Notes: 1. Figures in parentheses are total number of households in the sample.

2. Calculated percentages do not include observations with missing values.

Source: Calculated from unit record data of VDSA for year 2011-12. Production data are taken from the Cultivation Schedules and consumption data taken from Food Expenditure (Transactions) Schedules.

Given these figures, it is no surprise that the simple bivariate correlations between production and consumption are insignificant for fruits and vegetables for each of the land categories; in fact, for the sample as a whole, the correlation is perversely negative but significant only at the 10 per cent level, as shown in Annexure Table

A-5.1. In the case of eggs and milk, the correlations are all nearly positive and significant, at least at the 5 per cent level. The positive correlations among the landless are worth highlighting in particular, given that they do not (by definition) have land on which to cultivate crops.

Annexure Table A-5.2 presents correlations between consumption of non-cereal foods and the BMI for adult women (unfortunately there is insufficient information to compute nutritional outcomes for young children). For fruits and vegetables, the correlation is significant for the entire sample, but insignificant when disaggregated by landholding category. The relationship with eggs is also weak, but strong for milk, particularly for the households with the larger landholdings. This is consistent with other studies: for instance, Mamidi et al. (2011) highlight the role of milk consumption in explaining variations in adult heights.

Note, however, that the absolute quantities consumed are still very small. For example, landless households in the VDSA sample report less than 100 ml consumption of milk per capita per day, while the medium and large farm households consume 160 ml per capita per day. Egg consumption is lower still, averaging between 0.03 and 0.04 eggs per capita per day across all landholding categories.

Challenges in Making Every Farm a Nutri-Farm

This brief review suggests several lessons to make agriculture nutrition-sensitive and to meet the challenge of making every farm a nutri-farm. First, there is still a great dearth of rigorous evidence on what levers enable a leakage-less transition down the pathway from higher production to increased consumption to better nutritional outcomes. To this extent, the explicit incorporation of a baseline and monitoring of impact indicators being undertaken by the M.S. Swaminathan Research Foundation in the Farming System for Nutrition (FSN) study under the project on Leveraging Agriculture for Nutrition in South Asia (LANSA) is welcome. The FSN initiative envisages tackling malnutrition by combining nutritious crop production interventions (including biofortified crops, cultivation of vegetables and fruits on homestead land, livestock, fisheries and

dairy) with community-level nutrition education, and a specific focus on eco-system fragility and innovation systems. In doing so, the initiative is not only giving agriculture a nutrition orientation, but also highlighting the need for improving diet quality while recognising the need for a holistic approach to tackling undernutrition.

Second, nutrition-sensitive agricultural interventions must explicitly account for trade-offs that are bound to occur in land-scarce situations—for example, increased area under vegetables may come at the expense of cereals; fodder for livestock may compete with food crops. Interventions such as biofortification are particularly attractive because they minimise the potential for such trade-offs.

Third, despite considerable increases in fruits and vegetables, dairy and poultry production, productivity improvements are essential, since from a nutritional-security perspective, the per capita availability of these foods is still fairly small. These and other interventions need to be planned with gender as an integral component for maximal nutritional impact.

Finally, nutrition security and the concept of a nutri-farm must embrace landless households who are among the most vulnerable and lack access to cultivation outside of homestead lands. That more households report consuming diverse foods than producing them suggests that it is important to improve the local (and not merely farm-level) availability of diverse nutritious products.

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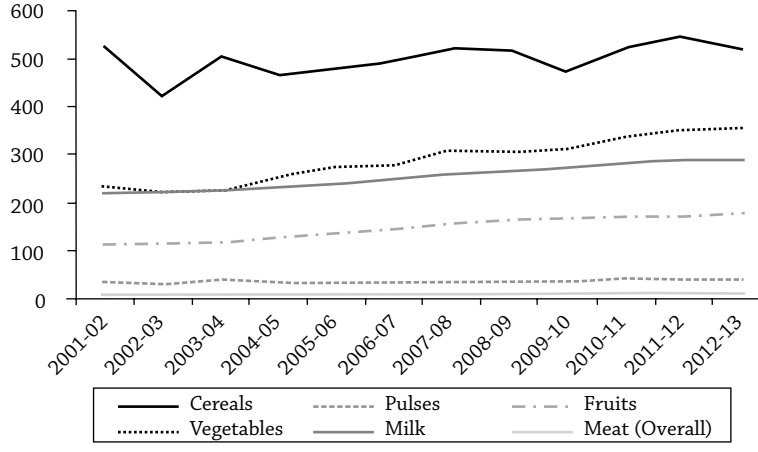
Annexure Figure A-5.1

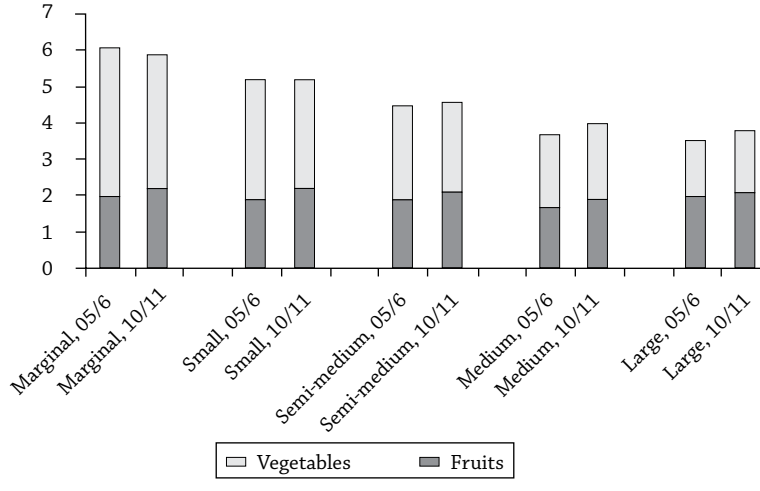
India: Per Capita Production of Various Foods, 2000-01 to 2012-13 (Grams Per Capita Per Day)



Source: GoI (2014b; 2014c; 2014d).

Annexure Figure A-5.2

India: Share of Area Under Food Crops Devoted to Fruits and Vegetables, by Size of Operational Holding, 2005-06 and 2010-11 (%)



Note: "Marginal" landholdings are defined as those less than 1 ha in size; "Small" landholdings are greater than or equal to 1 ha but less than 2 ha in size; "Semi-Medium" landholdings are greater than or equal to 2 ha but less than 4 ha in size; "Medium" landholdings are greater than or equal to 4 ha, but less than 10 ha in size; and "Large" landholdings are defined as those greater than or equal to 10 ha in size.

Source: GoI (2012).

Annexure Table A-5.1

Bivariate Correlation Between Production and Consumption

	Fruits and Vegetables	*Eggs*	*Milk*
All households	-0.06*	0.28***	0.40***
Landless	-	0.27***	0.46***
Marginal	0.07	0.14*	0.51***
Small	-0.03	0.27***	0.42***
Semi medium	-0.55	0.24***	0.26***
Medium and large	-0.10	0.44***	0.47***

Notes: 1. ***, **, and * refer to significance at 1%, 5% and 10% levels, respectively.

2. Production is defined as the per capita annual output in numbers for eggs and in litres for milk, whereas for fruits and vegetables the value of production is taken as proxy for production. Consumption is defined as annual per capita consumption in numbers for eggs and in litres for milk. For fruits and vegetables, budget shares are taken as proxy for consumption.

Source: Calculated from unit record data of VDSA for year 2011-12. Production data are taken from the Cultivation Schedules and consumption data taken from Food Expenditure (Transactions) Schedules.

Annexure Table A-5.2

Bivariate Correlations between Average Body Mass Index of Women 20-50 Years Within the Household and Consumption of Non-cereal Foods

	Fruits and Vegetables	*Eggs*	*Milk*
All households	0.12***	-0.003	0.09**
Landless	0.02	0.13	0.02
Marginal	0.03	0.08	0.1
Small	0.05	0.15*	0.23***
Semi medium	0.05	-0.01	0.09**
Medium and large	0.14	-0.06	0.09

Notes: 1. ***, **, and * refer to significance at 1%, 5% and 10% levels respectively.

2. Consumption is defined as per capita consumption in numbers for eggs and in litres for milk. For fruits and vegetables, budget share is taken as proxy for consumption.

3. BMI is defined as the weight in kg divided by the square of the height in m (kg/m^2).

Source: Calculated from unit record data of VDSA for year 2011-12. Production data are taken from the Cultivation Schedules and consumption data taken from Food Expenditure (Transactions) Schedules.

6

R. RAMAKUMAR

Agriculture and Youth in the Asia-Pacific Region

Status and Challenges with Special Reference to India

The question of unemployment among youth in rural areas is of great relevance for academics, policymakers and political activists. According to the Food and Agriculture Organization (FAO), in 2010, about 24 per cent of the working poor in the world were young people and a majority of them lived in the rural areas (FAO, 2013). Given the shrinking employment opportunities in a globalised world, public policy across the world faces the challenge of exploring ways in which rural youth can be productively employed in agriculture itself. Making agriculture attractive for young people is not just imperative for the livelihoods of rural households at large, but also for the success of efforts to ensure food security in the developing world.

In this paper, I try to address the issue of youth interest and youth employment in agriculture in the Asia-Pacific region with special emphasis on the Indian case. In Section 1, I review the literature around rural youth employment and agriculture in the Asia-Pacific region as a whole. In Section 2, I analyse issues related to rural youth employment and agriculture in India, using existing literature as well as secondary data from the National Sample Survey Organisation (NSSO). In Section 3, I discuss the different potential pathways out of youth disinterest in agriculture, in the context of India.

Rural Youth Employment in Asia and the Pacific

The question of youth unemployment in the Asia-Pacific region has attracted much policy attention in recent years. In 2010, about 750 million young persons aged between 15 and 24 years, accounting for about 60 per cent of the world's youth (UNESCAP, 2012), lived

in the Asia-Pacific region. For the area as a whole, the population of youth is assumed to have peaked in 2010 and is expected to fall after this date. In some countries in East and Northeast Asia, the youth population had begun to fall before 2010 itself.

Compared to 2010, the rural population of countries in the Asia-Pacific region is also expected to decline to a smaller proportion of the total population by 2050. According to projections, the rural population in many Asian countries would be less than one-third of their total population in 2050 (Jones and Dommaraju, 2012). For instance, if the rural population in countries like South Korea and Malaysia constituted 78 per cent of the respective total populations in 1950, the corresponding share in 2050 is expected to be less than 12 per cent. In Asia, only Sri Lanka and Cambodia are expected to have more than 50 per cent of their population residing in rural areas by 2050.

Yet, addressing the question of youth unemployment is of utmost urgency. First, by their sheer size, the young constitute a large segment in the working populations of Asia-Pacific countries. Second, youth unemployment is significantly higher than adult unemployment in most Asia-Pacific countries.[1] Together, these two factors are transforming youth into game-changing actors in the politics of many countries. Outside Asia-Pacific too, the recent uprisings in countries like Egypt, Syria, Tunisia and Yemen were led by young people; frustrations triggered by rising youth unemployment were an important factor associated with these uprisings.[2] Globally itself, such concerns have turned the attention of public policy towards the generation of new jobs for youth; alongside, there are also initiatives to generate new jobs for youth within rural areas, and within agriculture itself.

The initiatives to generate new jobs within agriculture, however, have been seriously constrained by the multitude of economic and sociological changes that the rural areas of Asia-Pacific have

1. Globally, if the estimated adult unemployment rate is 4.8 per cent, youth unemployment rate was 12.6 per cent in 2010 (UN, 2013).

2. In 2010, the youth unemployment rate in West Asia was estimated to be 25.5 per cent (UN, 2013).

witnessed over the last 2–3 decades. The most important among these changes has been the attitude of youth towards working in agriculture. There is increasing evidence to state that, despite the young being significantly represented in agricultural jobs in most countries, agriculture is increasingly seen as an occupation of last resort by rural youth. White (2012a: 10) argues that in the absence of interest among rural youth, no alternative agricultural policy based on small and marginal farmers can be successfully conceptualised and implemented:

> ...claims about small-scale alternatives...assume (although the question is rarely raised) that there is a generation of rural youth who want to be the nation's future small farmers. If not, then of course small-farmerist proponents have no argument against a future agriculture based on large-scale, corporate, industrial farming. It is therefore quite important to ask what lies behind rural youth's apparent rejection of farming futures.

Rural Youth Disinterest in Agriculture

Leavy and Hossain (2014) report the results of a 2012 survey of 1500 people in 23 rural, urban and peri-urban communities in low and middle income Asian, African and Latin American countries. Their survey was an effort to explore youth aspirations and opportunities with regard to agriculture. The interviews that Leavy and Hossain report from the Asia-Pacific countries are revealing; I quote a few responses below:

> *A 60-year-old matriarch in Karachi, Pakistan:* 'May Allah forbid our future generations from farming. Although you can get money from it, we don't want the money; we need our children to be educated so their future may be better...If Allah pleases, they will grow up to become doctors and engineers.'
>
> *A young man in rural Naogaon, Bangladesh:* 'Last night my father and I found with calculations that this year we didn't get a single taka more than production cost—[that] means no profit. We did such hard work, engaged labourers in rain and scorching [heat], we cultivated by turning our blood into water, but if we do not profit from it how will we survive? What is the benefit of this crop cultivation? [He said

with a smile] We will sell all our land and go to the city. I said to my father, let's go to the city.'

A farmer near Dhaka, Bangladesh: 'The young men these days don't want to do farming as it requires working in the mud and water; rather they prefer to do service [formal sector occupations, usually government jobs] staying in urban areas so that they can wear a shirt and trousers.'

A 33-year-old worker in Dhaka, Bangladesh: 'Agriculture is at the top position than any other profession. But it is impossible to take the profession without a piece of land... The profession is determined by investment...We need experience and support...The rate of production cost is increasing in such a way that the farmers are being neglected. So, how could a person desire to be a farmer?'

A 19-year-old female work seeker in rural Indonesia: 'I never want to be a farmer, ever...I don't want to work under the sun; my skin will be darker. My mother said that I shouldn't be a farmer; the [earnings] are not enough to provide for life; it doesn't have a future; it'd be better to look for a job in the city...It is better becoming a factory worker; I don't have to work under the heat, it is not dirty. The wage can be used to buy a cell phone, clothes, cosmetics, bags or other things needed by a teenager. It can be saved for parents, too.'

A 21-year-old rural work seeker in Indonesia: 'Working in the rice field is very hard, you get money only once in three months, and there is no excess money to save. Working in a factory is much better, you get money each month, and the money can be saved for buying land for the parents.'

Leavy and Hossain (2014: 8) conclude that "the aspirations of young rural people are dominated by formal sector employment and modern urban lifestyles, and a generalised reluctance, found across contexts, to consider farming as an employment option." Similarly, Hall, Hirsch and Li (2011: 118) maintain that "there is increasing evidence from across Southeast Asia that farmers would like to get out of agriculture themselves and, even more, that they hope their children will not become farmers." White (2012a: 9-10) has reviewed the literature for Indonesia and says that:

> Both young men and women in rural areas are often encouraged (and sometimes compelled) by parents to move away from villages, whether in search of further education...or to seek work in urban or periurban factories (both genders) and malls (especially women), and a variety of other jobs, including domestic servants (mainly women) and the entertainment and commercial sex sectors....

Reviewing literature from East and Southeast Asia, Jones and Dommaraju (2012: 116) too state that rural-to-urban migration of youth is the order of the day in most villages. For Malaysia, Vietnam and Indonesia, they note that:

> Young, unmarried people are predominant in this rural-urban migration, and there is also a female predominance among these young migrants, which is particularly marked in migration to the largest cities of Indonesia, Thailand and the Philippines—Jakarta, Bangkok and Manila. This appears to relate to the employment opportunities for young females in the cities in manufacturing, clerical activities, in domestic service and in the sex industry.[3]

According to Lim (2011: 5), evidence from the Asia-Pacific region also shows that "young migrant workers, especially young female migrants, often end up in situations of serious disadvantage, discrimination, marginalisation and vulnerability" in their urban destinations. Reviewing evidence from the Melanesian and Polynesian countries, Ware (2004: 3) maintains that rural youth moved into urban areas on a "lottery principle" because the probability of finding work in urban areas was low; such willingness to risk livelihoods indicated, for Ware, the "lack of opportunities in the rural areas." In the absence of adequate and appropriate work in urban areas, these migrants were transformed into a "rootless potential rag-tag army."

The extent of out-migration of youth has led to a particular phenomenon in the rural areas of Indonesia, Malaysia, Thailand and Philippines: "a distinct excess in proportion of children in rural areas, a deficiency in the proportion aged 15-29 and to a lesser extent at ages 30–49, and an excess in proportion of population at ages

3. Jones and Dommaraju (2012) also argue that the extent of female out-migration from rural areas is relatively less pronounced in South Asia, where female migration other than for marriage is restricted by a number of social factors.

over 50" (Jones and Dommaraju, 2012: 116). Thus, the rural areas have a relative shortage of the working-age population to engage in agriculture. Lim (2011: 5) also points out that in the Asia-Pacific countries as a whole, higher rural-to-urban migration of the youth leads to "shortage of workers for agriculture and food production."

Leavy and Hossain (2014: 13) argue that the implication of youth exiting agriculture is that the sector becomes starved of the "brightest and the best" in rural areas who could 'absorb new technologies, innovate, engage in rapidly changing factor markets, and...be entrepreneurial." According to them, the solution lies in government and society signalling their strong wish and intention to value and support agriculture, as well as invest in, and modernise, the sector.

For Leavy and Hossain (2014), the lack of appeal of agriculture to youth reflects the influence of three factors. First, there is a deficiency of effective public investment in smallholder agriculture as well as in rural infrastructure and marketing. Second, young people in agriculture face the acute problem of decline in access to land as a productive asset and the decline in average size of farms. They also face uncertain access to farm inputs as well as the rising prices of such inputs. Third, the spread of mass education has resulted in different forms of social change, resulting in a decline in the perceived status of agriculture as a vocation.

White (2012b: 11) has identified three reasons for youth disinterest in agriculture: a) the de-skilling of rural youth and the consequent downgrading of farming as an occupation; b) the disregard of small-scale agriculture and rural infrastructure by governments; and c) problems of access to land faced by young rural people in the villages. As an illustration of the first point, White focuses on the current state of secondary education, which 'contributes to a process of "deskilling" of rural youth in which farming skills are neglected and farming itself downgraded as an occupation'. As an illustration of the second and third points, White (20b: 12) focuses exclusively on the "large-scale, government-supported corporate acquisition of contested lands and common lands, and the accompanying dispossession of local farmers, pastoralists and forest users" in many African countries.

Studies have emphasised the importance and spread of education as an important reason behind the rising aspirations of rural youth in the Asia-Pacific region. According to Jones and Dommaraju (2012), the spread of schooling and urbanisation in the Asian and Pacific countries has expanded the access of rural people to urban areas. As a result, there is increasing diffusion of urban values into the countryside. From a study in Thailand, Jones (1997: 239) points out that "the expansion of education had brought literacy and heightened aspirations to the most isolated rural areas." Leavy and Hossain (2014: 9) note from their large survey that:

> Better education and communications appear to have had the effect of dramatising the hardships of a farming life: a generation has grown to adulthood which, in some of the less developed locations in particular, has for the first time had the means to compare a future as a farmer…with other possibilities. Many of these young people speak movingly about the sorrow they feel witnessing their small farmer parents' often desperately hard struggles to earn a living. The lessons of such hardship have been hard won for many, both parents and children. For young women, in particular, there can be very strong motivations for escaping a life as subsistence farmer or farmer's wife.

For scholars like White (2012b), an additional reason for youth disinterest in agriculture is the dominance of "local gerontocratic structures", where the older generation of farmers are reluctant to pass on independent control of their farms to the next generation. Thus, what appears as the reluctance of youth to engage in farming might actually be an expression of their frustration at the long period of wait before they could take independent decisions on the farm.

Finally, rural youth unemployment is also an outcome of a disastrous set of policies popularised and implemented in the aftermath of the Washington Consensus. The new economic policies have led to a sharp fall in the generation of new jobs and have heightened the frustrations of rural youth. These policies increasingly favour the interests of capital as opposed to that of labour. They have rendered developing economies fragile and vulnerable to regular crises. In every period of crisis, it is the youth who are the "last to be hired" and the "first to be dismissed" (UN 2013: 1). In the rural

areas of Asia-Pacific, the impacts of new policies on the youth labour market have been severe.

Making Agriculture Attractive

At the same time, scholars also argue that in those countries where the governments have signalled high value and support for agriculture, rural youth have tended to view the sector positively. According to (Leavy and Hossain, 2014: 40-41),

> ...agriculture could be made more appealing to young people with the right kinds of measures and support. First, public policies need to improve the fit between the aspirations of young people and opportunities in agriculture and agri-food more broadly. This could include providing the right kinds of training at appropriate levels to reflect the demands of the job market and broader public investment. Second, an important factor in enabling young people to see the potential of different employment choices, in agriculture and other sectors, is the presence of positive, successful role models. Finally, a strong message emerging from across all the countries in this research is that farmers, across all generations, need support for accessing markets and to improve productivity, such as access to inputs and in the uptake of modern technologies.

FAO and International Fund of Agriculture Development (IFAD) jointly organised a major survey of rural youth to understand how to facilitate their access to agriculture. According to more than half of the respondents in this study, low incomes from agriculture forced rural youth to be engaged in pluri-activity (employment in more than one sector) as a risk management strategy. In order to ensure that rural youth engage more with agriculture, the opportunities of generating income from agriculture needs to be expanded significantly. For this purpose, governments need to take a far more direct interest in agriculture than at present. Based on the responses from rural youth in the Asia and Pacific regions, the study states:

> ...rural youth...are full of hope and energy to turn the tide and create a 'new rural reality'. Rural youth are trying to mitigate the low profitability of agriculture...and temporary migration to urban areas. They aspire to become 'agripreneurs' who are involved in all links of the value chain from production to transformation and

> marketing. Keen on organic farming and other niche markets, rural youth are very creative in exploring these new opportunities. Conscious of the effects of climate change on the environment and aware of the depletion of natural resources, rural youth are excellent environmental stewards who promote sustainable agriculture... Rural youth are willing to become modern farmers and are taking advantage of new ICTs to learn about new agricultural techniques and to facilitate the marketing of their produce. Although they are skilled users of new ICTs, they equally value traditional knowledge transmission methods and are very much in favour of knowledge sharing across generations. Rural youth desire to be respected and heard at local, national, regional and global level. Participatory approaches not only in the drafting but also in the implementation and monitoring of rural policies, programmes and projects are emerging, as decision-makers are realising that rural youth are the future of the agricultural sector (FAO-IFAD 2012: 24).

Rural Youth Employment: The Case of India

In India, the share of young persons (defined as those either between 15 and 39 years or between 15 and 29 years) in the age structure of the rural population has increased over the census years. As per the 2001 Census, there were about 290 million persons in rural India in the age group of 15-39 years, who constituted about 39 per cent of the total rural population. The youth, thus, form a substantial section of the Indian rural population.

In this section, I try to analyse secondary data related to youth employment in agriculture in India. The data used are from the National Sample Survey Organisation (NSSO), which conducts quinquennial surveys of employment and unemployment in the rural and urban areas of the country. I also try to review the evidence related to the decline of interest of rural youth in agriculture.

Participation of Youth in the Rural Labour Force

Labour force participation rate (LFPR) is an important indicator used to measure the extent of participation of persons in the labour market. LFPR refers to the share of the population that is: a) currently working; and b) not working, but actively looking for work

(i.e., the unemployed). The data on LFPR used are from the surveys conducted by the NSSO; the last survey of the NSSO was conducted in 2011-12.

It is important to note that LFPRs of youth in the Indian labour force and workforce are significantly different across: a) rural and urban areas; b) gender; c) caste; and d) land ownership status.

First, rural LFPRs of youth are higher than those of urban youth. In 2011-12, rural men in the age group of 15–19 years and 20–24 years had significantly higher LFPRs than urban men in the corresponding age groups (Table 6.1). For age groups between 24 and 39 years, LFPRs of rural and urban men were largely comparable. On the other hand, LFPRs of rural women were higher than those of urban women in all the age groups between 15 and 39 years. Measured in terms of share in their respective workforces, there were more rural women than urban women in the higher age groups of what constitutes youth (25–39 years).

Table 6.1

Age-specific LFPRs, by Usual Status (Principal and Subsidiary), India (%)

Age Group	*Rural Men*	*Urban Men*	*Rural Women*	*Urban Women*
5 to 9	0.0	0.1	0.1	0.1
10 to 14	2.9	3.5	3.0	0.9
15 to 19	33.3	25.6	16.4	8.9
20 to 24	78.8	66.4	29.7	19.7
25 to 29	96.3	95.1	36.9	25.3
30 to 34	99.0	98.9	43.1	25.9
35 to 39	99.1	99.0	48.0	28.4
40 to 44	98.8	98.8	48.2	27.6
45 to 49	98.8	97.9	48.4	24.5
50 to 54	96.6	94.6	44.4	21.9
55 to 59	93.5	86.9	39.4	17.7
60 and above	64.9	36.5	21.3	7.8
All	55.3	56.3	25.3	15.5

Source: NSSO 68th Round, 2011-12.

Second, while overall LFPRs were comparable for rural and urban men in 2011-12, the LFPR for rural women (25.3%) was higher than that for urban women (15.5%) (Table 6.1). Also, while the LFPR for rural women was 25.3 per cent, that for rural men was significantly higher at 55.3 per cent.

Third, between 1993-94 and 2011-12, while the overall LFPR for rural men remained largely unchanged, that for rural women fell sharply from 33.1 per cent to 25.3 per cent (Table 6.2). Among young people, between 1993-94 and 2011-12, LFPR for rural men fell only in two age groups: 15–19 years and 20–24 years. However, LFPR for rural women fell sharply in all age groups between 15 and 39 years. While higher attendance in schools and colleges could be cited as one reason for the fall in LFPR of rural men between 15 and 24 years, no such justification could be offered for rural women; even in the age group of 35–39 years, LFPR fell from 61 per cent in 1993-94 to 48 per cent in 2011-12. Clearly, there have been major factors at work that have shrunk female youth employment as compared to male youth unemployment in rural areas.

Table 6.2

Age-specific LFPRs, by Usual Status (Principal and Subsidiary), Rural India (%)

Age Group	*Rural Men*			*Rural Women*		
	1993-94	*2004-05*	*2011-12*	*1993-94*	*2004-05*	*2011-12*
5 to 9	1.1	0.3	0.0	1.4	0.3	0.1
10 to 14	13.9	7.0	2.9	14.2	7.5	3.0
15 to 19	59.8	52.9	33.3	37.1	33.1	16.4
20 to 24	90.2	89.1	78.8	47.0	43.5	29.7
25 to 29	98.0	98.2	96.3	52.8	53.0	36.9
30 to 34	98.8	98.8	99.0	58.7	59.3	43.1
35 to 39	99.2	99.1	99.1	61.0	64.2	48.0
40 to 44	98.9	98.5	98.8	60.7	62.7	48.2
45 to 49	98.4	98.2	98.8	59.4	61.6	48.4
50 to 54	97.0	96.3	96.6	54.3	56.2	44.4
55 to 59	94.1	93.1	93.5	46.8	50.9	39.4
60 and above	69.9	64.5	64.9	24.1	25.4	21.3
All	56.1	55.5	55.3	33.1	33.3	25.3

Source: NSSO reports, various issues.

Fourth, LFPRs of youth from backward caste households were higher than those for the population as a whole and for youth from the general category.

- One, LFPR of Adivasi youth was the highest among all caste groups in 2009-10 at 60.6 per cent (Table 6.3). This was followed by Dalit households (52.1%) and OBC households (48.4%). Persons from the general category recorded the lowest LFPR at 44.3 per cent. Importantly, if we look at the data across sex, the disparities across caste groups in male LFPRs were far less decisive and significant than those across caste groups in female LFPRs.
- Two, current attendance rates in educational institutions were lower for youth from backward caste households than from other households in 2009-10 (Table 6.4). If about 48–52 per cent of the Dalit or adivasi men in the age group of 15–19 years were attending educational institutions, the corresponding share was about 64 per cent for the general caste group. If about 13 per cent of the Dalit or adivasi men in the age group of 20–24 years were attending educational institutions, the corresponding share was about 25 per cent for the general caste group. The persons out of school in these age groups may be represented in the higher LFPRs noted for backward caste groups; a small section of them may also be out of the labour force itself.

Table 6.3

LFPR among Youth Aged 15-29 years, by Caste Groups, Rural India (%)

Caste group	*Men*	*Women*	*All Persons*
ST	74.2	47.5	60.6
SC	72.1	31.1	52.1
OBC	66.8	29.1	48.4
General	63.8	23.1	44.3
All	68.0	30.2	49.6

Note: ST–Scheduled tribe, SC–Scheduled caste, OBC–Other backward caste.

Source: Mitra and Verick 2013.

Table 6.4

Current Attendance Rates in Educational Institutions, by Age Groups and Caste, Rural India (in %)

Caste groups	*Current Attendance Rates (%) in the Age Group of*					
	1999-00			*2009-10*		
	5–14	*15–19*	*20–24*	*5–14*	*15–19*	*20–24*
ST men	63.2	35.5	9.4	81.4	47.8	13.2
SC men	70.1	37.9	8.6	86.1	52.2	12.9
OBC men	74.3	41.7	8.6	87.8	61.9	18.8
Other men	80.2	52.5	15.6	90.2	64.1	24.9
ST women	52.7	20.0	4.8	81.4	37.3	5.8
SC women	58.6	21.1	2.6	82.1	43.5	5.7
OBC women	62.1	23.4	2.4	84.5	47.9	8.0
Other women	73.8	36.8	6.2	87.4	54.5	12.1

Source: NSSO reports, various issues.

In sum, the participation of youth in the rural labour force is differentiated across fundamental as well as historically ascribed socio-economic divisions. It follows that youth in rural areas are a heterogeneous socio-economic group and face different forms of challenges in the rural labour market.

Youth as Cultivators and Agricultural Labourers in India

In the two major groups of workers within Indian agriculture —cultivators and agricultural labourers—youth are significantly represented. In this section, I have used results from a unit-level analysis of data from the NSSO to understand the proportion of rural youth employed in agriculture and allied activities. Unit-level data from the NSSO allows us to analyse the distribution of workers according to the National Industrial Classification (NIC), 2008. NIC-2008 classifies workers into Sections, Divisions and Groups. Our interest in this paper is Section A, which is titled 'Agriculture, Forestry and Fishing'. For classification of workers, the criterion of usual status (principal plus subsidiary) has been used.

The data on the distribution of workers employed in Agriculture, Forestry and Fishing (henceforth Agriculture in short) is given

in Table 6.5. The Table provides us with some interesting figures on the proportion of youth (i.e., those aged between 15 and 39 years) employed in Agriculture in rural India during 2011-12. Here, employment in Agriculture would refer to both cultivators and agricultural labourers.

Table 6.5

Distribution of Workers Employed in Agriculture, and All Industries (NIC-2008), by Age Groups (in %)

Age Group (Years)	*Share of Workers within Sections (%)*				*Share of Workers within Each Age Group (%)*			
	AFF		*All Industries*		*Rural Men*		*Rural Women*	
	Rural Men	*Rural Women*	*Rural Men*	*Rural Women*	*AFF*	*All Industries*	*AFF*	*All Industries*
5-9	0.0	0.0	0.0	0.0	47.2	100.0	2.9	100.0
10-14	0.5	1.0	0.4	0.9	53.5	100.0	67.9	100.0
15-19	5.2	5.0	5.1	5.2	43.7	100.0	58.5	100.0
20-24	9.5	7.9	10.6	8.8	38.7	100.0	55.1	100.0
25-29	11.5	10.0	12.9	11.1	38.1	100.0	55.5	100.0
30-34	11.4	13.5	12.8	13.7	38.5	100.0	60.7	100.0
35-39	12.7	16.7	13.9	16.4	39.1	100.0	62.7	100.0
40-44	12.0	12.5	12.1	12.7	42.5	100.0	60.8	100.0
45-49	11.1	11.7	10.8	10.7	44.1	100.0	67.1	100.0
50-54	7.9	7.7	7.6	7.5	44.7	100.0	63.6	100.0
55-59	6.4	6.4	5.7	6.1	48.3	100.0	64.6	100.0
60+	11.7	7.5	8.1	6.8	62.5	100.0	67.8	100.0
Total	100.0	100.0	100.0	100.0	42.9	100.0	61.5	100.0
Youth Sub-total	50.3	53.1	55.3	55.2	-	-	-	-

Note: AFF: Agriculture, Forestry and Fishing.

Source: Computed from NSSO unit-level data, 68th round, 2011-12.

- In 2011-12, among all rural male workers employed in Agriculture, 50.3 per cent were youth. Among all rural female workers employed in Agriculture, 53.1 per cent were youth (Table 6.5).
- The share of youth among workers employed in Agriculture was comparable to the share of youth employed in all

industries together. In 2011-12, the share of youth among workers in all industries together was 55.3 per cent for rural men and 55.2 per cent for rural women (Table 6.5).

- Within each age group representing youth too, employment in Agriculture was well represented in 2011-12. Within each age group of rural male workers between 15 and 39 years, the share of workers employed in Agriculture ranged from 38.1 to 43.7 per cent. Within each age group of rural female workers between 15 and 39 years, the share of workers employed in Agriculture was considerably higher: the range here was 55.1 to 62.7 per cent (Table 6.5).
- When all age groups were considered together, the share of workers employed in Agriculture did not differ much from the corresponding share for youth (Table 6.5).

Data in Table 6.5 show that young people are actually represented in large numbers among cultivators and agricultural labourers. More than half of all the persons employed in Agriculture were young in 2011-12. Yet, certain trends in the last two decades are undeniable. It has become something like a cliché to argue that youth are increasingly withdrawing from cultivation, and agriculture as a whole. Results of the Situation Assessment Survey (SAS) of NSSO in 2003 showed that about 40 per cent of farmer households in India did not like farming due to either poor profitability or risk. Such a perception may have been stronger among the younger than older members in farmer households. Among agricultural labourers also, similar trends have been noted.

The tendency among rural youth to be disinterested in cultivation or agricultural labour may be linked to a number of factors. In the Indian context, I believe that one needs to identify a more specific set of factors associated with their lack of interest in agriculture. Here, I confine to three major factors: a) spread of education and the rise in aspirations of rural youth; b) decline in the relative profitability of agriculture *vis-à-vis* other vocations; and c) falling labour absorption in agriculture.

Youth and Education

Spread of Education

First, more young people are attending educational institutions today than before. Across India, school enrolment rates have risen over time; according to official data for 2010-11, the GER (gross enrolment ratio) in India was estimated at 96 per cent among children in the age group 6-15 years (GoI, 2014). In the 1970s, the corresponding GER was in the range of 60-65 per cent only. There are two disquieting features that need to be read with the record of rising GER. First, the enrolment ratio declined with age; in the age group 16-17 years, the GER in India in 2010-11 was only 39.4 per cent. Second, dropout rates remain high. In 2010-11, the dropout rate among children in the age group 6-15 years was 49.2 per cent.

The GERs in higher educational institutions too have risen over the years. In the age group 14-17 years, the GER has risen from about 25 per cent in the early 1990s to about 50 per cent in 2009-10. In the age group 18-23 years, the ratio has risen from about 6-8 per cent in the early 1990s to 15 per cent in 2009-10. The rise in enrolment ratio in higher education is pronounced among Dalits and adivasis also. In 2009-10, the GERs in the age group 18-23 years among Dalits and adivasis were, respectively, 11.1 per cent and 10.3 per cent.

The majority of workers employed in Agriculture were either illiterate or poorly educated in 2011-12. Data from the 68th round of NSSO in 2011-12 show that 33.1 per cent of all rural male workers and 63.5 per cent of all rural female workers employed in agriculture were illiterate (See Table 6.6). Further, about 62 per cent of rural male workers and about 85 per cent of the rural female workers employed in agriculture were either illiterate or schooled only till the primary level. Only about 8 per cent of rural male agricultural workers and about 2 per cent of rural female agricultural workers were educated up to or above the higher secondary level.

In which avenues were the rural educated employed? Among all illiterate male workers in rural India in 2011-12, 54.7 per cent were in agriculture; for all illiterate female workers, the corresponding share was 72.1 per cent (Table 6.6). The second important avenue of work

Table 6.6

Distribution of Workers Employed in Agriculture and All Industries, by Educational Level

(in %)

Educational level	*Share of Workers within Sections (%)*				*Share of Workers within Each Educational Level (%)*			
	Agriculture		*All industries*		*Rural men*		*Rural women*	
	Rural Men	*Rural Women*	*Rural Men*	*Rural Women*	*Agriculture*	*All Industries*	*Agriculture*	*All Industries*
Illiterate	33.1	63.5	63.5	59.6	54.7	100.0	72.1	100.0
Literate, no schooling	0.3	0.1	0.1	0.2	48.6	100.0	32.7	100.0
Literate, through TLC	0.0	0.1	0.1	0.1	29.2	100.0	71.1	100.0
Literate, other means	0.3	0.2	0.2	0.2	42.8	100.0	76.4	100.0
Literate, < Primary	13.5	10.3	10.3	10.3	49.7	100.0	67.4	100.0
Primary	14.9	11.0	11.0	12.2	43.4	100.0	61.1	100.0
Middle	18.4	8.5	8.5	11.2	41.6	100.0	51.6	100.0
Secondary	11.1	4.5	4.5	7.1	37.9	100.0	43.0	100.0
Higher Secondary	5.4	1.5	1.5	3.4	34.4	100.0	30.2	100.0
Diploma, < graduate	0.4	0.0	0.0	1.1	11.6	100.0	2.9	100.0
Graduate	2.2	0.3	0.3	3.3	18.1	100.0	6.0	100.0
Above graduate	0.4	0.0	0.0	1.6	8.8	100.0	0.8	100.0
Total	100.0	100.0	100.0	100.0	43.0	100.0	67.8	100.0

Notes: (a) Literate, but with no schooling implies attainment of literacy through non-formal courses or adult literacy centres or through the Total Literacy Campaign (TLC) or through other means. (b) < refers to below the level referred to; (c) Agriculture refers to 'Agriculture, Forestry and Fishing'.

Source: Computed from NSSO unit-level data, 68th round, 2011-12.

for male and female illiterate workers was construction. The share of workers employed in Agriculture fell with a rise in educational achievement. Among those educated up to the higher secondary level, the share of workers employed in Agriculture was 34.4 per cent for rural men and 30.2 per cent for rural women. At this level, more men were employed in wholesale/retail trade and in the repair of automobiles and household goods; more women were employed in the educational sector as teachers and staff.

Among all graduates, only 18.1 per cent of rural men and 6 per cent of rural women were employed in Agriculture. The predominant avenue of employment for both rural men and women at the graduate level was in the educational sector, mainly as teachers and staff in schools and small rural colleges.

Rise in Aspirations

The spread of education, combined with factors like the growth of migration, inflow of remittances, and the growth of a consumerist society, have brought about larger socio-cultural changes in India's village societies. Rising levels of aspirations among rural youth is one important socio-cultural change. On the one hand, educated youth among cultivators tend to link cultivation to poor incomes relative to their educational achievements as well as to incomes in the urban service sector. On the other hand, educated youth among labour households do not choose to take up rural manual wage work, especially agricultural labour.

Nowhere in the country is the spread of education and aspirations better developed than in the state of Kerala; certain changes in Kerala's labour market are an indication of what is in store for other states with the spread of education. Francis, who studied the Kuttanad region in south Kerala, found that while educated young men of rural Kerala preferred jobs that involved automobile repair, lathe work and apprenticeship in printing presses, educated females wanted to be trained in typewriting and tailoring. In effect, "both young females and males seem to avoid manual labour in agriculture, but prefer to go for some non-agricultural activity" (Francis, 1990: 90). In an interesting sociological work on social mobility among Ezhavas (an OBC group) in south Kerala, Osella and Osella argue

that there was an increasing desire among Ezhavas for upward social and economic mobility, which has found expression in a number of ways, including work preferences, purchase of consumer goods and preferences in dressing. They write that:

> ...for Izhavas, agricultural or manual labour represents what is locally deemed as the unsuccessful section of the community, those whose occupation offers neither wealth nor prestige, who have hence failed to find upward mobility. Since most agricultural labourers continue to be drawn from the 'lowest' untouchable caste, the Pulayas, and since Pulayas overwhelmingly continue to be employed as agricultural labourers, this type of labour is strongly identified with Pulayas and low status...Izhavas have increasingly been practicing forms of distancing between themselves and...Pulayas, who act as a sort of anti-reference group from whom clear 'distinction' must be asserted if Izhavas are ever to free themselves from the hated avarna tag (Osella and Osella, 1999: 994-95).

In my research work in north Kerala in the early 2000s, I found that from the younger generation of work seekers, particularly those under the age of 30 years, the supply of agricultural labourers had almost stopped (Ramakumar, 2004).

Studies from other States too have arrived at similar conclusions. Ramachandran et al., (2002) reporting their results from Gokilapuram village in Tamil Nadu note the emergence of a new group of educated never-employed youth from agricultural labour households who are unable to find adequate or appropriate non-agricultural employment. Jeffrey (2010) finds that in Meerut district in western Uttar Pradesh (UP), college students from Jat peasant households see themselves increasingly alienated in the new post-liberalisation scenario of being educated and unemployed. He describes the condition of youth in Meerut as one of "time pass", or purposeless waiting.

> In Meerut, time pass reflected the concatenation of multiple spatiotemporal insecurities: the disappointment of being unable to acquire secure salaried work despite having spent a long time in formal education, the frustration of being unable to travel and start a family in the manner of a 'successful man,' and the sense of loss that accompanies being removed from spaces associated with modernity and development (Jeffrey, 2010: 477).

Social-anthropological studies like Jeffrey (2010) or Osella and Osella (1999) inject a sense of urgency into the need for creative public policies to address the challenge of youth unemployment. White (2012b: 10) underlines the difference between two understandings of youth: firstly, of youth as a "group", and secondly, of youth as a "state or condition". Implicitly reflecting on youth as a condition, Jeffrey (2010: 477) notes that educated unemployed young men could also end up fostering "reactionary class-based political activity." According to him, time-pass cultures of Jat youth in Meerut were often marked by "efforts to mark their distinction *vis-à-vis* low castes and Muslims" and that they were also "strongly gendered."

Declining Profitability in Agriculture

Second, relative levels of profitability in agriculture have fallen in the 1990s and 2000s. Such decline has been an outcome of neo-liberal policy changes in agriculture after 1991 (Sen, 2003; Sen and Bhatia, 2004; Surjit, 2008; Dev and Rao, 2010). Using data from the Cost of Cultivation (CoC) Surveys, Sen points out that there was a general slowdown in the diffusion of yield-increasing technologies and inputs in the 1990s compared to the 1980s. On the other hand, mechanisation in agriculture grew faster in the 1990s than the 1980s, although at varying rates across regions. However, output prices of agricultural produce tended to stagnate or fall in the 1990s compared to the 1980s. To summarise Sen's conclusions:

> During the 1980s, when yield growth was higher and prices of most crops tended to rise faster than the cost of living, the real per hectare margin of GVO [gross value of output] over cost...increased for all crops except maize...During the 1990s, with yield growth slowing down for most crops and prices of crops other than cereals and sugarcane rising slower than the cost of living, the real GVO-cost margin fell for most crops other than wheat, sugarcane, barley and turmeric...Across States also, increases in GVO-cost margins were less evident during the 1990s than during the 1980s (Sen, 2003: 38).

Dev and Rao use updated figures for GVO (gross value of output) and costs of cultivation to analyse changes in profitability in Indian agriculture. They compute ratios of GVO in rice and wheat to two

indicators of cost of cultivation: C2 costs and A2 costs (see Table 6.7). Both ratios showed a decline of profitability in rice and wheat between the early 1990s and the mid-2000s. Dev and Rao reject simplistic explanations that link rising administered prices in the 2000s to the growth of agricultural profitability. They argue:

> ...the farming community is not necessarily better off as a result of higher support prices, as these prices are meant to compensate for the rising CoP [cost of production]...[R]ising costs necessitated higher support prices to sustain the long-run margin of 20% over total costs...[I]f the MSPs were not hiked sufficiently as in case of rice in the late 1990s and early years of the new millennium, margins would have gone down and distress would have spread... (Dev and Rao, 2010: 180).

Table 6.7

Ratios of GVO to Measures of CoC, Averages for Five Year Periods, 1981-82 to 2006-07, Rice and Wheat

Period	*Rice*		*Wheat*	
	GVO/C2 CoC	*GVO/A2 CoC*	*GVO/C2 CoC*	*GVO/A2 CoC*
1981-82 to 1985-86	1.27	2.21	1.21	2.06
1986-87 to 1990-91	1.24	2.09	1.21	2.10
1991-92 to 1995-96	1.25	2.30	1.30	2.45
1996-97 to 2000-01	1.17	2.13	1.33	2.64
2001-02 to 2006-07	1.07	1.89	1.23	2.31

Source: Dev and Rao (2010).

Falling Labour Absorption in Agriculture

Third, there has been a general fall in the levels of labour absorption in agriculture, which has stifled the growth of new employment opportunities within the sector. In this paper, I first consider labour absorption in *kharif* paddy cultivation in India as an illustration. In Table 6.8, I have presented state-wise data from Commission for Agricultural Crops and Prices (CACP) reports on labour absorption per acre in paddy at four time-points: 1981-82, 1991-92, 1998-99 and 2010-11. The data show that the quantum of labour absorption increased over the 1970s and 1980s, peaking by

the early 1990s. However, 1991-92 onwards, there was an absolute fall in labour absorption in most of the states for which data are presented.

Table 6.8

Estimates of Human Labour Absorption in Paddy Cultivation, in 8-hour Person-days Per Acre

State	*Total Labour Use (in 8-hour Person–Days Per Acre)*			
	1981-82	*1991-92*	*2001-02*	*2010-11*
Andhra Pradesh	56.7	63.7	49.0	36.8
Assam	32.6	34.0	37.6	34.7
Bihar	39.4	45.2	40.4	37.8
Haryana	-	42.1	28.9	30.3
Kerala	54.8	-	40.5	26.0
Karnataka	55.0	57.9	64.5	49.9
Madhya Pradesh	31.4	31.2	36.3	27.0
Orissa	52.3	55.1	56.5	52.1
Punjab	43.4	30.8	22.5	19.6
Tamil Nadu	86.3	88.4	50.3	38.6
Uttar Pradesh	43.5	42.3	41.3	39.8
West Bengal	61.0	66.9	58.2	61.2

Source: (a) CACP reports (various issues) for all states except Tamil Nadu.

(b) Surjit (2008: 83), Table 14, for data on Tamil Nadu.

Field studies from rural India in the 1990s also show a decline in labour absorption per acre in paddy cultivation. In a re-study of Gokilapuram village in Tamil Nadu, Ramachandran and Swaminathan (2004) note that between 1977 and 1999, that of paddy area ploughed by tractors had risen as compared to the share of area under bullock ploughing. The number of rounds of hand–weeding had fallen owing to the use of weedicide. Paddy harvested from more areas of land was threshed, at least partially, with mechanical threshers, thus reducing the days required for threshing. The quantity of manure used in basal manuring had fallen, as more quantities of manure were used in the cultivation of non-paddy crops.

Harriss-White et al. (2001: 30) note that between 1973 and 1993-1994, in their Tamil Nadu study villages, the labour absorption

on one hectare of paddy land fell by 15 per cent on small farms and 12 per cent on large farms. Harriss-White et al. (2001) identifies mechanisation of ploughing, irrigation and threshing as the major reasons for this decline in labour absorption. Da Corta and Venkateshwarlu (1999) observe that between 1970 and 1995, there was a net fall in the number of male and female labour absorption on one acre of paddy land in Andhra Pradesh, mainly due to the introduction of power tillers and tractors.

Secondary data on labour absorption in *rabi* wheat in a selected set of five states also gives similar results (see Table 6.9). As opposed to paddy, there appears to be a secular decline in the number of days absorbed for the cultivation of one acre of wheat in all the states examined.

Table 6.9

Estimates of Human Labour Absorption in Wheat Cultivation

State	*Total Labour Use (in 8-Hour Person-Days Per Acre)*			
	Mean: 1970-81	*Mean: 1981-91*	*Mean: 1991-2001*	*2011-12*
Haryana	24.2	19.2	17.0	15.3
Madhya Pradesh	22.5	18.8	18.6	14.5
Punjab	22.0	20.0	16.4	8.1
Rajasthan	34.4	29.3	28.4	25.3
Uttar Pradesh	33.8	29.7	25.8	22.6

Source: (a) CACP reports (various issues); (b) Raghavan (2008: 125), Table 2, for data on the averages for 1970-81, 1981-91 and 1991-2001.

When labour absorption is falling, it becomes more unlikely that labourers can successfully bid up wages. As a result, increasing numbers of agricultural labourers have moved out of their primary occupation of agricultural labour into non-agricultural occupations where wage rates are higher. For more numbers of rural workers, especially men, agricultural labour today constitutes only a subsidiary source of employment and income.

India: The Response

It may be apt to begin this section with a quote from the report of the National Commission on Farmers (NCF), chaired by M.S.

Swaminathan. The NCF report maintains, while covering the three factors noted in the previous section, that:

> Over-riding priority should go to fighting the famine of jobs/ sustainable livelihood opportunities through the creation of *economically rewarding* and *intellectually stimulating* work opportunities in villages. This is the only way to attract and retain educated youth in villages (GoI, 2004: 11, emphasis added).

Let me take the two phrases used in the NCF report separately, even though they are inter-related.

Making Cultivation "Economically Rewarding"

The most important challenge in the rural areas today is to make cultivation "economically rewarding" for small and marginal cultivators. It is well-documented that the major reasons for non-viability of cultivation are the fall in output prices on the one hand and the rise of input prices on the other. Both these have clearly been policy-induced under the present neo-liberal regime.

Over the longer period of neo-liberal reform of agriculture between 1992-93 and 2010-11, agricultural growth rates have slowed down relative to the 1980s (see Ramakumar, 2014). In the 1990s and 2000s, there was a weakening of public institutional support to agriculture. The protection offered to agriculture from predatory imports was removed, resulting in a fall in prices of many commodities. As part of fiscal reforms, the input subsidy system was restructured, due to which input prices and costs of production increased sharply. The growth of public capital formation in agriculture stagnated, as did the growth of public expenditure on agricultural research. Given the declining public expenditure on agricultural extension, farmers have lost access to the public extension. In its place, farmers have become dependent on agents of seed, fertiliser and pesticide companies—a dependence that has attained disastrous dimensions in many regions. The expansion of rural credit slowed down in the 1990s, re-opening the doors for the informal sector. In the 2000s, public banks increasingly catered to the needs of large farmers and corporate agri-business groups. Regulated markets came to be treated as obstacles to efficient marketing, and

were sought to be weakened. All these factors have converged to foster a crisis of profitability in agriculture in the 1990s and 2000s.

A number of official committees have emphasised the point that economic reform deepened the crisis in agricultural profitability. The R. Radhakrishna Committee that submitted its report in 2007 notes:

> The crisis in agriculture was well under way by late 1980s and the economic reforms beginning with 1990s have deepened it. The crisis in agriculture in the post-reform period has become pervasive... Internally, the structural adjustment process had far reaching implications for Indian agriculture. Fiscal reforms adversely affected the agricultural input support system and institutions...Marginal and small farmers are increasingly finding that their holdings are not viable...The market driven liberalisation process in agriculture is bound to be strongly biased towards rich farmers, traders and prosperous regions...The *root cause of the agricultural crisis* lies in the neglect of agriculture in designing development programmes and in the allocation of development and plan resources (GoI, 2007: 40, emphasis added).

What is required to make agriculture profitable again? Clearly, an alternative policy programme for agriculture is the need of the hour. The major components of the alternative policy programme should be as follows:

a) The relevance of trade protectionism in agriculture needs to be evaluated, and a crop-specific assessment of the benefits of higher tariffs should be introduced.
b) The recommendation of NCF to institute an expanded regime of minimum support prices pegged at 150 per cent of the imputed costs of cultivation needs to be accepted and implemented. Input subsidies need to be retained where it is clear that the biggest beneficiary is the small and marginal farmers.
c) Higher public expenditure should be set aside for agricultural research and extension; India should aim to invest at least 2 per cent of its agricultural GDP (gross domestic product) in agricultural research.

d) Rural credit needs to be reoriented towards small and marginal farmers, away from corporate agri-business groups.
e) The role of the government in marketing needs to be one where the relative bargaining power of the farmer is strengthened, and not weakened.

On the side of agricultural labour, falling levels of public investment in infrastructure, such as irrigation, have held up the possibilities of any increase in employment opportunities in cultivation (Ramakumar, 2012). Irrigation raises labour requirements by making multiple cropping possible; cultivation of more than one crop in a year leads to the absorption of more number of workers annually per unit area. When irrigation is available, new and improved varieties of seeds, fertilisers and pesticides are used, which further raises labour absorption per unit area. Modern varieties of seeds are transplanted, in contrast to the direct sowing for many traditional seed varieties. Transplanting requires greater amount of labour, especially female labour. In the absence of any substantial investment in the expansion of both surface irrigation as well as groundwater irrigation, employment expansion within agriculture has stagnated, if not fallen. A reversal of the fall in public investment in agriculture is inevitable, if we are to expand agricultural employment in rural India.

Making Cultivation "Intellectually Stimulating"

Let me come to the second phrase used in the NCF report: that agriculture should be "intellectually stimulating" too. I would argue that the challenge to make agriculture intellectually stimulating is a task that need not be comprehensively linked to the struggle against neo-liberalism. Intellectual apathy with a traditional occupation can result even when economic viability of the occupation remains unchanged. In some sense, the problem is a corollary of the spread of modernity itself, and has to be resolved positively.

Agriculture is a vast sphere with different sub-components like horticulture, livestock, poultry, fisheries and bee-keeping. The strategy with respect to the landed rural youth has to be in the promotion of integrated production systems in agriculture, that bring

together crops, livestock and poultry to raise cash incomes per unit area of land. Among landless agricultural labourers, our interventions should aim to transform them into skilled workers, thereby adding economic value to their time and labour.

There should be a detailed employment generation strategy in agriculture to create additional skilled jobs through horticulture, cotton, energy plantations, animal husbandry and biomass utilisation. Horticulture can be an important area where truly "intellectually stimulating" employment opportunities can be generated for the youth. The National Horticulture Mission (NHM) should promote human resource development for generating skilled manpower trained in different horticultural enterprises. The suggestion in the NCF report to begin farm schools may be a major entry point in upgrading skills of educated rural youth. Yet another area where new jobs for the youth can be generated is in the post-harvest phase of farming.

Encouraging Rural Youth Groups in Lease Farming

A necessary condition for the success of youth forays into agriculture is the presence of corresponding forms of production organisation. In entering agriculture, an important constraint that rural youth face is lack of adequate access to land. Indeed, in states where land reforms have not yet been fully implemented, an emphasis on land redistribution is the most appropriate method to expand access to land. However, even in states where land reform has been implemented to a large extent, rural youth face difficulties in accessing land. For instance, many small and marginal farmers do not cultivate their plots either due to lack of time to monitor hired labour or due to sheer disinterest. Even if rural youth obtain access to land on lease, they continue to face difficulties in accessing finance from banks, which insist on tenancy deeds. In many states, small and marginal farmers are hesitant to formally lease out land for fear of tenancy laws.

It must be clear that the solution to the above problem is not the weakening of tenancy laws so as to render further land reforms untenable. The solution has to be carefully calibrated, allowing states

with some progress in the implementation of land reforms to think of introducing more relaxed guidelines. In this context, the example of the Kudumbashree scheme being implemented in Kerala needs to be studied in greater detail. The Kudumbashree scheme works through Neighbourhood Groups (NHGs), which are groups of young women who voluntarily come together to identify fallow land and lease it for cultivation for a period of 1–5 years. The village *panchayat* facilitates the women's groups to obtain land from the landowners as well as negotiate the lease amount. The fallow lands owned by the *panchayat* and public institutions are also leased out to NHGs for cultivation. The *panchayat* too supports access to subsidised finance from public banks or co-operatives for NHGs. As per official estimates, about 24,741 hectares of land is under cultivation across Kerala by about 36,468 NHGs. In all, it is estimated that 367,270 households have benefitted from the Kudumbashree scheme (for details, see Mukherjee-Reed and Reed, 2013).

As is clear, much of the upgradation of skills discussed above are geared towards helping educated youth to organise market-driven enterprises. In this respect, the role of the state is central. Experience from across the world has shown that the retreat of the state and shift towards free market policies has accentuated the crisis of being young in rural areas. According to Ben White (2012b: 11),

> The problems generating mass youth unemployment are structural ones...; this is happening in agriculture and all other sectors... Structural problems require structural solutions, but in a neo-liberal world, governments are not inclined to spend money on these things. The young are then forced to improvise their own survival strategies, and this is reflected in current policy shifts away from genuine 'employment generation' to an increasing emphasis on promotion of 'entrepreneurial' skills in World Bank and ILO policy discourse and national youth policies, thus a new kind of 'do-it-yourself ' employment strategy for the young. There is little evidence that these policies increase employment prospects or earnings.

Thus, two elements are central to the success of the strategy advocated. First, there is a need to restructure and re-orient our public banking network towards financing new enterprises. The

success of the Kudumbashree experiment in Kerala shows that the role of public banking institutions is central to the success of rural enterprises. Second, there is a need to provide substantial public support—financial and logistical—in creating marketing institutions for the products. Indeed, in the neo-liberal era, both these spheres face a crisis. While a number of branches of rural banks in India have closed down after 1991, regulated markets are increasingly seen as obstacles to efficient marketing. The official strategy regards the exit of regulated markets and the entry of private markets led by multinational retail chains and corporate farming as the way forward. While there might be a need for rural enterprises to link up with large retail chains, the lesson from global experience is to encourage more inclusive and collaborative business models than ones that allow indiscriminate entry of fly-by-night profit seekers. Thus, the strategy towards generating more "intellectually rewarding" jobs in agriculture cannot be divorced from the demand for the reversal of neo-liberal policies in the sphere of agriculture.

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N. ANIL KUMAR and L. VEDAVALLI

Conservation of Family Farming Heritage

Introduction

Family farming or smallholder farming is recognised for the sustainable management of farms as well as for ensuring the cultural, culinary and curative needs of the farm families. Family farmers, particularly women, help to strengthen the conservation of biodiversity based on cultural, culinary and curative diversities. This is more evident in parts of the Asia-Pacific and African regions and Latin America where household labour, along with several other inputs like seeds, manure, and energy generated in situ, is used to produce the bulk of a household's consumption needs for food, medicine, fodder, etc. Such farming has been practised for centuries with minimum negative externalities to culture, biodiversity and ecosystem services. However, the countries in the Asia-Pacific region are facing problems of food and nutrition security, and it is believed that unless the concerned governments take appropriate measures to increase their food production and address the problem of undernourishment, food insecurity issues will aggravate. Food and Agriculture Organization (FAO) warns that in order to avoid the food security crisis, some of the countries in this region need to enhance their food production by 77 per cent by 2050. The Asia-Pacific region holds 60 per cent of the world's population and has a hungry population of more than 550 million (and nearly half of them are in India) (FAO, 2014).

While investigating the issue of strengthening the in situ on-farm conservation traditions of family farmers of the Asia-Pacific region to address the challenges of feeding 60 per cent of the world's population, it can be seen that it is dependent on the effective

management of four dimensions that are linked to family farming: cultural diversity, culinary diversity, curative diversity (i.e. medicinal plants and herbs) and the overall farm agro-biodiversity. Although it appears that these four dimensions have different objectives and require different approaches, in reality they are interrelated by function and thus need to be managed holistically and in partnership with the key stakeholders involved, especially the men and women of farm families, for yielding better results.

Among the four dimensions, agro-biodiversity provides distinct genetic variability in crops and breeds, as also agro-ecosystem variability with a range of biodiversity and ecosystem services. This 'functional agro-biodiversity' supports agricultural production and farm income in a long-term sustainable manner (Bianchi et al., 2013). The loss of functional agro-biodiversity—the beneficial insects and predators, pollinators and innumerable below-ground biodiversity —from fragmented farms is a major challenge in maintaining the sustainability of small-scale farming. Cultural diversity is valued in sustaining family farming as it leads to the preservation of locally-appropriate agricultural techniques, innovations and practices. Culinary diversity becomes essential in supporting family farming; although family farming itself may be even more important in fostering culinary diversity. There has been very little research on understanding the role of curative diversity in sustaining family farming or indeed about the cultivation of medicinal plants in family farms and consumption of medicinal herbs at household level.

The smallholders of China, India, Indonesia, Bangladesh and Vietnam—Asia's five most populated countries—alone account for 300 million small farms out of the world's 500 million farms in this category. These "small farmers" are engaged significantly in the production of diverse grains and starchy staple foods like different roots and tubers as well as tending to a wide range of livestock and fishery produce (FAO, 1996; IFAD 2014). However, emphasis on high-yielding and broadly-adapted varieties has greatly led to the loss of crop diversity and genetic variability in crop plants. Although historically, families of artisans, pastoralists, gatherers, small peasants and indigenous communities have discovered some

50,000 varieties of edible plants, modern urban society has adapted to only a few crops like wheat, rice, maize and potato, because of the relative advantage of buying such varieties from supermarkets and due to various other factors. The demand for only market-driven farm produce has resulted in a decline in farmland biodiversity and simplification of agro-ecosystems in various spatial scales. FAO (2014) states that almost all the PGR (plant genetic resources) of small farms will be extinct by 2050 unless concerted efforts are taken on the ground to save such diversity.

The greatest challenge for sustainable management of family farms in the Asia-Pacific region is the integration of economic, social, cultural and environmental concerns. In this paper, we discuss the role of family farming in promoting agro-biodiversity, cultural, culinary and curative diversities using case studies from India, in the operational area of the M.S. Swaminathan Research Foundation (MSSRF). The paper also gives a few suggestions to revitalise the family farming heritage in the Asia-Pacific region.

Transition Challenges

The literature on family farming in the Asia-Pacific region is rich in terms of identifying the transition challenges that smallholders have to confront because of changing political, social and economic processes. The most fundamental transition challenge for the millions of small farmers in the region is having to operate in the neo-liberal era with market-friendly economic policies, without bringing about any catastrophic qualitative change in the basic outcomes of smallholder farms.

Poor access to technologies that are simultaneously beneficial for farm productivity and sustainability is also a great challenge. Often small farmers do not have either the resources to buy the technology, the infrastructure to support it, or the specialised knowledge of how to use it to their best advantage. Therefore, improving the access of family farmers to technology and skills can unleash their productivity potential and improve food security for their whole community (Grande, 2014). Communication technologies like the use of mobile phones enable family farmers to access important economic and

ecological information such as market prices, climate predictions, consumer trends and prior warning of adverse weather events. For example, Silva and Ratnadiwakara (2008) calculated that in Sri Lanka, information costs make up 11 per cent of farmers' total costs and 70 per cent of transaction costs. This was the result of being uncompetitive in the market against more commercial farmers who were better connected with the state of the agricultural economy. The roll-out of mobile phones to sardine fisheries in Kerala allowed fishermen and women to find out current sardine prices at different landing points while still offshore. Based on this information (and factoring in travel costs), the fisher people were able to decide where to land their catch that day in order to obtain the best profits. The scheme successfully decreased price volatility and variation, increased wages of fishers by an average of 8 per cent and, by eliminating waste, allowed consumer prices to fall by an average of 5 per cent (McNamara 2009). Similar experiences have been recorded by farmers and fishermen in Tamil Nadu, Puducherry and Andhra Pradesh by MSSRF (MSSRF, 2013a; 2013b; 2013c; 2014). Other economic challenges faced by family farmers include gaining access to financial services such as insurance, which will allow them to take more risks in growing and diversifying their business.

Family farmers are also increasingly facing environmental challenges created by climate change and environmental degradation. An example of this is the problem created by declining productivity of rice and wheat in the Indo-Gangetic plains and East Asia. According to Thapa and Gaiha (2011), rice yield growth in irrigated areas of Asia declined from 2.31 per cent per annum in 1970-1990 to 0.79 per cent in 1990-2000, primarily due to the displacement of cereals with higher value crops, and also because of deteriorating soil and water quality; intensive paddy systems in several Asian countries have reported degradation of soils and build-up of toxins (Thapa and Gaiha, 2011). This, while an immediate problem for commercial farmers, has a severe effect on family farmers who have to work with land degraded by commercial farming. For instance, pollution such as the influx of high levels of drug residues into the environment and the emergence of antibiotic-resistant strains of bacteria because

of indiscriminate use of antibiotics are very severe environmental challenges for family farmers of the Asia-Pacific region (FAO, 2014). Wet rice fields are also a major source of methane emission, a greenhouse gas that is 20 times more detrimental than carbon dioxide at trapping heat (EPA, 2014). As so much of East Asia relies on irrigation, land degradation in irrigated areas through salinisation and waterlogging is a key challenge for family farmers. This combines with fertiliser nutrient runoff and the subsequent algal bloom to destroy wetlands and wildlife habitats (Thapa and Gaiha, 2011).

The region's family farming heritage systems and landscapes are quite a few, and have evolved similar to the multitude of social, cultural and ecological systems of the globe. The Kolli Hills Malayali/Malayalar Agricultural System, the Wayanad Kurichya Agricultural System, the Kuttanad Below Sea-level Farming System and the Koraput Traditional Agricultural Systems are some prominent examples of family farming heritage in India. FAO has recognised the latter two as Globally Important Agricultural Heritage Systems. The recognition of these unique farming traditions instilled pride among the local communities and bestowed further inspiration for conservation and enhancement of such farming heritage. Details of the functioning of these systems are presented as case studies (See Annexures A-7.1, A-7.2 and A-7.3). The studies clearly outline the interrelationship between culture, biodiversity and household food and nutrition. They also highlight the multifarious struggle that small farmers face to sustain their food production systems and cope with the socio-economic transition. The trend of moving away from a household-level farm production system to an alternative system of growing largely for the market continues in these regions.

Family Farming and Agro-biodiversity

The biological diversity present in agricultural landscapes and common property lands are managed by local communities, often poor farmers, herders, fishermen or indigenous people. Their role in the creation, management and conservation of agro-biodiversity still remains largely unrecognised or insufficiently conceived in strategies aimed at conserving biological diversity, even though it

has been acknowledged officially in international documents such as the Convention on Biological Diversity (CBD) and the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA).

The single most environmental catastrophe in 21st century farming is the loss of agro-biodiversity. The process of losses occurring in the diversity of crop plants, which has been termed as "genetic wipe out", is not restricted to staple food crops like wheat, barley, rice, millets, sorghum, potatoes; a number of fruit varieties also come under this category (Fowler and Mooney, 1990). In China, about 10,000 wheat varieties were cultivated in 1949; after 20 years, in the 1970s, a mere 1000 varieties were cultivated. China also reported loss of wild groundnut, wild rice and an ancestral variety of cultivated barley. The Republic of Korea registered 74 per cent varietal loss in 14 crops within a time span of 8 years from a particular farm (FAO, 1996). In Bangladesh, the promotion of high-yielding rice varieties characterised by mono-cropping has led to the displacement of 7,000 traditional rice varieties (Hussein, 1994). It is stated that in Bangladesh, the Green Revolution varieties covered about 96 per cent of wheat area in 1998 with 67 per cent of wheat land planted with a single variety. In the Philippines, two rice varieties developed by the International Rice Research Institute (IRRI) occupied about 90 per cent of the entire rice-growing area during the 1984 dry season (FAO, 1996). During the last 50 years, before the spread of new varieties of rice, Indian farmers may have cultivated 30,000 different varieties. It is estimated, in 15 years only 10 varieties may have covered as much as 75 per cent of the total rice acreage in the country (Jain, 1982).

MSSRF's studies on the Malayalis of Kolli Hills (MSSRF, 1996; Vedavalli, 1998; 2004; Vedavalli et al., 2002) have revealed that commercial cropping has resulted in extensive changes in the land-use pattern. Traditionally, most of the upland area or *uzhavukadu* was utilised for raising diverse food crops. In the traditional farming system, multiple use strategies were promoted to enhance the multiple functions of agriculture. The cultivated crops took care of food and nutritional requirements and provided thatching material for house roofs, fodder for cattle, manure for fields, and also various

other household needs. The horticultural crops took care of cash needs to an extent (Vedavalli, 2004).

The intensive mono-crop cultivation in Kolli Hills at present affects agro-biodiversity and other natural resources like soil and water. A major portion of the *mettu kadu/uzhavu kadu* or uplands has been taken over by tapioca, a cash crop, and more recently by crops such as coffee, pepper, cloves, etc. The undulating rocky terrain known as *kollakadu* or *kothu kadu*, where traditionally long-duration varieties of *samai* (*Panicum miliare*) and *thinai* (*Setaria italica*) like *perum samai* and *perum thinai* were cultivated, is being converted into pineapple-growing areas. In earlier times, only one season was utilised to raise crops like *samai* and *thinai,* and the land would be left fallow for rest of the year. Further, the household utilised only a portion of the *kollakadu*. Hitherto unutilised *kollakadu* is being utilised now for raising crops like silver oak and mango. These crops are gradually spreading to the hill slopes where the bush-fallow system has been predominantly followed. On the steep slopes, the Malayali households in general used to raise various tree species and fruit trees/crops. The tree species were generally utilised for green leaf manure, construction purposes, and to make agricultural implements. The expansion of tapioca cultivation, followed by pineapple and other tree crops like silver oak, has greatly affected the maintenance of different agricultural habitats that generated agro-biodiversity in the land under the control of the farmers. Grazing lands (*kirai*) are increasingly being converted into agricultural lands. With the decline in the number of cattle, the grazing lands have also gradually lost their significance in the traditional agricultural system of Kolli Hills. These lands have either been converted to produce crops for sale or have been sold to outsiders (Vedavalli, 2004).

Different strategies are required that go beyond a narrow conservationist approach for the long-term conservation of this locally-managed agro-biodiversity. Rather, it is necessary to actively integrate agro-biodiversity into the overall issue of sustainable agriculture, giving equal consideration to its three dimensions—economic, ecological and social sustainability. Conservation issues, cultivation knowledge, consumption awareness and commercial

aspects would all need to be integrated into one overarching policy strategy.

Family Farming and Cultural Diversity

Cultural diversity is important in sustaining family farming as it leads to the preservation of locally-appropriate agricultural techniques. For instance, the origin of the land tenancy system—the "nine squares"—in the northern part of the plains of China is rooted in ancient Chinese philosophy and culture of integrating positive (Xiang Cheng) and negative (Xiang Ke) relationships to get mutual benefit. Under the nine square system, large portions of land were divided into nine equal squares, of which the central square belonged to the landlord and the eight edge squares were managed by the serfs to the landlord. This tradition that dates back to 1100 BC resulted in the gradual establishment of private land ownership and development of self-sufficient farming systems—crop husbandry, animal husbandry, silviculture, sericulture and domestic handicrafts — in which the family was the production unit (Wenhua, 2001).

It was shown at the FAO 2010 Technical Workshop that countries, communities and cultures that maintain their own traditional food systems are better able to conserve local food specialties with a corresponding diversity of crop varieties and animal breeds (FAO, 2010). Family farming is at the heart of the local rural culture in the Asia-Pacific region. For example, among the tribes of the Koraput region of Odisha in India alone, there are 48 rituals that are associated with the planting, growth and harvest of rice or involving the presentation of rice in some way. Rice is used by the Bhumia, Paroja and Kandha tribes for bride price; by the Paroja tribe to remunerate the midwife upon the birth of a child, by the Bhatara and Bhumia tribes for fertility rites and the Gadaba tribe offer both rice and fish to a dead body on its way to the cremation ground (Mishra et al., 2013). Among the Kurichyas, a tribal community in Kerala in India, the whole process of rice cultivation is ritualistic, from sowing the first seed for raising the nursery to the harvest of rice (Vedavalli and Kumar, 1998). There are six different rituals associated with rice

cultivation among them, all of which are observed in the first season (*nanja*) of rice cultivation. This is one of the reasons Kurichyas are very particular about cultivating traditional rice varieties during *nanja*, with specific rituals associated with the different rice varieties, based on crop duration and special characteristics (see Annexure A-7.2).Among the Malayars of Kolli Hills, the particular rice variety *karu nellu* and the plantain variety *karu vazhai* have ritual and religious significance. A local deity by name Kongayi Amman worshipped by 12 villages is believed to be very powerful. A special cooked preparation of *karu nellu* rice and *karu vazhai* fruit are important offerings to this goddess. The households continue to cultivate this rice variety at least in a small piece of land (Vedavalli, 1998).

The MSSRF study among the Malayalar tribal families of Kolli Hills shows the interplay of culture, property inheritance, income and biodiversity conservation (Vedavalli, 2004). Primarily, property among the Malayalis means landed property and house. The Malayalars, being an agricultural community, consider land a valuable resource. The other forms of property (movable property) include cattle, pig, gold/silver jewels, agricultural implements and household utensils. They consider the *pala maram* (jackfruit tree) as one of the components to be divided among the sons during partition of the property because of its high economic value and its great potential as a significant source of income for nearly 4-5 months in a year. Interestingly, the land where the tree is located need not always necessarily belong to the person who inherits the tree. The tree may belong to one individual and the land where the tree is planted may belong to another. It has also been found that one single tree is divided among two or three sons. In such cases, the total number of main branches in the tree is taken into account and accordingly the branches are allocated to the sons. Getting one or more branches of the tree by an individual is generally referred to as *kilai bagam* (i.e., *kilai* = branch, *bagam* = share). The tree itself is thus considered as an item of property by the Malayalars. Similarly, although not very often, tamarind trees are also divided among the sons. In this case, the sons share the yield of the tree when there is just one tree

and more than one person to inherit the same. It is also a source of conflict sometimes among the kin members (Vedavalli, 2004).

In order to sustain such an elaborate ritual system, it is necessary to maintain the traditionally conserved agro-biodiversity and put in a large amount of time and resources into the family farm. Or, if looked at from a different angle, the dominance of agriculture in daily lives of the Koraput tribes as well as the Kurichyaand Malayali tribes has led to its central position in their ritual structures. After all, as Grande (2014) points out, family farms are embedded within local culture, and so one would expect them to substantially contribute to the shape of that culture.

Family Farming and Culinary Diversity

Culinary diversity is highly important in sustaining family farming; although family farming may be even more important in fostering culinary diversity. Growing incomes and technological improvements in storage and transport have opened the way for international food trade. This, along with intense media marketing, has led to a profound shift in diets from unprocessed, local, culinary diversity to a processed, imported, uniformity of refined fats and carbohydrates. This rising consumption of processed energy-rich, but nutrient-deficient, foods is leading to the double burden of obesity and chronic disease alongside malnutrition and undernourishment in many countries in the Asia-Pacific region (FAO, 2010). Furthermore, the intensive agriculture needed to produce these food items is increasingly leading to environmental degradation through overuse of fertilisers, soil salinisation, waterlogging and misuse of pesticides (FAO, 2010). Hence it has become increasingly necessary to promote sustainable diets based on local agricultural diversity. Culinary diversity is key in preventing micronutrient deficiencies, which affect 30 per cent of the world's population (FAO, 2013). Micronutrient deficiencies can lead to stunting in children, a condition which affects 25 per cent of the world's children or some 165 million individuals. It is particularly prevalent in the South Asia region where 40 per cent of children are stunted (FAO, 2013). This can be easily prevented with a

more varied diet; the only thing required to supply it is greater agro-biodiversity of the kind found on family farms.

The plight of Malayali women and men of Kolli Hills substantiates this statement. "*Ratha kothipu* (hypertension), *sarkarai vyadi* (diabetes) were unknown to us. We never felt fatigue and weakness. Such was the quality of our food," lamented Muthammal, an old woman around 70 years, and there were many other voices that echoed this sentiment. They said: "Consumption of *ragikali/kanji* (*ragi* gruel) and *samai soru* (cooked *samai* rice) used to make us feel energetic throughout the day." Their daily diet consisted of diverse foods like *samai/thinai/ragikanji* (gruel) in the morning, for lunch *samai soru/ragi kali* with *kuzhambu* prepared with pulses (like *karu mochai* or *sem mochai* or *avarai mochai*) or greens and for dinner *ragi kali* (a semi-solid porridge) or *samai soru* with some pulses as a side dish. Since they consumed a variety of food, they obtained different essential nutrients from them that were necessary for their physical fitness. These days physical exhaustion sets in after a little bit of work done in the field, said the villagers. They also mentioned that, as the traditional subsistence crops are mostly cultivated with organic manure, the foodgrain harvested was also of good quality, very nutritive (*sathanadu*) and often with a pleasant fragrance. The regular consumption of these diverse nutritionally rich crops by the people made them very strong and resistant to disease. It was very rare for people to consult doctors in those days. According to them, *oosi* and *marundu* (inoculation/injection and medicine) are recent happenings (Vedavalli, 2004).

Despite these benefits, people have been brought to a situation today where they have overlooked the advantages of their traditional food crops. A majority of the villagers, including youngsters, share the view that cash inflow is much more now than what it used to be some 20-30 years ago. At the same time, they realise that it is at the expense of their food security and nutrition security that they have easy access to cash. Malayalar farmers, who were once the producers and also the consumers of their produce, essentially play the role of only producers these days (Vedavalli, 2004).

It is evident that family farms in their preservation of intra- and inter-species biodiversity provide nutrition security for the community relying upon them for food. This is one of the main reasons that family farms are so important: they are a key pillar of sustainable agriculture. Family farms preserve traditional agricultural techniques and are embedded within local markets, meaning that their income goes back to the community and creates jobs, and they also act as major employers in the agricultural sector (Grande, 2014). With 500 million family farms worldwide, family farms act as the main producers of day-to-day food items (FAO, 2010). Add to this the fact that most of the people facing food insecurity are smallholders (small-time family farmers), and it becomes obvious that the support of family farmers is integral for reducing hunger and poverty.

Family Farming and Curative Diversity

There seems to have been very little research conducted on the role of curative diversity in sustaining family farming or indeed on the cultivation of medicinal plants on family farms. MSSRF is attempting to address this gap, but further research is urgently needed in order to assess the impact of medicinal plant cultivation on the sustainability of family farms and further to this, on the health of farmers.

There are about 8,000 plant species in China and around 7,500 species in India with known medicinal value, mostly found in semi-wild habitats (Oldfield and Jenkins, 2012). The MSSRF studies among a few indigenous communities in India show that botanical remedies have been employed over generations by the majority of the families inhabiting the fringes or interior forests. Often herbal treatment is part of their culture and dominant mode of therapy due to their long history of interaction with the plant kingdom. One such study by MSSRF conducted among families of the Irula tribal community in Tamil Nadu shows that around 14 edible greens are used as medicine by them, which are generally prepared as vegetables and consumed. *Paasati* (*Assystasia violacea*), *kolemukku* dagu (*Polygonum chinense*), *mullu dagu* (*Amaranthus spinosus*), *povi dagu* (*Cansjera rheedii*), and *lingakatti dagu* (*Bryonopsis laciniosa*) are a few of the leafy

vegetables found wild to be growing on their farmlands that are used in therapies for ailments like dysentery, indigestion, gastric trouble, swelling in the hands and legs, body pain, etc., by the families of this community (Kumar and Vedavalli, 1996). Similarly, the tribal families of the Koraput region of Odisha have developed and standardised innovative methods to control diseases and pests in the rice fields and protect the grains from storage insects. Leaf diseases like leaf blast, leaf rot and leaf blight are controlled by a decoction of fresh green leaves of neem, *bel* (*Aegle marmelos*), *karanj* (*Pongamia pinnata*), and *tulsi* (*Ocimum sp*) and turmeric, mixed with fresh cow dung and urine. The decoction protects rice plants by making the young leaves bitter. Leaf folder, caseworm, stem borer and *gundhi* bug are controlled by fruits of neem, twigs of *kendu* (*Diospyrus melanoxylon*), kerosene oil and snails. Powdered leaves of lemon, neem, turmeric and *karanj* are mixed with rice grains to protect them from insects. Big bamboo baskets sealed with straw and plastered with a mixture of red soil and cow dung are used for grain storage.

One would expect that cultivation of such diverse medicinal plants would be more common on family farms than in large commercial agricultural businesses as medicinal plant use is generally linked to local traditional knowledge of the kind kept alive by the Irula community and the tribal people of Koraput. However, much more research is needed before these claims can be given any evidential backing. More exhaustive studies on the nutritional and medicinal properties of medicinal plants found in agricultural landscapes are urgently needed.

Conclusions and Recommendations

The review and case studies from India illustrate the role and functions of family farming: it is both a way of life and livelihood for millions of people in the Asia-Pacific region. Family farms play a more significant role in maintaining agricultural biodiversity, local customs and traditions, sustainable diets, and healing herbs compared to larger farms, which mainly specialise in monocultures. The variability in such diversity and the plurality in cultural traditions and knowledge domains, developed and safeguarded by smallholder

families, are extremely important in providing vital goods and services to humanity and for the genetic enhancement efforts in modern agriculture. But, maintaining such farming heritage is very challenging in view of the changing socio-economic situations. Therefore, revitalisation of the on-farm conservation heritage and rejuvenation of the resilience of agricultural landscapes assume much relevance, especially in view of sustaining the gains already accrued in agriculture, biodiversity, ecosystem services and the livelihoods of local communities. Examples from many other heritage sites show this is possible by strengthening local community efforts that promote integrated conservation methods, such as the selection, enhancement and sustainable use of local genetic resources, along with traditional knowledge and innovations benefitting both the socio-economic systems and ecological systems of the present and future generations of the world.

Creating conditions for revitalisation of millions of smallholder farms requires a major shift from the current policy of "mass production of food" to "production of food by masses". As Prof M.S. Swaminathan advocates, the major objective of family farming should be to enhance every smallholder's farm into a bio-fortified farm where nutrient-rich diverse food and dietary diversity are readily available. The success of revitalising family farms towards this direction will greatly depend upon the approach and methodology adopted at different spatial scales. One of the practical strategies for achieving sustainable food production is the '4C continuum' that MSSRF promotes in many agro-biodiversity hotspots in India. In this approach, equal importance is given to conservation, which includes enhancement and sustainable use of biodiversity and comprises in situ, on-farm and ex situ conservation methods; cultivation that promotes low external input, sustainable agriculture based on principles of sustainable farming; consumption that covers food security and nutrition, and revitalisation of traditional food baskets; and commerce that creates an economic stake in conservation through options in livelihood security. Implementation of the National Food Security Act in India that provides for distribution of

millets to eligible households will add impetus to the 4C approach by guaranteeing markets for nutritious millets grown by small farmers.

In view of these observations, we recommend the following framework and objectives for intervention.

Revitalisation of family farming should be undertaken as a mission by every country of the region by integrating it in their National Biodiversity Strategy and Action Plan (NBSAP). The ultimate success of this mission would be in achieving the Zero Hunger goal by all countries by 2020. The thrust of such a mission should be the establishment of an enabling social, economic, and physical environment at community level that revitalises and enhances local heritage in the area such as food production, promotion of nutrition-sensitive dietary diversity, and conservation of agro-biodiversity and ecosystem services.

The overall objective of the family farming revitalisation mission has to be the improvement of the living standards of smallholder farm families through the 4C continuum approach by undertaking thoughtfully-selected actions in conservation, cultivation, consumption and commercialisation pertaining to their agriculture. In all these actions, adequate care should be taken that farm women are not overburdened.

The core objective can have three sub-objectives:

a) Research, documentation and policy to undertake scientific research on the functional aspects of family farming and bring out high quality outputs on the issues and problems related to three priority topics:
    i) Functional agro-biodiversity (FaB), with a focus on improved scientific understanding of its contributions to sustainability of regional farming.
    ii) Food biodiversity, giving emphasis to its integration in traditional foods and promotion of sustainable diets.
    iii) Family farm resilience, with reference to climate vulnerabilities and risks.

    Advocacy workshops should be conducted to disseminate the findings to policymakers from local to regional and national levels.

b) Education and training to improve awareness on nutritional importance and the need to consume diverse edibles and to impart skills in horticulture among youth, mothers and children through nutritional literacy campaigns. Intensive trainings targeting all important stakeholders, including marketing groups, should be undertaken. Such trainings also need to focus on the four key areas of functional capacities identified by FAO: knowledge and skills, partnering, implementation and policy and normative.

c) Livelihoods and development to develop sustainable livelihood options by maximising local food production and nutrition security. This should be done by finding opportunities for the community members, particularly youth, in the utilisation of modern technologies in processing, value addition and marketing of produces from family farms as well as the 'socio-ecological production landscapes' of the rural areas. The concept of functional bio-fortified foods should be established with the full involvement of local food producers.

To conclude, although family farmers are at the heart of preserving the diversity of food systems, their capacity in terms of resources and technologies to meet the challenge of feeding the growing population of the region is woefully inadequate today. Technology integration in production enhancement, value addition and marketing of products from family farms and landscapes, as well as promoting new innovations by synergising traditional knowledge, technologies and modern science, would help small farmers to achieve many of the global and national targets.

Needless to add, the role of the state in making farming a viable activity is extremely important. It is, therefore, necessary to immediately launch multipronged, action-oriented, mission-mode programmes that help revitalisation of the family farming heritage of the Asia and Pacific region.

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Annexure A-7.1

Traditional Agricultural Practices of the Malayali/Malayalars of Kolli Hills

This case study explores the traditional farming practices of the Malayalis of Kolli Hills of Tamil Nadu, India. Kolli Hills has a total area of 490 sq km and comprises about 252 tribal villages. The Malayalis are patrilineal families with patri-local residence. Land and property inheritance and succession to various political authority offices are accomplished along the male line.

Economy

The main economic pursuit of the Malayalis is agriculture. Their traditional subsistence agriculture has been characterised by duties and responsibilities shared by all the household members and others in the same hamlet/village or surrounding ones. Agro-biodiversity is a fundamental feature of the Kolli Hills traditional farming system. Agro-biodiversity conservation has been linked with rich cultural diversity and local knowledge, particularly that of women. The traditional crops are well adapted to the local environment and thus less vulnerable to pests/diseases. Yield security, duration of the crop, taste, land availability, cultural and climatic and edaphic conditions and other functions of the crop, all determine the choice of crop to be cultivated. Choice of crops that are to be planted during a year also depends on a woman's preference for taste, good yield and easy processing of the grains.

About 15-20 years ago, the agricultural fields were cultivated with diverse food crops, which included a variety of cereals, millets, pulses, oil seeds, fruits and vegetables. The harvest of one crop was followed by another food crop. The primary staple food was *ragi*, followed by *samai* (*Panicum miliare*), paddy (*Oryza sativa*) and *thinai* (*Setaria italica*). The main sowing season begins with the onset of the south-west monsoon.*Vaigasi pattam* (season) or *Adi* (July-August) *pattam* are considered the optimum periods to sow the traditional food crops.

Land Use and Crop Management

The Malayalis are prudent in utilising the available water and land resources to cultivate various crops. The region receives rain from both the south-west and north-east monsoons. Malayalis classify their cultivable lands into *vayal*, *mettukadu* and *kollakadu* or *kothukadu*. Lowlands, where natural seepage of water is present, is known as *vayal*. This lowest region is usually covered by alluvial soil. *Mettukadu* or the uplands have medium to low water-holding capacity. This is the intermediate level characterised by sandy loam soil. Terrace cultivation falls in this topography. *Kollakadu* is generally characterised by rocky terrain with gravelly skeletal soil, and is at the highest level. The tribal farmers plan the cultivation of different crops and agricultural operations depending on the nature of the cultivable land, whether *vayal*,

mettukadu, or *kollakadu*. Traditionally, in the *mettukadu*, minor millets, pulses, *cholam* (Zea maize) and *puzhuthikar nellu* (dryland paddy) are grown as rainfed crops while in the *vayal*, wetland paddy varieties are grown. In the *kollakadu,* crops requiring less water and the least care such as *samai*, sorghum (*Sorghum bicolor*) and *thinai* are cultivated. Nearly 86 per cent of the agricultural lands in Kolli Hills come under rainfed cultivation. All of the traditional food crops, except a few cereal varieties, are suited for rainfed cultivation in the *mettukadu* and to some extent in the *kollakadu*.

Mixed cropping is widely practised in the uplands. Mixed cropping is a strategy where 4-5 crops are grown on the same plot. Mixed cropping and crop rotation as followed by the farmers are essentially risk-minimising strategies, aimed at food availability throughout the year. *Ragi*, *lablab*, mustard, pumpkin, thinai and amaranthus have been cultivated as mixed crops. *Ragi*, the main crop under mixed-crop cultivation, is considered to be very nutritious and can be consumed throughout the year.

Thottam or garden land, by and large found near houses and villages, is part of their agricultural production unit where fruit trees such as jackfruit, guava, banana and citrus species, as well as other crops like coffee, cardamom, and, in a few areas, tamarind are grown essentially for the market. Another type of land is *kirai*, which is the grazing land for cattle.

Such diverse cropping systems have been followed to ensure food security. Mixed cropping has been useful not only for a household's food security and dietary balance (which consisted of nutritious millets and protein-rich pulses) and nutritional benefits, but also enabled additional monetary benefits. The household generally has surplus items like mustard and pulses cultivated as crops in the mixed farming system. Benefits of mixed cropping include soil fertility, moisture retention, erosion control and fewer weeds.

Changing Trends in Traditional Farming

The traditional agricultural system of the Malayalar people at Kolli Hills has been undergoing changes and modifications in varying degrees during the past 20 years or so. Subsistence farming which was generally the characteristic feature until recently, has been greatly affected by the entry of tapioca (*Manihot esculenta*), a commercial crop, into their agricultural system. While tapioca cultivation has generated reasonable monetary gains, resulting in changing the lifestyle of the people, it has however contributed to the marginalisation of their traditional millet crops, pulses and a dryland rice variety. Pineapple (Ananus comosus) has also to a lesser extent played a role in displacing the traditional crop varieties. Similarly, the introduction of high-yielding rice varieties has contributed to the downgrading of their traditional rice varieties like *samba*, *mattakar* and *vellakar*. Associated agricultural practices and knowledge are

also under constant threat of disappearing. The Malayars have now primarily become producers rather than consumers of their farm produce.

Agriculture is not considered viable these days. There is a preference for non-farm jobs—a tendency increasingly surfacing particularly among the younger generation of the Malayalar community. Customarily, farm activities require the full and active participation of family members. Relatives and others in the hamlet are obliged to work for one another or render assistance during the peak season. Slowly, this is also changing. Dependence on outside work for livelihoods was not common. The process of selling their labour to outsiders has now begun and may increase.

Over the last 15 years, MSSRF has been engaged in promoting various interventions that focus on conservation, cultivation, consumption and commerce of minor millets in Kolli Hills (MSSRF, 1996; Vedavalli, 1998; 2004).

Annexure A-7.2[1]

The Kurichyas of Wayanad: One of the Largest Family Farmers of the World

Kurichya farmers of Wayanad district in southern India practise collective family farming by holding large areas of land through a unique family organisation. Kurichyas are "one of the largest joint families ever reported in anthropological literature" (Aiyappan and Mahadevan, 2008). These landed agriculturalists have organised themselves into big joint families. They are well known for organised game hunting, conservation of diverse plant and animal species, and for the immense traditional knowledge they possess on the natural resources around them (Kumar et al., 2010). A Kurichyamittom is a joint family of more than 100 members living in one single house complex with a large area of land under possession (Chacko, 1994; Kumar and Vedavalli, 1996; Ravivarma 2004). The agrarian system of the Kurichyasis based on collective ownership of land, cooperative agriculture and kinship labour (Aiyappan and Mahadevan 2008). It resembles the agrarian society of Kerala before the introduction of the caste system in the Sangam period. The unique social organisation based on matrilineal succession and the subsistence-based agriculture complemented each other to survive as a sustainable natural resource management model.

Kurichyas follow the matrilineal joint family system. The joint family live in a single house complex under the leadership of an elder male member called *odekkaran*. As an agricultural and hunting community, they consider land and their family members as important assets. They worship the ancestral spirit (*negal/muni*) as the sole owner of their properties. The man who established the *mittom* by acquiring land and mobilising the clan becomes a *negal* (shadow) after his death. The whole system works in the belief that the land and the family is the property of the *negal*. The present generation has to protect these resources as custodians. *Kunjukuttiyum makkalum* (the sisters and their children) are the second concern of the Kurichya system. Property rights and membership in the family descend through the females members. Farming, herding cattle, maintaining the house and cooking are the main chores of a Kurichya *mittom*.

Labour Organisation

In the joint family, the male and female members are organised under a family head called *odekkaran* (*pittan*). The odekkaran is in charge of managing the property and organising the members for family affairs and agricultural activities. He is given special respect by all in a Kurichya *mittom* (Aiyappan

1. Contributed by T. R. Suma.

and Mahadevan, 2008). The odekkaran will be one of the eldest male members of the family, elected by all elder male members. The decision will also have to be approved by the ancestral spirit (*negal*) and the three main gods through the shaman. The main duty of the *odekkaran* in day-to-day affairs is organising male members for agricultural activities, while his wife, the *odekkarathi*, deputes women members for work in the agricultural fields and kitchen and act as a leader of the womenfolk. The *odekkaran* is the custodian of the grain and seeds storage of the *mittom*, and he has to release sufficient volume of grain for daily cooking to the *odekkarathi*. She selects a group of women for that day's cooking and hands the grain over to them. They organise themselves into different subgroups and undertake all necessary steps to cook the food, including collection of vegetables from the yard. Cooking for the large family in the common kitchen is a group activity of women belonging to different generations. These groups work on a rotation basis. Distribution of cooked food is always the duty of the *odekkarathi*.

There is a clear gender division of labour among the members; cooking and maintaining the house is solely women's responsibility. Cattle herding, land preparation, sowing, and manuring are men's domain, while replanting, weeding, reaping, cleaning the harvested grains, etc., are women's domain. In the process of land preparation, sowing and harvesting, both men and women have different assigned interdependent tasks and roles. But the decision-making council of all male members called *kootam* has to approve all the decisions.

Contribution to Biodiversity Conservation

Currently the Kurichyas conserve 12 land races of paddy, many vegetables, 13 varieties of banana and numerous medicinal plants and tubers in their homesteads. In dry land, they cultivate coffee and other cash crops. Diverse food crops, varieties of traditional rice germplasm, medicinal trees, sacred groves and life-saving crops that can withstand adverse environmental conditions like drought, flood, etc., are found in Kurichya lands (Kumar et al., 2010). The culture and tradition of the Kurichya is associated with biodiversity. Rice varieties like *Chennellu*, *Veliyan* and *Gandhakasala* are common offerings at religious rituals and feasts. The cultivated diversity of vegetables, rice and other cereals and tubers in a Kurichya homestead is still the highest among the communities in the region.

The Kurichya community includes traditional healers, basket weavers and skilled carpenters, and there are a number of native plants associated with their work traditions. More than 50 species of inland fish and numerous plant species seen in the paddy fields are part of the Kurichya diet. The game meat from the neighbouring forests was an integral part of Kurichya culture and diet, until the enactment of the Indian Wildlife Protection Act in 1972.

Rituals

The Kurichya joint family system is rooted in its culture, and is expressed through numerous rituals and beliefs. There are three types of rituals observed in a year: life-cycle rituals of individuals, annual offerings to the deities and rituals associated with agriculture. Important life-cycle rituals are observed on birth, puberty (for girls), marriage, and death of an individual. All these rituals are the responsibility of the maternal *mittom* of the individual, irrespective of gender. It is the responsibility of all members to be present and organise the annual offerings to the family gods and goddesses. There are six different rituals associated with rice cultivation. All of these are observed in the first season (*nanja*) of rice cultivation. Specific rituals are associated with different rice varieties, based on crop duration and special characteristics. Thus variety conservation is greatly integrated with culture.

The whole process of collective rice cultivation is ritualistic. First the *koottam* (assembly) is called to get permission from the *negal* and *Thampayi* (God). Every stage of cultivation is started with a ritual. Sowing of the first seed for raising the nursery (*vithidal*) is observed on the very next day after *Vishu* (the popular harvest festival of Kerala). Beginning of transplanting of rice is *nattivaekkal*. This is started witha big feast called *sambalamoot*. Buffaloes are worshipped before starting ploughing and land preparation. The Kurichyas believe that *Makam* in the Malayalam month, *Kanni* is the birth star of rice. To celebrate the day, they worship the blooming first rice panicles. The following month is the celebration of reaping the first rice panicle of the season. The ritual associated with this is called *kathirukettal* and after this they go for a ritualistic game hunt in the nearby forests. *Koythu thudakkam* is the official beginning of the harvest. At the end of harvesting, they conduct *puthari* kolu, which is the offering to God as a 'thanksgiving' for a good harvest.

Changing Cropping Patterns and Agrarian Distress in Wayanad

The 20th century witnessed large-scale peasant migration from the southern plains of Kerala to Wayanad. Migration was encouraged under the "Grow more food" programme to address the food crisis after the Second World War by leasing out forest lands. This migration continued for 20 years and led to extensive dispossession of Adivasis, mainly Mullukurumas and Kurichyas, from their agricultural land. Encroachments and illegal transfers of Adivasi land made many of these traditional agriculturalists agricultural labourers, and they lagged behind the general development scenario of the state (Prasad, 2003; IIMK, 2006). This course of migration changed the demographic profile of Wayanad by making the Adivasi population a minority. In 1942, the Adivasi population of the region was 61,000 out of the total population of 74,000. But currently, the Adivasi population is only 17 per cent of the total population of the district (Krishnaprasad, 2010).

The peasant migration along with state agricultural policies changed the cropping pattern and ecology of Wayanad by starting intense food crop production and then shifting to cash crops in smallholdings. The capitalistic cash crop economy could not ensure sustainability in the economic development and biodiversity management of the region (Kurup, 2010). The price fluctuation of cash crops in international markets as also crop failures destroyed the agrarian economy of the district. Over 400 farmer suicides were reported from Wayanad during the period 1999-2006, owing to the indebtedness associated with farming (Mohanakumar and Sharma, 2006). Incidentally, none of the Kurichyas belonged to those "ultimate" lists; in fact the unique model of joint family farming had given them greater chance to survive the pressures and they could keep their traditions more or less intact.

The agricultural policies that aimed at mass production encouraged extensive use of chemical fertilisers and pesticides. Introduction of improved seeds swept away the traditional agro-biodiversity. The Kerala Biodiversity Board after analysing the data from Peoples' Biodiversity Registers reported the loss of 160 rice varieties, 12 pepper varieties, 13 banana and numerous vegetables and tubers from Wayanad's agro-ecosystem. The biodiversity hub became a land of plant diseases, soil and water pollution, and faced a steep decline in the productivity of all crops. In 1960, there were 40,000 hectares of rice fields in the region. It had come down to 11,832 hectares in 2007 and that also is scattered (Kumar et al., 2010). The changes in the agriculture and land use priorities disturbed the livelihood patterns and social organisations of the Adivasi communities, which evolved around the rice production system (Kurup, 2010).

Amidst all these changes, the Kurichya joint families have prevented the invasion of the capitalistic mode of cultivating cash crops and continue as subsistence producers with rice as their principal crop. The large area of land under collective ownership helps the Kurichyas develop a land and resource management system, which ensures continuity of the ecosystem, water cycle and maximum recycling of organic matter. As the Kurichyas put forward a model for natural resource management and family farming, they demand greater attention in this context.

Annexure A-7.3[2]

Kuttanad and Koraput: Two Globally Important Agricultural Heritage Systems

Kuttanad Below Sea-level Farming System and the Koraput Traditional Agricultural System are two prominent examples that foster the family farming heritage in India. FAO has recognised both these systems as Globally Important Agricultural Heritage Systems. The recognition of these unique farming traditions has inspired pride among the local communities and bestowed further motivation for conservation and enhancement of such farming heritage.

Kuttanad Below Sea-level Farming System

Spread over an area of 110,000 hectares of networked lagoons and creeks, Kuttanad is one of the significant rice cultivation centres of Kerala, a densely populated state of India where historically the land for large-scale cultivation has been very scarce. Kuttanad Below Sea-level Farming System (KBSFS) is unique as it is the only system in the country that practises rice cultivation below sea level and is a masterpiece of manual reclamation dauntlessly done by individual entrepreneurs with rudimentary and scanty resources and traditional technologies.

With differing composition, structuring and use patterns, KBSFS is functional and efficient in terms of conserving biodiversity and ecosystem services—largely regulation of the hydrology of the region and maintenance of livelihood services to the local people. Agriculture and inland fisheries are the major land/water use practices of the system, and are considered the largest wetland use system in the west coast of the Indian peninsula (MSSRF, 2007). Traditionally, the efficiency of KBSFS has been demonstrated by the cultivation of one crop of paddy without any external fertiliser inputs, followed by inland and estuarine fish wealth, notably the endemic prawn species, pearl spot and clams.

The natural land formation in the region made the people aspire for more and more land and start developing the polder system of pumping out water and changing the course and intensity of river flows and lowering lake depths to reclaim land. One of the inventive practices of the early days was construction of retaining walls with dry rubble packages, known as pulimuts, that served as speed barriers to change the course of the flow of water and to protect the river banks. The reclaimed and naturally formed lands, popularly known as *puncha vayals*, were used mainly for one-season rice cultivation.

2. Contributed by Smita Mishra.

Contiguous flat patches of *puncha vayals* that range between a few hectares to 2500 hectares in size are known as *padasekharams*, and are bordered with coconut gardens on the bunds and criss-crossed by water canals, offering a wonderful sight. Out of the 14 districts of the state, only two have fairly large areas of rice cultivation and production—Palakkad district and Kuttanad. These two are the "rice bowls" of Kerala and are very dissimilar in their ecology and landuse approaches. Even with the changing environmental and socio-economic conditions, rice will be the only crop that is suitable to the lowland of Kuttanad, and Keralites who are mainly rice eaters need to give high priority to protect this system.

Koraput Traditional Agricultural System

The Koraput district of Odisha, India, is well known for its rich cultural and biological diversity. Tribal communities inhabiting this region belong to Proto-Australoid ethnic stock and speak the Austro-Asiatic language, Munda. Sixty-two tribal communities in varying concentrations live in the district and constitute 49.6 per cent of the total population. Of the total population, 83 per cent live in rural areas and 84 per cent live below the poverty line. Their main livelihood option is agriculture and 32.45 per cent of the population are cultivators. Marginal and small farmers are dominant in the district with a holding of 0.1-4 ha. They have rich, time-honoured knowledge on existing agricultural crops and practices and forest species. Most importantly, their knowledge systems are also constantly evolving in response to changing climatic and environmental conditions.

Koraput district forms a major part of the Jeypore tract of Odisha, which has been established as one of the centres of origin and diversity of Asian cultivated rice (*Oryza sativa L.*). Numerous landraces and traditional varieties of rice with impressive morphological, agronomic and physiological characters are cultivated in different ecologies situated at elevations varying from 150-1000 metres above mean sea level. Tribal farm families have been cultivating these landraces for thousands of years, which allowed them to evolve naturally to adapt to changing biotic and abiotic stresses.

Rainfed agriculture is predominant, and cultivation is carried out in three seasons, *viz*., summer, autumn and winter, extending from May/June to February/March. Rice is cultivated in fragmented lands located in different agro-ecological zones—upland, medium land (irrigated and rainfed), low land and *jhola* land (deep lowland). Within each such zone, numerous rice landraces/traditional varieties are grown, depending on family preferences and local trading. Traditional rice varieties are well adapted to the agro-ecological conditions and provide stable yields with low inputs under unfavourable climatic conditions. Duration of the crop varieties, family food needs and the requirement for socio-cultural and magico-religious functions

form the basis for selection of the varieties grown.Some specific landraces are tolerant to disease and pest, drought and flood.

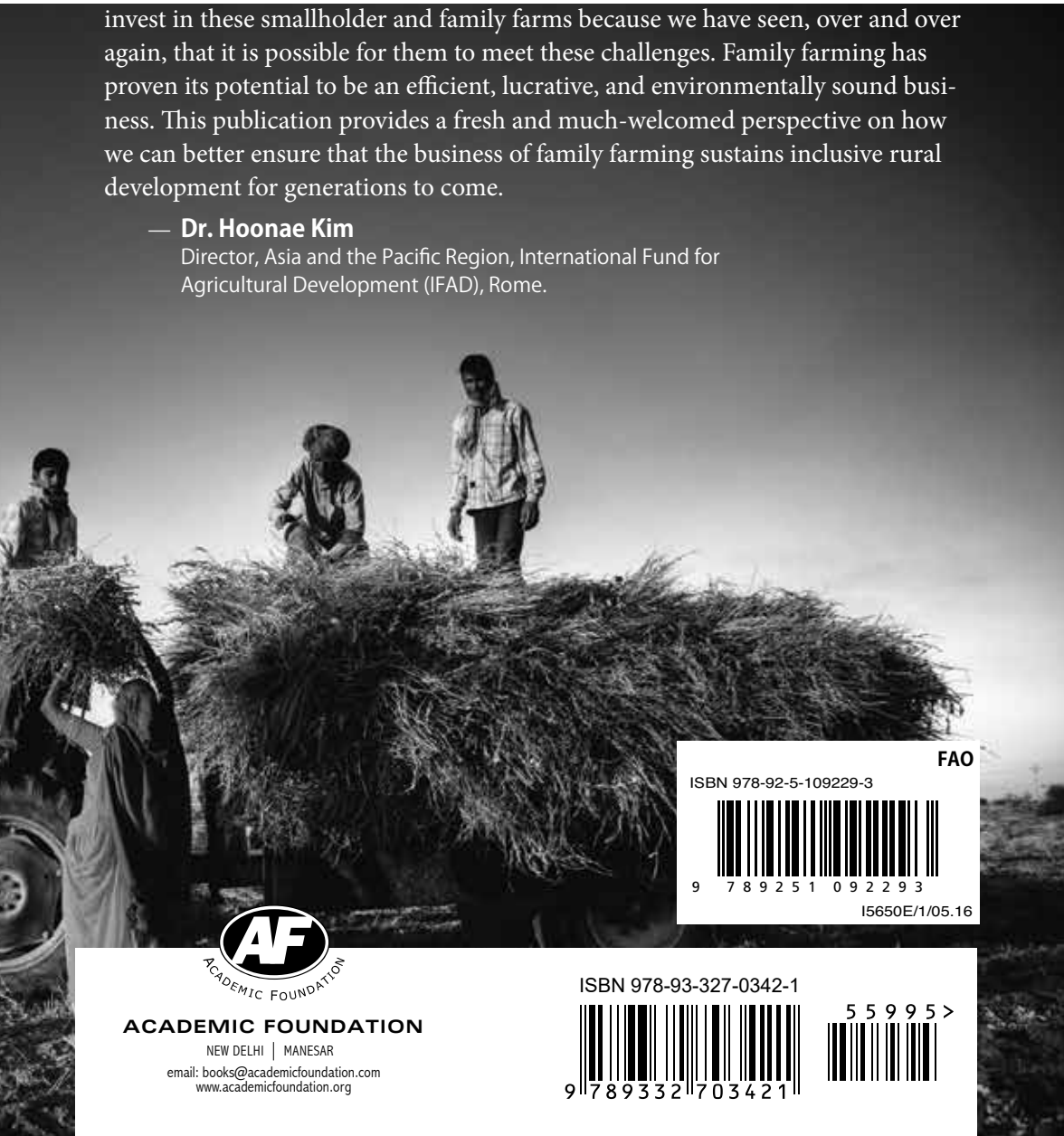
Tribal farm families use various selection criteria before going in for cultivation of a particular landrace. These include landraces that are tall, resistant to lodging, diseases and pests, with black or purple leaf sheath, holding long and heavy panicles, and having bold and medium slender grains with good threshing and milling quality. Long and broad leaves are given priority as they suppress weeds. Black or purple leaf sheath helps in identifying weeds at an early vegetative stage. Grains with pigmentation are often selected as that helps in rouging the field and physical cleaning of the grains while selecting the seed. Coarse grains are preferred for daily consumption as they swell on cooking and provide a thick gruel that could be consumed as a meal during lean periods. Landraces that are suitable for value-added products (like popped, puffed and pressed rice) are highly preferred by the communities. Aromatic landraces have good palatability and fetch a good market price compared to normal landraces. Tribal traditional farming systems are highly sustainable; they have been practised for thousands of years without harming the ecology of the region. Tribes have emotional attachments to their landraces as those are the only legacy they have received from their forefathers, and they respect them by continuing their cultivation.

Brilliantly written and well-grounded in real life examples, this collection of research papers explores in a concise form the role family farming has played in addressing one of the pressing challenges of our age—reducing hunger.

— **Dr. Daniel Ruiz de Garibay**
Asia-Pacific Sector Coordinator, World Rural Forum.

Family farms produce the majority of Asia's food using, on average, a hectare of land or less a piece. As populations grow, living standards rise, and as populations migrate into cities from rural areas, they will be under more pressure than ever to improve their yields and to withstand climactic and market shocks. At IFAD, we invest in these smallholder and family farms because we have seen, over and over again, that it is possible for them to meet these challenges. Family farming has proven its potential to be an efficient, lucrative, and environmentally sound business. This publication provides a fresh and much-welcomed perspective on how we can better ensure that the business of family farming sustains inclusive rural development for generations to come.

— **Dr. Hoonae Kim**
Director, Asia and the Pacific Region, International Fund for Agricultural Development (IFAD), Rome.



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