Review of social and economic issues for food security studies in the Eastern Gangetic Plains

Report for Food Security through Food System Innovation: Inquiry 3

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CSIRO Ecosystem Sciences and Sustainable Agriculture Flagship

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List of Acronyms

ABL	Above Poverty Line
ADB	Asian Development Bank
ADBL	Agricultural Development Bank Ltd
ADBN	Agricultural Development Bank - Nepal
AIC	
AMC	Agricultural Marketing Corporation (Nepal)
AMIS	Agency Managed Irrigation Scheme
APC	Agricultural Prices Commission (India)
APMC	Agricultural Produce Marketing Committee
APP	Agriculture Perspective Plan (Nepal)
ASC	Agricultural Supply Corporation (Nepal)
ATMA	Agricultural Technology Management Agency
BADC	Bangladesh Agriculture Development Corporation
BC	Backward Caste
BPL	Below Poverty Line
BSFCSC	Bihar State Food and Civil Supplies Corporation
CIMMYT	International Maize and Wheat Improvement Center
CSD	Civil Supplies Department (Bangladesh)
CSIRO	Commonwealth Scientific and Industrial Research Organisation (Australia)
DAE	Department of Agricultural Extension (Bangladesh)
DOA	Department of Agriculture
DOI	Department of Irrigation
DTW	Deep Tube Well
EAP	Employment Assurance Scheme
EGP	Eastern Gangetic Plains
EPA	Enemy Property Act (Bangladesh)
ePDS	Electronic Public Distribution System
FCI	Food Corporation of India
FFE	Food for Education (Bangladesh)
FFW	Food for work (Bangladesh)
FMC	Food Management Corporation (Nepal)
FMIS	Farmer Managed Irrigation Scheme
GDP	Gross Domestic Product
GFC	Global Financial Crisis
GOI	Government of India
GPS	Global Positioning System
GSDP	Gross State Domestic Product
Ha	Hectare
HDI	Human Development Index
HP	Horse power
HYV	High Yielding Varieties
HYVP	High Yielding Varieties Program
IAAP	Intensive Agricultural Areas Program
ICT	Information and Communication Technology
IDE	International Development Enterprises
IFAD	International Fund for Agricultural Development
IFPRI	International Food Policy Research Institute
ILO	International Labour Organisation
IMF	International Monetary Fund
IMT	Irrigation Management Transfer
IRDP	Integrated Rural Development Programme
IRRI	International Rice Research Institute
IWMI	International Water Management Institute
JRY	Jowahar Rozgar Yogana
Kg	Kilogram
KVK	Krishi Vigyan Kendras
LRAP	Land Reforms Action Program (Bangladesh)

MASL	Metres above Sea Level
MDG	Millennium Development Goals
MOU	Memorandum of Understanding
MSP	Minimum Support Price
NAP	National Agriculture Policy (Nepal)
NARC	Nepal Agricultural Research Council
NCCLRP	NGO Coordination Council for Land Reform Programme
NDA	National Democratic Alliance Party (Bihari political party)
NFC	
NGO	Non Government Organisation
NREGA	National Rural Employment Guarantee Act
NREP	National Rural Employment Program
NSC	National Seed Company (Nepal)
NSP	National Seed Board (Nepal)
NW	Northwest
O&M	Operation and Monitoring
OBS	Other Backward Castes
PAR	Participatory Action Research
PDS	Public Distribution System
PFDS	Public Food Distribution System
PIM	Participatory Irrigation Management
PPS	Party-less Panchayat System (Nepal)
PRADAN	Professional Assistance for Development Action, Indian NGO
RCNP	Royal Chitwan National Park (Nepal)
REC	Rice Export Companies (Nepal)
REDD	Reduced Emissions from Deforestation and Degradation
RJD	Rashtriya Janata Dal (Bihari political party)
RKVY	Rashtriya Krishi Vikas Yojna
RLEGP	Rural Landless Employment Guarantee Program
RMP	Rural Maintenance Program (Bangladesh)
Rs	Indian Rupees
SAARC	South Asian Association for Regional Cooperation
SC	Scheduled Caste
SEB	State Electricity Board (India)
SGRY	Sampurna Gramin Rojgar Yogana
SHG	Self Help Groups
SMS	Short Messaging Service for mobile phones
STW	Shallow Tube Well
TP	Treadle Pump
TRIPS	Trade Related Intellectual Property Rights of WTO
TW	Tube Well
VDC	
VGD	Vulnerable Group Development
VPA	Vested Property Act
WFP	World Food Program
WGP	Western Gangetic Plains
WHO	World Health Organisation
WTO	World Trade Organisation
WUA	Water User Association
WUG	Water User Group

1 Executive summary

This literature review aims to contribute towards understanding the incentives, constraints and innovation pathways that have and could increase food security in the alluvial East Gangetic Plains (EGP). The EGP is in hydrological terms part of the Ganges River basin and in geological terms it comprises the eastern section of the Indo-Gangetic Plains. In terms of jurisdictions, it is comprised of: the contiguous Indian States of Bihar and northern West Bengal; the northwest of Bangladesh; and the Terai region within Nepal. In socio-economic terms, the region's jurisdictions are in varying degrees of agrarian transition and terms of integration into the global economy. There is little doubt as to the persistence of food insecurity in the 'poverty square' of South Asia or the fact that it cannot be explained in purely biophysical terms. All of these hydrological, geological, jurisdictional and socio-economic aspects of the EGP are integral to the problem of achieving food security. Thus a systems perspective is necessary to pinpoint consequential interdependencies for increasing food security in the EGP, such as those between energy markets and irrigation development, land redistribution reform and the fragmentation of agricultural holdings, rural livelihood diversification through migration and the availability of agricultural labour.

1.1 Historical and political origins of food insecurity

The persistence of food insecurity within the EGP has clear historical and political origins (Figure 1). Under the British Raj during World War II, the inflammatory war economy and threat of Japanese invasion led to the Great Bengal Famine of 1942. The Bengal Famine was a failure of entitlement; food was available but unaffordable. Peasant rioting ensued from 1945 to 1946 over the exploitative terms of sharecropping which entitled landlords to 50% or more of crops. The fight for food security polarised the Hindu Congress and Muslim League Parties. The British 'resolved' this agrarian conflict by partitioning the Muslim east (Bangladesh) and west (Pakistan) from Hindu India in 1947, and granted India independence in 1951. Subsequent short wars between India and Pakistan (1965) and East and West Pakistan (1971) re-partitioned the subcontinent into three nations. Newly independent but war ravaged Bangladesh was famine ridden by 1974. Ironically, being the recipient of world's second largest flow of food aid by 1975 enabled Bangladesh to harness the structural adjustment pressures that ensued in the 1990s to kick-start a Green Revolution that has achieved national foodgrain self-sufficiency.

India, in its sheer economic and demographic enormity, has evolved from British Raj into a consequential multi-ethnic democracy, as evidenced by the retention, indeed attraction, of Muslim Bengalis. Able to launch a Green Revolution with American expertise and aid on the Western Gangetic Plains in the 1960s, India reached foodgrain self-sufficiency much earlier than Bangladesh. India has since confronted the persistence of its poverty traps under the glare of official designation of the poor as belonging to backward castes and tribes. A distinctly Indian welfare net providing subsidised employment and foodgrain to these groups has evolved through the federally fractured power struggles between elite and marginalised socio-economic groups. Both criminal and reformist state governments in India's north-eastern states of West Bengal and Bihar arose from this agrarian dynamic with profound effects upon levels of agricultural production and food security. In comparison to Bangladesh, structural adjustment pressures have essentially been shrugged off by India.

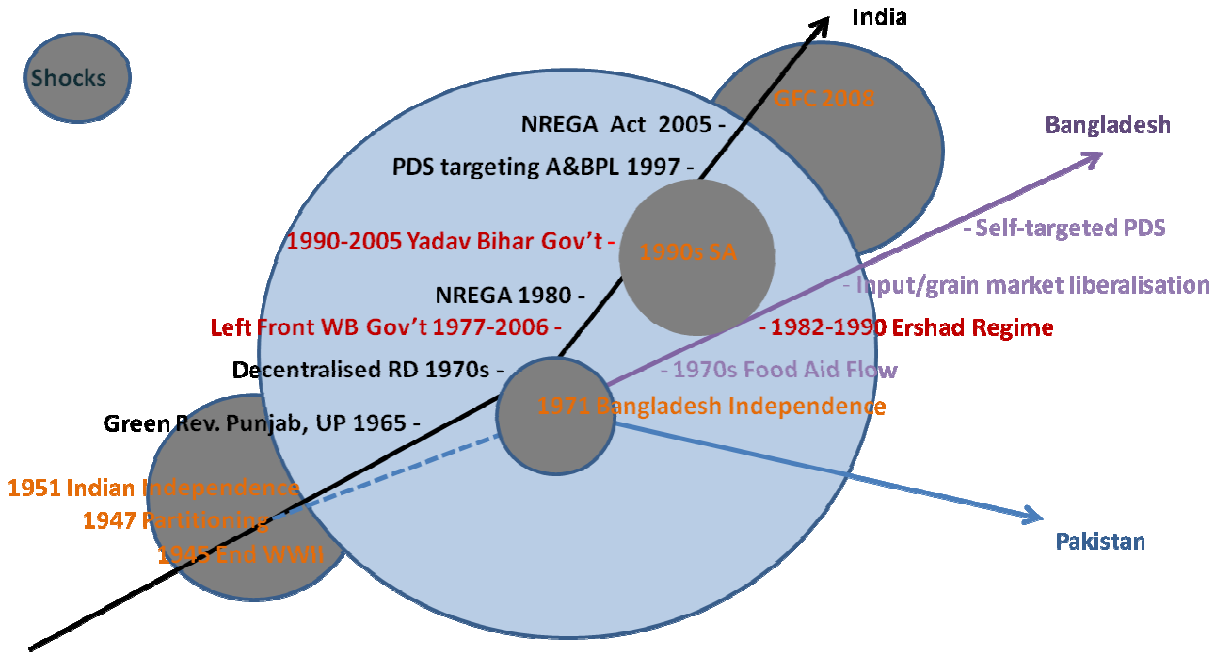

Figure 1 The differentiation of Bengal

Nepal (Figure 2) only emerged from centuries of political isolation as a national entity in 1950 in contra-distinction to the British Raj. Over the past 60 years, Nepal has transitioned from a tributary state dominated by an upper caste Kathmandu elite. The most dramatic facet of Nepal's transition is the unplanned colonisation and deforestation of the Terai Plains by marginalised socio-economic groups seeking food security. A highly factional politics has prevailed in Nepal under both authoritarian and democratic forms of governance that has fragmented aid efforts and confounded the harnessing of structural adjustment pressure to increase food security evident in Bangladesh. Nepal's deeply entrenched poverty was instead challenged through a Maoist inspired peasant rebellion now mostly contained in parliament. However the elite view of Nepal as a pure Hindu state and poverty of multiple ethnicities and tribes is yet to be constitutionally resolved. Although the lowland convergence concentrated agricultural production on the Terai over the past 50 years, production remains at subsistence levels.

The famines and chronic food insecurity that have shaped the political contours of contemporary EGP are deeply engrained on the psyche of farmers and policy makers alike. Decisions entailing strong path dependencies were made at the moment of the nations' emergence. A preference for prioritising national foodgrain self-sufficiency and avoiding food imports became entrenched. A legacy of the EGP's political history is the tendency to conflate household food security with achieving national food self-sufficiency by focusing upon raising agricultural production. However, the Green Revolution that famously unfolded in India's western states in the 1960s enabled large landholding elites to monopolise benefits which had the effect of increasing the food insecurity of the asset-poor landless and sharecroppers. Further, the systems established during the 1950s to distribute subsidised foodgrain to the food insecure have proved prone to elite capture which has resulted in high leakage rates from these safety nets, most particularly in Bihar.

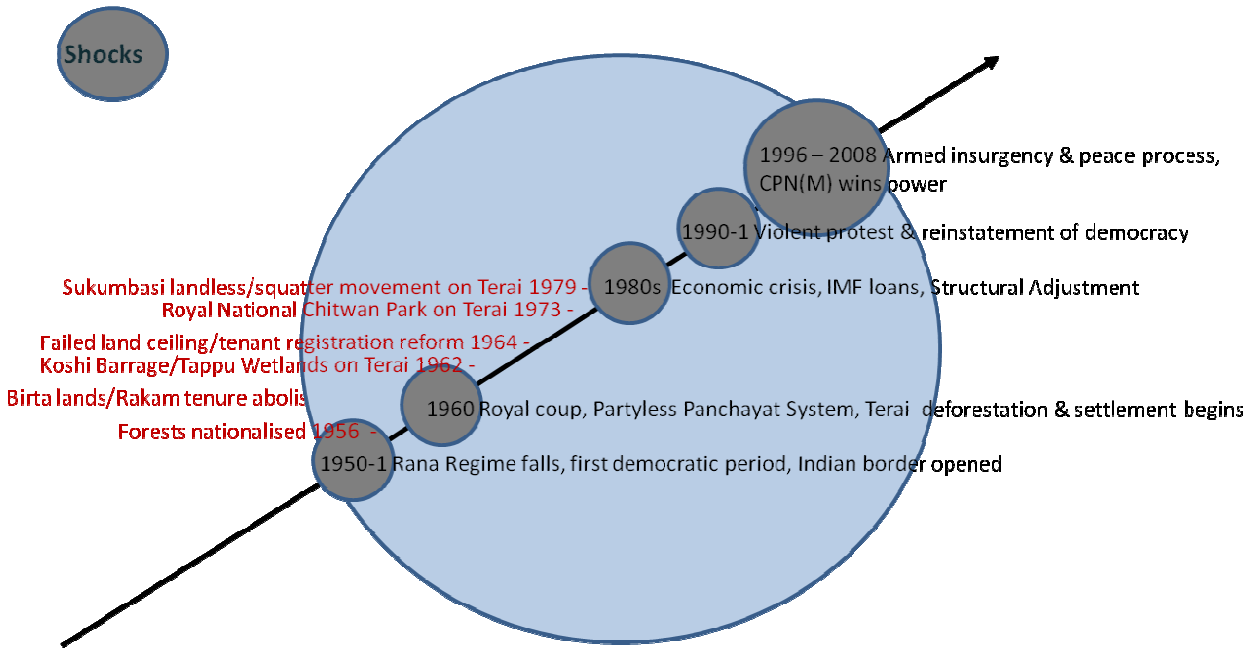

Figure 2 Nepal's historical trajectory

Reforms to redistribute land confiscated from holdings above a 'ceiling' and tenant registration programs such as Operation Barga were successful in West Bengal under a Left Front Government, but received largely rhetorical support elsewhere in the EGP jurisdictions. The intersection of India's caste system and populist electoral politics has politically mediated caste identities in Bihar and West Bengal. New caste alliances, more secular behaviour and increasing social mobility across caste barriers form strong trends. The politics of caste tend to worsen economies of scale – partially successful land reform increased land fragmentation and infertility in West Bengal.

Trying to address the varied political-institutional contexts within the EGP solely with the technical solutions of the Green Revolution will not necessarily encourage links to be made between the socio-political and technical domains in manner helpful to the food insecure. How to encourage such links in the varied contexts of the EGP forms a pivotal overarching research need.

1.2 Production trends

Trends in agricultural production within the EGP appear to follow jurisdictional contours. Production of rice is high for West Bengal and Northwest Bangladesh, but remains low for Bihar and the Terai of Nepal, largely because of their small areas of dry season rice and minimal use of groundwater irrigation. Rice yields for the summer/boro rice crops (~3-3.5 tonnes/ha) are higher than the kharif rice crops (~2-2.5 tonnes/ha). Rice yields have been steadily increasing across the region, but it is summer/boro rice crops that have provided the greatest gain in production due to the use of supplementary irrigation. Bangladesh's significant increase in rice production over the last 20 years demonstrates the feasibility of achieving food self-sufficiency within all of the EGP jurisdictions.

The key physical and technical issues preventing increased rice production in Bihar and Terai include the inadequacy of irrigation and transport infrastructure, poor availability of pumps (diesel or electric), power tillers, tractors and high yielding varieties, under–utilisation of fertiliser and lack of access to markets. Obtaining inputs is particularly difficult for the majority of farmers who are landless or lack adequate holdings. The prevalence of exploitative sharecropping arrangements and insecure tenure disallow

investment in irrigation infrastructure as land is required as equity to obtain institutional credit. Tenants and sharecroppers may well require short turn around and high return crops to justify investment in inputs.

Unlike the now functional rice market of Bangladesh, Bihar's farmers are not obtaining India's minimum procurement prices for rice, so lack an incentive to grow rice beyond subsistence levels. Bihar has been considered India's most backward and politically regressive state. While the governance of Bihar has much improved since 2005, increasing production will still take considerable time and effort. Such barriers raise the question as to whether using irrigation to increase the cropping intensity of summer (dry) season rice production in Bihar and Terai constitutes the best approach to increasing food security. An alternative approach to would be to increase the diversity of higher-value crops and utilise potential irrigation water in the dry season to improve livelihoods. Both strategies require groundwater utilisation and improved infrastructure to link products to markets and, potentially, longer value chains. Diversification into cash crops or horticulture in the dry season using groundwater is a proven strategy in West Bengal.

It is uncontroversial to recommend improving the physical and technical aspects of production such as irrigation, road infrastructure, varieties and rice crop management (e.g. fertilisers and other chemical inputs). However, improving household food security in the more challenging jurisdictions of Nepal's Terai and Bihar may also benefit from policy and institutional measures such as:

- Improved implementation of minimum procurement prices for rice;
- Encourage state government extension services to utilise NGOs expertise in upliftment and empowerment to develop the capacity of marginalised farmers to negotiate contracts, land access and niche markets; and
- Explore whether land tenure and sharecropping arrangements could be made more equitable and profitable.

1.3 Water and food security

Increasing agricultural production in the EGP is reliant upon dry season irrigation. There is currently insufficient irrigation, particularly in the Terai and Bihar. Climate change is expected to lower dry season flows while increasing catastrophic flooding events making a more regional style of cooperation and coordination between the EGP jurisdictions pressing. Cross-border cooperation is currently restricted to bilateral treaties between the economically dominant India with Nepal and Bangladesh respectively. Equitable sharing of water flows during the dry season has remained a contentious issue since the three nations emerged.

Engineered structures such as India's Kosi Barrage, located on Nepal's Terai, and the Farakka Barrage in West Bengal that 'divides' water between India and Bangladesh have controversial downstream impacts. Improved operation and management of the Farakka and Kosi barrages to reduce water logging and flooding would assist food production and security at the household level, particularly in flood prone Bihar. Researchers also recommend moving from an engineered approach to flood control to flood management by using softer systems such as community based upstream–downstream flood forecasting to move information rapidly across borders.

As the modern engineered surface water schemes have proved to yield disappointing command areas, rehabilitation of traditional surface water Farmer Managed Irrigation Systems to achieve dry season irrigation has become popular with researchers and donors. However attempts to revive the tradition of self-governance so as to transfer operation and maintenance costs for deep tube wells and tertiary canals to farmer groups in the Terai and West Bengal have proved patchy. One reason for farmer resistance to these attempts at 'participatory irrigation management' is the relative advantage of investing in shallow tube well bores and pumps to tap groundwater on an individual basis.

Shallow tube well (STW) irrigation makes water available on demand at the point of use and encourages complementary investments in agricultural inputs. Local water markets have developed as owners seek to recover their costs, a development which has made groundwater more accessible to small and marginal farmers than land. The STW economy has grown rapidly across South Asia over the past thirty years. Within

the EGP, growth has been strongest in Northwest Bangladesh, significantly slower in West Bengal, and surprisingly poor in groundwater rich Bihar and Terai.

Electricity is a cheaper pump fuel than diesel and rural electricity provision in Bihar and Terai is poor. Reliance on diesel in Nepal and Bihar explains their less intensive use of groundwater. There is a: '...clear but paradoxical east-west energy-divide in India, with the water abundant Eastern states saddled with diesel pumps, while water-scarce western and southern India are well endowed with electric pumps ...' (Mukherji, 2008:1084).

The sheer number of individual investments facilitated by the STW economy has led to troubling cascade effects in north-western Indian states. Rural vote banks, protective of subsidised electricity supply, have developed in India's western and southern states. West Bengal, in contrast, has metered all STWs and charges farmers at near commercial rates, which has stimulated high levels of innovation (economising).

Current data on groundwater depletion in West Bengal and Northwest Bangladesh indicate that current groundwater utilisation levels are sustainable given the high rainfall and groundwater replenishment in the EGP compared to the Western Gangetic Plains. It is a research priority to what incentives at what threshold would strengthen STW development in Bihar and Terai.

1.4 General socio-economic setting – who and where are the food insecure?

Population pressure in the face of limited land resources is the main driver of household food insecurity in the EGP. Landless households suffer the worst food insecurity and landlessness typically correlates with the Indian Scheduled Caste, Backward Caste and Other Backward Caste designations, which have constitutional status. The Scheduled Caste of Dalits (untouchables), for example, are predictably landless, disempowered and impoverished. Thus, food insecurity is entangled with caste and tribal identities and their relative socio-economic status within Hindu caste hierarchy. To the extent that low status, identity-based groups cluster in particular districts and villages, the spatial arrangement of food insecurity will be predictable.

The West Bengal experience indicates that land redistribution is an incomplete solution to this problem. Land is tightly held, and highly fragmented, across the EGP, having deep cultural resonance further to its economic utility. It is possible that the political limits to such reform have already been reached. Improving the security of tenants through registration and improving the terms of sharecropping seem more promising avenues for households with no land or insufficient land to meet their subsistence needs.

The agrarian transition, that is, reduced importance of agricultural sector relative to industrial and service sectors, is least advanced in the Terai followed by Bihar. Apart from the high number of food insecure households on the Terai, there is also more fragmentation among households along ethnic-caste lines. However, there is also more social capital within these traditional affinity groupings that is used to ease food insecurity within groups. The agrarian transition is most advanced in Bangladesh followed by West Bengal; as indicated by their higher access to alternative and urban or overseas employment. The dynamics of transitioning turn on how feudal rural power relationships are. Specifically, the more landless households there are, the more landlords can extract from agricultural labourers, sharecroppers and tenants. Downward pressure on agricultural wages will then prevail. Where households with insufficient land to subsist can access alternative (urban or overseas) employment, upward pressure is placed on agricultural wages. Access to non-agricultural income, however, is spatially variable which is why West Bengal's poverty decreases towards Kolkata – a major unskilled labour market.

Access to credit is another key variable and this has suffered across the EGP under economic liberalisation since the 1990s. However, West Bengal has demonstrated the self-help groups (SHGs) can be an effective way to increase institutional credit provision to the impoverished.

Food insecurity is culturally and socio-economically stratified within and between the EGP jurisdictions. The intensification of foodgrain production through purely technical interventions has historically been prone to elite capture and is unlikely to assist food insecure households and groups. Households reliant on

agricultural labour for income lack the ready means to participate in and benefit from such intensification. Either an exit from rural labour markets altogether or opportunities to participate in a stronger and more inclusive rural economy without needing substantial land-ownership will be necessary. Whether more inclusive rural economies could be encouraged with innovation platforms around improved marketing, input provision, value-adding and small scale mechanisation and its servicing arising from dry season irrigated crops is highly researchable.

1.5 Key drivers of labour availability

India's National Rural Employment Guarantee Act (NREGA) and, throughout the EGP, migration are important livelihood strategies for the rural poor. NREGA and migration provide a source of cash income that can supplement other forms on-farm and off-farm income as well as subsistence agriculture. In the case of India's NREGA, there is considerable opportunity to target NREGA's earth works for the creation of productive irrigation assets. Scope exists also for fostering partnerships between the state departments managing NREGA and NGOs who often have closer ties with rural communities and understand their challenges and priorities more intimately. Access to NREGA is also an issue for the rural poor, with the opportunity to secure the 100 days of paid unskilled labour entitlement proving to be highly variable in Bihar and West Bengal. Once again, fostering partnerships between NGOs and underserviced communities to facilitate access to such entitlements can enhance purchasing power and consequently, food security and access to education and health services. Researchable areas include investigating where NREGA is ineffective and why. Greater understanding of the key issues and developing partnerships and linkages in the field can foster the creation of innovation platforms where NREGA representatives, NGOs and underserviced communities work together to improve service delivery and create productive assets.

Both NREGA in India and migration in the EGP, while providing important supplemental income to rural households, have created the paradoxical 'labour shortage' in one of the most populated regions on earth. These institutions have increased the opportunity cost of agricultural labour. The low returns to labour provided by paddy cultivation also favour these alternative livelihood strategies. To keep farmers farming, it would be necessary to increase the returns to agricultural labour which could be achieved through reducing costs (e.g. economies of scale, consolidation of farming blocks), increasing productivity of staple crops, or through the cultivation of higher value agricultural commodities. Improving the efficiency of agricultural value chains can also increase farm gate prices, and therefore, the returns to their labour. Particularly in India, the predominance of the Public Food Distribution System, high leakage rates in Bihar and West Bengal, and how this relates to farm gate prices are important researchable issues. Research around value chains and how to enhance value at the producer level is also a theme not well addressed in the literature.

With male migration, women are increasingly becoming involved providing agricultural labour – the so-called feminization of agriculture. Women's involvement in agriculture has important implications for rural extension and NGO engagement where traditionally, these services were targeted toward the male headed rather than female headed household. In Bangladesh's experience, migration has had an important impact in increasing women's household decision-making authority though this seems to be less true in the case of India. How are NGOs responding to this changing dynamic? Are their models of service delivery evolving as a response? Answers to these questions can help design service delivery strategies that are responsive to this dynamic and better targeted to diverse household priorities.

Male migration and rising labour costs have also increased the demand for labour-saving technologies on farm. Mechanization has occurred at a rapid pace, particularly in Bangladesh. Significant adaption of the mechanisation strategy is required to cope with plot size and fragmentation and to target appropriate technologies specific household types. Consideration should also be given to how mechanisation affects female-headed households and female casual agricultural labour.

In India, migration has reduced the relevance of caste. Furthermore, those that migrate and later return to the country-side often return with new ideas which can enhance innovations in agriculture as well as in

non-farming activities such as in the development of rural industries. Exploration of the role of out migration in contributing to social equity and rural development are researchable topics of importance.

While maintaining agricultural production may have important consequences for household food self-sufficiency, households also require disposable income for consumption of food not produced on farm, and to purchase services such as education, health and other basic necessities. In many cases, the potential for staple crop cultivation in delivering disposable income is very limited. Off-farm developments and sources of income are important. Greater access to education could for example deliver the greatest gains in achieving food security and an improved standard of living in the long run. Exploring the returns to develop assistance can provide insights that can help target aid.

1.6 Input and output markets

Both Bangladesh and Nepal began liberalizing their markets and reducing domestic support for agriculture in the 1990s, though Nepal has been less successful. Bangladesh offers a low level of domestic support to agriculture while in India, large subsidies are offered, particularly for fertilizer. The penetration of subsidies in Bihar and West Bengal is less than in other regions of India while the dysfunctional public food distribution systems (PFDS) in Bihar and West Bengal offer further disincentive for producing foodgrains.

Bangladesh is ahead with regards to high yielding varieties (HYV) seed, but could still achieve productivity improvements with greater supply. In West Bengal and Bihar, limited improvements in yields, grain quality and taste, the price of seed, farm gate price of HYV paddy and farmer awareness all partially explain a lack of uptake. Legislation in favour of the patenting of seed has been shown to be effective in increasing private sector investment in the case of maize in Bangladesh. Research into the development of HYV and in innovative ways of getting seed to farmers when demand is greatest is important in all of the EGP sub-regions.

Investigating the potential for farmers to add value to their product can enhance food security. Bangladesh's experience in this regards is interesting, where lower quality rice is being processed by mills and transformed to higher quality fine rice. However, since the value added is created by the processors, farmers do not capture these margins. The Bangladesh experience indicates that labour and input outlays are similar for the production of different qualities of rice. Increasing production of higher yielding varieties of fine rice seed could increase both producer and consumer surplus.

A low ratio of the number of extension agents to farmers is symptomatic across the EGP. Fostering linkages between research universities and institutes and NGOs can be a viable model to developing appropriate technologies and getting them to farmers as well as generating awareness with regards to their entitlements. In the case of Nepal, farming is a relatively recent activity. Knowing what basic capabilities are required and developing delivery options could generate significant gains at low cost.

Low levels of irrigation in West Bengal, Bihar and Nepal partially explain their poor agricultural performance. Access to electrification is a significant barrier to increasing irrigation and as a result, ground water pumps are largely diesel-operated in the EGP, exposing farmers to international price fluctuations which have a significant impact on agricultural profitability. In North West Bangladesh and in West Bengal in particular, there is concern around groundwater depletion. Benchmarking and monitoring groundwater supply in the EGP and research designed to inform ground water extraction policy would be useful research goals.

Overall, it is important to understand the constellation of factors governing the incentive structure that makes rice production an economically viable proposition in the North West of Bangladesh, but much less so, and often only a subsistence activity, in West Bengal, Bihar and the Nepalese Terai. Relative input-output prices, variable yields, cropping strategies and intensity, differing availability of infrastructure and transport margins are all important variables. A systematic comparative cost benefit and value chain analysis of key agricultural commodities conducted in each country of the EGP region would shed light on potential intervention points to enhance food security. Comparative studies of this nature do not exist in

the literature. Cost benefit and value chain analyses that do exist are for a single country or region, are often out-dated, and employ methods that render the results incomparable.

The variable impact of market liberalization on agricultural development in the EGP is an important puzzle. Both Bangladesh and Nepal liberalized significantly in the 1990s, though Nepal is lagging behind in terms of productivity. India on the other hand has maintained tight controls on trade and provides substantial support to its agricultural sector in the form of subsidies. The PFDS, while relatively small in Bangladesh and Nepal, is a behemoth in India and results in significant distortions. In contrast, market liberalization resulted in the downsizing of the PFDS in Bangladesh and Nepal. What sorts of trading arrangements could leverage comparative advantages between while enhancing food security across the EGP jurisdictions?

1.7 Public food distribution systems

India has the largest PFDS in the world. Bangladesh's PFDS manages a small share of total grain production and is targeted through the use of (less desirable) wheat and in-kind programs such as food for work. Nepal's system is also small, less targeted and suffers from logistical challenges arising from Nepal's extreme geography. All systems are plagued with problems of leakages. Given the importance of the PFDS in influencing foodgrain supply in India, understanding how it works and why it doesn't is imperative for enhancing food security. In Bangladesh, reducing leakage through better governance, accountability and awareness is important while in Nepal, overcoming logistical challenges in getting food to the most marginalized is the key obstacle.

In India generally, the effectiveness of the PFDS in acquiring and distributing food differs regionally. In some states such as the Punjab and Haryana, farmers are able to access the procurement price. In Bihar and West Bengal, the system does not function as designed and in many cases, farmers are not paid the procurement price and often are forced to 'distress sell' their harvest to partially recover costs of production. As a result, the appropriate market signals which trigger farmers to produce are distorted in Bihar and West Bengal and farmers lack incentive to produce a surplus. It may be argued that agricultural research for development which may serve to increase productivity by 10-20% will be insufficient to stimulate significant increases in output until the PFDS is corrected. Greater output will go to waste in the absence of procurement. Policy research aimed at understanding the PFDS in Bihar and West Bengal can help identify bottlenecks and potential intervention points.

The potential gains from improving the PFDS in Bihar and West Bengal may be significant. With the introduction of computerized public distribution or ePDS, citizens are advised of the availability of grains and the Panchayat are informed of the supply of grains to local dealers. Individuals are empowered with knowledge of their entitlements, while the Panchayat may provide a degree of oversight. While this mechanism will see to those that are entitled will have access to grains, government procurement will also have to keep pace in meeting demand. While correlation does not necessarily indicate causation, rice production in the state of Bihar nearly doubled between 2010-11 and 2011-2012 while government procurement of rice between 2010-11 and 2011-2012 in Bihar increased from 0.88 million tons to 1.53 million tons; in West Bengal, the increase over the same period was from 1.31 million tons to 2.04 million tons (USDA, 2013).

2 Introduction

2.1 Context of this Review

This literature review aims to contribute towards understanding the incentives, constraints and innovation pathways that have and could increase food security in the alluvial East Gangetic Plains (EGP). The EGP is in hydrological terms part of the Ganges River basin and in geological terms it comprises the eastern section of the Indo-Gangetic Plains. In terms of jurisdictions, it is comprised of: the Indian States of Bihar and northern West Bengal; the northwest (NW) of Bangladesh; and the Terai region within Nepal. In socio-economic terms, the region's jurisdictions are in varying degrees of agrarian transition and integration into the global economy. There is little doubt as to the persistence of food insecurity in the 'poverty square' of South Asia or the fact that it cannot be explained in purely biophysical terms. All of these hydrological, geological, jurisdictional and socio-economic aspects of the EGP are integral to the problem of achieving food security. Thus a systems perspective is necessary to pinpoint consequential interdependencies, such as those between energy markets and irrigation development, land redistribution reform and the fragmentation of agricultural holdings, rural livelihood diversification through migration and the availability of agricultural labour. We take the idea of an interlinked and interdependent social-ecological system as a suitable systems framework for understanding the EGP.

Recent thinking on food security has also shifted to a system perspective in order to highlight the relationship between food availability, access and the actual absorption of nutrients. Sen (1981) first pointed out that even if food is available, people may not be able to afford it. Furthermore, even if food can be purchased, it is of little use while diseases are spread through poor hygiene and lack of clean water. At the 1996 World Food Summit, food security was defined as a situation when '…all people at all times, have physical, social and economic *access* to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life' (FAO, 1996). The 1999 World Summit of Food Security established the four pillars of food security as availability, *access*, utilization and stability, with nutrition an integral dimension of the system (Ecker and Breisinger, 2012).

The EGP, particularly the Indian states of Bihar and northern West Bengal, have high potential for increasing agricultural productivity and improving livelihood outcomes that have been sub-optimally and inconsistently realised. This shortfall was pointed to over 30 years ago in the case of Bihar compared to the positive contribution the Green Revolution made in the western Indian states of Uttar Pradesh and the Punjab to national food security. Institutional arrangements have been identified as confounding factors responsible for poor growth in agricultural production (Ladejinski, 1969). More recently, Erenstein and Thorpe (2011) have delineated an agro-ecological and livelihoods gradient that runs from the relatively wealthy west to the poverty stricken east of the Indo-Gangetic Plains, despite the fact that rainfall increases from west (600 mm/annum) to east (2,000 mm/annum).

Erenstein and Thorpe (2011) provide an overview and comparison of livelihoods between the north-western Indo-Gangetic Plains (area around Punjab) and the EGP. In the EGP, farm size is smaller, herd size is lower, rainfall is higher, irrigation is less, mechanisation is less, population density is higher, aggregate asset base is less and poverty is greater. Furthermore, in the EGP, labour wages are lower, land price and interest rates are higher, institutions are less developed and women's role in agriculture is greater. Women-headed households grow rice for their own consumption, and sometimes a second rice crop for cash (Lahiri-Dutt 2012). The major cash crops are wheat, maize and lentils. The marked decline in livelihood assets from west to east was particularly pronounced for natural and financial assets. The Western Gangetic Plains was the Green Revolution heartland and benefitted from favourable policy support and investments.

The literature reviewed in this study is predominantly peer reviewed and published over the past 44 years (1969 to 2013). It thus focuses on the historical development of food insecurity in the EGP region to provide both a sound understanding of past food security interventions and how enduring (but evolving)

institutional arrangements affected the impact of those interventions. The term *institution* refers to deep, habitual socio-economic and socio-political patterns that *delimit and shape* what sort of organisations, policies, services, and ultimately value chains arise:

> *Institutions embody the deeper norms, rules, and regularized patterns underpinning societies. In that way, they are distinct from organizations, which manifest these structural settings, and from variable policy processes and governance regimens through which specific concerns are defined and addressed (Dube et al 2012: 3).*

Social institutions, such as caste and sharecropping, operate to differentiate farmers into small to large landholders, sharecroppers and landless labourers with different and conflicting livelihood interests.

Institutions are important because they form the context that structures, without predetermining the outcomes of, action. As conceptualised by the International Fund for Agricultural Development:

> *... the factors that determine the roles and responsibilities of different actors may not come from 'inside' the action arena itself, but be generated by the overall institutional context that surrounds it ... many of the factors that influence poverty most strongly are likely to be found in this institutional context – what is known as 'structural' poverty' (IFAD, 2012:1).*

The multiple jurisdictions of the EGP offer rich material for a comparative institutional analysis to untangle the reasons for the persistence of food insecurity in the EGP despite its agro-ecological wealth.

Just as a systems approach is suited to understanding the EGP as a social-ecological entity, we take a systems rather than sectoral approach to understanding how food security *innovations* have been and can be further facilitated in the EGP. For example, the development of an affordable bamboo shallow tubewell technology involved a range of organisations, enterprises and individuals and is a pivotal technology for the intensification of cropping as it makes groundwater available for dry season irrigation. The World Bank's conceptualisation of an innovation system is taken as authorative:

> *...a network of organizations, enterprises, and individuals focused on bringing new products, new processes, and new forms of organization into economic use, together with the institutions and policies (i.e. institutional environment) that affect their behaviour and performance (World Bank, 2007).*

Food value chains are embedded in an innovation system. A value chain comprises a set of actors, activities and organizations, where interactions are rule-based (Anandajayasekeram & Gebremedhin, 2009). Value is added at each stage in a value chain, which includes input supply, production, post-harvest, storage, processing, marketing, distribution and retail food services. A value chain may cross other supply changes, span political boundaries and include public and private sector institutions (Jaffee et al, 2008). Integrated value chains represent forward (marketing) and backward (input supply) linkages (World Bank, 2007a).

The terms under which rural households are involved in the value chains, whether involved in food production, distribution and consumption, matter a great deal to poverty and food security outcomes. Innovations that drive equitable outcomes are likely to have negotiated these institutional issues effectively. Successful food security innovations, such as poverty responsive value chains, have been able to harness the enabling (and cope with disabling) features of their institutional environments. An efficient value chain may be defined as collaborative and information sharing arrangements between organizations working together towards technological, managerial, organizational and institutional change in agriculture (Anandajayasekeram & Gebremedhin, 2009).

The innovation systems environment contributes to the efficiency of a value chain and may be defined as collaborative and information sharing arrangements between organizations working together towards technological, managerial, organizational and institutional change in agriculture (Anandajayasekeram & Gebremedhin, 2009). Innovation may be in the form of new technologies, management approaches, institutions, coordination and service delivery (Anandajayasekeram & Gebremedhin, 2009). Innovation can enhance a value chain's ability to adapt to changing contexts and ensure ongoing profitability (World Bank, 2007a).

Value chain analysis can focus on a specific product or a meaningful group of commodities with market relations with the aim of providing insight into appropriate interventions to improve system performance (Anandajayasekeram, 2011). A value chain study emphasizes the critical vertical dimension which describes how effective input supply, production, processing and marketing are coordinated (Anandajayasekeram & Gebremedhin, 2009). Analysis of value chain vertical integration brings to bear concepts from New Institutional Economics where theories of transaction costs, information asymmetry and imperfect markets aid in understanding system performance. In the analytical process, participants and their functions in the chain are mapped, and profit and cost structures, product flows and entry and exit conditions are evaluated (Kaplinsky & Morris, 2000).

In short, our goal is to delineate how food security innovations can negotiate potentially disabling features of institutional contexts to tap their enabling features. We ask: How sustainable have food security interventions proved? What food security innovations have been devised and championed? How do food security innovations manifest in terms of the prevailing value chains entailed in rice cropping in the region? What configuration of socio-economic, technical and institutional factors have influenced this outcome, and how we can use this understanding to frame future investment in food security research?

2.2 Methodological Approach

The systems framework used to guide this research pivots on understanding the EGP as an interlinked and interdependent social-ecological system. It has involved comparative analysis of the EGP jurisdictions that crosscut the Eastern Gangetic basin and alluvial plains. The Government of India and State Governments of Bihar and West Bengal all affect agricultural production and food security in the EGP. The Government of India's social welfare net, infrastructure investment and treaty making with Nepal and Bangladesh impact foodgrain and labour markets as well as irrigation water availability and quality in both countries.

The Bangladesh and Nepal national subregions within the EGP are not as clearly jurisdictionally and politically demarcated as West Bengal and Bihar are. This ambition of finding regionally specific literature has not always been met. We try to make clear where we have made national level statements and where we have found material to differentiate Bihar, West Bengal, Northwest Bangladesh and the Terai.

Other that a review of grey and peer reviewed literature reporting on the EGP, several field visits were undertaken in the EGP to conduct key informant interviews. A Rapid Rural Appraisal in West Bengal and Bihar was also undertaken in conjunction with Indian NGO PRADAN and the States' Agricultural Universities. A shortcoming of any literature review is a time lag regarding recent developments of around five years. For this reason we refer the reader to the trip reports.

2.3 Structure of this report

This report is structured with thematic sections under which information on the EGP subregions is organised. Chapter 3 deals with the political and historical differentiation of the EGP into the three nations and how it relates the acute (famine) and chronic food security. The commonality of the institutional arrangements concerning foodgrain production and distribution the nations began with and how they have diverged since1950 are summarised.

Chapter 4 untangles food production trends across the EGP and identifies the barriers that have held Bihar and Terai back. Chapter 5 reviews the role of water in these production variations within the EGP, both the level of national cooperation over irrigation and flood management and the rates of growth in the shallow tubewell groundwater economy sub-regionally.

Chapter 6 examines the distribution of food insecure households in each sub-region and how this relates to their asset base and caste/ethnic identities. Chapter 7 reviews the non-farming livelihood responses by those households (migration and state guaranteed employment) and its affect upon agricultural labour markets within the EGP.

Chapters 8 and 9 deal with input and output markets involved in rice dominated value chains as well current operation of the nations' public food distribution systems. This lays out the structure of incentives governing rice production (prices), specifically the thresholds at which producers would invest in inputs to go beyond a subsistence level of production.

3 Historical and political origins of food insecurity

At independence, all countries in the Indian subcontinent inherited a set of laws, institutions, and practices that provided tight government control of foodgrain production, supply, and distribution. These controls originally emerged in response to the severe supply dislocations that arose during the convergence of a catastrophic famine and World War II ... the Governments of India, Pakistan and Bangladesh inherited at independence a common legislative framework for controlling the supply and distribution of foodgrains (Ahmed et al, 2000:13).

3.1 Pre-independence

Prior to the British colonisation of the Indian subcontinent, the delta communities of Bengal (Figure 3) were self-subsisting and self-perpetuating. Peasant cultivation was the norm, cultivation was oriented to consumption and the question of formal property rights did not arise. References to the self-governing nature of village communities go back as far 1200 BC. Panchayat assemblies of five respected elders with both policing and judicial powers formed the point of contact with higher authorities (Mathew, 1996:200). Under the Persian influenced Muslim Moghal emperors who dominated Bengal from 1526 to 1757, the Panchayat judicial powers were curtailed but local affairs were left unregulated (Mathew, 1996:201). Hence, dominant castes (e.g. twice born castes such as the priestly Brahmin) continued to inspire respect, consultation, deference and settle disputes (Sahay, 2009:420). However, a land revenue system was established that distinguished between residential and non-residential cultivators. As only the former were granted land rights contingent on the payment of dues and the latter enjoyed no security of tenure, land-ownership became more concentrated and caste hierarchies were reinforced.

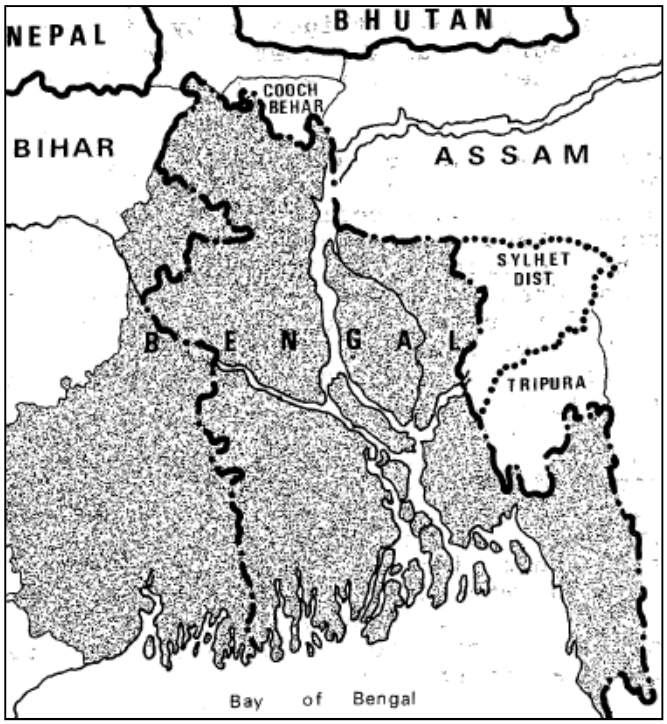

Figure 3 Bengal in 1943

Source: Chattopadhyay and Spitz (1987:6)

The East India Company purchased these revenue collection rights in a series of contracts between 1698 and 1765 (Bhaumik, 1993:24) having made their Bengal headquarters in Calcutta in 1700 (Dutt, 1902:3). Chattopadhyay and Spitz argue that from this point famine became inevitable:

> *Within five years following the institution of what was to be described by nineteenth century Indian economic historians as the process of 'economic drain', the famine of 1770-1771 had devastated contemporary Bengal, taking a toll of nearly one third of the population (1987:2).*

Despite this catastrophic famine, land revenue obligations to the British Empire were fixed in cash in perpetuity via the Permanent Settlement in 1793 (Dutt, 1902:13). Extraction of revenue was achieved through district revenue collectors called *zamindars,* who had originally served the Moslem rulers but had not been granted ownership over land. By granting the *zamindars* private title to land the British encouraged their evolution into absentee landlords. Zamindars met their tax obligations by leasing land to tenants (Chattopadhyay and Spitz, 1987:1) and the essentially feudal system of sharecropping or *Barga* cultivation became deeply institutionalised. Subsequently trader and wealthy farmer *jotedars* and upper caste '*bhadralok jotedars'* purchased these land rights entrenching a trajectory of privately controlled foodgrain speculation that further entrenched rural poverty (Bhaumik, 1993:30-31).

During this mid Eighteenth Century period, the British treated Nepal as a neighbouring territory called *Gorkha*; the name of King Prithvi Narayan Shah's ancestral home (Figure 4). King Shah acceded in 1742 and by 1769 had united the member states of *The League of 24 Kingdoms.* By 1814, King Shah had annexed the kingdoms and tribal people located in what is today the north eastern Indian State of Bihar. The Shah dynasty traced its royal descent from the Rajputs of western India and was committed to Hinduism despite ruling the numerous indigenous peoples of Nepal (Burghart, 1984:101-107). Nepal's population is still comprised of both elite Indo-Aryan caste Hindus and Tibeto-Burman Buddhists of Mongoloid origin (Yadav, 1992). Thus, Nepal can be seen as the interface between Tibetan Buddism and Indian Hinduism and in fact the historical Buddha was born in Nepal and reached enlightenment in Bihar. For over a century Nepal limited political and commercial contacts with the Company on the basis that it was the only 'pure' Hindu kingdom remaining on a subcontinent ruled first by Moslems and then Europeans, thus remaining in relative isolation until 1950s.

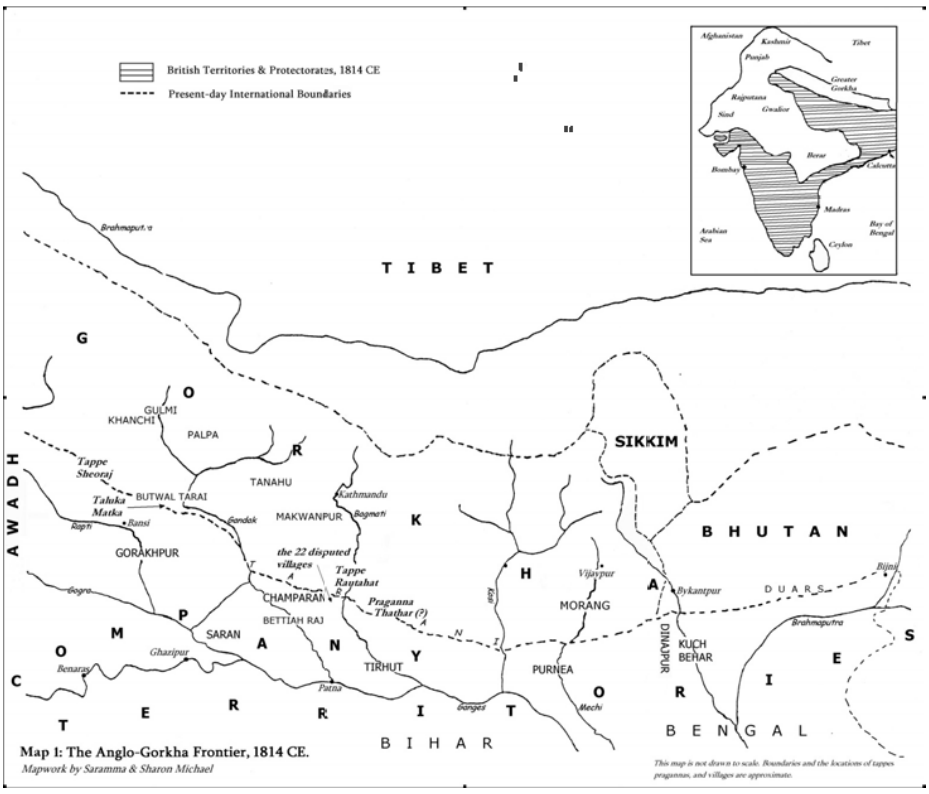

Figure 4 The Anglo-Gorkha Frontier, 1814 CE

Source: Michael (2009:8)

Public and common resources have long been used in Nepal to strengthen private networks that are typically personality based within geographically oriented coalitions. The ruling elites used Raikar (state owned land) tenure to progressively privatise Kipat (tribal or communal land) common land under several tenurial arrangements. Birta tenure granted land to nobility, priests and military officers while Jagir tenure involved short term land grants to government bureaucrats in lieu of salary. Guthi granted land used and managed for charitable or religious purposes. Jimidari land grants were instituted in 1861 on the Terai plains when the revenue system was extended to the village level. The village functionaries appointed were called Jimidars. They were 'allowed to use their entrepreneurial ability to re-claim virgin, waste and forest lands'. Birta and Jagir lands were traditionally worked under Rakam tenure where labour was unpaid and compulsory. As stated by Riedinger: 'Traditionally, Nepali rulers used Raikar lands as a means of consolidating their patrimonial rule ... State policies thus facilitated the concentration of landholdings in families of high caste status' (1993:23-24).

Like the Indian *zamindar* system, these tenurial arrangements created landlessness during the 19th Century. Tenants could not accumulate sufficient income to purchase land and independent peasants were marginalised into landlessness. Economic marginalisation occurred via exploitative taxation and unpaid labour obligations. Peasants were obliged to pay tax despite poor harvests and competition for productive land inflated rents, conditions that resulted in constant indebtedness to local money lenders. Functionaries possessed uncontrolled power to raise taxes and tributes to supply the royal palace and meet the needs of functionaries (Pandey, T., 1986:41-44).

Continuing a tradition initiated in 1559, King Shah established alternating summer (Kathmandu) and winter court (in the valley floor on the India/Tibet trade route). The winter court was abandoned in 1815 (Burghart, 1984:110-112) and concentrated Nepal's elite classes in Kathmandu Valley. Relations between Gorkha and British India were determined by the difficulty the Gorkha King had in collecting tributes from Terai 'big men' (revenue collectors), revenue that defined the King's possessions (land). This tax collection arrangement meant that the frontier between the East India Company and King's territories constantly shifted as collectors sought to increase their revenue by attracting tenants or claiming revenue from tenants on other collectors' lands. Collectors encroached on East India Company territory, fights occurred between rival collector gangs and farmers regularly fled. Finding this disruptive, the Company sought an exclusive definition of territories.

Following the 1814-1816 Anglo-Gorkha war, the Company was in a strong enough position to demand the border be fixed with stone pillars: 'It was decided that the new boundary would be drawn 2 cos (about 4 miles) from the southernmost point of the old frontier. The line was to be a straight one ... where indentation occurred exchanges of territory were to be made to keep the line direct' (Michael, 2009:14). This process dragged on until 1821 reflecting the degree of mutual distrust between the parties (Figure 4). Similarly, Nepal's northern boundary with Tibet was not understood as a mutually exclusive definition of territory until the Twentieth Century. It took 100 years, from 1760 to 1860 for the Terai to crystallise in its present form (Burghart, 1984:113-114; Michael, 2009:14).

Although the East India Company was abolished in 1858, the Bengal land revenues were transferred to the Crown (Dutt, 1902:xv) and the expropriation of peasant holdings that ensured a constant threat of famine continued. The colonial famine codes assumed periodic famines were natural and inevitable events (Chattopadhyay and Spitz, 1987:19). The Famine Commission held in 1880 viewed the problem as one of getting relief supplies to the hungry rather than increasing agricultural production (Mathew, 1996:202). British administrator turned economic historian Dutt pointed out a century ago that: 'By a moderate calculation, the famines of 1877 and 1878, of 1889 and 1892, of 1897 and 1900 have carried of fifteen millions of people' (1902:viii).

Famines were not politicised nor their driving forces re-conceptualised until the Bengal Famine of 1943 in which between 1.5 and 3 million died. This decisive famine occurred as Bengal's integration into the British Empire ultimately turned the region into a theatre of the Second World II. The deflationary depression beginning in 1928 swung the terms of trade away from agriculture resulting in peasant disinvestment of assets (distress selling). Small land owners were forced to join the sharecropping *bargadars* and labour under a 50:50 division of produce with the landowner under crippling levels of rural debt (Chattopadhyay and Spitz, 1987:32). The subsequent war economy was highly inflationary which pushed up the price of

foodgrains. The British decision to embargo rice diverted food from civil to military uses and removed grain stocks from districts in order to deny food to the encroaching Japanese army. Rural foodgrain prices doubled in late 1943 and quadrupled by mid-1943 (Ahmed et al, 2000:121). The deaths of those unable to afford food began in Calcutta in 1942 (Chattopadhyay and Spitz, 1987:46-56).

The Great Bengal Famine proved a turning point for the delta region. The legitimacy of colonialism ended in peasant rioting. The 'most extensive peasant revolt in Bengal' took place in 1945-1946 during which sharecroppers demanded the Zamindars' crop share be reduced from half to one-third (Chattopadhyay and Spitz, 1987:34). Conflict between the Hindu Congress Party and Muslim League Party led the British to partition the subcontinent along Hindu and Muslim lines, creating East Pakistan (Bangladesh) and West Pakistan in 1947 (Chattopadhyay and Spitz, 1987:57) (Figure 5). During Bangladesh's period as East Pakistan, fear of smuggling to India replaced fear of the Japanese and bordering regions were cordoning to staunch what was a traditional export flow. A high proportion of foodgrain procured for public distribution in East Pakistan was from these border areas, especially Rajshahi, in the northwest (Khan and Jamal, 1997:477-47.

Figure 5 Eastern India in 1987, prior to the split of Bihar into Bihar and Jhakhand

Source: Chattopadhyay and Spitz (1987:x & 6)

Amayarta Sen used the Great Bengal Famine to mount a highly influential argument (disputed by Bowbrick, 1986) that famines had little to do with food availability but rather the poor's legal entitlement to food: 'The law stands between food availability and food entitlement, and famine deaths can reflect legality with a vengeance' (Sen, 1981:462).

These historical processes resulted in a distinctive institutional legacy. Firstly, the entrenchment of land ownership and revenue raising rights through the Zamindar system in India and Bangladesh and Raikar system in Nepal systematically generated households that were either landless or reliant on suboptimal holdings and thus chronically food insecure. These poverty traps held substantial proportions of the EGP population.

Secondly and consequently, caste and ethnic identities have become more polarised making such large poverty traps more visible and difficult to politically ignore. Caste remains the primary socio-economic institution in the EGP. India's numerical and historical dominance shows in the continued tendency to translate tribal and Muslim identities into hierarchical caste terms. Caste categories define groups of people by occupation and social role. These categories were administratively underlined by the British through the Government of India Act in 1935 which 'scheduled' (legally defined) castes.

Traditionally, caste alliances were predicated on the maintenance of a harmonious relationship between social elite and poor communities – the poor seek out and forge networks with upper castes on the terms of the latter (Roy, 2008: 698). While caste barriers are currently breaking down, particularly in urban settings: 'In Indian villages, caste is still the principal institution structuring allegiances and relationships ...' (Sahay, 2009:411). In practice, caste based power struggles results in hostile village situations that can develop into violent conflict – over issues such as fishing in public pond, appropriating public land for farming, cross-caste elopement and straying cattle (Sahay, 2009:422-423).

Both India and East Pakistan (Bangladesh) abolished the *zamindari* system, and Nepal made Raikar forms of tenure illegal, in the Twentieth Century. However, domination of their agricultural economies by large, powerful, absentee landlords was deeply institutionalised making land reforms very difficult to actually implement, despite new laws towards that end. Where reforms were successfully undertaken, as in West Bengal, the resulting fragmentation of holdings confounded the goal of increasing foodgrain production due to poor economies of scale.

Thirdly, because: 'Bengal emerged from its wartime experience badly scarred, with a visceral fear of private speculators', state control of foodgrain production, distribution and marketing retained strong emphasis (Ahmed et al, 2000:122). The new nations of India and Bangladesh to this day utilise a planned economy approach to nation building using five year planning cycles, as did Nepal when it emerged as a nation in the 1950s. However, tight government over foodgrain value chains have persisted longer in India than Bangladesh or Nepal.

The Indian, Nepal and Bangladesh experiences of Public Food Distribution Systems (PFDS) typify the policy differentiation concerning food security that has occurred in South Asia:

> *The major countries of South Asia - Bangladesh, India, Nepal, Pakistan, and Sri Lanka ... Beginning in the 1960s with a nearly uniform policy stance - protectionist at the border and interventionist at home ... have diverged over time ... These included both external policies, such as trade barriers, and within-border policies, such as support prices and input subsidies, with a corollary emphasis on agricultural infrastructure and research expenditures to promote productivity ... understandably, given a widely shared colonial heritage as well as the commonality of the problem ... (Ganesh-Kumar et al, 2010:2–3)*

A policy shift towards better targeting PFDS to the food insecure occurred across the EGP nations under structural adjustment pressure during the 1990s. In India, this has been controversial, as it: '... enables politicians not to make unpopular statements about a reduction of government support for the agricultural sector' (Mooj, 1999:119). However, unlike Bangladesh, India retains a highly protectionist economic policy stance and is attributed with what is probably the largest PFDS in the world. Ironically, if India chose to liberalise rice exports it could well lower the global price of rice (Jha et al, 2010).

The political economy of food insecurity within Bangladesh, West Bengal, Bihar and Nepal is brought into the modern era in the Independence and Democracy country sections below. These accounts are followed by an account of how the equally pivotal relationship between water and food security has unfolded in the EGP.

3.2 Independence and Democracy in India

> *Indian development thinking has traditionally been suspicious of markets; it has painted the private trader as the villain of the society. Usury practised by money-lenders and the role of grain traders in accentuating famines in the pre-Independence era contributed to this attitude (Shah, 1996:108).*

Raj, one of the authors of India's first Five Year (1951-1956) Plan has commented that India's political independence and consolidation was a top-down process favouring a command economy pathway. The Second Five Year Plan (1956-1961) pursued a socialist pattern of society, defined as:

> *The attainment of positive goals, the raising of living standards, the enlargement of opportunities for all, the promotion of enterprise among the disadvantaged classes and the creation of a sense of partnership among all sections of the community (Mathur, 1996:27).*

Up until 1965, this blend of Gandhian and Marxist visions of a modern, progressive and egalitarian rural society meant that agrarian policy focused on land reform, community development programs and cooperative farming (Shah, 1996:86). In practice however, national policy tended to favour the interests of 'dominant castes' such as the Brahmin as represented by the Congress Party. Under the Congress Party dominated national parliament, the post-independence class compromise, including limited and skewed land reforms, left large landowners untouched.

Lack of village authorities were recognised as a barrier to rural policy ambition during the 1950s. By 1959 all States had passed Panchayat acts and by the mid-1960s all parts of India were covered by three tier Panchayat assemblies (a system called Panchayat Raj) at the block (Panchayat Samiti), district (Zila Parishad), and village (Panchayat Gram) levels. However, Panchayat institutions were easily dominated by privileged groups where State Governments did not insistent on holding regular elections. Under these circumstances, legal efforts to ensure the implementation of land ownership ceiling laws of the 1960s failed dismally due to the self-serving behaviour of administrative and political elites at the state and village levels (Shah, 1996:88-89). India's rural work for food programs formed a counterpoint to some extent. These programs date from the late 1960s and include the: Rural Public Works Program; National Rural Employment Program (NREP); Rural Landless Employment Guarantee Program (RLEGP); Jowahar Rozgar Yogana (JRY); Employment Assurance Scheme (EAS); and Sampurna Gramin Rojgar Yogana (SGRY).

India switched to a technocratic investment approach to rural policy and planning after 1965 following a severe food crisis in 1959-1960. The Green Revolution was pursued through the fourth Five Year (1969-1974) Plan via an Intensive Agricultural District Programme with strong support from the Ford Foundation (Mathur, 1996:180; Shah, 1996:86). Within a decade, the modernisation of Indian agriculture was described by American agronomist Ladejinsky as 'virtually an accomplished fact in at least two states', i.e. the Northwest Indian States of Punjab and Uttar Pradesh. However, the benefits of the sharp growth in agricultural productivity in North West India were not widely shared as growth was not accompanied by distributive justice measures (Mathur, 1996:182). The Green Revolution package was designed to resolve physical rather than institutional impediments. Development was spatially uneven as the strategy concentrated on areas offering the greatest return (Ladejinsky, 1973:A143). In Punjab, for example, more powerful landowners monopolised the benefits by raising rents (Ladejinski, 1976:8).

Consequently, the 1970s saw a sharper focus on rural poverty using a policy of decentralisation to tackle persistent rural poverty (Raj, 1988:173). This shift took place during the difficult agricultural year of 1972-73 when food price spikes had crippling economic impacts (Ladejinsky, 1973:A133). An era of special schemes to alleviate poverty without directly challenging elites began with the Fifth Five Year Plan (1974-1979). The flagship Integrated Rural Development Program targeted small famers in the attempt to make them economically viable. This effort generally failed in 'the absence of serious and imaginative local level

planning' (Mathur, 1996:186-189), but was successful in West Bengal due to a supportive Left Front state government. The influential Asoka Mehta Committee recommendations of 1977 inspired the West Bengal government to institute a 'second generation' of genuinely political Panchayat Raj Institutions. Panchayat elections were held, underprivileged candidates fielded, and Operation Barga – a program to register sharecroppers to strengthen their tenurial rights – was implemented (Mathur, 1996: 193).

Such experiences led to recognition that constitutional support of the Panchayat Raj system of government was necessary for the rural poor to be able to participate effectively in development efforts. The 73rd constitutional amendment act of 1992 realised this ambition, an evolution of the institutions of self-government that took place over 100 years (Mathew, 1996:207–220). India progressively revised the British Constitution (Scheduled Castes) Order of 1950 to more comprehensively capture those who engaged in impure work (untouchables), menial labour, lacked upward mobility and suffered severe social exclusion. The category Other Backward Castes (OBC) was added to capture those who were socially excluded despite a higher position in local hierarchies. The category OBCs includes Muslims and has been operational from 1990. The term 'forward castes' is a derivative and colloquial counterpart (Sahay, 2009, ftns 1-5).Taking force in 1993, the Panchayat Raj amendment ensures development plans are prepared and seats reserved for scheduled castes, scheduled tribes and women.

By the eighth Five Year Plan (1992-1997) the role of government and planning in development is reconsidered in favour of privatisation and liberalisation policies, a development evident across the EGP. It was noted that the post-independence regulatory regime that licensed production and imports, controlled distribution and administered prices and subsidies had protected the economy from debt traps and social unrest. However, the problem with this approach, as expressed by Shah is that:

> *Each new subsidy springs to action a new class of 'rent-seekers' – the 'per cent-wallahs' – who earn their living not by productive activity but as specialists in mastering the procedures and cultivating the 'contracts' needed to secure their 'cut' in subsidies (1996:94).*

However limited and skewed the land reform effort in India might have been, an agrarian transition is well underway as evidenced by a new social category of medium owner cultivators comprised of diverse backward castes. Successful political representation by State Governments has intersected the caste system with electoral politics to erode the power of dominant castes and diversified caste alliances:

> *Numerical as well as economic and political strength is shared between several castes. Not only do the major castes compete and manoeuvre for power, even the minor castes challenge the major castes' attempts at establishing dominance, by approaching the courts and, in the case of disputes, making strategic alliances with one major caste in order to oppose another (Sahay, 2009:411).*

We focus below on the modern political economic experiences in the north-eastern Indian States of West Bengal and Bihar where a host of state government entitlements and subsidies for backward caste blocs have emerged (Roy, 2008: 680). The West Bengal and Bihar cases demonstrate the process by which caste identities are now politically mediated (Witsoe, 2012a, 2012b) and rural Indians more prone to secular behaviour, including livelihood diversification in pursuit of upward social mobility (Sahay, 2009).

3.2.1 WEST BENGAL

West Bengal is a middle ranking Indian state that has successfully implemented land reform and poverty targeting programs. As a result of such successful agrarian reform, rural poverty in West Bengal significantly declined during the 1980s. This (brief) success in increasing agricultural production is attributed to the Left Front party's domination of the state assembly and Gram Panchayats from 1977 to 2006. Mallick points out that the Left parties capitalised on tribal discontent in the 1960s and 1970s and made it their support base, adding that: 'The proletarianisation of the tribal peasants is not different from the proletarianisation of the non-tribal peasants' (2010:13). A study by Bardhan et al (2009) found that half of the total state population, namely scheduled castes, scheduled tribes and the landless formed a secure vote bank for the left, and further that:

> *... receipt of recurring benefits like Integrated Rural Development Programme (IRDP), credit, mini-kits, employment and relief programmes had a positive correlation with voting for the Left (Bardhan et al, 2009:49).*

The Left Front Government's reforms included Operation Barga's land redistribution and tenant registration, provision of institutional credit, titling of homestead plots, and food for work programs. Operation Barga was particularly impressive in West Bengal. The Left Front government amended the 1971 Land Reform Act to make land hereditary, eviction punishable and shift the onus of proof regarding the identity of sharecroppers to landlords. A mass mobilisation drive was then undertaken with farmer unions and Gram Panchayats to identify the sharecropper tenants and increase their crop share from 25% to 50%. One million tenants were registered by 1981 and 1.5 million by 1990. Estimates of the total number of sharecroppers registered ranged from 48-80% (Bardhan and Mookherjee, 2011:192). A decade of sustained agricultural growth ensued from 1985 via more intensive cultivation, higher wages, wide distribution of HYVs through mini-kits, small scale irrigation and local market deregulation. Prices were supported by the State Department of Agriculture by using cultivation surveys to set procurement prices for agricultural commodities on a cost plus basis.

This Left Front's voting bloc crumbled during the 2008 Panchayat elections due to the left parties' commitment to diversifying West Bengal's economy through industrialisation, including establishing free economic zones. Khatun and Roy (2012) point out that the West Bengal economy is indeed diversifying at faster rate than the all-India level and only 41% of the West Bengal workforce is economically dependent upon agriculture. However, they also conclude that diversification of agricultural livelihoods is much more difficult for the poor given their lack of assets and thus favours the better educated and resourced. The reaction of the agriculturally dependent to attempts to convert farming land to establish industries was negative, as:

> *... the high-handed and violent ways of meeting any resistance on the ground have galvanised the opposition in the whole state, apart from causing disunity within the Left coalition and eroding its general credibility as a defender of the interests of vulnerable sections of the rural population (Bardhan et al, 2009:58).*

An analysis of a land dispute by Nielsen (2010) where farmers refused to hand over land for a car manufacturing plant found that rural voters were unwilling to sacrifice the certainties of agriculture for the sake of unattainable skilled manufacturing jobs. Chakrabarti et al (2011) concur with such concerns: 'Land-conversion may seriously affect micro food security shaking the very foundation of non-farm growth.' (2011:184).

The fragility of the Left Front Government's Green Revolution became evident during the mid-1990s when the state relapsed into agricultural stagnation due to land fragmentation, exhaustion of the HYVs' potential and reduced land fertility (Bardhan and Mookherjee, 2011; Ghosh, 2009; Nielsen, 2010). Reformist achievements unravelled also with a dramatic reduction in the supply of institutional credit in rural West Bengal followed the financial sector reforms of the 1990s. Bank operations were scaled down and branches closed (Chatterjee, 2008-9, Nigam and Sau, 2010). The withdrawal of diesel subsidies in the late 1990s and poor rural electrification has also meant that West Bengal farmers are coping with increased diesel costs for pumping groundwater by switching out of boro to less water intensive crops (Mukherji, 2007).

3.2.2 BIHAR

Unlike West Bengal, Bihar's backwardness compared to other Indian states has been both notorious and persistent. Within Bihar, the Kosi region comprises an area of 17,000 square miles bounded by the Kosi and Ganges Rivers and bordering both Nepal and West Bengal (Clay 1982:190). The region was targeted for agricultural intensification in 1966 by the Intensive Agricultural Areas Program (IAAP) and High Yielding Varieties Program (HYVP) following the completion of the Kosi project in the late 1950s. The two programs constituted: 'the institutional forms of the first phase of the green revolution' and replicated the Ford Foundation package program that stimulated the Green Revolution of north western India in the early 1960s (Clay, 1982:192). As in the Western Gangetic Plains programs, the highest potential areas were

identified (21 of 59 blocks), extension staff doubled, and credit for lift irrigation, machinery and land levelling extended through a Small Farmers Development Agency. IAAP was extended to all 59 blocks in 1970-1971 (Clay 1982:192).

However, as far back as 1969, Ladejinsky reported that the Green Revolution was faltering in the Kosi region of Bihar, not because of the inadequacy of the technological package, but because poor institutional conditions restricted access to the package:

> *The existing institutional credit arrangements with their well known bias in favour of the big owners, the generally poor state of the cooperative credit societies, the prominent role of the moneylenders providing loans at usurious interest rates and the lowly and insecure position of the tenantry - all these preclude the participation of the vast majority of the cultivators in the new package of practices (Ladejinsky,1969:A147).*

The Kosi project encouraged the development of a frontier melting pot. Large Zamindar owned estates exceeding 1,000 ha were traditionally sharecropped by tenants. However, threats of land redistribution and the advent of the tractor led Zamindars to shun sharecroppers in favour of hired labour. A Muslim minority persisted despite the exodus that followed the partitioning of the subcontinent and: 'Immigration continues of backward and scheduled caste people who have been attracted by employment and tenancy opportunities'(Clay, 1982:191 -192).

Governance of Bihar was dramatically altered by a transfer of power from upper caste dominated Congress party to political coalitions dominated by backward castes. Between 1985 and 1995 Other Backward Caste (OBC) Members of Parliament doubled in numbers to take 50% of state assembly seats while upper caste members of parliament halved in number to occupy 27% of seats (Witsoe, 2012a:318). Political representation of the backward castes assisted the Musahar (rat eaters), one of the lowest divisions of Dalits (untouchables), that attracted NGO attention following Bihar's severe drought of 1966-1967. The Musahar are dispersed across five districts, comprising 4% of Bihar's total population and form one quarter of the scheduled caste population overall. Described as unaware of their rights let alone prepared to assert them, they are mostly landless, illiterate agricultural labourers. Traditionally the Musahar worked Zamindar properties without asking for payment, received starvation wages in-kind and were vulnerable to sexual exploitation. Under the new political environment, in 1987 the Musahar achieved the redistribution of 35,000 acres of state and ceiling land following refusal to work the land of the landowner of 10,000 acres (Prasad, 2007:157–158; 162).

In power from 1990 to 2005, Laly Prasad Yadav, charismatic leader of the Dalit party Rashtriya Janata Dal (RJD), put issues of power and voice above rural development. Yadav weakened the upper caste dominated state institutions without attempting pro-poor measures. Policing, public education and health services nearly collapsed. Yadav did, however personally ensure the protection of Bihar's Muslim community from pogroms as Muslims formed a crucial part of RJD support base. A democratisation of corruption occurred under this government. The resulting surge of criminality included a kidnapping industry and sand mining mafia. Zamindars lost access to credit from cooperative banks (which became insolvent), were cut off from patronage and commissions, deprived of the political and policy connections that had ensured the protection of standing crops and enforcement exploitative sharecropping arrangements. Smaller Yadav, Kurmi and Koeri caste family farms took over most cultivation relying upon family labour (Witsoe, 2012b:51-52). Although Yadav was imprisoned on corruption charges in 1997, his wife won the next three consecutive elections (Witsoe, 2012a:318-326).

This dramatic era ended in 2005 when the Bihar State Assembly elections were won by the National Democratic Alliance Party (NDA) on a pro-development platform, followed by a bigger win in 2010. The support base of NDA is comprised of more diverse and numerically weaker backward castes and low caste Muslims, compared to the more numerous Yadav, Kurmi and Koeri backward castes that had formed the RJD support base (Witsoe, 2012b). Most supporters of the new government demanded an end to political mediation via brokers altogether, which resulted in:

> *... a state government that quickly weakened the political class and strengthened the bureaucracy, issuing circulars for bureaucrats and police to ignore requests by politicians, even from the ruling party (Witsoe, 2012b:53).*

Prospects for rural development in Bihar have dramatically improved following the reinstatement of law and order.

3.3 Independence and Democracy in Bangladesh

It would be an understatement to say that the partitioning Muslim East Pakistan (now Bangladesh) and West Pakistan from Hindu India in 1947 did not resolve regional tension. The two Muslim territories were separated by 1,000 km of Indian territory as well as significant cultural, socio-economic and linguistic differences. The India-Pakistan War in 1965 which lasted for 17 days was designed to evict Bengali speaking Hindus from West Pakistan – one third of the then population.

The subsequent war between East and West Pakistan in 1971 was driven by West Pakistan's economic dominance but triggered by West Pakistan's insistence on the privileging of Urdu over Bengali as the national language. A Bengali language movement preceded a brutal 11 day war of independence of East from West Pakistan. The decisive result issued from India's decision to fight with Bangladeshis, facilitated by its accommodation of a government in exile and the Awami League's good relations with India's Congress Party.

Bangladesh emerged as a tattered nation having suffered massive destruction of infrastructure, the abandonment of most industrial enterprises by fleeing Pakistanis and the loss of the one third of its external trade that had been oriented to West Pakistan:

> *... Pakistanis had dominated banking, insurance, foreign and domestic trade, transport and shipping. Their departure created a vacuum that lasted nearly five years (Ahmed et al, 2000:5).*

The Awami League succeeded the Independence movement and freedom fighters. Bangladesh's first Prime Minister of Bangladesh, Sheikh Mujibur Rahman, was the leader of the Independence movement.[1] In 1972-1973, agricultural production fell to 83% of the 1969-1970 level. The new government declared a socialist development policy, established a Planning Commission in 1972, and produced the first plan which aimed to alleviate poverty in 1973. Famine, however, ensued by 1974. The world's second largest flow of food aid began flowing in 1975 and reached its peak in 1990 (Ahmed et al, 2000:2).

The post World War II partitioning marked the beginning of constant cross-border migration by both Hindus and Muslims in search of stable livelihoods. The Nehru-Liaquat Pact signed in 1950 between India and Pakistan to ensure the safety and security of their respective minorities, saw 32,000 Muslims elect to return from East Pakistan (Bangladesh) to West Bengal by 1954 (Das, 2011:46). The 2001 census held in West Bengal found that Muslims still form 25% of the state's total population and are largely located in districts along the border (Dasgupta, 2011:18 -19). This location: '... has fuelled the belief that 'infiltration' is the chief cause of population growth among the Muslims in West Bengal despite the fact that all these districts have had high Muslim population from the early part of the 20th Century' (Dasgupta, 2011:35).

The 1971 war triggered larger scale communal violence that displaced nearly 10 million Muslim and Hindu Bengalis (Dasgupta, 2011:18). The Indira-Mujib Accord of 1974 saw the India-Bangladesh border fenced with barbed wire. The border zone consumed 450 feet of arable land, impoverishing villages on both sides of the border and fuelling continuing skirmishes and displacement (Das, 2011:52-53). Similarly, Hindu refugees from Bangladesh have settled along the border, often taking the houses of fleeing Muslims (Nakatarni, 2011). Hindus continue to be displaced from Bangladesh:

> *During the last 40 years since 1961, the relative share of the Hindu population has declined from 18.4% of the total population in 1961 to 12.1% in 1981, to 10.5% in 1991, and further down to 9.2% in 2001 (Barkat, 2011: 96).*

[1] Sheikh Hasina Wajed, daughter of Bangladesh's first Prime Minister has led the League since the 1990s. The current opposition in Bangladesh, the Bangladesh Nationalist Party, is regarded as more hostile to India.

A major reason for Hindus to abandon Bangladesh is the loss of land under the Enemy Property Act. The total area of land lost by Hindu households is estimated at 2.01 million acres, which amounts to 45% of the total land owned by Bangaldesh's Hindu community (Barkat, 2011: 91-106). The Act accompanied a declaration of a state of emergency by the Pakistani regime during the 1965 India-Pakistan War. Although the state of emergency was lifted in 1969, the enemy property law continued by an ordinance and was granted continuance in 1974 following the War of Independence. The Awami League repealed the Act in 2001. However the deadline of 180 days to prove reparation cases, and unlimited time for the government to publish a list of returnable properties means that effectively the Act is still in force (Barkat, 2011:91-94). As Barkat points out:

> *The operation of the Vested Property Act (VPA) as a continuation of the Enemy Property Act (EPA) has its root in distinct historical doctrine in the religion-based statecraft of Pakistan. Depriving Hindu minority through EPA and VPA is not an historical accident per se. It is rather an outcome of conscious decision by the Pakistani rulers to Pakistanise East Bengal ... (Barkat, 2011:114).*

Harassment of Hindus continues with Barkat (2011) reporting that the first decade of this Century has seen 50% of Hindu households report verbal abuse, one third report theft, and 25% report obstruction of harvesting. This amounts to a Hindu specific deprivation trap within Bangladesh (Barkat, 2011: 91-106).

Land redistribution in Bangladesh is thus redistribution to Muslims. Reform hinges on *khas* – unoccupied or government owned managed by the Ministry of Land. Khas land is possessed, reclaimed from the sea or rivers, vested in the government as surplus to the allowable ceiling, purchased by the government, or otherwise surrendered, abandoned or confiscated (Hindu) land. Three major pieces of legislation define the agrarian reform effort: the East Bengal State Acquisition and Tenancy Act of 1950; Collection of Presidential Orders (1972); and the Bangladesh Land Reforms Ordinance of 1984. The first two pieces of legislation achieved very little, khas lands ended in the hands of powerful elites and inter-elite competition for the land was intense. A whole new entrepreneurial group was engendered to collect information on khas land. Collusion between local and national elites was probably inevitable given that politicians and bureaucrats are often large land owners themselves, if not depend on rich peasants for support. Consequently, attacking the interests of large landholders constitutes political suicide (Devine, 2002:404-405).

Erhsad's military regime assumed power in 1981 seeking credibility at home and abroad. Erhsad made the Land Reforms Action Program (LRAP) to distribute khas land the centrepiece of his 1984 land reform package. The program focused on transfer of assets to the landless, defined as owning less than 0.5 acres (Devine, 2002:404-405). Devine attributes this policy move to a longstanding friendship between the Land secretary of the time and a senior staffer of Oxfam and points out that:

> *The most unusual feature of the LRAP was the establishment of a Land Reform Cell staffed by members of the NGO Coordination Council for Land Reform Programme (NCCLRP) set up in 1987 to manage cooperation between the Land Ministry and the NGO community. The NCCLRP represents one of the earliest attempts in Bangladesh at establishing a network or umbrella of like-minded NGOs (2002: 405).*

Those excluded from this arrangement, the opposition party and other political groups, accused the participating NGOs of conspiring with the military regime and initiated a mass movement that toppled Ershad three years later.

Zia, leading the Bangladesh Nationalist Party, won the 1991 elections and terminated the program. It was replaced with Operation Thikana, a competing khas land allocation and agricultural inputs program. Fifty-five alternative NGOs were selected to implement the program; however subsequent evaluation has showed that unutilised public land is still grabbed by influential people. Devine concludes that without political support, smaller NGOs are defenceless against local elites, even households who received land found it difficult to retain possession (Devine, 2002:406-408).

Although the intense aid flows to Bangladesh since 1975 could be said to have aggravated corruption, considerable corruption existed before then for which General Ershad was scapegoated in the national press. But according to Lewis (1996) much of the nation's administration remains similar in performance since democracy. He observes that loyalty to a recently formed and/or still contested state competes with

primordial loyalties to family and kin (Lewis, 1996:21-24). Furthermore, as elsewhere in the EGP, the dominance of patron-client relations ensures that:

> *Corruption often involves the incorporation of low level officials into systemic corruption by those higher up, and the former may end up taking the bulk of the blame if discovered (Lewis, 1996:25).*

Bangladeshi dependence on donors exposed it more starkly to structural adjustment pressures during the 1990s than India. Acceptance of economic liberal policy philosophy led to a third Five Year Plan that aimed to privatise public sector enterprises, operations and institutions:

> *The step-by-step liberalisation of markets for modern inputs in agriculture was carried out under pressure from foreign donors and with the realisation that various direct interventions were fiscally unsustainable and unproductive in the long run (Ahmed, 2000:49).*

The liberalisation of agricultural inputs has driven an unanticipated green revolution Bangladesh. Subsequent uptake of HYV, irrigation and multiple cropping has seen foodgrain yields double over the yields achieved in the 1960s. A large proportion of even marginal farmers (up to 0.2 ha) have become net sellers of paddy in good seasons. Aid flows enabled heavy public investment in rural infrastructure (roads, electrification, phone lines, water transport etc) which have reduced foodgrain processing and transport costs and times (Chowdhury and Haggblade, 2000:73-75). These technological improvements encouraged an increase in cropping intensity which has had the effect of smoothing price fluctuations (Goletti, 1994:3).

Bangladesh's growth of rice marketing is even more dramatic than that of rice production with farmers' marketed share jumping from 10-14% to 50% by the 1990s. This has led to a remarkable consensus regarding the ability of liberalisation to improve food security, at least in Bangladesh. According to Golotti (1994), foodgrain markets have proved to be efficient transmitters of regional price shocks and scarcity signals. The dynamic private foodgrain marketing sector facilitated by liberalisation has been effective in moving commodities both over time and over space with relatively stable prices. Fear of trader hoarding behaviour proved to be unfounded. In fact, increased private storage, both on farm and as trading stock, have contributed to temporal smoothing of foodgrain prices (Goletti, 1994:3). This emergence of a national rice market is viewed as a major achievement:

> *Overall, a picture of robust growth emerges, with increasingly competitive rice and paddy markets. This conclusion does not argue for complacency, of course, but for the aggressive continuation of the policies that have led to these favourable trends: access to HYVs, modern inputs, alternative credit, rural roads, telephones, and other rural infrastructure (Chowdhury and Haggblade, 2000:88).*

3.4 Independence and democracy in Nepal

The Ghorka Regime (led by King Shah of the Rana dynasty with whom the British India Company fought and negotiated) fell after 104 years in 1950 when an alienated faction of the Rana family combined forces with King Tribhuvan to overthrow it. From 1951 to 1959, an experiment in parliamentary democracy took place (Burghart, 1984:119), supported by King Tribhuvan, who offered rhetorical commitment to agrarian reform (Joshi and Mason, 2011:151). The Shah regime was just as feudal, anachronistic and chaotic as its predecessor. Foreign aid was spent on extending their power structure while the land reform and resettlement programs formulated in the 1950s languished for lack of effective administrative machinery (Pandey, 1986: 43-44). For example: The 1951 tenure security act in Kathmandu valley failed due to the lack of reliable tenancy records and poor enforcement. The Royal Land Reform Commission of 1952 recommended fixed tenure and a rent ceiling fixed at 25% (of annual yield). While the subsequent Lands Act of 1957 did afford tenancy rights and capped rents, poor enforcement meant many landlords evicted tenants and raised rent to 50% of annual yield.

Traditionally, Nepalese regimes had granted *Birta* land tenure to nobility, priests and military officers and short term *Jagir* land grants to government bureaucrats in lieu of salary. The Shh Regime's abolition of Birta and Jagir lands without compensation:

... suddenly made the then-current holders of Birta and Jagir land permanent owners of that land ... (Joshi and Mason, 2011:156).

Very few of those cultivating Birta lands for landlords received land. In any case, Birta and Jagir land owners retained the legal right to evict tenants if they chose to self-cultivate and tenants paid an annual fee to renew their lease (Pandey, 1986:41-42; Riedinger, 1993:26). *Guthri* lands, devoted to religious purposes and comprised 3% of state lands, degenerated into hiding Birta lands likely to be confiscated. Indigenous communal *Kipat* lands located in both the east and west hill region, by then reduced to 4% of state land, were eliminated between 1961 and 1968.

Legislative initiatives failed as committed land reform candidates were not elected. The mainstream Nepali Congress and Nepal Communist political parties lacked identities based on policy positions. Their frequent factional splits shifts (lubricated by side payments) resulted in weak and volatile governing coalitions (Joshi and Mason, 2011:156). Party system fluidity meant that the mobilisation of patrons was the most efficient political strategy. Landed elites controlled 90% of the seats in the first (1950-1951) parliament with second and third generation elites owning an average of 16.8 ha in the prestigious hills and 10 ha on the productive Terai. In practise, the Rana Government diverted resources to urban electorates, providing public goods to avoid urban unrest rather than investing in agrarian reform (Joshi and Mason, 2011:157-158).

A royal coup unfolded by 1960. King Mahendra dismissed the government, outlawed all political parties and trade unions and imposed an authoritarian Party-less Panchayat System (PPS) (Riedinger, 1993:24). This state retained dominance by high caste Brahmin, Chhetri and Newar castes such that 22% of the population held 90% of the country's top civil service posts. PPS involved a series of assemblies from the village to national level along with the Panchayat Development and Land Tax, continuing the institutional pattern of a tributary state oriented to the support of a Kathmandu Valley aristocracy. Nepal's border with India had opened and remained unregulated since 1950. However, no effort was made to generate employment outside agriculture in the face of a massive inflow of Indian manufactured goods that undermined traditional occupations and industries (Pandey, 1986: 43-44). Traditional elites continued the highly factional style of politics. As the King hand-selected cabinet members, cabinet could not command the bureaucracy and inter-ministerial cooperation failed to develop, a problem replicated at the district level (Joshi and Mason, 2011:151; Riedinger, 1993:24).

Under King Mahendra, the Lands Act 1964 placed regionally variable ceilings upon landholdings which saw some tenants registered and thus made more secure. More frequently, the ceilings were evaded by evicting tenants and transferring land to relatives and straw men. While 34,705 ha of land were acquired by the state, only 32,640 ha had been redistributed by 1988 and this land was of poor agricultural quality. Only 300,000 tenants were granted formal certificates of tenancy (Riedinger, 1993:26). Nepal's 1988 White Paper on land reform was received with considerable scepticism as it: 'all but invites landlords to coerce tenants to relinquish their rights to land transfer' (Riedinger, 1993:27-29). Food insecurity and population growth place severe pressure upon natural resources making disputes and controversies are common (Adhikari et al, 2009:523). Nepal's Private Forest Nationalisation Act (1956) eroded traditional forest management regimes while demand for wood increased nationwide. The consequent deforestation of Nepal's uplands coincided with heavy rainfall, landslides and flooding in the EGP including flooding in Bangladesh in the 1970s and 1980s.

An economic crisis in the early 1980s culminated in conditional IMF loans and structural adjustment implementation ensued in 1985 and 1988. Quantitative restrictions were dismantled, industrial licensing simplified, tariffs reduced and disparities in tariff rates reduced gradually (Pyakuryal et al, 2010:95-97). Far from resolving Nepal's difficulties, ten weeks of violent protest unfolded in early 1990. The PPS was abolished by April, multi-party elections held (Riedinger, 1993:24) and democracy reinstated in 1991. Three subsequent parliamentary elections and two local elections with 60% participation did not improve economic conditions. Nepal's Human Development Index (HDI) score rose initially after the reinstatement of democracy but showed significant district wide variations (Joshi and Mason, 2011:152). Food Security and Agricultural Projects Analysis Service ESAF calculated an increase in poverty from 33% in 1977 to 42% in 1995-1996, amounting to nine million or 40% of the population living below the US$77 national poverty line. Nepal's HDI was 143 out of 175 countries. Most of the poor (85%) were rural and poverty increased in the remote mid- and far-western hill and mountain districts (Food Security and Agricultural Projects

Analysis Service ESAF, 2004:8). Reforestation with livestock reduction and control was viewed as the solution. 'Community forestry' transferred management to local communities; however, a Forest Amendment Act (1998) imposed mandatory forest inventories to limit harvesting. Re-forestation also occurred in community pasturelands which restricted grazing and collection of forest products (Dhakal et al, 2011:88-89). Over 60% of farming households in Nepal's hill region suffer a food deficit and starvation is more common in remote districts where the livestock economy is most affected by conservation policies.

An armed Maoist insurgency began in 1996 and intensified in 2001 and emergency rule was announced in November. Tiwary (2005) commented that the poorer sections of community were forced to play host to rebels and even women recruited to fight leaving several areas without farming activities. Many forests that served for food and fuel were made off-limits by the government on the basis they harboured insurgents (Tiwary, 2005:142). Those most dependent on landed patrons joined the insurgency in greater numbers as land was redistributed and peasant debts cancelled in Maoist controlled villages. The insurgents recruited most successfully from the most food insecure districts in the mid- and far-west. Since the peace agreement of late 2006, Maoists have transformed into the Communist Party and gained more seats than mainstream party rivals by successfully mobilising marginalised and neglected groups, raising the issue of land reform and fielding candidates from marginalised groups (Joshi and Mason, 2011:170-172).

The global slowdown added to this political and fiscal instability. Restructuring of the Nepal Food Corporation, the main element of domestic market reforms, started in 2000 and was the last major change made before Nepal joined the World Trade Organisation in 2004. Nepal now has the lowest tariffs in the South Asian Association for Regional Cooperation (SAARC) for most products although it sets an export tax of 5% where most South Asian countries offer incentives and diminishing exports have kept Nepal in national economic decline since 2000 (Food Security and Agricultural Projects Analysis Service ESAF, 2004:10; Pyakuryal et al, 2010:95-97).

During the preparation of the tenth National Plan, hill farmers demanded improved access to forest resources but the government delivered even more stringent environmental policies and Nepal has since been selected for Reduced Emissions from Deforestation and Degradation (REDD) program funding. Nepal's protected areas increased from 7% in 1988 to 20% in 2008 (Dhakal et al, 2011:88-89) while forest cover decreased from 32.7% in 1990 to 27.3% in 2000. The decline in agricultural production is particularly stark in the remote mountainous region where deforestation results in floods, erosion and loss of arable land (Bhandari and Grant, 2007:17).

3.5 Lowland Nepal: the Terai

Traditionally, according to Shrestha et al (1990), where the hill region (Pahar) is a socio-ecological mosaic, a complex of terraces and the cultural hearth of Nepal that concentrates decision making in Kathmandu, the Terai is derived from Persian word for damp. The Terai is fed by Nepal's three main rivers, the Kosi, Gandaki and Karnali, all of which feed into the Ganges (Shrestha et al, 1990:7). Although the Terai is around 100 m asl, the northern Terai swells up to meet the hill zone so is actually comprised of northern uplands, with the north western valleys in rain shadow and the flat southern plains benefiting from monsoonal rains (Tiwary, 2005: 124-125). Yadav (1992) maintains that the Terai is culturally and geographically indistinguishable from northern India. North Bihar shares the same flood and drought problems as the Terai and Uttar Pradesh and Bihari border towns retain a Nepali character.

It took 50 years to shift Nepal's population centre from the hills to the Terai such that the population is now distributed among the mountains 7%, hills 43%, with the Terai holding 50% with 23% of Nepal's land area, (Poertner et al, 2011:24). The lowland convergence ensued from the early 1960s (Tiwary, 2005:126-127). Most migrants to the Terai are highland Nepalese, attracted by the prospect of practising settled agriculture under more favourable conditions. By 1981 the Terai had gained 700,000 migrants via north-south regional flows in a corridor like movement reflecting the importance of proximity and the hill-Terai foot trails in channelling migration (Shrestha et al, 1990:26-28). The Terai now enjoys better infrastructure and service provision than the hill and mountain regions. For example, in the Kali-khola watershed, Bhandari and Grant (2007:24) found that 92% lowlanders had piped water within a 15 minute walk

compared to 39% highlanders. Despite this comparatively good infrastructure and the Terai's mere 50 years of cultivation, a Green Revolution has yet to occur (Tiwary, 2005:128).

Poor institutional conditions for agricultural intensification in the Terai can be attributed to the highly contentious manner in which the Terai was 'opened'. Widespread spontaneous settlement began in the 1950s in Chitwan, proximate to Kathmandu Valley in the southern Terai and intensified in the 1960s when the Rapti Valley Development Project ended. The Chitwan Valley's population of 42,000 in 1951 increased to 355,000 in 1991; an annual growth rate of 3.19% (Bhandari, 2004). King Mahendra legalised squatter holdings in 1961, a political move intended to undermine building support for the Nepali Congress party. Marginal and landless rural households migrated from the hills to find formal re-settlement processes unavailable and squatting their only livelihood avenue. In 1977 only 7,691 families were officially settled on the Terai (Pandey, 1986:45). As the physical hardship and risks of the earlier phase reduced, migration expanded rapidly. Land was sold without title on the basis that it was relinquished willingly and a type of land speculation – 'professional landlessness' – developed. Migrants fanned out from the forest fringe and squatted on communal pasture land (in groups as local villagers were enraged). When the Land Reform Act was enacted in 1964, large landowners evicted their tenants further fuelling squatting as did highway construction.

The government tried settling ex-military servicemen in the Terai to institute law and order but servicemen were inclined to follow the hill migrants' example. Panchayat leaders actively promoted encroachment and forestry officials helped squatters for money. Sporadic attempts from the early 1970s to evict farmers led to civil-government conflict as no economic alternative was available to settlers. During the 1979 Panchayat elections, peasants were both encouraged to settle in forest-lands in exchange for votes and later re-evicted, the same year the Sukumbasi landless (public land encroachment) movement developed (Pandey, 1986:44-46; Shrestha et al, 1990:227-244).

The spontaneous settlement of the Terai consumed 56,000 ha of forests between 1964 and 1972 (Pandey, 1986:45) resulting in access disputes between smallholders and officials charged with protecting forests. The Royal Chitwan National Park (RCNP) is a prime example as the first national park to be gazetted in 1973. Comprising 93,200 ha and a buffer zone of 76,750 ha, the park was originally used as a tiger and rhino hunting reserve for the Rana family and their English and Indian guests. Gazetting was met by smallholder protest as decades of local resource extraction were curtailed. The State's response was both to deputise the Nepalese Army to enforce park regulations and establish a legal system for co-existence and development through the Buffer Zone Management Act 1996 (Adhikari et al, 2009:524). Economic opportunities were provided to smallholders under a Park and People Program initiated in 1994. However, only higher caste groups derived benefits (increased agricultural income) from this program due to their superior bargaining power. As most of the settlements in the park's buffer zone are poor, the Park and People Program failed to prioritise support to the section of the community most in need (Adhikari et al, 2009: 535). A similar situation has unfolded within the Koshi Tappu Wetlands created after the construction of the Koshi Barrage in 1962 (Dulal, et al, 2010:628).

Nepal's announcement of an interim constitution in 2007 that made no reference to ethnic autonomy or federalism (only committing to the end of a unitary State) was followed by the intensification of the insurgency on the Terai. During a three week mass uprising 40 people were killed and 11 civilians abducted. A hills/plains division was evident in the conflict. Activists wanted the Terai to be an independent state with radical ethnic insurgent groups claiming that: 'people that have migrated from hills to be colonisers and [we] want their complete eviction from the Terai region' Dulal et al (2010:629).

3.6 Implications for modern food security

The historical and political origins of food insecurity on the EGP discussed above are schematised in Figure 6 and Figure 7 below. Bangladesh differentiated out of the Indian sub-continent as a distinct nation through a series of shocks and political reactions to those shocks that originated in the upheavals of World War II (Figure 6). The Great Bengal Famine of 1942 was predictably followed by peasant rioting in 1945-1946 over the terms of sharecropping. Conflict between the Hindu Congress Party and Muslim League Party was

'resolved' by the British by partitioning the subcontinent in 1947 and leaving the field entirely in 1951. Subsequent short wars in 1965 between India and Pakistan and in 1971 between East and West Pakistan wars re-partitioned the subcontinent. War ravaged Bangladesh was famine ridden by 1974. Ironically, being the recipient of world's second largest flow of food aid by 1975 enabled Bangladesh to harness the structural adjustment pressures that ensued in the 1990s to kick-start a Green Revolution that has dramatically improved food security at both the micro and macro levels. However, both formally and informally, Bangladesh jettisoned its Hindu population while appropriating Hindu assets.

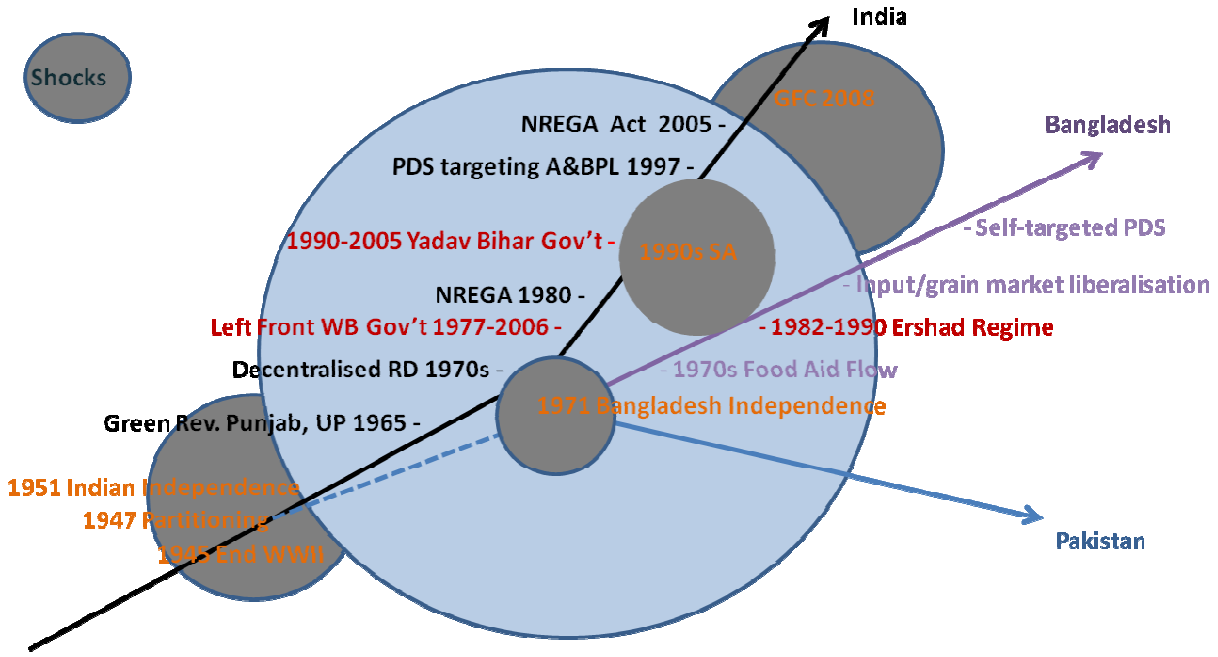

Figure 6 The Differentiation of Bengal

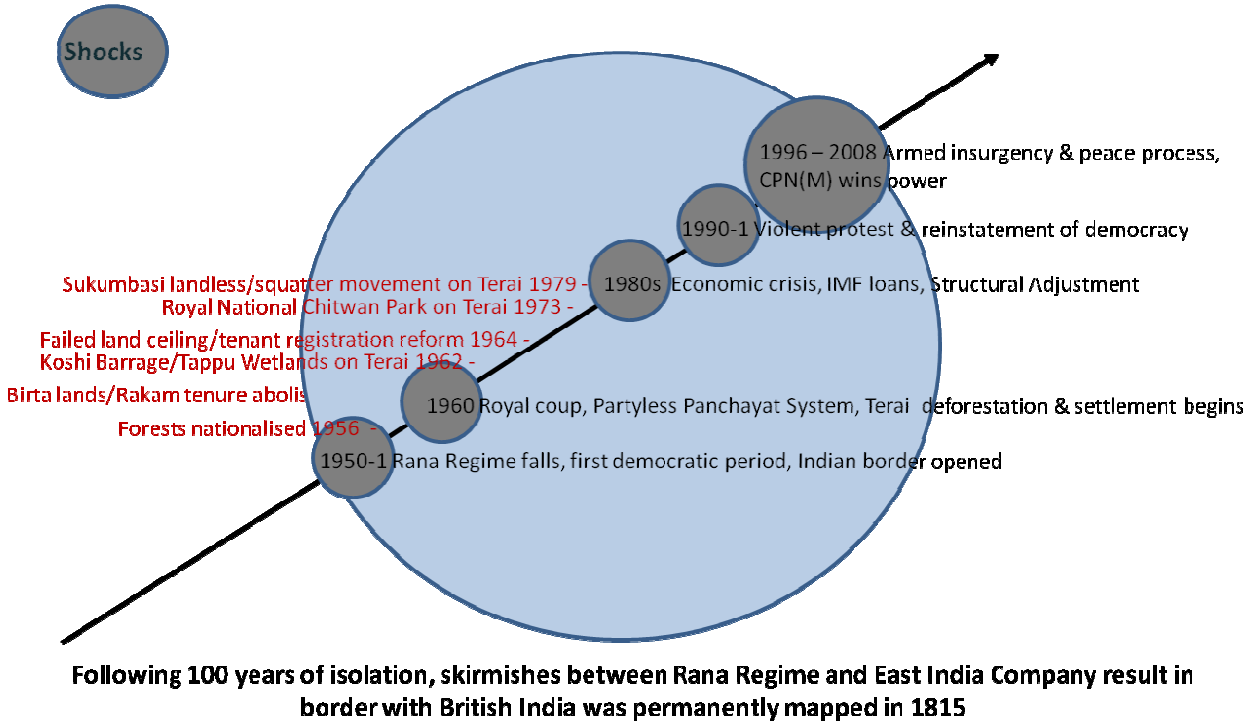

Figure 7 Nepal's Historical Trajectory

Nepal (Figure 7) only emerged out of its political isolation in opposition to the presence British outsiders as a national entity in 1950. Over the past 60 years, Nepal has transitioned from a tributary state dominated by a Kathmandu elite through the massive convergence of marginalised socio-economic groups on the Terai Plains seeking food security. Geographically based elite personalities played a highly factional politics regardless of whether authoritarian or democratic forms of governance prevailed until very recently. Disrupted by Maoist inspired peasant rebellion, the stand-off between poor and elite is now contained in parliament but without constitutional resolution of the tension between the elite view of Nepal as a pure Hindu state and Nepal's staggering array of ethnicities and tribes. Although agricultural production is concentrated on the Terai, this land use is only 50 years old and no Green Revolution has yet occurred despite Nepal suffering the worst food insecurity in the EGP. Nepalese factionalism has fragmented aid efforts and the potentially constructive force of structural adjustment pressure to fracture Nepal's huge poverty traps.

India, in its sheer economic and demographic enormity, has evolved from British Raj into a consequential multi-ethnic democracy, as evidenced by the retention, indeed attraction, of Muslim Bengalis. Able to launch a Green Revolution with American expertise and aid on the Western Gangetic Plains in the 1960s, India reached foodgrain self-sufficiency much earlier than Bangladesh. India then faced its persistent poverty traps under the glare afforded by official designation of backward caste and tribal poor. A distinctly Indian welfare net (NREGA and PFDS) developed out of the federally fractured power struggles between elite and marginalised socio-economic groups. Both criminal and reformist state governments in India's north-eastern states arose from this agrarian transition. Structural adjustment pressures have essentially been shrugged off by India.

History matters because famines, whether recent or those remembered on an intergenerational basis, are deeply engrained on psyche of farmers and policy makers alike, encouraging decisions to be made that entail strong path dependencies. Policy aversion to food imports characterises the EGP jurisdictions because famines left a strong preference for national foodgrain self-sufficiency. Authors agree that public Food Distribution Systems are difficult to reform despite high leakage rates rendering them ineffective in targeting the food insecure. Poorly targeted PFDS contribute to standing deficits capable of bankrupting states.

This legacy also means that food security and food national food self-sufficiency tend to be conflated and require careful disentanglement. The Bangladesh experience offers important clues as to how carefully sequenced economic reforms need to be in order that macro-economic alterations dovetail with helpful micro-economic motives and opportunities at the household level.

All policies that necessarily ensue from the overall intent to address food insecurity by intensifying agricultural production need to be seen in that light. How irrigation waters are made available in the dry season, whether the PFDS tempts farmers out of subsistence production by procuring foodgrain via an attractive minimum support price, the availability of institutional micro-credit, energy and fertiliser subsidies etc are all necessary conditions to trigger (and sustain) a Green Revolution

By implication, farm level research that is purely technically focused will fall short as it did on India's Western Gangetic Plains where benefits were captured by elites while sharecroppers were converted to agricultural labourers without the assets to improve their situation. Trying to solve political-institutional problems with technical solutions will not link the socio-political and technical domains in manner helpful to the food insecure.

4 Trends in food production

4.1 India

In general, rice production is increasing in India[2]. West Bengal's rice production is one of the highest for India (14,853,000 tonnes in 2011/12), similar to Uttar Pradesh (14,025,000 tonnes) (Figure 8). In 2008/09, West Bengal contributed over 15% of domestic rice production but less than 5% to procurement (Figure 8). Other key rice producing states are Andhra Pradesh (12,888,000 tonnes) and Punjab (10,542,000 tonnes). At a national level, in 2008/09, rice accounted for 40% of the production and 36% of the area under cereal crops, respectively. Wheat was second to rice, constituting 34% of production and 22% of the area, respectively (Figure 9).

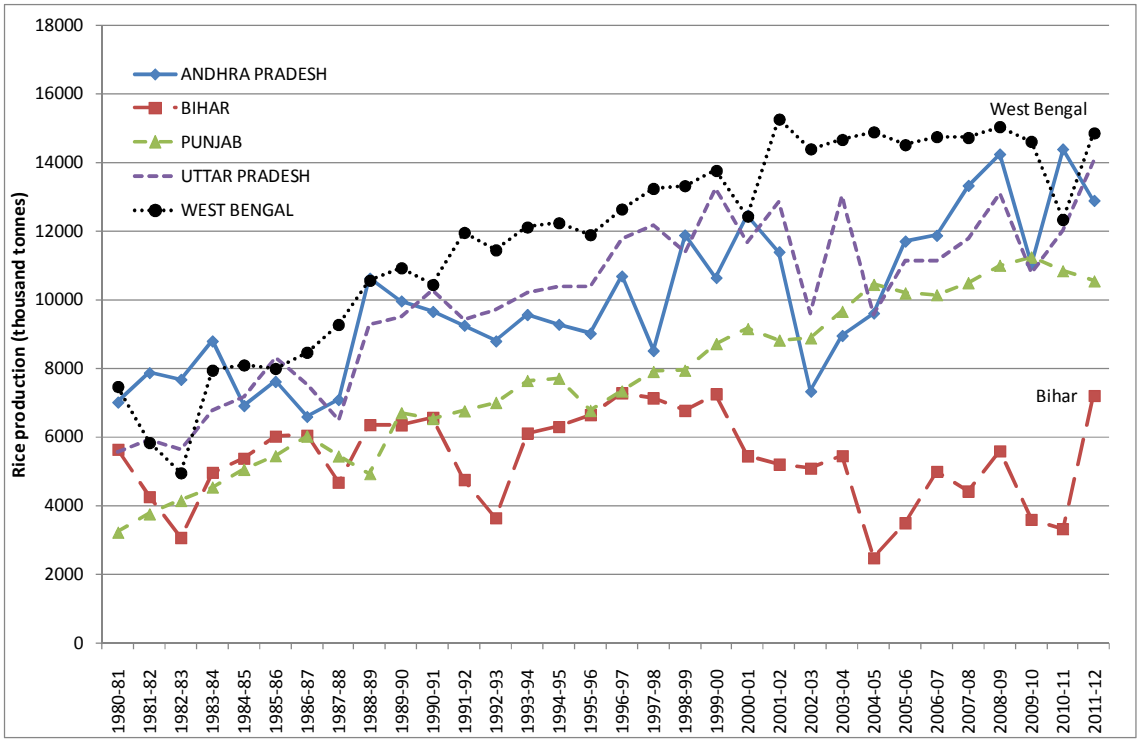

Figure 8 Rice production in Bihar and West Bengal compared to other key rice producing states

Source: Handbook of Statistics on Indian Economy. Figures in thousand tonnes;

[2] Note that some of the data presented here are sometimes slightly different to that reported in the sister report of Kirby et al. (2013), but not substantially different.

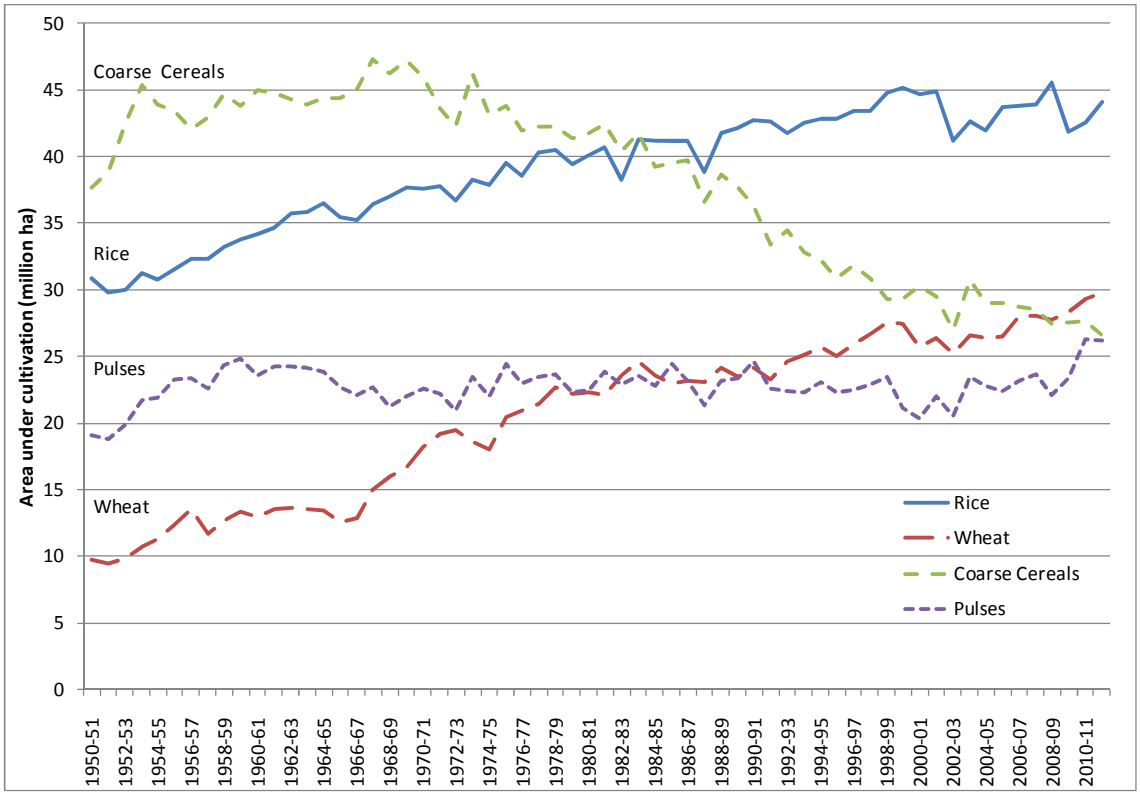

Figure 9 Trend in area under cultivation for major food crops for all of India

Source: Handbook of Statistics on Indian Economy. Figures in million ha

Irrigation in the Kharif season (wet season) enables increased reliability of the crop, and irrigation in the rabi season (dry season) allows increased cropping intensity. The timing of the key crops are shown in Table 1. Irrigation is used primarily used during the dry season crops in the Eastern Gangetic Plains, from November to May (see Kirby et al. 2013 for details[3]).

Table 1 Timing of sowing and harvesting of key rice and wheat crops in Bihar and West Bengal

Season	J	F	M	A	M	J	J	A	S	O	N	D
Rice Kharif							Sow	→	→	→	Harv	
Rice Aus					Sow	→	→	→	Harv			
Rice Boro	→	→	→	Harv								Sow
Wheat	→	→	Harv								Sow	→
Rainfall	18	11	10	21	63	187	265	240	212	83	5	3
Season	Rabi			Pre-Kharif			Kharif (wet)				Rabi	

Source: Indian Meteorological Department (www.imd.gov.in). Rainfall data for Bhalgulpur (Bihar) in mm.

Across all of India, yields have significantly increased for rice (now average of ~2.4 tonnes/ha), wheat (3 tonnes/ha) and coarse cereals (1.5 tonnes/ha) (Figure 10). The area under cultivation is increasing for rice (45 million ha) and wheat (30 million ha), but is declining for coarse cereals (26 Million ha) and pulses remain steady (~25 million ha) (Figure 9). Productivity of Bihari rice was low at 1,090 kg/ha in 2011 which was less than half of the national average of 2,608 kg/ha. Rice productivity in West Bengal was significantly

[3] Kirby, M., Ahmad, M.D., Poulton, P., Zhu, Z., Lee, G., and Mainuddin, M. (2013). Review of water, crop production and system modelling approaches for food security studies in the Eastern Gangetic Plains. Unpublished Report for Food Security through Food System Innovation, CSIRO.

higher at 2,485 kg/ha. Wheat in both Bihar and West Bengal showed good productivity (2,084 kg/ha and 2,658 kg/ha, respectively) relative to the national average of 2,038 kg/ha (Ministry of Agriculture, 2012).

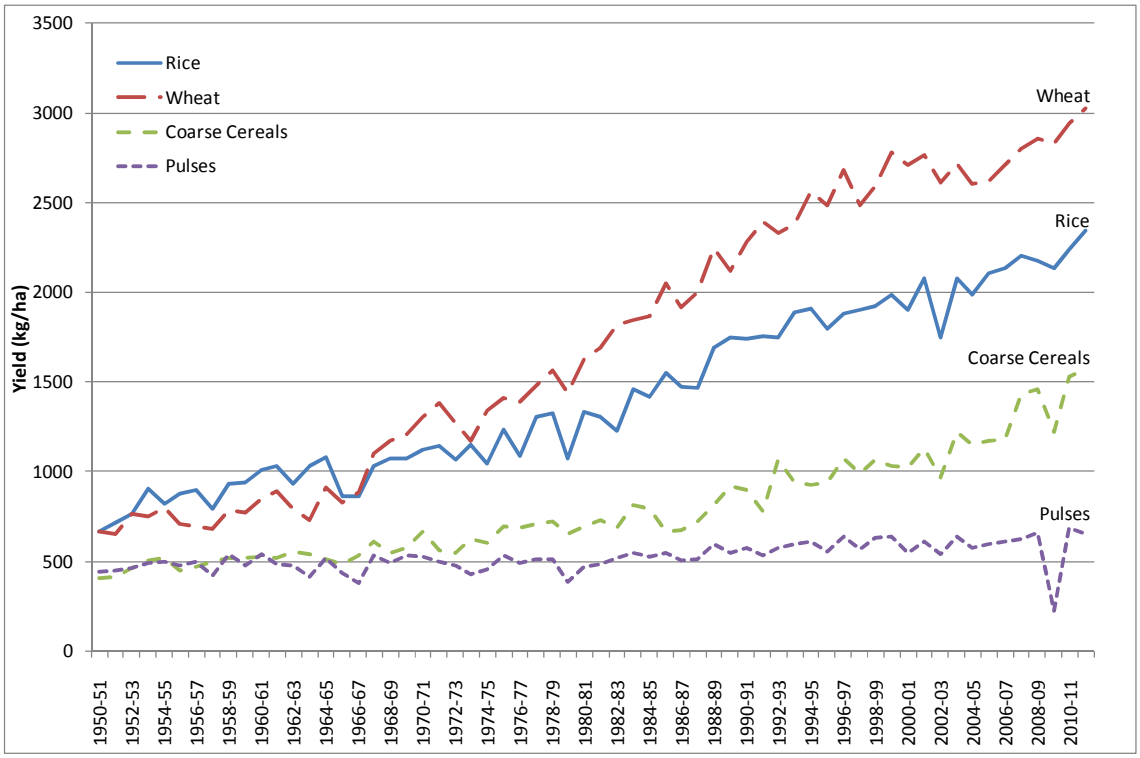

Figure 10 Trend in yields (kg/ha) for major food crops for all of India

Source: Handbook of Statistics on Indian Economy

4.2 Production trends in Bihar

Bihar forms part of the Northwestern and Northeastern subtropical zones (Das 2006). Rice production is important for Bihar. In 2008-09 Bihar contributed over 5% of the national share of rice production and a negligible amount to procurement. This in part reflected the fact that rice in Bihar has been primarily a subsistence crop (World Bank, 2007b). By 2000 Bihar produced 11.4% of India's rice crop (5.08 million ha). Other significant crops are wheat (7.7% of India's crop; 2.1 million ha), maize (11.3%), other coarse cereals (2.9%), and a range of others (gram, tur, other pulses, rape seed & mustard, other oilseeds, and sugarcane). The main cropping system is rice-wheat, but other cropping systems are important: rice-pulse, maize-wheat, sugarcane-ratoon–wheat (sugarcane is cut once, then regrown before preparing for the wheat crop). Most farming households cultivate cereals followed by pulses, oilseeds, vegetables and jute. In the selected districts of Bihar (according to Das 2006), paddy (36.84%) followed by wheat (19.88%) and khesari (grass pea) (12.44%) occupied the largest proportion of area.

Clay reported in 1982 that the Kosi region was primarily experiencing a wheat revolution that roughly quadrupled the wheat cropping area from 100,000 acres in 1965-1966 to 400,000 acres in 1977-1978. However, at least half the wheat crop was entirely rain-fed and exploited residual soil moisture, an unanticipated development similar to the expansion of the wheat crop in West Bengal and Bangladesh. Despite the construction of the Kosi surface irrigation scheme in the late 1950s, Kharif canal irrigation was only providing supplementary water to existing rice land and continuous water logging of lower lying paddy land was evident (Clay, 1982:194-196).

Production has increased weakly in Bihar, compared to Punjab and NW Bangladesh. Bihar's production is much lower than these other major rice producing states (7,201,000 tonnes), but also is not increasing

(Figure 11). Rice production in Bihar is highly variable year-to-year, without any discernible increase or decrease over a 30-year period. The share of Gross State Domestic Product (GSDP) from agriculture in Bihar is 25.34% and from non-agriculture was 74.66% (Haque et al. 2010). The cropping intensity is moderate in Bihar (160.80%). The relative importance of agriculture is declining (in terms of share of GDP) and was 25% in 2007/08. Forestry and fishing increasing share of GDP. In 2007/08, agriculture including livestock was 88.8%, with forestry and logging at 6.1% and fishing at 5.1%.

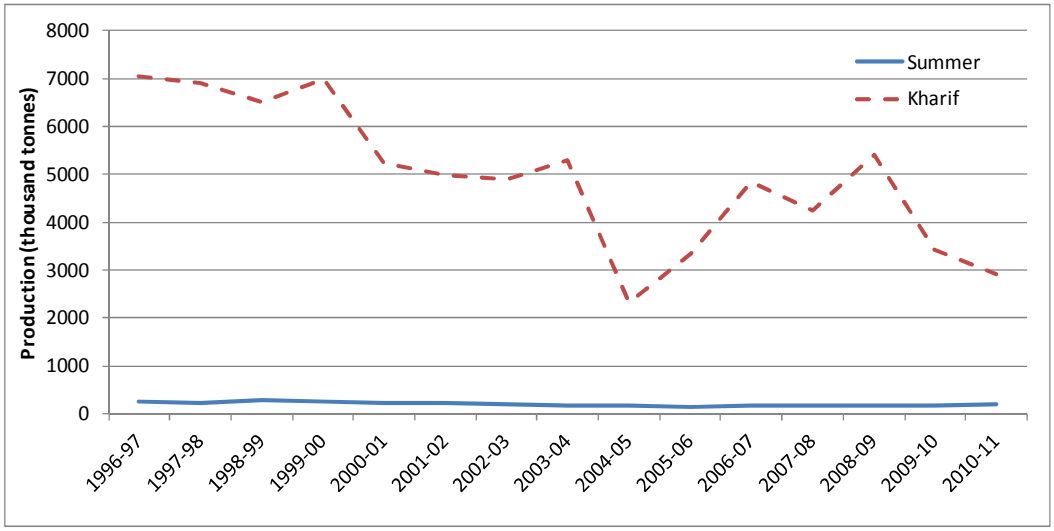

Figure 11 Production of rice in Bihar for summer and kharif crops

Source: Handbook of Statistics on Indian Economy. Figures in thousand tonnes; Includes Jharkhand until 2000.

Two centuries ago, the economy and culture of Bihar was relatively rich, but is now generally regarded as among India's poorest state (De Haan, 2002). There are high levels of illiteracy and poor health system as a result of past corrupt political administrations. There have been declines in cash crops, weaving, cloth, opium, indigo and sugar (De Haan, 2002).

The area of rice production (kharif) has decreased in Bihar from 5 million ha in 1996/97 to 2.7 million ha in 2010/11 (Figure 12) (although data for the State of Jharkhand are included up until the year 2000) (The Directorate of Economics and Statistics and The Reserve Bank of India). The area of summer rice remains small (~100,000 ha). Total rice production (kharif) declined from 7 million tonnes in 1996/97 to 3 million tonnes in 2010/11 (Figure 11). The production for summer rice remains at around 185,000 tonnes. Average yields remain at about 1.5 tonnes/ha for the kharif crop and about 2 tonnes/ha for the summer rice crop (Figure 13). Underutilisation of groundwater is strongly related to Bihar's sizeable yield gap (room for improvement for rice).

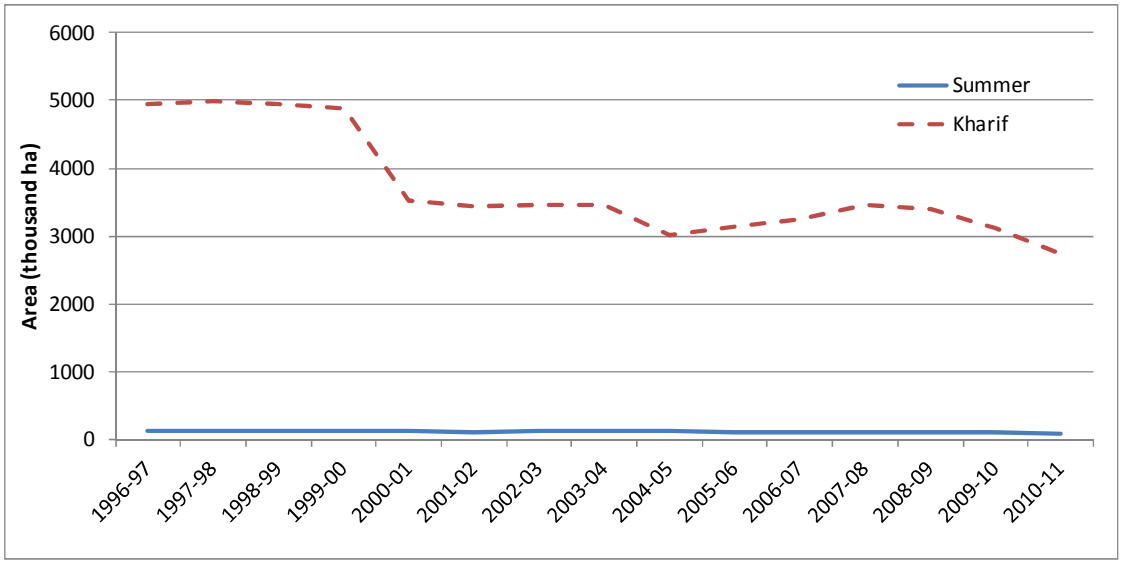

Figure 12 Area of rice grown in Bihar (summer and kharif)

Source: Handbook of Statistics on Indian Economy. Includes Jharkhand until 2000.

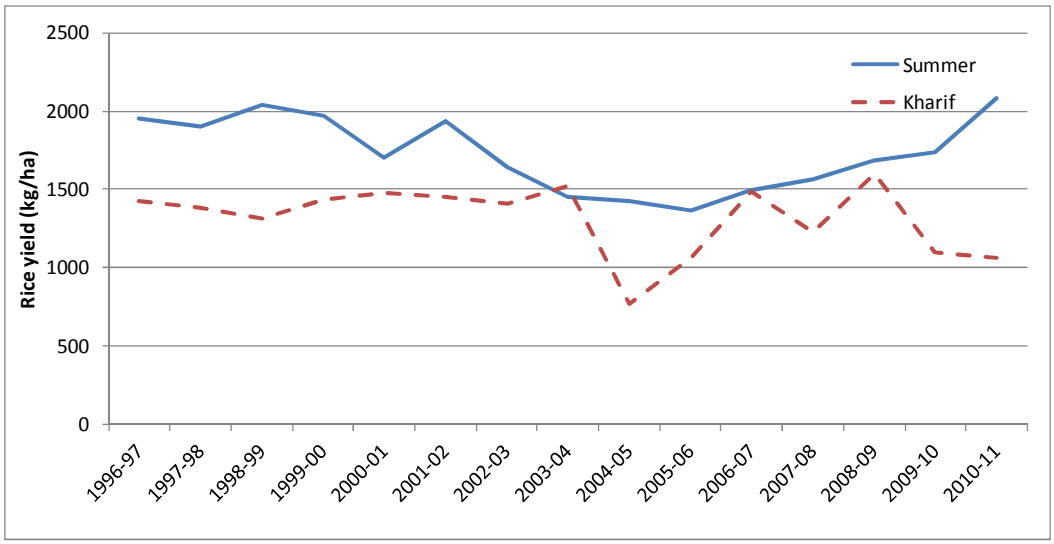

Figure 13 Rice yield (t/ha) in Bihar for summer and kharif crops

Source: Handbook of Statistics on Indian Economy. Includes Jharkhand until 2000.

4.3 Production trends in West Bengal

West Bengal forms part of the Northeastern and Central tropical zones, Temperate Zone (Darjeeling hills area), and Coastal humid tropical zone (Das 2006). In 2000, West Bengal produced 13.2% of India's rice crop (5.88 million ha). Other crops grown are of small production: wheat (1.4%, 0.4 million ha), maize (0.7%), pulses (0.8%), other oilseeds (1.8%) and sugarcane (0.7%). The main cropping system is rice-wheat. Potatoes are also grown (second or third largest producer in India).

In selected districts of West Bengal (according to Das 2006), paddy occupied the largest proportion of gross cropped area (83.42%) followed by mustard (8.60%), jute (2.65%) and vegetables (2.31%). Simpson's Index of Diversification was 0.16. There were a relatively high proportion of horticulture crops. There was a large increase in crop diversification from 1999/2000 to 2006/07. This was away from food grains and towards

oilseeds. The share of livestock was 36.1%. The proportion of cattle was 70%. The relative importance of agriculture is declining (in terms of share of GDP) and was 21% in 2007/08. In 2007/08, agriculture including livestock was 86.4%, with forestry and logging at 3.2% and fishing at 10.4%.

Production remained static in West Bengal, compared to Punjab and NW Bangladesh. The area of rice production (kharif) has decreased slightly in West Bengal from 4.8 million ha in 1996/97 to ~4 million ha in 2010/11 (Figure 14). The area of summer rice remains at a moderate size of 1.5 million ha. Total rice production (kharif) remains steady at around 10 million tonnes (Figure 15). The production for summer rice remains at around 4 million tonnes. Average yields have increased from 2 tonnes/ha to 2.5 tonnes/ha for the kharif crop and are 3-3.3 tonnes/ha for the summer rice crop (Figure 16).

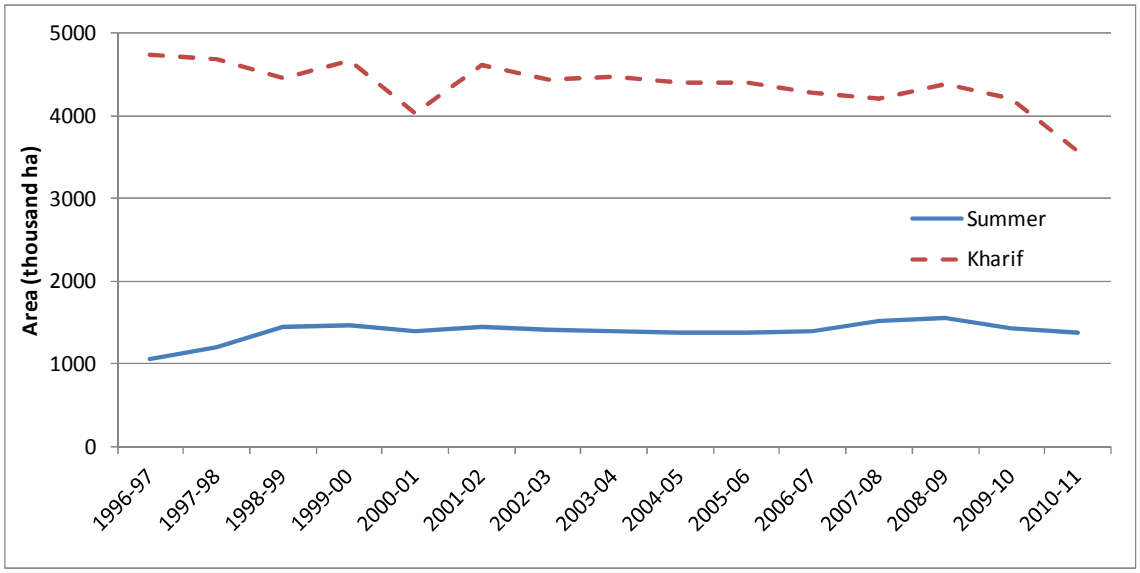

Figure 14 Area of rice grown in West Bengal (summer and kharif)

Source: Handbook of Statistics on Indian Economy

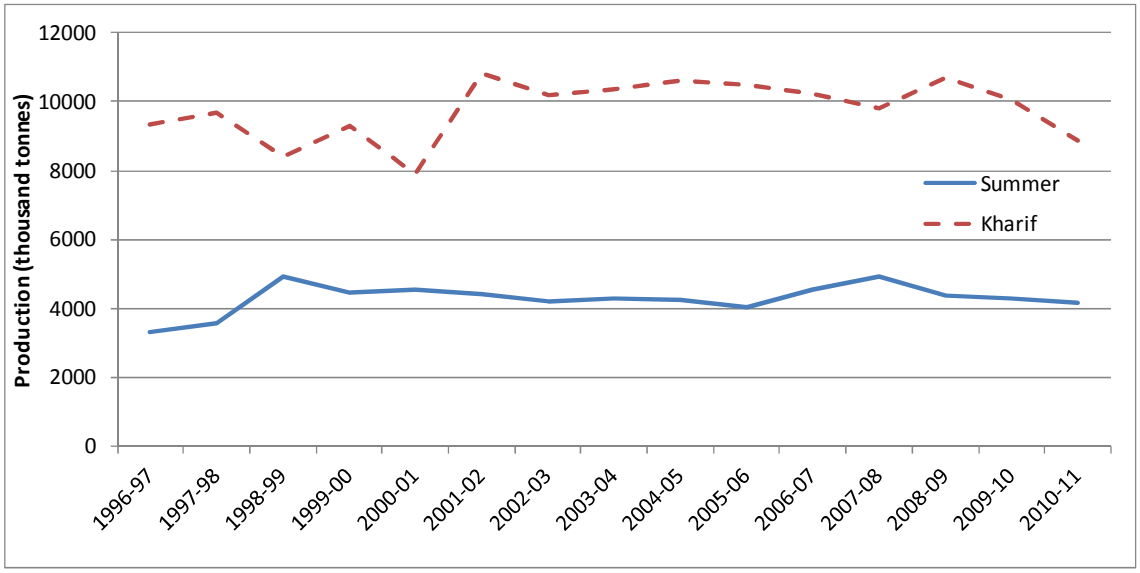

Figure 15 Production of rice in West Bengal for summer and kharif crops

Source: Handbook of Statistics on Indian Economy. Figures in thousand tonnes.

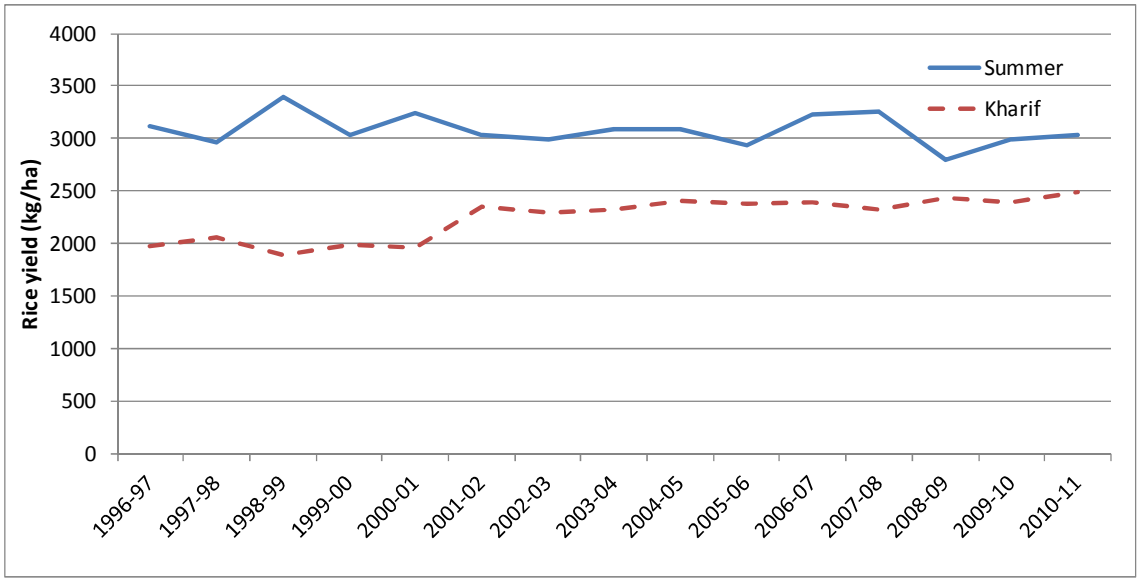

Figure 16 Rice yield in West Bengal for summer and kharif crops

Source: Handbook of Statistics on Indian Economy. Figures in t/ha.

4.4 Production trends in North West Bangladesh

There are three main rice crops grown each year in Bangladesh (Aman, Aus and Boro, see Table 2). Irrigation in the wet season (monsoon Aman crop) enables increased reliability and irrigation in the dry season (Aus and Boro) allows increased cropping intensity.

Table 2 Timing of sowing and harvesting of the three main rice crops grown in Bangladesh

Season	J	F	M	A	M	J	J	A	S	O	N	D
Aman						Sow	Trans	→	→	→	Harv	Harv
Aus			Sow	Sow	→	→	Harv					
Boro	→	→	→	Harv							Sow	→
Rainfall	11	18	25	64	136	264	321	274	296	106	16	11
Season	Winter			Summer			Monsoon (wet)				Winter	

Source: Rainfall data for Rajshahi (Northwest Bangladesh) in mm, Bangladesh Meteorological Department (www.bmd.gov.bd)

In Bangladesh, 25 million tonnes of rice are produced each year and production has been steadily increasing (Figure 17). Wheat and maize are also important, but production levels are not high.

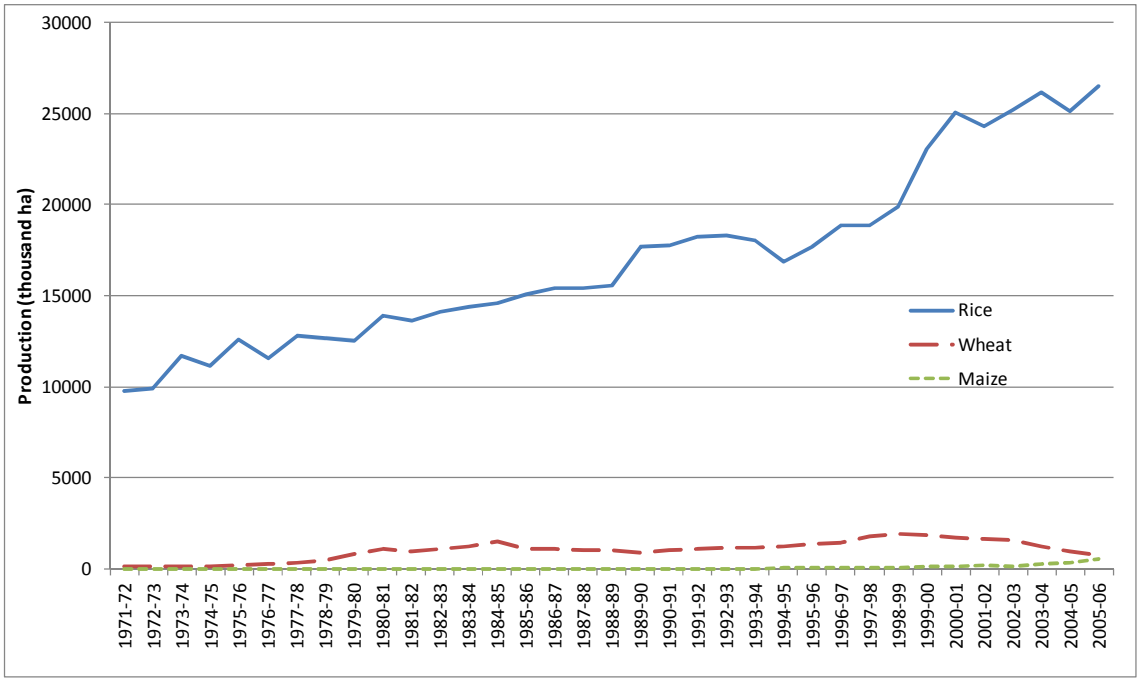

Figure 17 Food grain produced in Bangladesh (rice, wheat and maize)

Source: Ministry of Agriculture Handbook of Agricultural Statistics

In Bangladesh from 1971 to 2005/06, the area of aman rice grown has remained at 5-6 million ha, boro has increased from 1 to 4 million ha, and aus has decreased from 3 to 1 million ha (Figure 18). The amount of rice produced from 1971 to 2005/06 has increased for aman from 6 to >10 million tonnes, for boro from 2 to 14 million tonnes and decreased slightly for aus from 3 to <2 million tonnes (Figure 19). Average yields in 2005/06 for aman are 2 tonnes/ha, for boro are 3.5 tonnes/ha and for aus are 1.7 tonnes/ha (Figure 20).

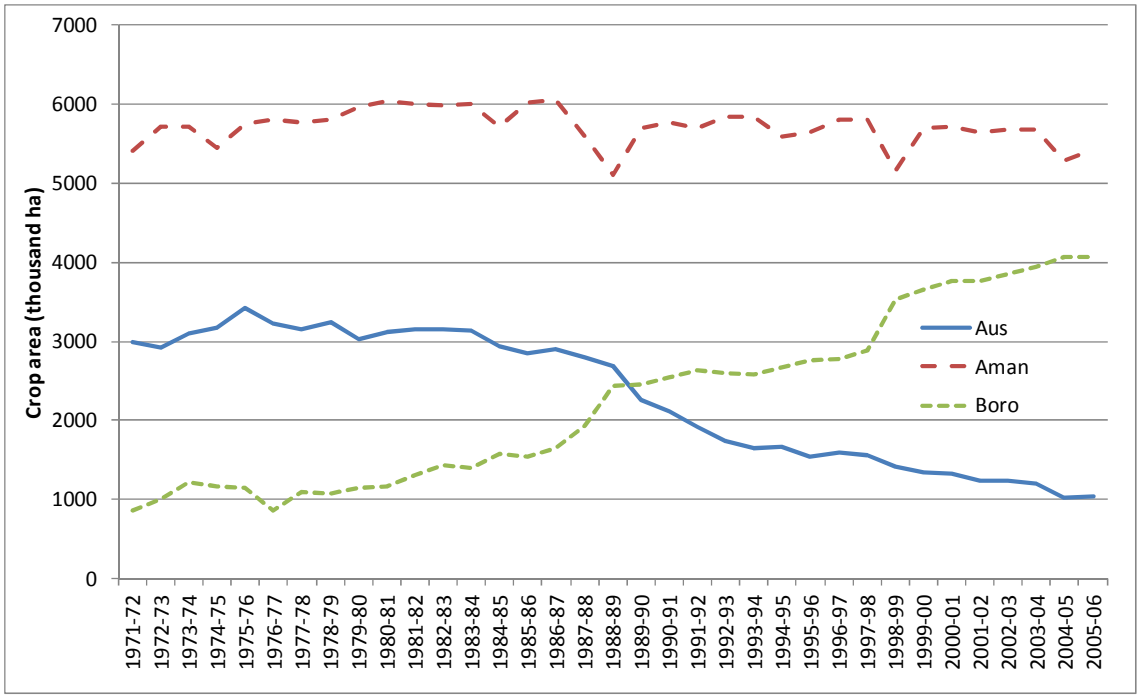

Figure 18 Area of rice grown in Bangladesh

Source: Ministry of Agriculture Handbook of Agricultural Statistics. Figures in thousand ha.

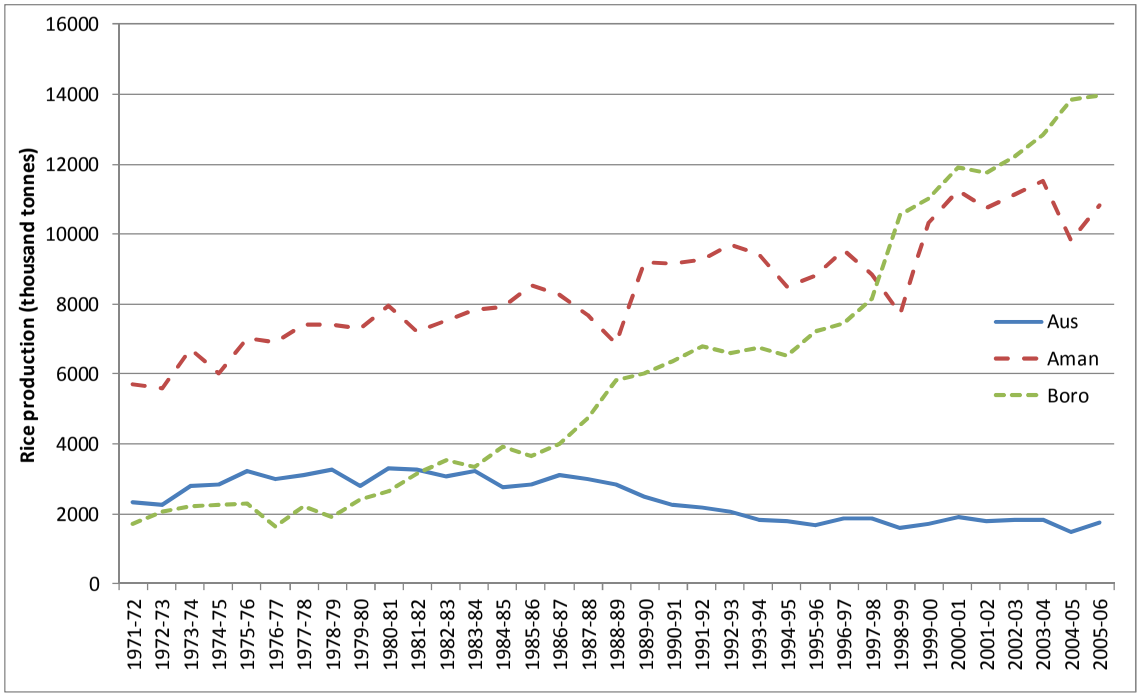

Figure 19 Rice production in Bangladesh

Source: Ministry of Agriculture Handbook of Agricultural Statistics. Figures in thousand tonnes.

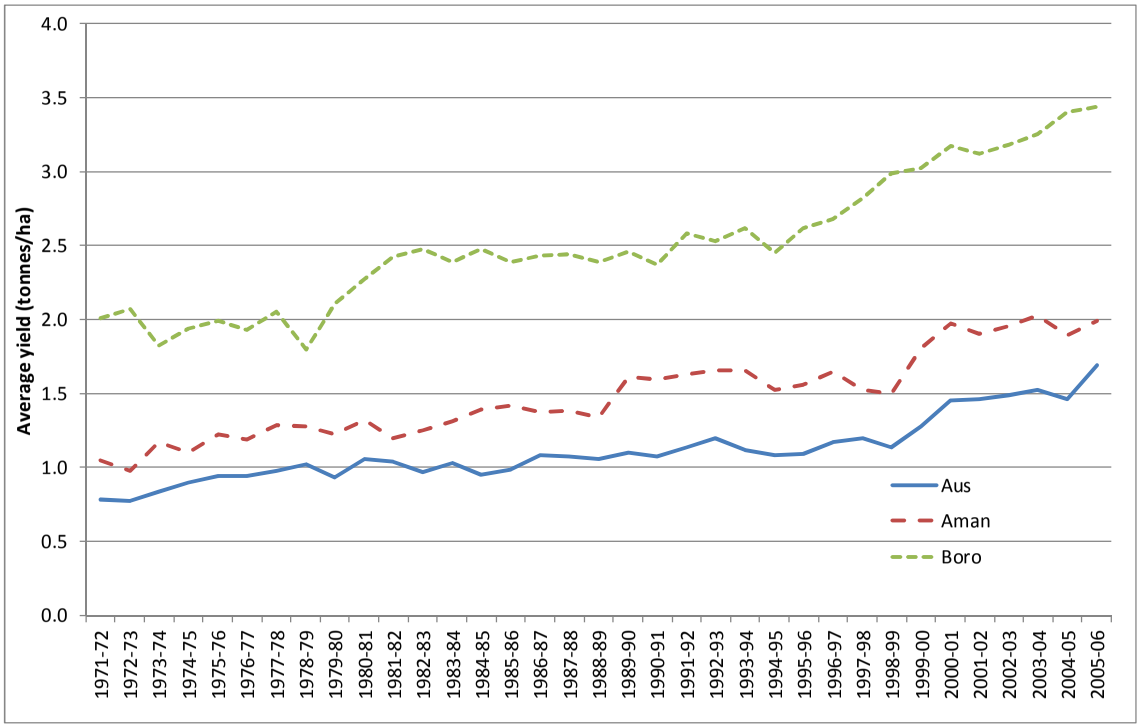

Figure 20 Average rice yields in Bangladesh

Source: Ministry of Agriculture Handbook of Agricultural Statistics. Figures in tonnes.

In Rajshahi District (Northwest Bangladesh), the majority of farmers (75%) are small farmers (0.05-2.49 acre), 21% are medium (2.5-7.5 acre) and 3% are large (>7.5 acre) (Figure 21). Most farmers practice double cropping (Figure 22). Most irrigation is through shallow tube wells.

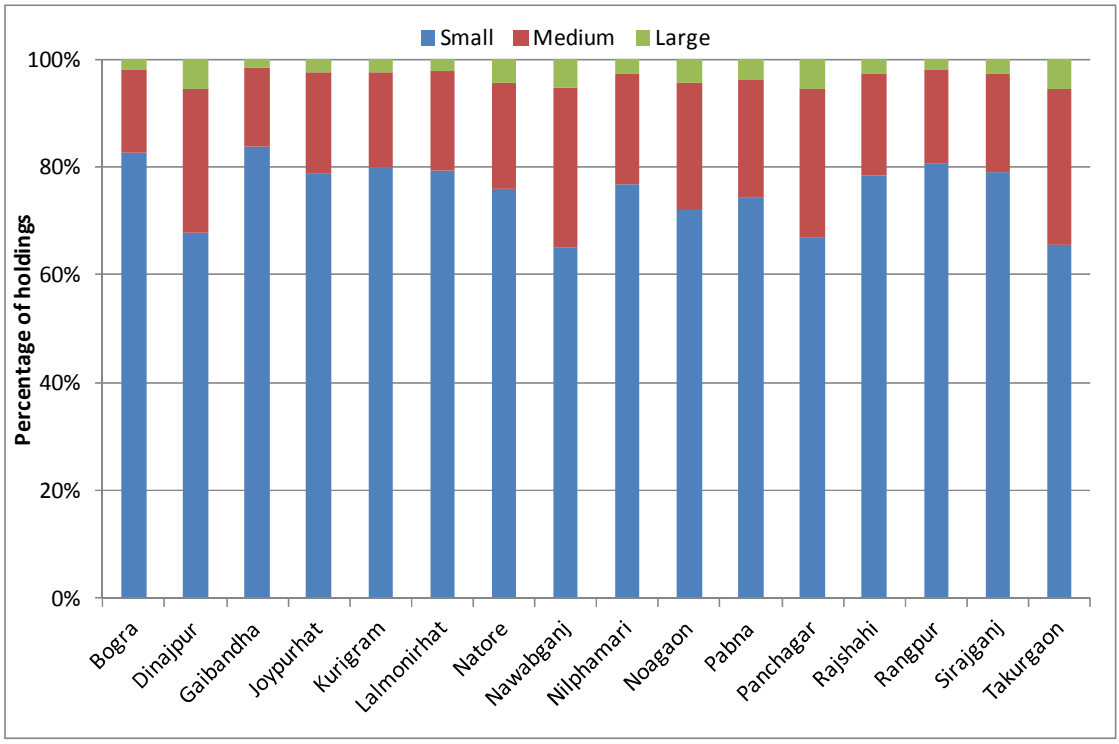

Figure 21 Percentage of holdings small, medium and large farms, Rajshahi Division Districts

Source: Bangladesh Census of Agriculture, 1996. Small =0.05-2.49 acre; medium =2.50-7.49 acre; large = 7.50 acre and above.

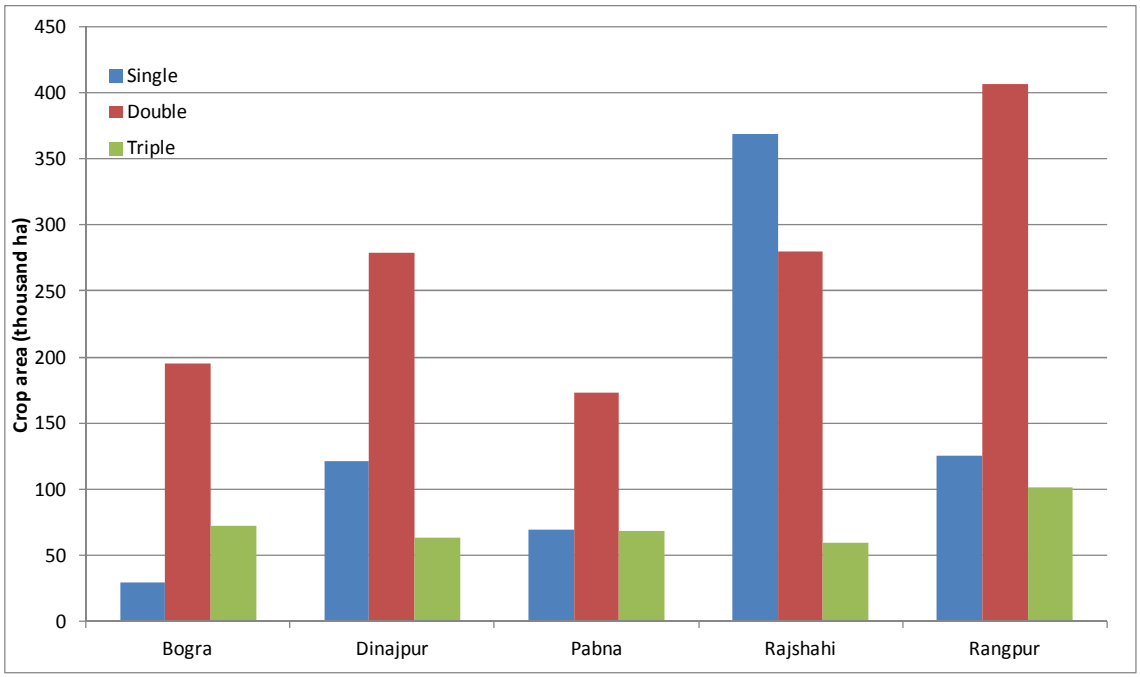

Figure 22 Cropping areas for single, double and triple crops, Rajshahi Division,

Source: Bangladesh Census of Agriculture, 1996. Figures in thousand ha.

The cropping intensity for all of Bangladesh is 177%, but is greater for districts within Rajshahi division, Bogra at 210-217%, Dinajpur at 187%, Pabna at 194-199%, Rajshahi is ~155% and Rangpur at 194-200%. The lower value for Rajshahi reflects the influence of the drier High Barind Tract, where there is not as much irrigation access.

4.5 Production trends in the Terai

There are limited data for agricultural production for the Terai in Nepal. Data comes from the National Sample Census of Agriculture 2001/02 (http://cbs.gov.np/) and IRRI rice statistics as well as from community studies. There are 20 Districts that lie on the Terai of Nepal. In the Terai, rice accounts for 75% of the area and wheat accounts for 34% of the area (Figure 23). Maize accounts for ~12% (spring/summer and summer combined).

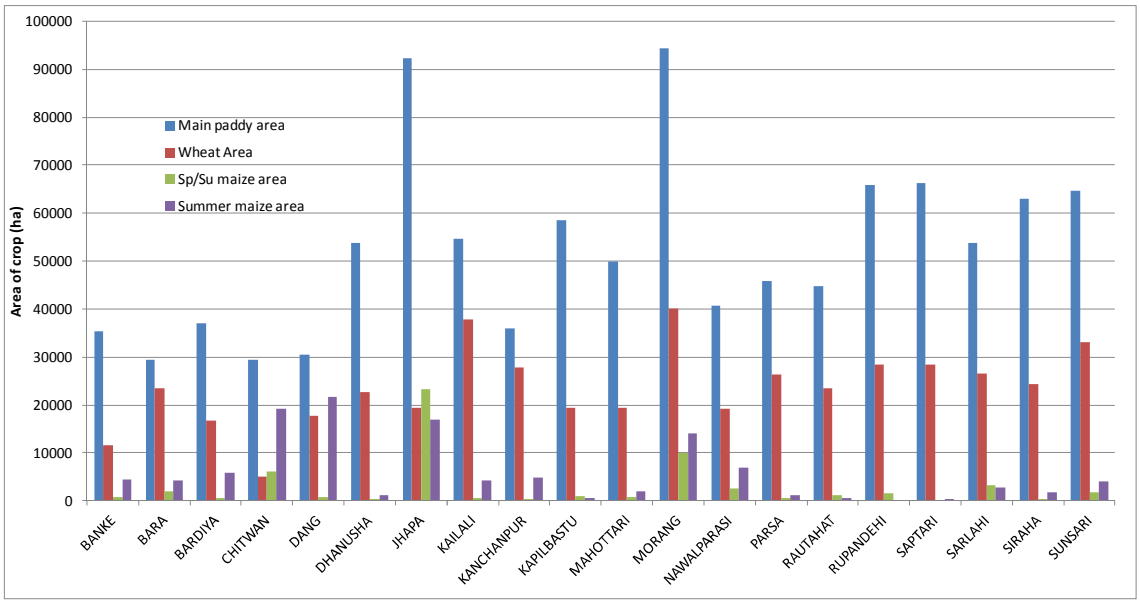

Figure 23 Cropped area rice, wheat and maize, Terai Districts, 2001

Source: National Sample Census of Agriculture 2001/02; http://cbs.gov.np/?p=570. Figures in ha.

The average land holding in the Terai is 1.2 ha, however very small holdings of 0.2 ha occupy 7% of total Terai lands. Thus: 'Although the Terai is relatively fertile with good ground water reserves, farming is subsistence oriented, little use is made of fertilizer, irrigation or high-yielding seeds, and agricultural productivity is low.' The Terai enjoys better infrastructure and services than the hill and mountain regions (excluding Kathmandu Valley) but inequality remains between the eastern and more remote western Terai (Food Security and Agricultural Projects Analysis Service ESAF, 2004: 22-23). For Nepal as a whole, average rice yields are steadily increasing from 2 tonnes/ha in 1961 to 2.5-3 tonnes/ha in 2009 (Figure 24). The area of harvested rice increased from 3 million ha to 4-4.5 million ha (Figure 24). The total production has increased from 800 thousand tonnes in 1961 to ~1500 thousand tonnes in 2009 (Figure 25). However, this is attributed to the expansion of the cropping area rather than an intensification of cropping itself as Figure 25 shows.

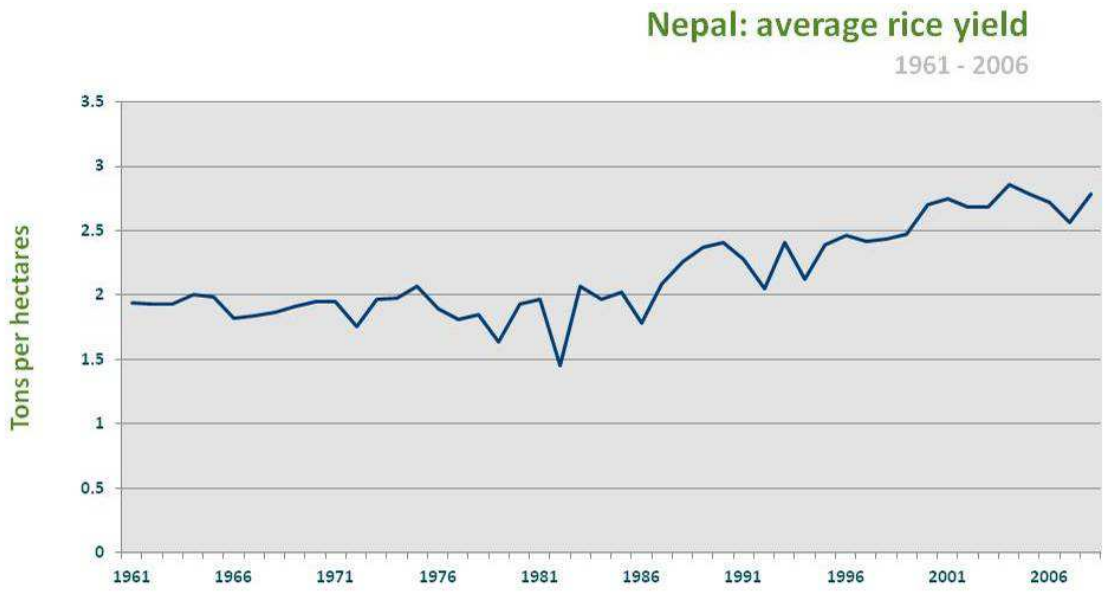

Figure 24 Average rice yield in Nepal

Source: http://irri.org/index.php?option=com_k2&view=item&id=11213:rice-in-nepal&lang=en

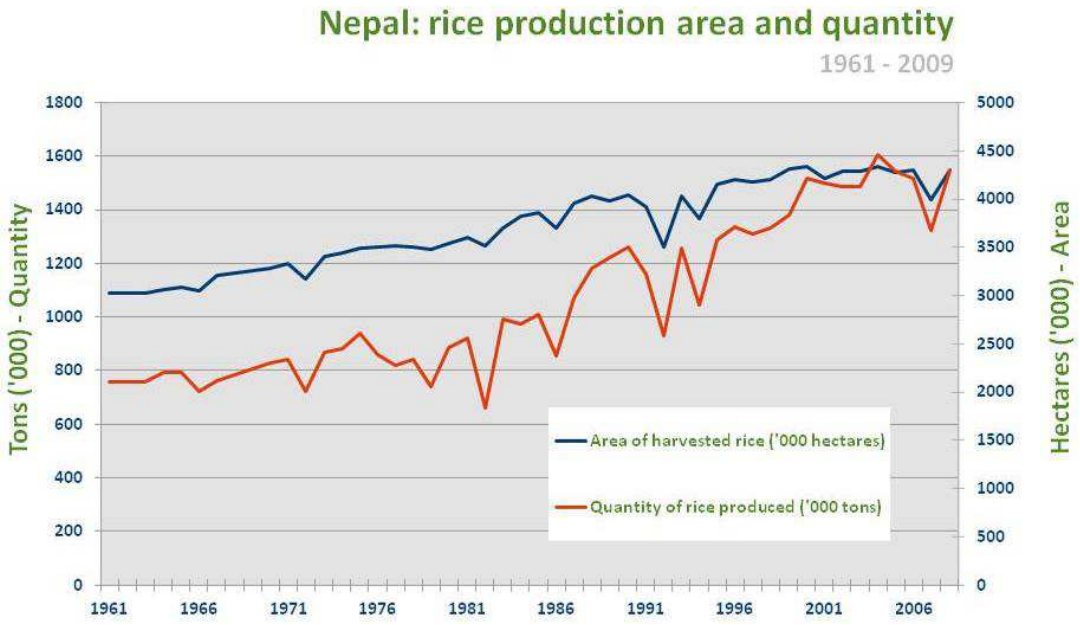

Figure 25 Average rice area and rice production for Nepal

Source: http://irri.org/index.php?option=com_k2&view=item&id=11213:rice-in-nepal&lang=en

There is agreement among researchers that Nepal's slow growth in agricultural productivity is due to dominance of rain-fed agriculture, deeply ironic in such a water rich country. Bhandari (2001) reported that although Nepal's agriculture comprises 42% of GDP, employs over 80% of the population, feeds agro-based industries, export products, and is the top priority in every five year plan, no productivity growth has occurred for 20 years:

> *Traditional technologies, low use of modern inputs and services, and heavy reliance on monsoon rains have been considered as the important reasons for the low rate of agricultural growth in Nepal (Bhandari, 2001:102).*

There are a range of infrastructure for irrigation in the Terai, the main ones being seasonal irrigation, perennial irrigation and tube well irrigation (Figure 26). There are few ponds and others. According to the National Sample Census of Agriculture 2001/02, the percentage of rice that is irrigated is ~60% up to ~160% (Figure 27). Kansakar et al, (2009) in contrast, reported in 2001 that irrigation was available in 33% total cultivated land and accounted for less than half of total cereal production. Similarly, Upadhyay claimed in 2006 that despite its possession of abundant surface and groundwater resources, only 40% of agricultural lands are irrigated, which represents < 1% of Nepal's water resource potential.

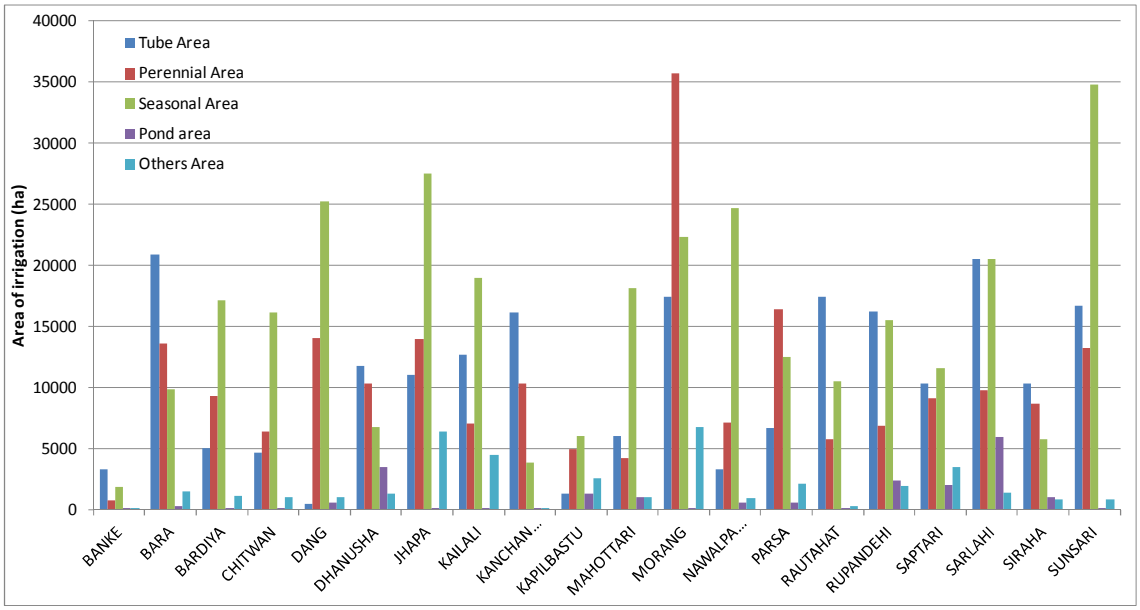

Figure 26 Area under different types of irrigation in Terai Districts

Source: Bangladesh Bureau of Statistics

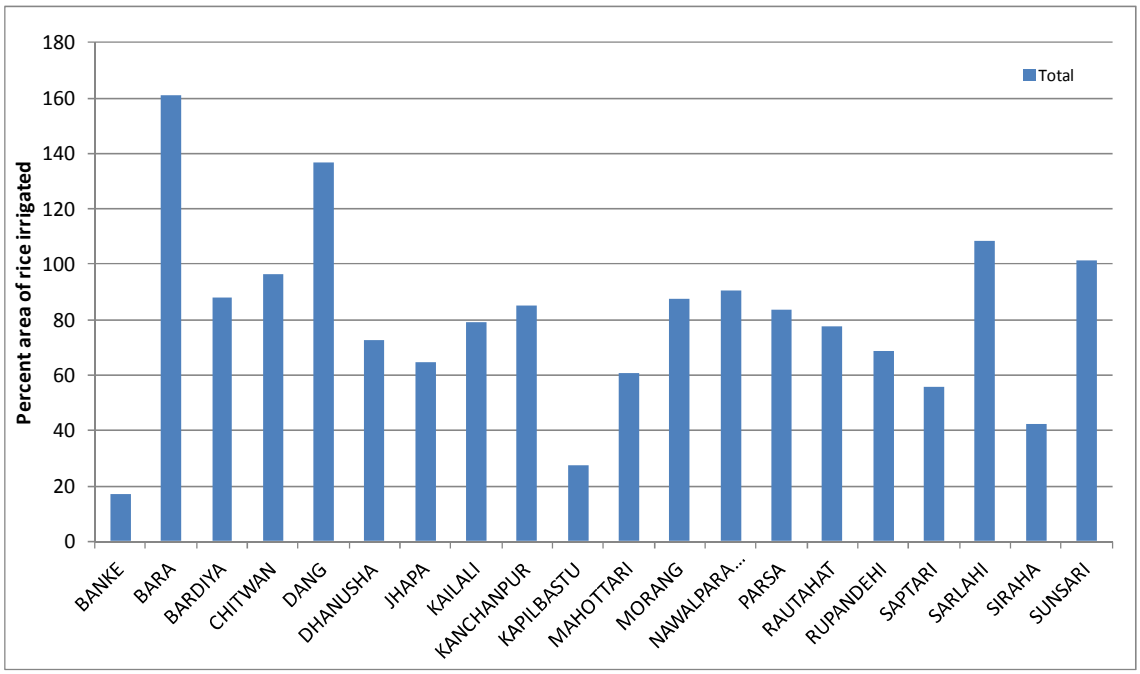

Figure 27 Percentage of rice area irrigated, Terai Districts

Source: Bangladesh Bureau of Statistics. Figures in irrigation area/main paddy area.

Recently, the Nepalese government has given priority to small scale irrigation projects, namely STW development. Policymakers have been attracted to small initial investment, low recurring costs to government, short gestation periods, freedom from organisational and management problems, year round operation and high return on public and private investment. In short, STW irrigation is more flexible, entails less loss in use, and yields higher productivity for the water used. Through credit and subsidy programs, the Nepal Government has facilitated the installation of 3,000 STW units per year between 1980 and 1996 (Bhandari, 2001:103).

Bhandari (2001) explored whether STW was suitable for small and fragmented holdings in Sarlahi District in eastern and Banke District in western Terai, chosen for their contrasting agro-ecological and socio-economic settings. For the crop year of 1987-1998, 324 STW/pump owners and 162 non-owners were randomly selected to be surveyed, with the non-owners further sub-classified into 129 water purchasers and 33 rainfed operations (Bhandari, 2001:103-104). Electricity being unavailable, 8 HP pump and diesel engines were found to be the most popular choice. As in the other EGP jurisdictions, informal water markets had developed in these districts that catered to non-STW owners. Water sales were not found to be purely commercial; rather, pump owners sold only excess water. Fragmentation of holdings, topography and conveyance loss meant that 45% of the owners surveyed installed more than one well (from two to five) and cut long canals to transport it. The fragmented holdings meant that sellers in one location become buyers in another; thus, 80% of non-STW/pump owners were water buyers. It was noticed that as the water market developed, in-kind payment (labour, crop sharing, water) became unpopular and cash payment became normalised (Bhandari, 2001: 107-108).

Most with access to STW water followed cash crop (vegetables, winter maize and spring rice) dominated cropping patterns whereas the rainfed farmers used cereal crop dominated cropping patterns. Furthermore, adoption of HYVs was higher among STW owners at 87%, compared to 59% of water purchasers and 31% of rainfed operators. STW ownership was highly distorted by the size of landholdings due to high capital outlay and O&M costs. Despite a staggered subsidy of 30% for individually owned STW and 60% for group owned STW, marginal smallholders owned none, small farmers owned 39%, medium owned 86% and 98% of large landholders owned STWs. Access to credit and subsidies rested on minimum landownership, lengthy procedures and unfriendly bank staff, all of which formed disincentives, especially for the poor. In short, STW development was functioning to widen income disparities (Bhandari, 2001:107-108).

Rice yield was 26% higher for STW/pump owners and their use of labour, fertiliser, pesticides, power and HYVs was significantly higher than rainfed operators such that net returns per ha for owners was four times higher than rainfed operators (Bhandari, 2001:109-110). Joshi's survey of 222 households in Nawalparasi and Banke Districts of the Terai, and subsequent modelling, showed that farm size and area under irrigation had a positive effect on fertiliser use, and owner operators use more fertiliser than tenants, as do farms closer to road heads and those which utilise markets more (Joshi, 2010: 23 & 28-29). Joshi found that the area of land planted to modern varieties (MV) increased from 40% in 1993-1994 to 85% in 2006-2007, and was highest in the Terai where irrigation, roads and market infrastructures are well developed (Joshi, 2010: 23 & 28-29).

Nationally, 66% of farm households fertilise rice, although the proportion is higher (77%) in the Terai. Fertiliser use in Nepal declined 0.7% per annum between 1990-1991 and 1996-1997 which Joshi attributes to deregulation from 1997 that limited the state subsidy which in turn limited supply. Since then, fertiliser use has increased 3.6% per annum from 1997-1998 to 2001-2002 and declined by 6% since leaving chronic shortages during the crop planting season. Rates of use declined from 26 kg per ha in the 1998-1999 season to 20 kg/per ha in the 2006-2007 season (Joshi, 2010:22-23). Most lowland and one third of highland smallholders (who rely largely on manure) used low quality chemical fertiliser illegally imported from India. The fertiliser was reported to be used at a rate of 20 kg/ha, in contrast to the recommended dose of 83 kg/ha) and was not being used in a balanced way. However, only 2% of highlanders used insecticide, relying instead on ashes, tobacco leaves and forest tree bark, whereas the lowland smallholders were completely dependent on chemical insecticides which they sourced from cooperatives of local markets (Bhandari and Grant, 2007:20-22).

Many households have iron ploughs but there are very few power tillers. As Nepal was physically isolated until 1950, it was not until the mid-1960s that 64 tractors and 30 pump sets were introduced to the country (Biggs et al, 2002:6). During the 1970s, Nepal's five year plans promoted four wheel tractors, tubewells and pump-sets. Concerned about the labour displacement effects of mechanisation during the 1980s, Nepal's five year plans promoted labour-intensive machinery and tools. However, during the 1990s the de facto laissez-faire policy that followed structural adjustment encouraged the private sector to import tractors and pump-sets as subsidies and regulations were reduced. Consequently, considerable maintenance and repair capacity has built up in major towns, although Nepal itself only produces wheat threshers and other simple machinery. The long Indian border facilitates the spread of machinery both due to harvesters being rented across the border and the regular migration of Bihari labourers to the Terai. Power units rapidly spread between 1980 and 1999. Four wheel tractors increased from 2,500 to 17,000; two wheel tractors from 400 to 1,400, and pump-sets from 10,000 to 50,000. Stationary Indian diesel powered pump-sets became widely available and are used to power most wheat threshers (Biggs et al, 2002:7-8).

Biggs et al (2002) point to the little known but 'strong power tiller innovation system' that has developed since 1999 on the Terai due to the NARC CIMMYT project that now has five importers trading in eight of the Terai's large cities. Although 500 tillers are in use, only minimum spare parts and after sales services are available and the innovations system project has started training mechanics to extend from pump-sets to power tiller repair, has translated manuals into Nepali and supported an NGO to become spare parts dealer (Biggs et al, 2002:15- 17). These authors argue that: 'Government policy has on the whole been one of non-engagement with non-irrigation types of mechanisation' (Biggs et al, 2002:33).

4.6 Key conclusions

The production of rice is high for West Bengal and Northwest Bangladesh, but remains low for Bihar and the Terai of Nepal, largely because of small areas of dry season rice and the minimal use of groundwater irrigation. Rice yields for the boro rice crops (~3-3.5 tonnes/ha) are higher than the kharif rice crops (~2-2.5 tonnes/ha). Rice yields have been steadily increasing in these areas, but the greatest increases in production have occurred in the boro rice crops, provided that adequate irrigation water and pumps are available for supplementary irrigation. Bangladesh achieved significant increases in rice production over the last 20 years demonstrating it is possible to increase production in the EGP and achieve food self-sufficiency.

The key physical and technical issues preventing increases in rice production in Bihar and Terai include Nepal's inadequate irrigation infrastructure, poor availability of pumps (diesel or electric), poor access to roads to access markets, and poor availability of high yielding varieties, particularly for small land holders. Access to these is better for large land owners, but they form a minority of landholders. The availability of power tillers, tractors and use of fertilisers is also low.

There are additional social and institutional constraints which are holding back agricultural production in Bihar, West Bengal and the Terai. Technical driven solutions, by themselves, will not be sufficient. The social and institutional constraints include:

- Poor land tenure arrangements and insecurity of land tenure mean that it is not possible to invest in irrigation infrastructure (particularly water pumps or tubewells) (see Chapter 3.2 about land tenure arrangements). These farmers need to have a short turn around and high profit returns because of the uncertainty of land tenure arrangements.
- In Bihar, farmers are not obtaining minimum procurement prices for rice, so there is no incentive to grow rice (see Chapter 9.2 for procurement prices). The markets are more functional in Bangladesh.
- Bihar is considered as India's poorest state meaning that changes to improve production will take time and considerable effort.

The question remains as to whether increasing the area for dry season rice production in Bihar and Terai through irrigation is the best approach to increasing food security (increasing intensity of rice cropping). An alternative approach would be to increase diversity of other higher-value crops and utilise potential

irrigation water in the dry season to improve livelihoods. This would require improvements in the technology available for pumping water from groundwater resources and improving infrastructure so that product can get to market or into the value chain. The social and institutional constraints also need to be alleviated.

Options for improving productivity include:

- Improving physical and technical aspects of irrigation, road infrastructure, varieties and rice crop management (eg fertilisers and other chemical inputs);
- Diversify into cash crops or horticulture in the dry season if groundwater can be made available;
- Examine land tenure arrangements and look for alternative approaches for sharecropping;
- Utilise NGOs in cooperation with state government extension services to uplift and develop the capacity of farming communities to negotiate contracts, land access and develop sharecropping and niche markets; and
- Improve minimum procurement prices for rice.

5 Water and food security

The EGP sits within the Ganges-Brahmaputra-Meghna basin, the second largest hydrologic region in world. The basin covers 1.75 million km^2 and houses a population of 600 million people of Hindi, Buddhist and Islamic persuasions. The basin involves the five co-riparian countries Bangladesh, Bhutan, China, India and Nepal. Bangladesh and India share all three rivers and Nepal hosts the headwaters of the Ganges (Ahmed, 2003:181). Regional arrangements for the Ganges-Brahmaputra-Meghna Basin have yet to coalesce, as they have with United Nations guidance in the neighbouring Mekong Basin. However, the Abu Dhabi dialogue has sought to build regional cooperation through annually convened discussion between the seven co-riparian nations (Bangladesh, Bhutan, China, India, Nepal Afghanistan and Pakistan) that span both the western (Indus) and eastern (Ganges) Himalayan rivers. To date, the waters of the EGP are managed through bilateral agreements between India, the most populous and economically dominant of the EGP nations, and both Nepal and Bangladesh.

The headwaters of the EGP's region's major rivers lie in Nepal, but flow through north-eastern India and Bangladesh to discharge into the Bay of Bengal in Bangladesh, significant for containing the world's largest mangrove forest. The mid reaches of the Ganges fall under India's jurisdiction. The extreme relief of the Himalayas which rise 6,000 m within a distance of only tens of kilometres affords enormous energy potential and numerous storage sites in Nepal – an attractive prospect for India. Bilateral arrangements are thus dominated by irrigation and energy hungry India and the water and potentially hydro-electric power rich (but politically disorganised) Nepal.

India's treaties with Nepal date back to 1920 when the Mahakali treaty between British India and Nepal was signed. The Gandak treaty of 1959 deprived Nepal of the prospect of irrigating the Gandak basin within the Terai plains, and was consequently revised in 1964 (Bandyopadhyay and Gyawali, 1994). From an upstream perspective, nine Nepali tributaries contribute 47% of the Ganges' average flow, as measured at Farakka barrage where Indian and Bangladeshi waters are 'divided'. Because 80% of annual rainfall is restricted to the 4-5 months during the monsoon, Nepal's contribution to the Ganges' flow during the dry season increases to 75% (Adhikari, et al, 2009:648).

The inability to raise agricultural production (by increasing cropping intensity) without reliable dry-season irrigation arguably makes inequality of water distribution within and between the five EGP jurisdictions a larger problem than land distribution – inequalities that Raj argues have widened with the availability of groundwater irrigation technology (1988:184). Five governments are involved in this problem: the Governments of India (GOI), Bihar, West Bengal, Nepal and Bangladesh. Only Bihar and West Bengal are completely geographically contained in the EGP. However, the food bowls of Nepal (the Terai) and Bangladesh (the north-west region) are geographically contained in the EGP.

India and Bangladesh have been in conflict regarding dry season flows (from 1st January to 31st May) since 1951 when India decided to build the Farakka barrage, unilaterally constructing it in West Bengal 18 km from the Bangladesh border by 1977. The barrage is viewed by India as needed to divert water into the Bhagirathi River to flush Calcutta's port. It is viewed by Bangladesh reducing average Ganges discharge by 60%.

India and Bangladesh signed a treaty in 1977, extended by Memorandums of Understanding (MOU) in 1983 and 1985. The Ganges Water Sharing Treaty was signed in 1996 for 30 years duration. This difficult deal was struck when the Indian Congress Party and Bangladeshi Awami League were in power and able to cooperate (Ahmed, 2003; Adhikari, et al, 2009:648; Khan: 2012). It was signed without the involvement requested by the Bihar State Government which is a loser of what constitutes a 'Dhaka –New Delhi agreement' (Gyawali, 1999). The Treaty provides a formula for calculating the sharing of the water. Critiques of the treaty point out that the formula defines how the flow should be divided without making provision for what the flow should be, and thus does not even guarantee a minimum flow (Nishat and Pasha, 2001; Rahaman, 2006). There appear to be few reviews of its operation in practice. The best known

of is in a blog by Khalequzzaman and Islam (2012), which analyses four years of recent flow data to show that, while Bangladesh has received what it should under the treaty 80% of the time, it is receiving a (mostly fair) share of a flow that is about half what would have been expected from the period of 1949-1988, which is the reference period for assessing the flow.

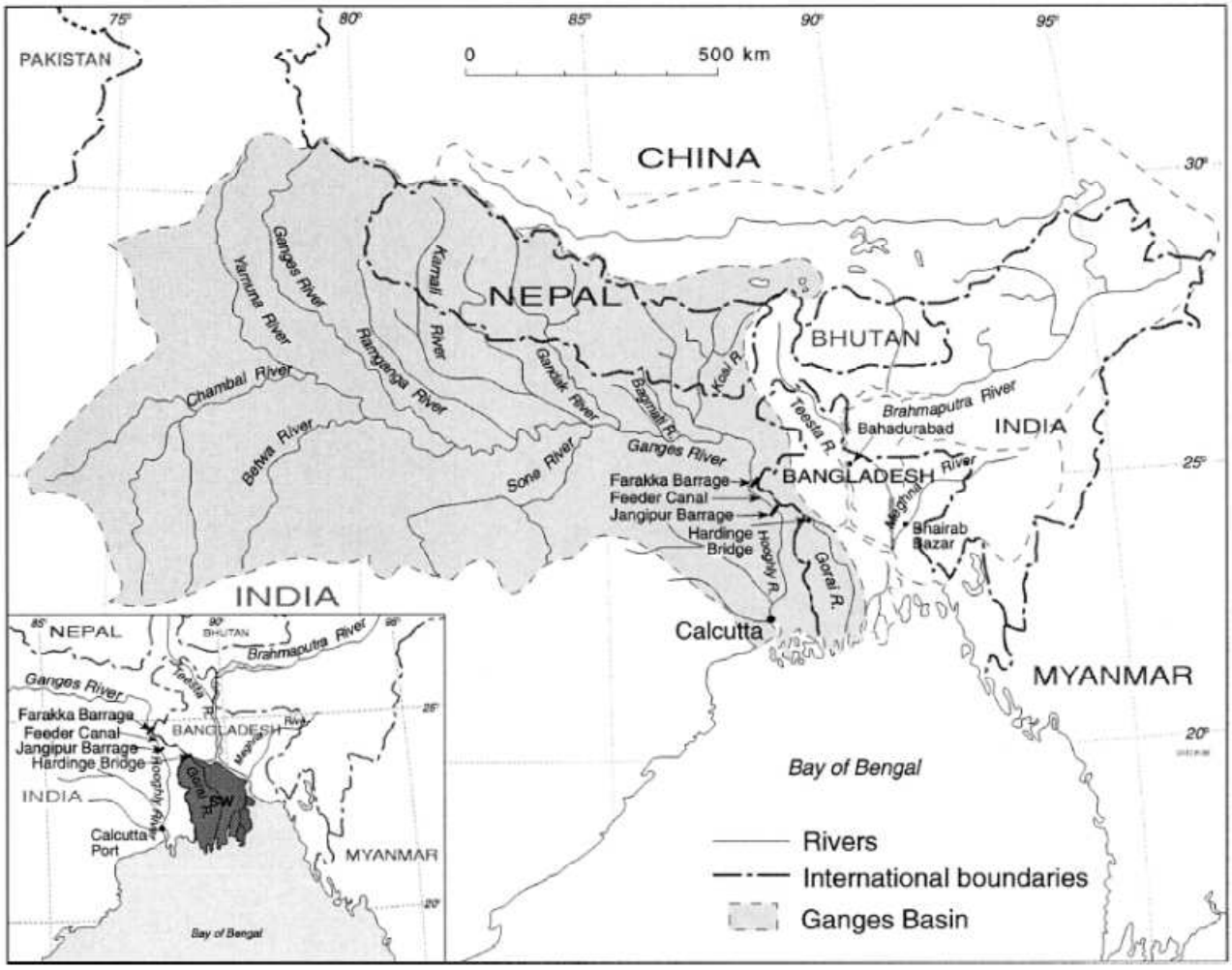

Figure 28 Ganges River basin and Farakka barrage

Source: Khan (2012)

A water management problem shared by West Bengal and Bangladesh is the mobilisation of arsenic in groundwater. Contamination was discovered in the 1980s in West Bengal and confirmed in Bangladesh in 1998 when a national survey was conducted. Ironically, 90% of Bangladeshis have been utilising groundwater for drinking supplies since most surface water was found to be microbiologically unsafe to use in the 1960s. The survey found that the majority of wells in 60 out of 64 districts (80% of the country) exceed the World Health Organisation limit of 10µg/L and only 30% of wells were below Bangladesh's standard of 50 µg/L. Wells with arsenic contamination exceeding 1,000 µg/L were found in 17 districts (Ahsan and Del Vallis, 2011). Arsenic is also accumulating in soils, rice (depending on the variety), and quite possibly livestock (Rahman and Hasegawa, 2011). The arsenic issue adds weight to Bangladesh's concern regarding reduced Ganges flow.

Floods and water logging affect food security in the EGP as profoundly as the need for dry season irrigation. During the wet season, snowmelt, landslides, alpine cloudbursts and glacier-lake outbursts in Nepal can be aggravated by days of highly concentrated rainfall that end in the synchronisation of river peaks. Subsequent flooding is concentrated on the Terai, West Bengal and Bihar. However, it is Bangladesh that

receives the brunt of floodwaters. Bangladesh's flatlands drain almost 75% of total Himalayan run-off within a three month period. Even in normal years, 30% of the country can flood and in a more extreme scenario, 80% of land is flood prone (Ahmed, 2003; Bandyopadhyay and Gyawali, 1994). Debate between British India and Nepal from the 1930s ended in the 1953 decision to construct the Kosi Barrage project in Nepal in the effort to control flooding in India. This decision developed further impetus due to severe flooding in 1954, the year India and Nepal signed the Kosi Treaty (Clay 1982:190-191).

The attempt to provide hydro-electricity, dry season surface water irrigation and flood control with the use of dams and barrages began in Bengal (India and Bangladesh) under British administration. The performance of this modern engineered infrastructure has been disappointing on all of these fronts and irrigation technologies have rapidly evolved since the 1950s in the EGP. Not part of British India, Nepal's modern irrigation history is more compressed than India's and Bangladesh's and its irrigation phases give some idea of this in the EGP:

1. Up until the mid- 1950s, Nepal's hill and Terai communities developed their own irrigation facilities to provide supplementary irrigation to the main crop. These Farmer Managed Irrigation Systems (FMIS) were managed by the users themselves with traditional norms and rules and are still in existence in remote hill areas;
2. From 1956 to the 1970s, the government funded medium and large surface irrigation schemes projects, diversion weirs and main canal distribution systems;
3. From the early 1970s to 1980s, there was extensive development of command areas, expansion of irrigation infrastructure and FMIS rehabilitation;
4. The mid 1980s to the present saw more integrated development of land and water resources, further renovation and expansion of FMIS; groundwater (shallow tubewell) development where surface supplies are seasonal and the involvement of NGOs as implementing agencies (Upadhyay, 2006:69).

This evolution of irrigation technology is unpacked below.

5.1 Engineered dams and barrages

The Kosi Barrage, built in Nepal but intended to benefit the three north-eastern districts of Bihar, illustrates the difficulties experienced with modern engineering approaches to flood mitigation and dry season irrigation in the EGP. The fact that groundwater is rarely more than three metres deep in north Bihar was not considered. The fact that the Kosi River carries the highest flow and silt load of the Ganges tributaries and has shifted course 100 km westward due to a series of floods over the last 200 years was not considered. Being comprised mostly of meandering floodplains of ridges, basins and old channels interspersed with extensive higher tracts of sandy-silt soils, the Terai and northern Bihar is difficult terrain for the design and management of gravity flow irrigation (Clay 1982:190-191).

Completed in 1964, the project entailed the construction of a barrage and embankments to control floodwaters, a small hydroelectric station and provision of canal irrigation for 1.4 million ha. At the time of Clay's analysis in 1982, the Kosi canal system had not reached 20% of the (now abandoned) original target of 1.5 million acres for annual irrigation. Cost recovery languished as less than 30% of of water fees was being collected from irrigators. A symposium on the Kosi project was held in Bihar's capital Patna in 1979. The planning, management and organisational deficiencies common to all large irrigation projects were discussed. That is, there were no detailed field investigations, high land was not excluded from command estimates, the restriction of summer irrigation by heavy silt deposits was not anticipated, and the scheme lacked a drainage component to prevent increased water logging of land. There was no discussion of groundwater development and irrigation engineers employed the time honoured strategy of blaming farmers for the scheme's poor performance (Clay, 1982: 197-202).

The operation of the Kosi Barrage has suffered due to characteristically poor Indian maintenance regimes aggravated by fact the facility is on Nepal's Terai. Consequently, siltation has raised river beds above the height of adjoining land and clogged irrigation canals, while overtopping and breaching of embankments

have posed entirely new flood risks (Bandyopadhyay and Gyawali, 1994). A breach of embankments on the Kosi River in 2008 shifted the course of the river over 100 km and displaced 60,000 Terai residents and three and a half million Biharis (Moench, 2010; Shrestha et al, 2010). According to Gyawali (1999), the Kosi Barrage, meant to protect 214,000 ha, has degraded 292,000 ha of fertile land and left 800,000 people in 338 villages living in abject poverty between embankments (see also Singh et al, 2009).

Moench, discussing the Ganga basin as a whole, argues that barrages have undermined the adaptive capacity of both farmer and bureaucratic communities:

> *In protected areas, populations invest and build lives without considering flood risks. They have little incentive to diversify or invest in raising houses or other activities that would reduce their losses. On the other side of the embankments, those suffering from recurrent flooding have been trapped in a cycle of losses and battles over compensation that has probably contributed to endemic poverty in the area. Embankment technologies have, in essence, inherent path dependencies — they create divisions within society and encourage the growth of bureaucracies and sets of interests that are deeply embedded and difficult to change (Moench, 2010:982).*

Nonetheless, the engineering solution to water management in the EGP has inherent path dependency. By 1996, Bihar had 3,421 km of embankments. Water drainage was further compounded by road and rail expansion that also failed to account for water drainage. Effectively the EGP hydrological regime has been permanently altered. These experiences lend weight to a longstanding debate as to whether the Bengal Basin's silt deposits have been irrevocably disturbed by the installation of agency managed irrigation schemes (AMIS), and whether the paradigm of flood control should return to the pre-British era of less intensive but agriculturally attuned flood management (Biswas, 1987; Gyawali, 1999).

For the dam and barrage engineering strategy to further assist food security within the EGP, several biophysical issues need to be resolved. Physically, the seismic activity of the Himalayan region and high sediment loads of the rivers pose risks to dam safety and endurance. Modern surface water schemes persistently underperform in terms of: oversupply of the head and undersupply of tail farmers, command areas proving smaller than anticipated and low accountability to farmer clients (Mukerji et al, 2012:431). Persistently negative socio-economic impacts such as displacement also form strong concerns (Ahmed, 2003; Adhikari, et al, 2009:648). Gender analysts point to the differential impacts of large dam projects upon women who bear many responsibilities for water provisioning without enjoying corresponding rights of access (Lahiri-Dutt, 2012).

Civil protest against dam proposals has become predictable. The Pancheshwor Treaty of 1996 between Nepal and India proposing the construction of a high dam on the Mahakali River failed to proceed beyond the scoping stage due to the opposition of Nepali civil society: 'Embankments and large dams have become focal points for conflict between developers and environmentalists in many of the foothill areas' (Bandyopadhyay and Gyawali, 1994:16). As Moench points out:

> *... water resources and their management are heavily affected by asymmetrical relations between India and Nepal and by the engineering dominated paradigm for hydropower and other water resource development that characterizes South Asian hydropolitics (Moench, 2010:981).*

Regional debate is currently polarised over whether high dams in Nepal could contribute to dry season irrigation, hydro-electric power generation and flood 'cushioning' in both North East India and North West Bangladesh.

5.2 Traditional irrigation via self-governance

Traditional micro water harvesting techniques (ponds, tanks, pynes etc), referred to as Farmer Managed Irrigation Schemes (FMIS), have been put forward as a neglected alternative to the macro high dam focus (Koul et al, 2012). FMIS was once substantial in the EGP and Nepal's FMIS heritage is still evident: 'Presently, about 620,000 ha area in the country is served by the FMIS, which is 55% of the total irrigated lands contributing to 40% of the country's total food production ...' (Adhikari et al, 2009:2819).

Part of the attraction FMIS hold for researchers is their flexible technical qualities. Adhikari et al (2009) study of three FMIS in the Terai found that the schemes followed natural depressions in the command area that were linked to the source river with excavated channels. Unlike conventional gravity irrigation systems where canals are aligned along high lands which disallow return flows, the FMIS carried both surface water runoff and return flows from upstream fields. This diverts as much discharge as possible to field channels while reducing discharge to primary channel. Such a technique has the advantage of preventing bed erosion, enhancing soil fertility and groundwater recharge by spreading the floodwater over rice fields. In terms of flood management, the strict FMIS rule on the Terai was to keep field channels fully open in rainy season and undertake prompt repair of division structures. It was noted that: 'The most striking aspect common to all systems is the consistent reduction in size from upstream to downstream of the natural drainage being used as a primary canal of the FMIS.' The authors urge recognition that local drainages have been captured, controlled and converted into canals in the Terai FMISs (Adhikari et al, 2009: 2822- 2823).

Traditional surface irrigation schemes in the Terai are reported by Singh (2010) to be constructed from earthen bund with shrubs, logs and stones where available, and mostly open earthen canal networks. Because the use of indigenous material has depleted adjacent forests, the Nepal Irrigation Sector Project (NISP) undertook to modernise the FMIS in Terai's Kapilvastu District with contemporary materials in response. Nepal's Department of Irrigation (DOI) considered 581 km of Terai canal for rehabilitation with assistance from the World Bank, ILO and ADB via a credit pilot and an irrigation sector and irrigation development project.

The mode of assistance was debated; either support the bare minimum to relieve essential needs only and minimise sustainability and maintenance problems; or provide extensive engineering structures. A middle path was pursued between these two schools of thought as farmers demanded concrete canal linings. Because traditionally downstream users tap leakage from upstream diversion bunds, permanent diversion structures were avoided so as not to disturb the equilibrium of water usage and create water right conflicts among FMIS users. It was found that demand: '... in the Terai, it is mainly for diversion head works, cross drainage and other conveyance structures' (Singh, 2010:56-57).

FMIS in Bihar, more common on the South Bihar plains, are called ahar-pynes, a traditional surface water irrigation system that is river fed via diversion works and artificial channels. The Bihari FMIS date back 3,000 years to the Iron Age. According to Koul et al (2012) there are century old pynes and pynes over a kilometre long may command 400 ha area, although they are typically smaller. This type of FMIS was used to irrigate 35% of the cropped area of south Bihar in the 1900-1920 period, but by 1997 this proportion had fallen to 12%. The authors attribute the past success of the ahar-pyne system to: its ability to achieve equitable water distribution despite fragmentation of holdings as farmers held head, middle and tail plots; it was cheap, requiring only collective effort to maintain; cropping was synchronised; and well organised inter-caste water groups observed clear access rules.

Ironically, the ahar-pyne system waned with the abolition of the Zamindar system which centralised authority in the landlord. This is because Zamindars had a vested interest in maintenance and development of irrigation sources. During India's first and second five year plans of the 1950s, South Bihar diversion schemes took advantage of the existing elaborate indigenous irrigation network for subsidiary storage and water distribution but this policy has since languished (Koul et al, 2012:270). Koul et al recommend the integration and conjunctive use of FMIS and AMIS: '... if these indigenous systems are properly integrated with the recent canal irrigation schemes, the sustainability of both types of irrigations systems will enhance manifold' (Koul et al, 2012:270).

The revival of farmer self-governance traditions that FMIS represents is advocated by Maharjan et al (2011) in the context of climate change. Nepal signed the United Nations Framework on Climate Change in 1994 out of concern that temperature increases are occurring at a higher rate in Nepal than in the world. The authors argue that prevailing traditional knowledge, skills and experiences regarding climate variability and change produce indigenous innovations that should be documented and disseminated. To this end they document the adaptations made to increased drought and flooding by the subsistence oriented Tharu, well known as survivors of the Malaria outbreak on the Terai in the 1950s (Maharjan et al 2011: 35-36) and expert in traditional Terai FMIS (Singh, 2010).

5.3 Agency led deep tubewell irrigation

At the time of India's independence in 1947, tubewell (TW) irrigation was limited to large scale farmers able to afford the high capital investment. To make TW more affordable and accessible, Indian States, including West Bengal, invested in public Deep Tubewell (DTW) during the 1960s and 1970s. Buried pipe distribution networks were provided and water supply heavily subsidised (Shah et al, 2012:996). Fujita et al (2003) report on a village case study in Nadia District of West Bengal where two DTWs were completed in1964. The DTWs were operated directly by the State Government with three staff per DTW, while farmers paid a fixed highly subsidised charge on per acre basis. Following 35 years of this subsidy, the facility was approaching the end of its technical life at a time were budgetary pressures were beginning to bite. Consequently, the West Bengal government planned to charge farmers for overhauling the DTW at 16% interest as well as transfer operation and maintenance (O&M) costs. This policy is undermined by the fact it would cost the farmers the same as installing Shallow Tube Wells (STW) as individuals.

Clay commented in his account of the Kosi region that it became indefensible to continue sinking large diameter public deep tube-wells since 1971 as there is no technical rationale where groundwater tables are high; as they are in the EGP. Like the engineered surface water schemes, command areas had disappointed. Deep tubewells had only attained a mean irrigated area of 23 acres against a technical capacity to command 75 acres. Siting of DTW had also proven open to political patronage and private gain. DTW development was de-emphasised in India's fourth and fifth year plans because the rapidly developing STW technology looked likely to be both more efficient and egalitarian (Clay, 1982:202-203).

Deep tubewell development in the Terai was undertaken in the 1970s. Agency owned and operated DTW, built either by Nepal's Department of Irrigation (DOI) or external development agencies are scattered throughout the Terai. Water rates have not included O&M costs. However, the adoption of a policy of transferring O&M responsibility to Water User Groups (WUG) has met with as much reluctance on the part of farmers as it has in West Bengal. WUGs prefer electricity to diesel driven and battery operated engines provided by DOI as it is cheaper. Farmers restrict irrigation due to the cost of diesel (Ansari, 1994). Kansakar et al (2009:177) report from the Terai that electric pumps are five to six times cheaper to run than diesel. Ansari concludes in the Nepalese context that: 'The performance of agency-managed DTWs based on large projects is better than DTWs of small projects ... however; their recurrent cost recovery is so meagre that their sustainability is endangered' (1994:170).

The budgetary imposts placed on the EGP jurisdictions by both the upfront infrastructure investment and ongoing O&M costs of surface water and DTW schemes led to a policy emphasis on participatory irrigation management (PIM) as a corrective to the sharing of costs between the State and farmers. Participatory irrigation management (PIM), like FMIS, seeks to revive and harness farmer self-governance traditions but is oriented to cost-recovery.

5.4 Participatory irrigation management

Ostrom and her colleagues note that the last 20 years of irrigation policy in South Asia has focused upon building self-governing capacities of farmers by setting up a Water Users Association (WUA) in order to transfer irrigation management to farmers. Participatory irrigation management (PIM), or irrigation management transfer (IMT) initiatives have become a component of many national and international projects. Being able to organise a WUA became a condition of international donors for farmers to receive resources (Ostrom, et al, 2011:13-14).

India's commitment to PIM is promulgated through the National Water Policy. PIM involves WUAs taking over management, including O&M of minor canals and DTWs under the State Irrigation and Command Area Development Programs (Mazumdar, 2007:64). Essentially, whether it concerns a WUA in India or WUG in Nepal, joint management and cost sharing of state owned irrigation infrastructure is a strong water management policy trend in the EGP. How PIM is approached, however, varies widely, especially within the federated India:

> *Various State governments in India have gone in either for a 'big bang' approach of uniform and simultaneous introduction of PIM throughout the State based upon and preceded by legislation (the leading example being Andhra Pradesh), or have gone in for some sort of a 'bottom-up' slow and steady approach (starting with pilot projects) for motivating and facilitating the creation of WUAs wherever the farmers agree to voluntarily come together and form a WUA to gradually take over some functions of their local irrigation systems (Mazumdar, 2007:65).*

Such variability in how PIM is implemented makes it difficult to unpick the elements contributing to success or failure. However, much of the literature views PIM as unsuccessful (see for e.g. Mukherji, 2007:6414). Rigid insistence on WUA encouraged facades of rules-in-form that farmers were often unaware of in Nepal (Ostrom, et al, 2011:13-14). Mukherji and her co-authors discuss an IWMI review of 108 cases of PIM in South Asia that found a 40% success rate, indicating that the context-specific and process intensive conditions involved in PIM are difficult and costly to replicate. The authors argue that such mixed results relate to conceptual weakness of PIM model itself, namely:

1. The assumption that community managed irrigation systems are analogous to public irrigation systems such that farmers could manage them as well as they have managed community irrigations systems for centuries;
2. The assumption that irrigators within a command area are homogenous group, even head and tail farmers face different incentives;
3. There is no incentive on the part of irrigation bureaucracies because the same officials that lacked accountability towards farmers were entrusted with managing PIM (Mukherji et al, 2012:437-438).

Ultimately, as Ostrom and her colleagues note, mixed PIM results are due to the guessing game nature of designing new divisions of power and responsibility. The authors conclude that: 'If there was one lesson that decades of efforts to 'develop' local institutions had to offer, it would be that institutions cannot be imposed or transplanted easily as if they are physical capital.' (Ostrom, et al, 2011:13).

Up until the 1970s TW irrigation was regarded as complementary to surface irrigation. By the 1990s, individually owned STWs were substituting for surface irrigation. This trend has further weakened the performance pressure on canal system managers and slowed the progress of PIM (Shah et al, 2012:998).

5.5 Shallow tubewell irrigation

> *The area irrigated by groundwater wells now is far in excess of the area served by public canal systems and the small-scale community tanks that dominated irrigation for millennia (Shah et al, 2012:995).*

The disappointing performance of AMIS and DTW schemes was followed by 30 years of rapid growth of a 'booming but anarchic economy' of STW development. Development has been strongest in India's northwestern Green Revolution states (e.g. Punjab) and north-west Bangladesh (Mukherji, et al, 2005:53). STW development has been significantly slower in West Bengal compared to the western Green Revolution states of India. Uptake of STW in groundwater rich Bihar and the Terai is surprisingly poor. These variations form a major puzzle facing the project of increasing the intensity of foodgrain production in the EGP beyond north-western Bangladesh.

The success of STW can safely be attributed to their inherent relative advantages. STW irrigation makes water available on demand at the point of use, encourages economic use and complementary investment in agricultural inputs. For these reasons: '... of the agricultural productivity of a *representative* hectare, the portion contributed by groundwater irrigation is almost 35% more than that contributed by surface water irrigation ...' (Mukherji and Shah, 2005:55). There has been much research attention focused on the development of local water markets as a consequence of STW adoption. The equity effects of these water markets have generated researcher interest: '... access to GW irrigation is less skewed against the small and marginal farmers when compared to access to land' (Mukherji and Shah, 2005:63). In contrast, there is no evidence presented in the literature reviewed of surface water trading (Mukherji, 2008).

Ironically, STWs were originally developed in Bihar in response to fear of ceilings on land holdings being implemented and the disappointing performance of the Kosi scheme. Widespread experimentation by Bihari zamindars aiming to reduce the cost of their irrigation investment on fragmented holdings cut the cost of tubewells from Indian Rupees 4-6000 to less than Indian Rupees 200 for a 4 inch bore. Many zamindars possessed large consolidated upland plots out of canal command but suited for irrigated winter vegetables crops which provided high returns. However, the relatively equitable distribution of STWs in the 1980s indicated that large-scale farmers failed to completely monopolise their benefits (Clay, 1982:200-202).

Such equity can be attributed to the Special Deputy Director of Agriculture in Bihar's Saharsa District who used the resources yielded by the Intensive Agricultural Areas (IAAP) and High Yielding Varieties (HYVP) Programs to promote STW in face of initial opposition from engineers and credit agencies. The Deputy Director adjusted centrally funded credit programs to permit STW owners to purchase pump-sets on credit. In the drought year of 1972-1973 credit was extended to small farmers on a large scale. Clay argues that a regionally minded professional cadre and administrative structure ceding the authority to administrators to modify programs in the light of local experience were crucial factors in this innovation platform (Clay, 1982:200-204). North eastern Bihar went from having no STWs to boasting 1,500 STW by mid-1971, and to 19,000 STW 18 months later. The purchase of indivisible equipment was associated with the establishment of markets in pump-set services to those unable to afford STW ownership. The scale of water markets was indicated by the tubewell to pump-set ratio and the number of wells sunk on comparatively smaller plots (Clay, 1982:200-202).

Unfortunately, such progress in Bihar flowing from investments associated with the Kosi scheme reversed under the corrupt 1990-2005 Yadav administration (see Chapter 3.2.2).

In Nepal, the Royal Government assigned the Asian Development Bank of Nepal (ADBN) the job of promoting STW irrigation, which tasked International Development Enterprises (IDE) in the early 1990s. IDE had been running cheap drip irrigation programs for smallholders in collaboration with community based organisations and had begun promoting manual treadle pumps since 1992 (Upadhyay, 2006:69). Despite a 30-85%, subsidy of STW installation by the ADBN, STW installation in the Terai has been the slowest in the EGP. Subsidies failed to benefit the numerically dominant operators owning less than the 0.68 ha of land required for collateral for an individually owned STW. A new rule was attempted that a group with a contiguous area of 4 ha could qualify for a group owned STW. This criterion was reduced to 3.5 and then 2.5 ha and these agency organised groups reportedly collapsed within a few years of project completion (Kansakar et al, 2009). Experience on the Terai suggests that minimum levels of land ownership and access to institutional credit are necessary for individual farmer investment in STW to be viable. Group investment suffers from the same problems as FMIS revival and PIM.

The most dramatic driver of STW growth rates across both the western and eastern Gangetic Plains is the political economic nexus between groundwater irrigation and energy markets (Mukherji, 2007). Uptake of STW did not accelerate in India until the mid-1960s. Following three years of successive droughts from 1964 to 1966 and Indian dependence on US food aid, food security became paramount. State investment to kick-start the Green Revolution in Punjab and Uttar Pradesh entailed provision of a subsidised electricity network that reduced tariffs after a specified minimum use (Shah et al, 2012: 1997). Electric pumps are significantly cheaper to run than diesel pumps so electricity subsidisation opened smallholder access to irrigation waters.

Diesel remained heavily subsidised until the late 1990s when structural adjustment placed downward pressure on subsidies. The subsequent increase in the price of diesel in the EGP jurisdictions encouraged some farmers to shift to high value crops but many more to give up irrigated agriculture altogether according to Shah et al (2012:1000).

Mukherji (2007) argues that under flat rate electricity pricing the marginal cost of water extraction is effectively zero which motivates water selling (the development of local water markets) due to the fact that self-use of water is not the optimum justification for the electricity bill. In her earlier papers Mukherji concludes that electric pumps support more highly developed groundwater markets (breadth as

irrigation/ha and depth as household income from transactions) than diesel pumps and that metering electricity may hinder water sales (Mukherji, 2007).

However, lack of electricity metering in the India's western and southern states rapidly escalated costs for State Electricity Boards (SEBs) which held a monopoly over generation, transmission, and distribution. Their transaction costs (installing and reading meters, billing farmers and collecting charges) expanded. Moral hazards also grew and the cost of controlling meter tampering, under-reporting and under-billing escalated as rural connections were widely dispersed. SEB ground staff were also inclined to collude with farmers. The financial viability of SEBs was destroyed as consistent annual losses limited the ability to invest in and maintain the network. Increasingly frequent power shortages began to affect industrial and service sectors and power tariffs to non-farm consumers were increased to compensate. As the quality of supply degraded, pump repair and maintenance costs increased for farmers. Although SEBs tried dropping to one and two phase supply, farmers responded by using phase converters or difficult to inspect submerged pumps. An expert committee appointed by Reserve Bank of India found transaction costs constituted a third of total SEB costs (Shah et al, 2012: 997-999).

Intertwined budgetary pressure and moral hazards have meant that rural electrification has been an extremely volatile process in India. Rural vote banks protective of subsidised electricity supply developed in India's western and southern states making it politically difficult to implement more realistic pricing policies. Bihar abandoned the project of rural electrification altogether:

> *First, electric and diesel pumps have been more or less equally distributed with the exception of 1991–1992 when electric pumps outnumbered diesel pumps by a million and more. Indeed, this reflects the impact of various state governments' concerted efforts for rural electrification in the 1980s, which later lost steam in the 1990s after economic liberalisation and increasing pressure on state exchequers. As a result, in many parts of India, especially eastern India, a progressive rural 'de-electrification' has taken place. This means that due to lack of repair and maintenance, those villages (and pumps) that were electrified in the 1970s and 1980s, became de-electrified by the 1990s ... Second, eastern Indian states of West Bengal and Bihar have witnessed the largest percentage increase in number of pumps, with West Bengal recording over 1,100% increase in electric pumps and Bihar an increase of 625% in diesel pumps. In Bihar, however the number of electric pumps declined between 1976–1977 and 1991–1992 supporting the argument that there has been 'rural de-electrification' in Bihar (Mukherji, 2008: 1803-1804).*

West Bengal metered all STWs and charges farmers at near commercial rates, but provide good quality power supply around the clock. No subsidy is used and a consumer surplus is generated. This is the textbook economic solution advocated by power industry professionals and international funders. However, the political economy of the energy-irrigation nexus means such a solution is unlikely to be accepted in most of India due to the development of powerful vote banks based on access to cheap electricity. West Bengal could implement this solution as: it confronted a small number of electric pumps; already had an unusually high flat tariff; farmers liked the way metering eased cost recovery from water buyers; groundwater levels remain high enough for shallow tapping; and diesel pumps remain a viable alternative in any case (Shah et al, 2012:1002). Mukherji notes high levels of innovation (economising) in response to West Bengal's energy pricing policies:

> *In response to escalation in diesel prices, farmers have been resorting to various innovations for cutting their total irrigation costs. For instance, traditional large 5-horsepower diesel pumps are now seldom used. Instead, farmers use lightweight pumps (that go by the generic name of Honda pumps) or Chinese pumps smuggled from across the Bangladeshi border. Both these types of pumps consume only 0.3–0.5 l of diesel per hour and, alternatively, may be operated with kerosene. Traditional diesel pumps consume 0.8–1 l diesel in an hour (Mukherji, 2007:6426).*

Reliance on diesel in Nepal and Bihar explains their less intensive use of groundwater. As Mukherji states, there is a: '...clear but paradoxical east-west energy-divide in India, with the water abundant Eastern states saddled with diesel pumps, while water-scarce western and southern India are well endowed with electric pumps ...' (2008:1084).

The environmental costs of excessive pumping in India's WGP states became clear in early 1990s. Farmers have responded with competitive well deepening, a vicious cycle aggravated by changed farmer attitudes to surface water management (Shah et al, 2012:998). Although the West Bengal policy of metering electricity is motivated by the fear of replicating this problem of groundwater depletion, Mukherji argues this fear is unfounded. She reasoned that there had been continuous extraction for over 30 years in West Bengal and groundwater remained within 6 m of the surface with a 9 cm decline in pre-monsoon season which would afford another 32 years of extraction at current rates. She did note, however, that 12 out of 38 villages involved in her field research showed a falling groundwater trend (2007:6423).

As Mukherji points out, the use of groundwater for irrigation has the positive externality of lowering the groundwater table and can reduce water logging and flooding (2007:6421). However, there are no reports in the literature of groundwater harvesting development being designed to maximise this advantage in EGP. Mukerjhi and Shah do mention that Pakistan's Deep Tube Well (DTW) scheme, embarked upon in the early 1960s, was primarily designed to combat water logging (2005:62), so this strategy has been tried in the WGP.

5.6 Key conclusions

Increasing agricultural production in the EGP is reliant upon dry season irrigation. There is currently insufficient irrigation, particularly in the Terai and Bihar. Climate change is expected to lower dry season flows while increasing catastrophic flooding events making a more regional style of cooperation and coordination between the EGP jurisdictions pressing. Cross-border cooperation is currently restricted to bilateral treaties between the economically dominant India with Nepal and Bangladesh respectively. Equitable sharing of water flows during the dry season has remained a contentious issue since the three nations emerged.

Engineered structures such as India's Kosi Barrage, located on Nepal's Terai, and the Farakka Barrage in West Bengal that 'divides' water between India and Bangladesh have controversial downstream impacts. Improved operation and management of the Farakka and Kosi barrages to reduce water logging and flooding would assist food production and security at the household level, particularly in flood prone Bihar. Researchers also recommend moving from an engineered approach to flood *control* to flood *management* by using softer systems such as community based upstream-downstream flood forecasting to move information rapidly across borders.

As the modern engineered surface water schemes have proved to yield disappointing command areas, rehabilitation of traditional surface water Farmer Managed Irrigation Systems to achieve dry season irrigation has become popular with researchers and donors. However attempts to revive the tradition of self-governance so as to transfer operation and maintenance costs for deep tube wells and tertiary canals to farmer groups in the Terai and West Bengal have proved patchy. One reason for farmer resistance to these attempts at 'participatory irrigation management' is the relative advantage of investing in shallow tube well bores and pumps to tap groundwater on an individual basis.

STW irrigation makes water available on demand at the point of use and encourages complementary investments in agricultural inputs. Local water markets have developed as owners seek to recover their costs, a development which has made groundwater more accessible to small and marginal farmers than land. The shallow tubewell (STW) economy has grown rapidly across South Asia over the past thirty years. Within the EGP, growth has been strongest in Northwest Bangladesh, significantly slower in West Bengal, and surprisingly poor in groundwater rich Bihar and Terai.

Electricity is a cheaper pump fuel than diesel and rural electricity provision in Bihar and Terai is poor. Reliance on diesel in Nepal and Bihar explains their less intensive use of groundwater. There is a: '...clear but paradoxical east-west energy-divide in India, with the water abundant Eastern states saddled with diesel pumps, while water-scarce western and southern India are well endowed with electric pumps ...' (Mukherji, 2008:1084).

The sheer number of individual investments facilitated by the STW economy has led to troubling cascade effects in North-western Indian states. Rural vote banks, protective of subsidised electricity supply, have developed in India's western and southern states. West Bengal, in contrast, has metered all STWs and charges farmers at near commercial rates, which has stimulated high levels of innovation (economising).

Current data on groundwater depletion in West Bengal and Northwest Bangladesh indicate that current groundwater utilisation levels are largely sustainable, except for probably unsustainable use in the Barind Tract area of northwest Bangladesh (see sister report by Kirby et al. 2013). It is a research priority to what incentives at what threshold would strengthen STW development in Bihar and Terai.

6 General Socio-economic setting: who and where are the food insecure

The material reviewed so far in this document indicates that technical solutions, while necessary, are insufficient to increase food security at the household level. They may well be adequate to meet national food sufficiency, but this in itself does not guarantee that the situation of the food insecure will improve. It is important to consider who and where the food insecure are in the EGP so as to assess their capacity to directly or indirectly benefit from intensification of foodgrain production.

6.1 India

Erenstein and his colleagues (Erenstein and Thorpe, 2011; Erenstein et al., 2010) have conducted a west-east transect across the Indo-Gangetic Plains, sampling a grid of 72 villages to ascertain the region's agro-ecological gradient (2010 and 2011). Their examination of the livelihood assets for the states of Bihar and West Bengal[4] found that compared to the WGP, they had the highest population density (795 people/km^2), highest ratio of people below the poverty line (39.3%), lowest female literacy rate (31%), lowest immunization rate (29%), lowest percentage of villages with cooperative societies (30%), lowest percentage of villages with self-help groups (15%) and lowest percentage of scheduled castes/tribes (17%). Farm mechanisation is very low (2 tractors/cultivators per 100 households), the average distance to the nearest town is high (16 km) and the percentage of villages with paved road access is low (46%). Furthermore, the percentage of electricity supply is very low at 23% (Erenstein and Thorpe, 2011; Erenstein et al., 2010). Bihar and West Bengal have a relatively high share of indebted households (5.4% and 8.0%, respectively) in 2003 with over 23 thousand in Bihar and 34 thousand in West Bengal (Figure 29).

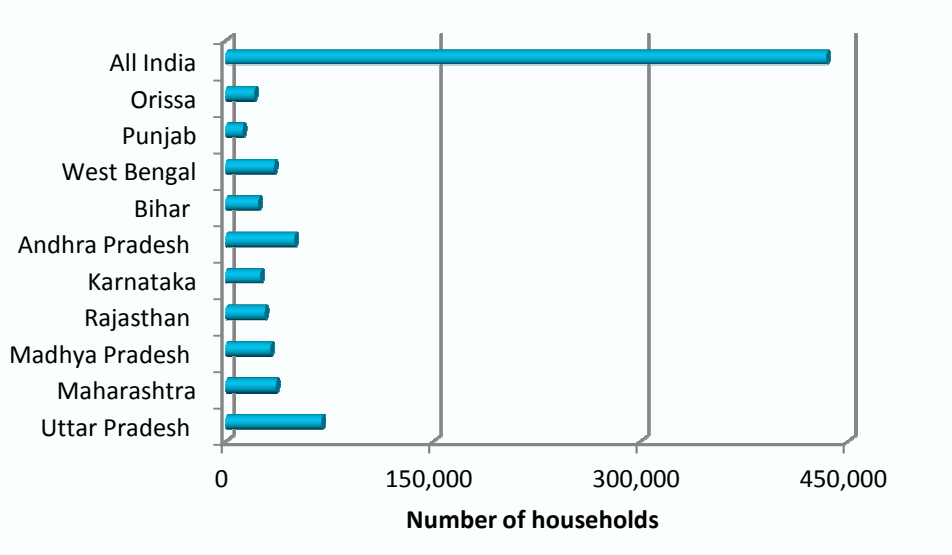

Figure 29 Number of indebted households, 2003 reference year

Source: Ministry of Agriculture (2012)

[4] Although the authors use the category of 'Mid Gangetic Plains' (MGP), stating that the MGP is largely composed of the state of Bihar. Similarly their term 'Lower Gangetic Plains' refers to West Bengal.

6.1.1 BIHAR

Bihar's population is around 100 million following its bifurcation into the states of Bihar and Jarkhand in 2000. Population density is 880 people per km^2 against the all-India average of 324 people per km^2 (UNWFP, 2009:10). Most industrial and urban centres, forest areas and mining resources (and their taxes, revenue, royalties and excise duties) went to Jharkhand. Bihar retained 54% of the land area and 75% of the population. The tribal population, characteristic of the upland forested regions, is now in Jharkhand rather than Bihar. Rural poverty in Bihar is highest for Scheduled Castes (64.2%) and for Other Backward Castes (38.5%) making poverty disproportionately distributed among OBCS and SCs (UNWFP, 2009:14). A large proportion of these are likely to be Dalits (untouchables) (UNWFP, 2009:115).

Nearly half (42%) of the population of Bihar live below the poverty line. About 90% of the total population is rural and 77% of total labour force is engaged in agriculture for livelihoods (Kumar et al. 2012). According to the Handbook of Statistics on Indian Economy, 35% of households are self-employed in agriculture and 35% as agricultural labourers. Only 17% of Biharis are involved in non-agricultural activities, 4% as other labour and 9% in other categories of employment (Handbook of Statistics on Indian Economy). Despite the significance of agriculture to at least 70% of Biharis, the share of Gross State Domestic Product (GSDP) from agriculture in Bihar is only 25.3%, compared to 74.7% from the non-agricultural sector (Haque et al. 2010). This contradiction can be explained the fact that the majority of farmers are marginal (40-50% own ~0.6 ha of land), or small (32-34% own 1.1-1.3 ha). Only 12-19% are medium (2.4 ha) and 0-4% or large (5.3 ha) agricultural operators.

Nearly two-thirds of the state of Bihar is flood prone causing damage to property, but also deterring agricultural investment (http://thelivelihoodschool.in/bihar-initiative/biharinitiative). Flooding is most extreme in northern Bihar, a problem that requires negotiation with Nepal Government to address (UNWFP, 2009:42). Despite, these rich water resources, 40% of agriculture in Bihar is still rainfed. Production is consequently highly drought prone with low and erratic yields.

The major constraints for paddy cultivation are the high cost of irrigation and ploughing with high diesel costs, poor quality seeds and fertilisers, lack of adequate storage and poor technical facilitation (NR International 2007). Furthermore, farmers are unable to achieve the minimum support price and lack on-farm storage so are unable to achieve better prices. Consequently, cropping intensity is 135-176%, on average (160.8%), or using Simpson's Index of Diversification was 0.18. There is a relatively high proportion of horticulture crops. Unsurprisingly, given the poor administration under the Yadav governments, there was a reduction in crop diversification from 1999/2000 to 2006/07. Livestock ownership levels are quite high with the share households owning livestock 31.3%, mostly cattle (52%).

The average monthly income for households was highest for crop cultivation (836 Rs/month), compared to dairy farming (122 Rs/month), casual wage labourers (212 Rs/month), wage earners (347 Rs/month), and non-farm business (185 Rs/month) (Handbook of Statistics on Indian Economy). The overall average household income of 1810 Rs/month is less than the average for the rest of India (2115 Rs/month).

There is a long history (> 100 years) of out-migration in Bihar (De Haan 2002) which is usually undertaken by single men. Migration is of a circular nature; close links are maintained with the areas of origin and invest their savings in the village rather than the town. The high population density in Bihar is considered one of the key factors. Although the poor have a higher propensity to migrate, they are less able to afford to migrate. They lack the necessary material means to invest in leaving. Personal contacts are essential for successful migration. Migration and remittances have contributed to the socio-economic structure of the area (De Haan 2002). There is a relatively slow growing economy, a large number of small landholdings, which are viable because of income from other activities and a large proletariat which find work locally or elsewhere. However, merely having a migrant in the family does not guarantee improvements in agriculture (Deshingkar 2012).

The United Nations World Food Program (2009) have mapped Bihar's food security on a district basis (Figure 30) which indicates a concentration of poverty in the the north-western districts. This research team comment on the continued relevance of agrarian reform in Bihar, suggesting it is crucial to improve food security for the landless – often Dalits:

The objective of distributing land to the landless is not one of creating 'viable' farms, but of enabling a reduction of food insecurity among the currently landless. In the current scenario where there is a lot of migration from the countryside, there could be scope for a market-mediated land reform programme ... The abolition of intermediary tenures is not any more an issue. What is important is: a) security of tenancy; b) redistribution of ceiling surplus land to the landless; and c) land rights of women. The last two are directly important for food security. One can also include the reduction of land ceilings in order to restrict ownership to the size of a family farm (United Nations World Food Program 2009:115).

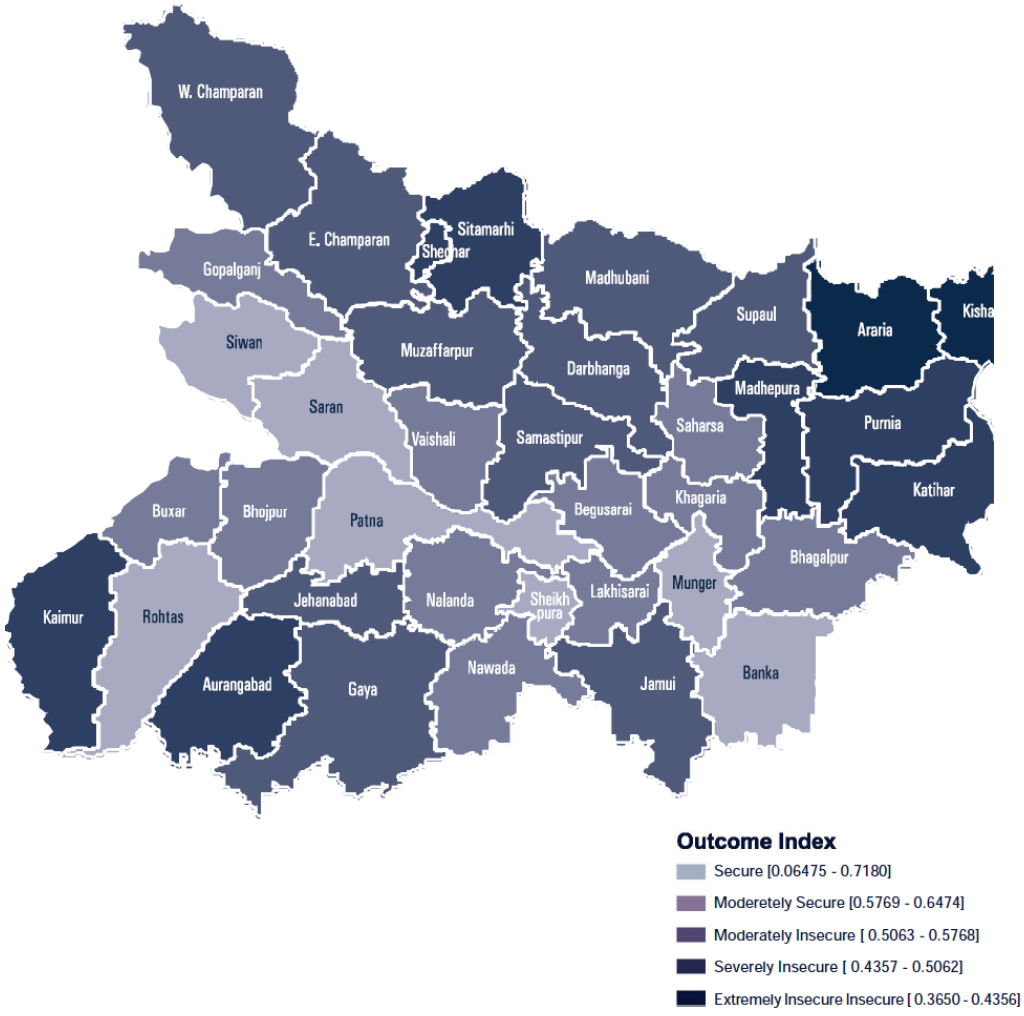

Figure 30 Food Security Map of Bihar

Source: United Nations World Food Program (2009)

6.1.2 WEST BENGAL

West Bengal has a population of 80 million, two thirds of whom live in rural areas, one half of these own and farm arable land while the other half are employed in agricultural and non-agricultural labour markets (Bardhan and Mookherjee, 2011:189). West Bengal houses Kolkata, one of the largest metropolitan regions of the world, while the Ganga River has contributed to some of the most fertile regions in the world. Land redistribution and reforms to land tenancy arrangements, the latter protecting sharecroppers from eviction, have had positive impacts on agricultural productivity in West Bengal (Bardhan & Mookherjee, 2011). Operation Barga in West Bengal provided tenure security to sharecroppers which promoted investment and facilitated access to credit. West Bengal, with only 2.4% of India's land mass produces 9%

of total foodgrains making it India's third largest foodgrain producer after Uttar Pradesh and Punjab (Ghosh, 2009: 665-666).

Despite the high land fertility and successful reforms, there are serious food production issues. Currently stagnant yield levels are of concern as there is no scope for extensification due to the density of the population. Pure tenant cultivators remain disadvantaged in that only 6.4% farmers own 34% of arable land (Laha and Kuri, 2010: 438). Poverty is unevenly distributed spatially: 'Districts like Mushidabad, Maldah, Bankura, Purulia, Cooch Behar and Dinajpur are the least developed'. This pattern that reflects the concentration of poverty in northern and western districts (bordering Bihar and Bangladesh) and concentration of wealth in the southern districts closer to Kolkata (Ghosh, 2009: 665-666).

West Bengal's development contracted in the 1990s under economic liberalist policy settings. West Bengal's institutional credit increased from 1980-1981 to 1989-1990. Following structural adjustment pressure causing a dramatic reduction in the number of rural bank branches, there was a decrease in the annual growth rate of both agricultural credit and agricultural production from 1990-1991 to 1999-2000 (Chatterjee, 2008-09: 303). Since then, evidence indicates that that rural micro-financing is mainly provided through self-organised self help groups (SHG). A SHG is an economically homogenous affinity group that collectively saves and accesses credit as per group members' decisions. SHGs have proliferated in recent years. The West Bengal Government is relying on this system as an inexpensive poverty alleviation and health promotion strategy (Das, 2010:180-181)

In West Bengal, 70% of the population is involved in agriculture, with 63% of the area of the state as arable land for agriculture. As in Bihar, the majority of farmers are marginal (40% hold ~0.4 ha of land) or small (30% farm 1.2-1.3 ha). The remainder of farmers are medium (25-30% farm 2.4 ha) and are large (0-5% farm 5.6 ha). Cropping intensity is 122-168%. The cropping intensity is high in West Bengal (148.7%). However the share of Gross State Domestic Product (GSDP) from agriculture in West Bengal is 21.4% while from non-agriculture it is 78.6% (Haque et al. 2010).

Currently, in West Bengal, 22% of households are self-employed in agriculture, 23% in non-agriculture, 35% as agricultural labourers, 12% other labour and 9% as other. The average monthly income for households was highest for crop cultivation (737 Rs/month), compared to dairy farming (76 Rs/month), casual wage labourer (389 Rs/month), wage earner (498 Rs/month), and non-farm business (378 Rs/month). The overall average household income of 2019 Rs/month is less than for all of India (2115 Rs/month). Despite low wage rates in West Bengal, seasonal mobility of Bengali labourers is typically confined to within their sub-region because of language and cultural restrictions (Erenstein and Thorpe 2011 citing Varma et al 2007). As for Bihar, women headed households in West Bengal grow rice for their own consumption, and sometimes a second rice crop for cash (Lahiri-Dutt 2012). The major cash crops are jute, lentils and tobacco.

6.2 Bangladesh

Bangladesh's rapid population growth has meant that one-quarter of the Bangladeshi population remains chronically underfed because they are largely without assets other than labour. Official estimates of 1988-1989 indicated that about 30 million people lived in extreme poverty (Goletti, 1994:2). Two-thirds of deaths among children younger than five years are malnutrition related. The most vulnerable households, headed by women, day-labourers, fishermen and boat pullers, are 87% rural; and concentrated in flood prone areas such as river banks and urban slums. On an intra-household basis, pregnant women and preschool children are worse off (Ahmed, 2000:213-215).

Food security remains a challenge with the share of non-producers who are net foodgrain purchasers growing due to twin phenomena of non-farm incomes and urbanisation (Chowdhury and Haggblade, 2000:73-7. Religious fundamentalism prevents effective family planning programs while the current 1.26% population growth means Bangladesh is growing at the rate of two million per year. A population of 233 million is expected to be reached by 2050 (Mondal, 2010:236-237).

By 2000, Bangladesh had eliminated the food gap of 454 grams/person/day of net production of domestic rice and wheat and reduced its dependence on food aid imports (largely wheat) (Dorosh and Rashid, 2012).

Bangladesh is now the sixth largest rice producer in the world. Despite food production meeting national food requirements, approximately 40% of Bangladesh's population lacks resources to enable a diet of 2,122 kilocalories per day plus basic necessities which the government considers the food poverty line. Rice dominates the Bangladesh food basket which has nutritive implications. Government promotion of diversification towards other crops as well as livestock, milk and fish has not been satisfactory in meeting demand (Huq and Arshad, 2010).

According to Mondal (2010), agricultural productivity suffers due to the loss of arable land. Between 1983 and 1986 one million hectares was lost to river erosion as well as land conversion for urbanisation, settlement and infrastructure provision. Statistically speaking, however, the one million hectares of char (coastal) and khas lands owned by influentials in political parties and administration is available and could be released for agricultural uses.

Another barrier to increased agricultural production is access to suitable credit. Although the landless receive NGO micro-credit, the terms of institutional credit neglect the 90% of landholders owning less than 2.5 acres. Only 27% of farmers receive (inadequate and late) institutional credit. Mondal also points out that farmer associations or cooperatives would assist price bargaining so that individuals are not forced to sell to intermediaries and such a measure could increase smallholders' ability to meet procurement requirements (e.g. 14% moisture content, absence of foreign materials) in order to benefit from the government's fixed price. Finally, Mondal claims the National Agricultural Research system under-functions. Only 2% of GDP is devoted to agricultural research and development. This level of investment is inadequate given that agriculture contributes 19.1% to GDP and employs 50% of the Bangladeshi labour force (Mondal, 2010:236 -239).

6.3 Nepal Terai

Nepal was food secure until the early 1970s, when it produced a surplus sufficient to export Terai produce, however, by 1980 under conditions of drought Nepal began receiving food aid and spending on food imports increased sharply between 1993 and 1999 (Pyakuryal et al, 2010:93-94). A food security gradient is evident with labourers, sharecroppers and marginal landholders in the Terai's more arid west worse off: 'To cope with drier and less productive land, the farmers in the western districts have built up large livestock bases'. However, the lack of infrastructure makes it difficult to market livestock, landholdings are more fragmented, the climate is drier with winter dominant rainfall and the productivity of land is lower (Tiwary, 2005:133-134).

Irrigation plays an important role particularly in the dry season, or boro, crops in the Terai of Nepal. The Terai of Nepal are characterised by abundant groundwater with an alluvial aquifer, and is also considered as being under-utilised (< 10% of irrigated area) (Shah et al. 2006). STW had a positive effect on the effect of cropping intensity, rice productivity, farm income and employment (Bhandari 2001), however, this is skewed towards larger farmers.

Up to 60% of households in the Terai have insufficient food to feed the household (Figure 31). In order to cope with the insufficiency, the majority of households seek additional income within the District (68%), followed by income from outside Nepal (13%), borrowing (11%), income within Nepal but outside the district (9%) and others (8%) (Figure 32).

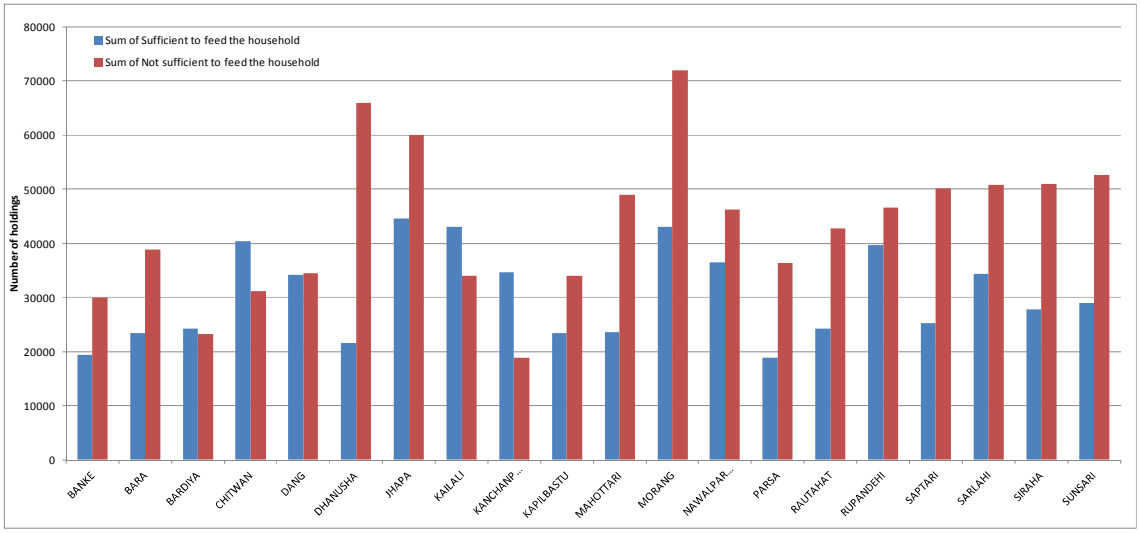

Figure 31 Number of households in Terai Districts with sufficient and insufficient food

Source: National Sample Census of Agriculture 2001/02 (http://cbs.gov.np/)

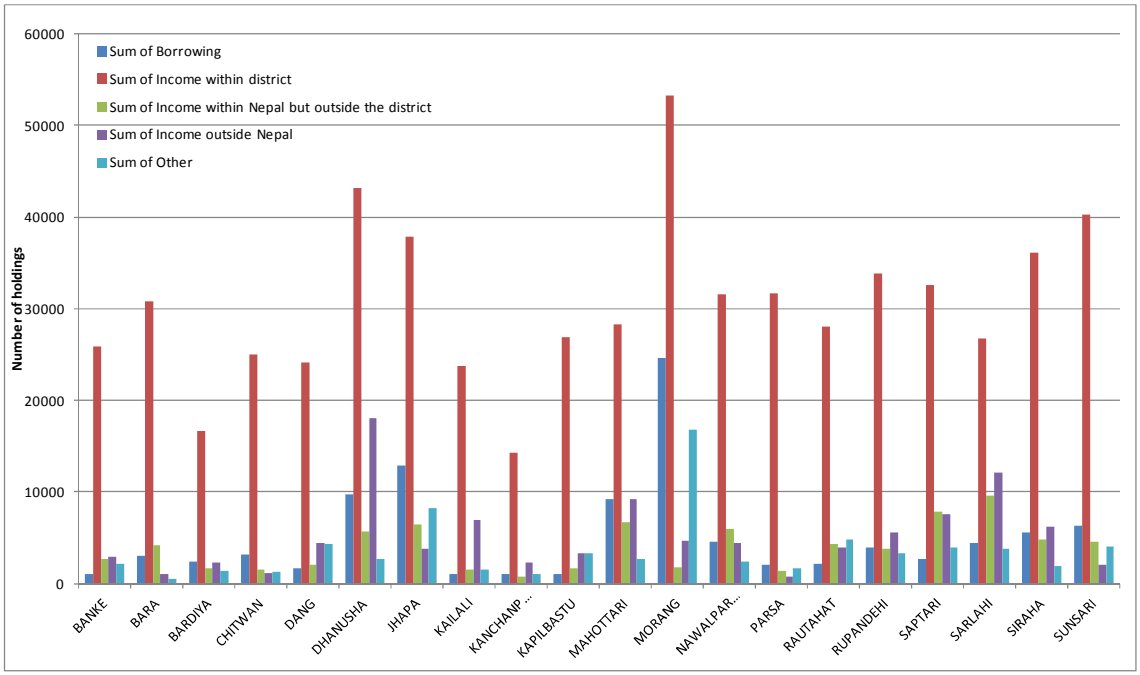

Figure 32 Manner of coping with insufficiency: Number of holdings in Terai Districts

Source: National Sample Census of Agriculture 2001/02 (http://cbs.gov.np/)

Rural Nepalese continue to labour under various degrees of peasant subordination. Apart from smallholders and sharecroppers, peasants also pay fixed cash rent, fixed product rent, rent in the form of a mortgage, or rent in the form of service. Smallholders are the least dependent on patrons but can be compelled to turn to landlords for production credit and emergency loans. Fixed rent in cash or product means the farming household can choose which crops to plant but take full responsibility for production. This form of tenure does provide incentive to maximise output but the farmer assumes all production risks without insurance. Tenancy agreements are verbal; the farmer can be evicted. Rent for service refers to bonded labour, the now ex-Kamayia who have historically been the most subordinate social group.

The more landless households there are, the more landlords can extract from sharecroppers and tenants (Joshi and Mason, 2011: 159-161). Sharecroppers give up 50% of their produce and are not free to vote

sincerely. According to Joshi and Mason, landlords often organise feasts the day before an election, offering alcohol and a day off. Thus, landlords both deliver voter blocs and contest seats (Joshi and Mason, 2011: 160-161).

Tiwary (2005) defines marginal farmer households as owning less than 0.5 ha; however, a typical marginal farmer is described as only owning 0.21 ha. Those without land: 'The sharecroppers and agricultural labourers are concentrated on the Terai, and fare worst in terms of food security status'. Nationally: the mountain region contains 45% marginal, labourer and sharecropper households; the hills hold 35% marginal farming households; and the Terai houses 48% of Nepal's marginal and labourer households even though the average size of Terai landholdings is 1.23 ha (Tiwary, 2005:131-132).

Lack of food cannot be directly attributed to malnourishment however, as Osei et al (2010) 2009 study in the far-western Terai Kailali District demonstrates:

> *Food insecurity was common in households with children 6 to 23 months of age in Kailali District of Nepal. The rates of stunting, underweight, wasting, and anaemia were also high. However, there was no significant association between household food insecurity and malnutrition among children. Therefore, not just access to food, but an integrated approach that improves the overall socioeconomic well-being of families, maternal education, and knowledge of optimal nutrition practices, together with adequate maternal nutrition, is needed to address malnutrition among young children (Osei et al, 2010:483).*

The Food Security and Agricultural Projects Analysis Service (ESAF) undertook vulnerable group profiling work in Nepal in 2004 and found that marginal farm households in Nepal's hills and the Terai, followed by the rural service castes and agricultural labourer households in the Terai formed the largest vulnerable groups in terms of food insecurity (Food Security and Agricultural Projects Analysis Service ESAF, 2004: 11-12) Nearly half (48%) of the Terai's population is viewed as vulnerable – include the tribal Chepang, hill and mountain migrants, and farm households (Food Security and Agricultural Projects Analysis Service ESAF, 2004:22). Within these socio-economic groupings, women, children but especially girls, and the lower caste groups suffered the worst food insecurity. For women and girls, this reflects rigid socio-cultural norms and practices such as being the last to eat and receiving leftovers. Where caste practises are more apparent on the Terai with gender inequity higher in the west, gender equity in Tibetan communities is higher as lower castes and ethnic groups are less conservative towards women. Nationally, child malnutrition rates have remained the same for 20 years with 50% of children under the age of five stunted and 10% wasted (Food Security and Agricultural Projects Analysis Service ESAF, 2004: 11-12; Tiwary, 2005:138-139).

The tribal Chepang originate from the isolated regions and migrated from hill and mountain districts adjacent to the Terai, such as Chitawan Hill District. They traditionally practised shifting cultivation under a common property system. They have recently moved (illegally) to settled agriculture in the Terai and live without legal title on marginal lands at the edge of recently cleared forests. They produce enough food for five months and cover the balance with hunting and gathering, selling goats, baskets and non-timber products, and by seasonal migration to India (Food Security and Agricultural Projects Analysis Service ESAF, 2004: 23-25). Tiwary puts their numbers at 15,000 households (2005:135).

Agricultural labourer households form 18.5% of the Terai population and work on short-term contracts for larger landowners. Most labourers are of low caste and possess little or no land holdings. (Food Security and Agricultural Projects Analysis Service ESAF, 2004: 25-26). This category includes the formerly bonded labourers the ex-Kamaiya – originally of the indigenous Tharu community. The Kamaiya were concentrated in the far western districts and to a lesser extent in adjacent districts. Bondage was a function of owing money to landlords when unable to leave until the debt was repaid. Thus the Kamaiya were kept in debt for years if not life and could be sold as excess to other employers. The entire household lived on a property leased from a landlord and all worked; the children as herders and women as maids. They were freed by the government in mid-2000 which enhanced the Kamaiya's social status while their economic wellbeing deteriorated (Tiwary, 2005:135-137). The ex-Kamaiya are among the poorest of labourer households and are extremely food insecure. Some have been able to access food-for-work programs, others work on a daily rate as bricklayers or rickshaw pullers, and growing numbers are electing to migrate. They are either

landless or possess small plots and few own animals being more likely to share-raise livestock with a landlord (Food Security and Agricultural Projects Analysis Service ESAF, 2004: 25-26).

Specialised labourers are from all castes and ethnic backgrounds but the majority are low caste and prejudices persist. Specialised labourers engaged in activities such as ploughing and care of cattle receive better wages and working conditions as they are able to change employer at the end of their contract (if not indebted). However they have difficulty covering their food needs in the non-agricultural period and often resort to borrowing grain from their landlords.

Rural service caste based occupations (singers and entertainers, shoemakers, leather workers, metal workers and tailors) have unregistered tiny plots of poor quality uplands capable of producing food for one to two months. Those remaining within caste-defined occupations suffer discrimination as they sit at the bottom of caste hierarchy. Consequently, only 6% have remained within their tradition with most now working as agricultural and non-farm labourers, for e.g. as porters and non-farm labouring. Entertainers are the most insecure as demand for their services have been undermined by the globalisation of communication. Leather workers, traditionally responsible for disposal of animal carcasses, face competition from factory produced goods and have been reduced to the less profitable repair of existing products. Of the metalworkers, goldsmiths do better. Tailors, although lowest in the Dalit hierarchy, earn higher incomes and around 45% remain within their traditional occupation (Food Security and Agricultural Projects Analysis Service ESAF, 2004: 2-29). Tiwary has commented that the undermining of Nepal's traditional occupations by cheaper Indian goods means a more equitable economic relationship with India is urgently needed than is provided for by the 1950 treaty which opened Nepal to Indian goods but: 'provides no formal platform to articulate Nepal's needs' (Tiwary, 2005:145).

Social capital is stronger among the poorest groups. The Kamaiyas, for example, elect a leader and hold public assemblies (khel) to mobilise labour for employment, community work, religious activities, and to resolve conflicts. As noted by Tiwary:

> *... intra- and intercommunity relationships are put to important use by poor farmers to secure livelihoods and ease food stress periods. The household members take turns looking after community livestock ... help finding jobs in informal economy sectors (portering, petty trading, etc.). Landless sharecroppers and agricultural labourers help each other with labour loans called, 'aicho-paicho', and during stress periods, the households exchange credits, in cash or kind. Exchange of gifts between households during times of food scarcity is also common (2005:138).*

6.4 Key conclusions

Population pressure in the face of limited land resources is the main driver of household food insecurity in the EGP. Landless households suffer the worst food insecurity and landlessness typically correlates with the Indian Scheduled Caste, Backward Caste and Other Backward Caste designations, which have constitutional status. The Scheduled Caste of Dalits (untouchables), for example, are predictably landless, disempowered and impoverished. Thus, food insecurity is entangled with caste and tribal identities and their relative socio-economic status within Hindu caste hierarchy. To the extent that low status, identity-based groups cluster in particular districts and villages, the spatial arrangement of food insecurity will be predictable.

The West Bengal experience indicates that land redistribution is an incomplete solution to this problem. Land is tightly held, and highly fragmented, across the EGP, having deep cultural resonance further to its economic utility. It is possible that the political limits to such reform have already been reached. Improving the security of tenants through registration and improving the terms of sharecropping seem more promising avenues for households with no land or insufficient land to meet their subsistence needs.

The agrarian transition, that is, reduced importance of agricultural sector relative to industrial and service sectors, is least advanced in the Terai followed by Bihar. Apart from the high number of food insecure households on the Terai, there is also more fragmentation among households along ethnic-caste lines. However, there is also more social capital within these traditional affinity groupings that is used to ease food insecurity within groups. The agrarian transition is most advanced in Bangladesh followed by West

Bengal; as indicated by their higher access to alternative and urban or overseas employment. The dynamics of transitioning turn on how feudal rural power relationships are. Specifically, the more landless households there are, the more landlords can extract from agricultural labourers, sharecroppers and tenants. Downward pressure on agricultural wages will then prevail. Where households with insufficient land to subsist can access alternative (urban or overseas) employment, upward pressure is placed on agricultural wages. Access to non-agricultural income, however, is spatially variable which is why West Bengal's poverty decreases towards Kolkata – a major unskilled labour market.

Access to credit is another key variable and this has suffered across the EGP under economic liberalisation since the 1990s. However, West Bengal has demonstrated the SHGs can be an effective way to increase institutional credit provision to the impoverished.

Food insecurity is culturally and socio-economically stratified within and between the EGP jurisdictions. The intensification of foodgrain production through purely technical interventions has historically been prone to elite capture and is unlikely to assist food insecure households and groups. Households reliant on agricultural labour for income lack the ready means to participate in and benefit from such intensification. Either an exit from rural labour markets altogether or opportunities to participate in a more inclusive rural economy without needing substantial land-ownership will be necessary. Whether more inclusive rural economies could be encouraged with innovation platforms around improved marketing, input provision, value-adding and small scale mechanisation and its servicing arising from dry season irrigated crops is highly researchable.

7 Key drivers of labour availability – migration, remittances and NREGA

7.1 NREGA

India's rural work for food programs culminated in the 2005 National Rural Employment Guarantee Act (NREGA) which targets below poverty line households, especially those categories constitutionally defined as underprivileged, namely, Scheduled Castes, Scheduled Tribes and women. NREGA is demand driven, treating employment as a right (Sarkar et al, 2011:438), and has covered all of rural India since 2008. It is '[u]ndoubtedly ... the largest ever public employment programme visualised in human history' (Bauri, 2010:169). Successful implementation of NREGA in all states is an important plank of India's eleventh (2007-2012) Plan which emphasises faster, more inclusive economic growth (Sarkar et al, 2011:438). Evaluations of NREGA's implementation to date reveal mixed results. For example, a common finding is that works built in the dry season do not endure past the following monsoon (Bauri, 2010).

Biswas' (2012) study of NREGA's operation in Jalpaiguri District of West Bengal found that NREGA had increased the participation of Scheduled Castes, Scheduled Tribes and women. However, women's participation was highest at 40-47%, while the percentage of Scheduled Tribe employment was the lowest. NREGA fund utilisation ranged from 64% to 85%. Biswas noted a dramatic increase in the number of households receiving the full entitlement of 100 days employment from a mere 123 households in the 2006-2007 financial year, to 8,528 households in 2009-2010. However the average number of days of NREGA employment was only 26 days (Biswas, 2012:97-99).

Sarkar et al (2011:438) concur that the rapid increase in the number of households participating indicates that substantial income is being provided. These authors found that: 'Education of children was given prime importance by the beneficiaries'. NREGA wages were devoted to consumption (food, child education, house reconstruction, health and sanitation, debt repayment and saving for times of need) rather than productive assets (2011:446). Of their survey of 102 respondents in the best performing district of West Bengal, 63% reported wage payment delay as their prime concern; followed by the non-availability of regular work by 34%, political disturbances associated with NREGA works by 26% and lack of provision for the aged by 21% (2011:447).

Singh's study of the NREP poverty alleviation program (a NREGA forerunner) launched in 1980 found that whereas decentralised planning processes were used to implement NREP in West Bengal, political corruption of NREP implementation dominated in Bihar (Singh, 1992) as a result of the Yadav political period. Witsoe comments that the largely negative view of the Yadav regime as undemocratic constitutes a: '... failure to understand social movements that seek to challenge the status quo using methods that deviate from liberal norms' (Witsoe, 2012a:328). This ethnographic research focused on the politically connected brokers who mediated access to the bureaucracy and state resources during Yadav's regime. Interestingly, this work revealed that brokers (politically aligned intermediaries) were essentially running the NREGA scheme by recruiting and managing labourers, dealing with engineers and other block staff, and appeasing potentially troublesome landowners who saw NREGA as threat to their agricultural operations (Witsoe, 2012b).

7.2 Migration and Remittances in the Eastern Gangetic Plains

As Shrestha et al (1990) put it: a general feature of agrarian societies is that the social distribution of resources is rigidly institutionalised, practically preordained inter-generationally, and the institutional arrangements of resource distribution are difficult to rearrange. Possible responses include revolt, passive adaptation to the existing order, intensification or migration: 'Migration is probably the most practical and

flexible one in that it can be practiced on a temporary (circular), long-term, or permanent basis and by certain family members or the whole household' (Shrestha et al, 1990:3-4).

7.2.1 INDIA

The Indian Reserve Bank calculated that $43.5 billion in international remittances were received nationally in the 2007-2008 financial year. While the contribution of international remittances to Indian GDP is only 4.1%, compared to the GDP contribution of international remittances of nearly 11% in Bangladesh and the Philippines, this figure masks the concentration of international remittances in certain states. For example, Kerala's migration stream to Middle East countries accounts for 40% and Punjab's migration stream to Canada, USA and the UK accounts for 13%. Domestic remittances were worth around $10 billion in the 2007-2008 year, the second largest domestic remittance market in the world. Of this amount, nearly 80% was remitted to households in rural areas (Tumbe, 2011), and 'Most of the North-Eastern States showed high usage of remittances towards education ...' (Tumbe, 2011:21).

Badiana and Safira's (2009) longitudinal study of circular (domestic) migration in the Indian states of Andhra Pradesh and Maharashtra reveals that between 1979 and 2002 labour market participation nearly doubled, and that:

> *Part of this increase is attributable to agricultural wage work, which has more than doubled over the period from 49 days to 88. Non-agricultural work has also expanded substantially from 44 days per adult to 121. In addition, households have seen a large decrease in the percentage of income emanating from farming (2009:45).*

Massey's (2009) survey of migration patterns in the West Bengali village of Jalpara in Bagri District conducted in 2005 found that circular migration forms a crucial livelihood strategy for 67% of the village's households. Migration was undertaken for both seasonal agricultural (such as paddy for four weeks) and non-agricultural work (brick kilns, road building, construction and cable laying in Kolkata, Delhi and Mumbai for up to six months). The average length of migration trips ranged from one to twelve weeks with villagers often using multiple trips or various combinations of labour within one trip.

As in the case of populist politics, economic needs tend to trump traditional practises, such that migration has become a source of social mobility in India:

> *When migrants were recruited by employers visiting the villages of origin, caste and class barriers, which were maintained between employers and labourers within villages, diminished ... the production requirements of employers override caste considerations, and both employers and labourers fail to act as classes-in-themselves (de Haan and Rogaly, 1994:55)*

Deshingkar et al (2009:143) in their study of Bihari migration point out that younger people consciously opt to migrate, with lower castes increasingly motivated to break away from village based caste oppression. Over a period of 17 years, migration from North Bihar has increased from 28% to 49% with remittances accounting for around one third of average annual income in surveyed villages. Whereas, migration used to be for agricultural labour in the Green Revolution state of Punjab, migration is now oriented to towns and cities across India: '... interstate migration to cities for factory work has become a kind of occupational mobility that has not been seen before and this is especially marked in the case of the Other Backward Castes' (Deshingkar et al, 2009:154).

This experience of migration has been found by Massey et al (2010) to be true of ultra poor landless and flood displaced men and women from both West Bengal and North Bangladesh who had taken to migration for begging as a livelihood due to inability to undertake hard physical work. The authors found that women considered begging tough, laborious and distress driven but nonetheless found the remittances better than earnings from agricultural labour.

Migrant remittances have been identified as one of the factors enabling agriculture intensification (Deshingkar, 2012). Agricultural intensification may improve the resilience of poor households to economic and environmental shocks but this does not necessarily mean an improvement in ecological resilience of the system. Initial negative effects of migration can be caused by the loss of labour but may be offset over

time as the inflow of remittances allows households to purchase agricultural inputs. The loss of labour, however, can deprive households of access to critical labour, resulting in falls in productivity, which leads to dis-intensification (Deshingkar 2012). This may lead to the adoption of labour-saving technologies or abandonment of labour intensive crops, or a decrease in labour inputs and fall in productivity. The effects of migration and remittances for males and females affect agricultural activities differently. The departure of men has been blamed for the feminisation of agriculture (Deshingkar, 2012).

Earnings from migration are being invested in agriculture to reduce the need to migrate, but mostly spent on consumption (Deshingkar, 2012). In the future, migration could provide an important source of capital for subsistence farmers struggling to manage unpredictable environmental conditions. Soil and water conservation appear to have been negatively impacted by migration.

7.2.2 BANGLADESH

The pattern of migration and remittances differs in Bangladesh compared to India as migration is international in nature. Migration is a historically anchored phenomenon in the region. According to Joarder and Hasanuzzaman (2008), Bengali migration dates from the eighteenth Century when sailors worked for the British merchant navy that operated out of Calcutta (now Kolkata) port. These migrants, including stowaways, travelled mostly to the UK and USA. Migration livelihoods are spatially patterned by this history. More than 50% of total migration from Bangladesh continues to be concentrated in source districts such as Sylhet and Chittagong where landlessness is common (Hadi, 2000). Remittances account for 70% of household income on average in Sylhet, making the district more economically stable and wealthier than any other part of Bangladesh. Callon (2007) shows that migration today is woven into Bangladeshi culture while Hadi (2001) points out that the remaining women have been beneficiaries of migration in terms of increased household decision-making power, increased consumption and better access to education.

As a modern Islamic nation Bangladesh has also been able to intensify a longstanding tradition of labour market relations with the Middle East to take advantage of the oil wealth expenditure of Gulf States on ambitious infrastructural and construction programs from the 1970s (Joarder and Hasanuzzaman, 2008). Raihan et al (2009) differentiate between three phases of modern Bangladeshi migration:

- Phase One ran from 1978 to 1989, was dominated by migration to the Middle East, and attracted a total of 724,000 migrants (or 52,000 migrants per year);
- Phase Two ran from 1990 to 2000, was based on the opening of the Malaysia and Singapore labour markets, and attracted 2.3 million migrants (or 205,000 migrants per year). This flow slowed due to the Asian Financial Crisis of 1997;
- Phase Three ran from 2001 to 2008 and has witnessed a diversification of destinations including East Europe, Italy, Korea and Malaysia following a three year Malaysian embargo on labour immigration. This flow of migrants constitutes 3.28 million (Raihan et al, 2009:4).

Joarder and Hasanuzzaman (2008) further distinguish between permanent migration which began in the early 1930s and temporary migration to the Middle East, followed by South East Asia on formal but short-term labour contracts that began in the 1970s.

Migration remittances form a highly significant component of Bangladesh's national economy; remittances from 2.8 million migrant workers formed 10% of national GDP in 2008 (Raihan et al 2009:1). Remittances are viewed as a 'safety valve' for a populous, flood-prone and very young nation that is comparable to flows of direct foreign investment and official development assistance. Remittances are calculated to have reduced headcounts of poverty by 6% (Raihan et al 2009:18), helping Bangladesh to meet the Millennium Development Goals (MDGs). However, this income flow is dependent on the ebbs and flows of the global economy as the bulk (around 70%) of Bangladeshi migrants are: young; male; un-skilled or semi-skilled; and working on temporary contracts in the Middle East and South Asia. Consequently, a current focus in migration and remittances literature is the potential impact of the Global Financial Crisis on the Bangladeshi economy, with modelling of this potential shock undertaken by Raihan et al (2009) and Raihan (2010).

7.2.3 NEPAL

Nepalis are synonymous with 'coolies' and have traditionally migrated (Bruslé, 2008:241) over a 200 year history that encompasses the movement of pilgrims, devotees, political refugees, and soldiers; the Nepalese fought in both World Wars (Gartaula et al, 2012b:401; Wagle, 2012:186).

The Anglo Nepalese Peace Treaty of 1816 empowered the British to raise three regiments in the Northern Indian hills. At the same time, Darjeeling's tea industry grew rapidly between the 1850s and 1900s with English tea planters preferring Nepalese workers. British policy fostered Nepali migration by recruiting the Nepalese into military service through centres established at Darjeeling. The treaty of 1950 between Nepal and India opened their shared border completely, reputedly a lawless zone prone to corruption. The construction of the Darjeeling Himalayan Railways in the 1970s strengthened this Nepal-India migration route (Datta, 2004:88 & 94).

Increased Nepalese migration in recent decades is unprecedented; from 88,000 in 1942 to over four million in 2008 (Gartaula et al, 2012a:181). Nepalese agriculture has been in relative decline since the 1980s, and accelerated decline since 2000. Consequently, remittances from urban Nepal and abroad constitute an important form of support for poor rural households (Food Security and Agricultural Projects Analysis Service ESAF, 2004:9).

The 1981 population census indicates that 8.6% of the Nepali population are native born internal migrants. Bhandari reported in 2004 that of the 2.7% of Nepalese who migrate internationally, 93% travel to India. Migration to East Asia and Arab countries is a recent but strengthening trend (Bhandari, 2004: 476-477). In 2012, Gartaula et al reported 3% living abroad: 77% in India and 15% in the Gulf countries (Gartaula et al, 2012b: 402). International migrants are almost entirely male and flows are dominated by migrants from the mid- and far-western regions (Bruslé, 2008:240). Bruslé comments that since international migration increased during the 1990s, officially captured remittances increased to 16.8% of GDP in the 2005-2006 year, but if unofficial remittances are included the proportion of GDP, might be up to 25%. According to Gartaula et al, (2012) remittances formed 30% of GDP in the year 2008-2009. One fifth of poverty reduction between 1995 and 2004 can be attributed to remittances (Gartaula et al, 2012b: 402).

According to Bruslé's field work, the status of a temporary migrant worker is passed down from father to son and is viewed as a rite of passage to adulthood. In economic terms migration is a coping strategy, mostly to pay back costly loans. Migrants are typically excess to on-farm labour requirements, often belonging to larger households who fit in short stints of paid labour that complement the agricultural calendar. If this involves a simple move from border districts, little money is needed. Although the young explore more distant opportunities, the tendency is after 10 to 15 years to marry and seek stability (Bruslé, 2008: 241-243).

According to Datta (2004) contemporary Nepali migrants to West Bengal tend to cluster in Jalpaiguiri and Darjeeling Districts, Kolkata, and the urban parts of 24 Parganas District. Information is readily available from relatives and friends living in Darjeeling regarding the district's large tea gardens. Short migrations are preferred as most economical; especially by poorer and less educated migrants. Kolkata is the nerve centre of East India and its large informal sector absorbed 25% of international migrants from Nepal in 1981 and 26% in 1982 (Datta, 2004:90-91). Datta reported that 100,000 to 200,000 Nepali women are believed to be working in the Indian sex industry, and vulnerable women are recruited through social networks (2004:99).

An alternate upland reaction to the economic lure of migrating to the Terai or India is indicated by Malville (2005). In 1997, Malville undertook a survey of the subsistence base of 50 porter households in Kenja (1,664 m asl) by opportunistically recruiting 50 adult males between 20 to 38 years of age. Most of the porters were married Tamang or Rai subsistence farmers. Their households had significantly more adult workers than non-porter households and owned on average 0.8 to 1.1 ha of land, although 28% could be classified as landless or nearly landless. Around 20% of land was irrigated, all porter households owned livestock and grew enough food for 9.8 months on average. Porterage was reported to be a longstanding tradition and porter families may be as prosperous as the average hill family. The availability of portage labour meant they could avoid long term migration to Kathmandu, the Terai or India. The authors conclude

that portering is an adaptive response to inadequate farmland and predictable seasonal food shortages (Malville, 2005:425-435).

Evidence is mixed on the impact of remittances on agricultural development. Remittances are spent on basic needs, education and consumption as well as overcoming agricultural labour shortfalls and investing in capital inputs (Gartaula et al, 2012a:181). Competing policies in Agricultural Perspective Plan (APP) of 1995 and Foreign Employment Act (FEA) of 2007 demonstrate that Nepal's conventional development discourse is shifting towards acknowledgement of the significance of mobility (Gartaula et al, 2012a:182). The APP and FEA are somewhat contradictory policies, with APP paralysed by the decade long Maoist insurgency during which many youths were forced out of villages; an incentive to migrate (Gartaula et al, 2012a: 192).

Regmi and Tisdell (2002) tested the relationship between remittances and rural development by using the National Migration Survey data of 1996. They found that overwhelmingly remittances were used to support household expenditure: 'Hence, the contribution of remittances to improving agriculture and increasing investment in rural areas seems to be very low in Nepal.' (Regmi and Tisdell, 2002: 85). The level of remittances was also low; 4% of the migrant's income reflecting low incomes rather than low propensity to remit. Migrants were more likely to remit if they possessed higher levels of education, visited frequently, had close relatives in their place of origin, and their parents owned land – suggesting migration was guided by implicit social exchanges. Little evidence was found that remittances significantly contributed to rural development; rather remittances were used for consumption (Regmi and Tisdell, 2002: 92).

Wagle (2012), analysed the National LSS data in terms of remittance winners and losers and found consistent evidence that assets were the most consistent predictor of remittances, no doubt due to the necessity of collateral in order to invest in migration. Households holding greater assets maximised foreign remittances and this relationship strengthened over time. While this finding is consistent with the Sustainable Livelihoods Analysis interpretation of migration (livelihood diversification), it does not imply any reduction in inequality as remittances increasingly went to families already enjoying higher non-remittance income. Secondly, Wagle found that remittances from migrants working in India were lower while no significant difference was found between remittances from East Asia and Middle East. Spatially, Kathmandu was a remittance winner, followed by other urban areas, then rural areas (Wagle, 2012:199-201). Caste status was a good predictor of the level of remittances: '... low caste households, Newars, and Muslims likely to receive lower amounts of foreign remittance compared to the HCH's including Brahmins and Chettris' areas' (Wagle, 2012:202). However, the mountain and Terai regions were faring significantly better than the hills belt: '...the Terai and especially Mountains reduced their reliance on India, massively increasing their migration to other regions and countries' (Wagle, 2012:202).

Focusing on inter-generational differences between Nepalese migrants, Gartaula et al (2012a) note a change from regarding land as a productive asset to a status symbol. The Gartaula et al study took place in Jhapa District of the Terai due to its high rates of out-migration. The settlement dates from 1912-1913, with increased permanent in-migration by entire households characteristic of the late 1950s, and circular out-migration by individuals beginning in the mid- 1970s and increasing ever since (Gartaula et al, 2012a:183). Over 75% of the households surveyed produced 12 months of food, with 57% of the 67 remaining households compensating with remittances, and 24% from wage labour. The study found that the greater the landholding, the higher both the food supply and tendency to out-migrate. Secondly, younger households with smaller landholdings were less interested in agriculture (Gartaula et al, 2012a:187) although their preference was to buy agricultural before residential land (Gartaula et al, 2012a:190). Overall, the authors note that:

> *Interestingly, migrant households spent more on agricultural inputs and technology than non-migrant households. At the same time, more migrant households than non-migrant households invested in residential land. So, the survey data present a mixed picture, showing that migrant households invest both in agriculture and in residential land (Gartaula et al, 2012a:189)*

Land speculation could reduce Terai's total acreage of land for agricultural production, placing Nepal's food security at risk (Gartaula et al, 2012a: 192).

Bhandari and Grant (2007) compared the agricultural livelihoods of highland (>1,000 m asl) and lowland (<1,000 m asl) communities within the 49 km^2 Kali-khola watershed using surveys, interviews and PAR between April and August in 2004. The authors found that 50% of lowlanders compared to 25% of highlanders maintained their livelihoods on the basis of agriculture alone. Highland farmers are also pastoralists and rely upon forests for firewood, fodder, timber and grazing. Lowland communities owned significantly more land but were disadvantaged by a shortage of labour. Lowland farmers relied on non-farm incomes such as employment in services and other small businesses. Over two thirds of the Terai smallholders had more than one internal or international migrant worker. Their highland neighbours, without English schooling, found it difficult to compete in migrant labour markets (Bhandari and Grant, 2007: 23). Bhandari studied migration patterns in 12 VDCs in the Western Chitwan Valley where 80% of the population depends upon agriculture for their livelihood, but 23.9% of households sent individuals away to work. With a district market and east/west highway link to the cities of Kathmandu and Polhara, services, business and wage jobs were relatively accessible. Bhandari found that the region was rapidly urbanising, both drawing migrants from its rural agricultural hinterland and facilitating increasing international out-migration (Bhandari, 2004:477-481).

A study focused on the neglected issue of linkages between internal and international migration was conducted in Kaili District; a popular Terai destination for adjacent hill district migrants. The district has had a high population growth rate since the 1980s including the study site – a homogenous community of high caste (Bahun, Thakur and Chhetri) hill migrants. Settlement had begun 18 years ago and intensified in response to the Maoist conflict in the hills (where child abduction was a problem) and the opportunity to improve economic livelihoods (Poertner et al, 2011). Apart from their (nucleated) Terai housing, these households held agricultural land in rural Terai that was cultivated by sharecropper tenants both for social status and to reduce food bills.

Over 80% still owned land in their hill village of origin and was usually cultivated by relatives. With 25% of the men holding a Bachelors or Masters degree, most households boasted a salaried husband (teacher or government official) and many still work in the hills (Poertner et al, 2011:31-33). This was due to a large incentive; a rural allowance:

> *In addition to a basic salary, government teachers (and other employees) receive allowances according to how remote their workplace is from where they live; the more remote the district, the higher the rural allowances. The rural allowances for working in Bajhang while living in urban Terai amounted to 75 percent of the basic salary (Poertner et al, 2011:35).*

Most households in the source hill district were also involved in migration to India with a few cases of successful Indian migrants effectively relocating their households to the Terai. Because fathers and grandfathers had sent remittances from India to purchase land and educate sons, they enabled their sons to obtain government jobs which led to the discontinuation of migration to India. This multi-local pattern of spatial household linkages was institutionalised in a local organisation that produces a telephone directory providing household numbers in both the in Terai and the original hill village of Bajhang (Poertner et al, 2011: 38-40).

Half of the women in this community were illiterate and all were housewives. While they had control over everyday decision-making, men made consequential decision-making, by father, then husband, and by the son on her husband's death. No fundamental renegotiation of gender relations was evident other than a decrease in the number of arranged marriages. Rather, the higher the caste the more restricted women's lives. Education was considered a pathway to upward social mobility with girls sent to local schools and boys sent to Kathmandu private schools. (Poertner et al, 2011:33-34).

Gartaula et al (2012b) argue that the socio-cultural dimensions of those left behind by migrants need to be integrated into migration studies, especially since social transactions over distances are now facilitated by ICT. A survey of 277 households in Terai's Jhapa District indicated that the majority of migrant households were high caste, originally migrated from the north-eastern hills, and that remittances formed 30% total household income. Most (72%) owned both agricultural and residential land while 23% owned just residential land and 5.4% were landless. Monogamy and virilocal residency dominate in Nepal; marriages are traditionally arranged and women move to their in-laws to form a co-residential household. The life

narratives of four women are reported on (Gartaula et al, 2012b: 402-406). Marked differences were found between women living with their in-laws and women who were de facto household heads (Gartaula et al, 2012b: 402-404). Remittances were found to enhance objective wellbeing by providing food security, a safety net and of benefit to the receiving society generally (Gartaula et al, 2012b:407). The labour participation of women in agriculture had increased and women living with in-laws benefited from task sharing.

Subjectively, the women were lonely. Although contact with their husbands had increased since using mobile phones, their relationship to in-laws ranged from very cold to harmonious. Patriarchal control over household resources was unequivocal, either by the husband or father-in-law, however, the women de facto household heads enjoyed more autonomy regarding resources (Gartaula et al, 2012b:415-416). Women's autonomy and self esteem generally increased age and childbearing and were enhanced by involvement in groups and cooperatives. The authors conclude that while objective wellbeing was improved by migration for left behind women, the cognitive and emotional dimensions were more context specific and often have not improved (Gartaula et al, 2012b:417).

These rich studies suggest that rural systems in Nepal could best be described as 'agri-migratory' (Bruslé, 2008:241):

> *For households in far-western districts, agriculture in Nepal and wage employment in India are complementary activities. Livelihood strategies definitely comprise diversification of income sources and mobility patterns (Bruslé, 2008:245).*

7.3 Key differences and implications for food security interventions

India's NREGA and throughout the EGP, migration is an important livelihood strategy for the rural poor. NREGA and migration provide a source of cash income that can supplement other forms of farm and off-farm income as well as subsistence agriculture. In the case of NREGA, there is considerable opportunity to target NREGA works for the creation of productive assets as well as fostering partnerships between state bodies managing NREGA and NGOs who often have closer ties with rural communities and understand their challenges and priorities more intimately. Access to NREGA is also an issue with the opportunity to secure the 100 days entitlement proving to be highly variable in Bihar and West Bengal. Once again, fostering partnerships between NGOs and underserviced communities to facilitate access can enhance purchasing power and consequently, food security and access to education and health services. Researchable areas include investigating where NREGA is ineffective and why. Greater understanding of the key issues and developing partnerships and linkages in the field can foster the creation of innovation platforms where NREGA representatives, NGOs and underserviced communities work together to improve service delivery and create productive assets would have welfare enhancing effects.

Both NREGA in India and migration in the EGP, while providing important supplemental income to rural households, have created the paradoxical 'labour shortage' in one of the most populated regions on earth. These institutions have increased the opportunity cost of agricultural labour. The low returns to labour provided by paddy cultivation also favour these alternative livelihood strategies. To keep farmers farming, it would be necessary to increase the returns to agricultural labour. Increasing the returns to labour could be achieved through reducing costs (e.g. economies of scale, consolidation of farming blocks), increasing productivity of staple crops, or through the cultivation of higher value agricultural commodities. Improving the efficiency of agricultural value chains can also increase farm gate prices, and therefore, the returns to their labour. Particularly in India, the predominance of the Public Food Distribution System, issues surrounding its implementation in Bihar and West Bengal, and how this relates to farmgate prices are important researchable issues. Research around value chains and how to enhance value at the producer level is also a theme not well addressed in the literature.

With male migration, women are increasingly becoming involved providing agricultural labour – the so-called feminization of agriculture. Women's involvement in agriculture has important implications for rural extension and NGO engagement where traditionally, these services were targeted toward the male head of the household. In Bangladesh's experience, migration has had an important impact in increasing women's

household decision-making authority though this seems to be less true in the case of India. How are NGOs responding to this changing dynamic? Are their models of service delivery evolving as a response? Answers to these questions can help design service delivery strategies that are responsive to this dynamic and better targeted to diverse household priorities.

Male migration has also increased the demand for labour-saving technologies. Mechanization has occurred at a rapid pace, particularly in Bangladesh. Appropriate technologies targeted to specific household types need to be designed. Consideration should also be given to the specific circumstances of female-headed households and where women supply a significant portion of agricultural labour. Research can serve to develop household typologies to match appropriate technologies to household characteristics.

In India, migration has reduced the relevance of caste. Furthermore, those that migrate and later return to the country-side often return with new ideas which can enhance innovations in agriculture as well as in non-farming activities such as in the development of rural industries. Exploration of the role of out migration in contributing to social equity and rural development are researchable topics of importance.

While maintaining agricultural production may have important consequences for household food self-sufficiency, households also require disposable income for consumption of food not produced on farm, and to purchase services such as education, health and other basic necessities. In many cases, the potential for staple crop cultivation in delivering disposable income is very limited. Off-farm developments and sources of income are important. Greater access to education could for example deliver the greatest gains in achieving food security and an improved standard of living in the long run. Exploring the returns to develop assistance can provide insights that can help target aid.

8 Input and output markets in rice-dominated value chains

8.1 India

The marketing chain for grains consists of procurement, storage, transport and distribution. This marketing chain is dominated by the government's Food Corporation of India. To balance the interest of farmers and consumers, the government manages a procurement price for paddy and wheat and a levy price for milled rice. The Minimum Support Price (MSP) was established to provide incentive for the production of rice and wheat, to encourage the adoption of new technologies, and to insulate farmers from risk, assure consumers of affordable grains, and minimize destabilizing speculation. The government also intervenes in the grains market, purchasing rice at a procurement price. Since the 1970s, the procurement price and MSP have been close to equal, though their initial intentions differed (Ganesh-Kumar et al, 2007).

The difference between levy rates and processing margins differs between states (Ganesh-Kumar et al, 2007). For example, regional variations in input prices and the presence and quality of infrastructure provide certain regions with a competitive advantage and are thus more attractive for the procurement of grains. In the western states, for example, heavily subsidized electricity in well electrified rural areas enables low cost irrigation, while relatively good transportation networks facilitate the acquisition of inputs and the transport of goods to market. In the case of Bihar, rural areas have very limited electrification and inadequate transportation networks. Given regional disparities, farmers in some states like Bihar are often pressed to sell grains at below the MSP due to distress (Chand, 2003; World Bank, 2007b). When surplus production does occur, inadequate storage systems often result in significant losses. As procurement has tended to focus on the Green Revolution states, the De-Centralized Procurement Scheme was developed to enable state agencies to procure from farmers directly at the MSP and from millers at the levy prices (Shreedhar et al, 2012).

Under the Rice Milling Industry Act (1958), processors are required to sell a fraction of total output to the government at a levy price. The Public Distribution System (PDS) delivers grains to state operated shops (so-called Fair Price Shops) where entitled households can purchase rice at prices below regular retail. The Food Corporation also maintains stocks to buffer against shocks such as world price and climate shocks.

Wastage of foodstuffs is chronic. India-wide, the Food Corporation has regularized losses of up to 1%, 1.5% and 2.5% for wheat, rice and paddy, respectively, though this is likely an understiamte with new stocks added continually (Shreedhar et al., 2012). Much of this loss may be attributed to open and inadequate storage facilities. It is likely that for states with less-developed infrastructure and storage facilities such as Bihar and West Bengal, these estimates would be higher. India-wide, considering both perishable and non-perishable agricultural goods, the lack of post-harvest storage results in losses of up to 30% (Nabard Consultancy Services PVT LTD, 2012). Bihar's wholesale agricultural prices are higher than most other regions because of wastage and high transport costs. In the case of some agricultural commodities, these costs can account for 40% of total margins along the value chain (World Bank, 2007b).

The Agricultural Produce Marketing Committee Act (APMC; 1960) was established to provide a fair and transparent platform for the sale of agricultural commodities. In India, there are around 2,170 APMCs that control 7,500 markets which operate as monopolies in agricultural commodities. As transparency of the system and remuneration declined over time, the system became more of a liability (World Bank, 2007b). In some states, the APMC has since been amended enabling the private sector to purchase from small farmers directly, to facilitate farm to firm linkages and to promote contract farming. Market infrastructure development was also opened to private sector investment (Ganesh-Kumar et al, 2007; Gulati, 2009; Gulati & Ganguly, 2010; Minten et al, 2009).

Bihar's own APMC was modelled along the lines of the Government of India issued APMC (1972). As such, wholesale trade of commodities is restricted to government-run markets, reducing the potential for creating backward linkages between processors, exporters and farmers. The Bihar State Agricultural Marketing Board has proposed amendments to the APMC Act, known as the Bihar State Agricultural Produce Marketing (Development and Regulation) Act 2005, though it has not yet been passed (World Bank, 2007b). Bihar ranked third from the bottom in quantity and quality of market infrastructure, also faring very poorly with regards to the number of markets per capita. West Bengal scored even more poorly on both counts (World Bank, 2007b).

8.2 Input output markets and the rice value chain in India

Input subsidies for fertilizer, pump sets and electricity were introduced during the second phase of India's Green Revolution (1973-1980). Policies and infrastructure development to promote agriculture were targeted towards those areas where marginal investment returns were highest, primarily in the states of the Punjab, Haryana, and western Uttar Pradesh. West Bengal and Bihar were largely neglected though they possess significant agricultural potential. India-wide, by the end of the 1990s, input subsidies accounted for 8.7% of agricultural gross domestic product (GDP; Shreedhar et al., 2012). Almost 75% of public spending in agriculture is allocated to subsidies (Gulati & Ganguly, 2010).

The public sector produces the majority of rice and wheat seed. The National Seeds Corporation and State Farms Corporation are national bodies, and 15 State Seed Corporations are responsible for seed research, production and distribution. With the National Seeds Project (1976 to 1995) and loans to the private sector for research and development, the private sector eventually became involved in seed production. Further supporting private sector entry was India's Policy on Seed Development (1988) and the New Industrial Policy (1991) which facilitated foreign investment in the seed sector. The National Seed Policy was passed in 2002 and the Seed Bill of 2004 provides implementation direction for the national policy (Shreedhar et al., 2012).

Following the World Trade Organization's Trade Related Intellectual Property Rights (TRIPS) agreement negotiated during the Uruguay Round (1986-1994), the Indian government passed the Protection of Plant Varieties and Farmers' Rights Act to protect plant varieties and the rights of farmers and plant breeders. This Act was also designed to encourage the development of new varieties, stimulate investment in research and development, and contribute to growing the seed industry. The proposed Protection and Utilization of Publicly Funded Intellectual Property Bill (2008), if passed, would enable public research institutions and universities to patent research and be rewarded for their innovation (Viswanadham, no date).

Seed replacement in West Bengal is low. Some key issues identified were the unavailability of quality seed from reliable sources at the right time, the high cost of seed and limited farmer awareness of the productivity potential of quality seed (Nabard Consultancy Services PVT LTD, 2012). Shreedhar et al. (2012) report that the sowing of hybrid seed is concentrated in the northern states as well as some eastern states including Bihar and account for over 80% of the area sown with hybrid rice. In India, overall the area of hybrid rice remains low and may be partially explained by relatively low yield gains, poorer grain quality, taste, and market price of hybrid rice (Shreedhar et al., 2012).

Nationally, the Fertilizer Control Order (1957) regulates the price and distribution of fertilizer. The Order fixes farm gate prices and subsidizes producers. With fluctuating oil prices and the price shock created by the 1973 Oil Crisis, the fertilizer subsidy bill increased dramatically requiring a change in policy. The 1977 Retention Price Scheme was instituted setting fertilizer prices according to production costs and included a 12% post-tax subsidy. This scheme had unintended consequences for the efficient production of fertilizer and its application, while the fertilizer subsidy bill continued to rise. Between 1976 and 1998, fertilizer subsidies increased by 30 times in real terms with paddy and wheat farmers being the majority beneficiaries. Fertilizer subsidies accounted for a 2.7% share of agricultural GDP in 2000, which was 5 times the government's expenditure on agricultural research and development (Fan et al, 2008).

Fertilizer (N-P-K) application was 165.6 kg/ha in Bihar and 168.6 kg/ha in West Bengal compared with the national average of 135.27 kg/ha in 2009/10. While greater than the national average, this was significantly less than application rates in the Punjab and Haryana for example (237.1 kg/ha and 209.9 kg/ha, respectively; Ministry of Agriculture, 2012). Nonetheless, fertilizer use in West Bengal has increased by over 37% in the last 5 years (Nabard Consultancy Services PVT LTD, 2012). Declining soil fertility in West Bengal is a serious constraint to increasing productivity: 25% of land is categorized as degraded. An unbalanced application of fertilizers is in part responsible for this degradation (Nabard Consultancy Services PVT LTD, 2012).

In 2002, the New Pricing Policy Scheme replaced the Retention Price Scheme in attempts to improve program efficiency however it had distortionary effects on N-P-K application ratios. Low nitrogen prices and price spikes in phosphorus and potassium due to market deregulation resulted in detrimental soil nutrient imbalances (Sharma & Jain, 2011). The Nutrient-Based Subsidy Scheme was introduced in 2010 which applies to phosphatic, potassic and complex fertilizers, and aims to reduce the subsidy bill and improve soil nutrition (Shreedhar et al., 2012). The New Pricing Scheme was introduced for urea which accounts for 78% of total nitrogen use (Sharma, 2012).

Originally, fertilizer subsidies were paid to fertilizer manufacturers and importers. Recent advice from the Unique Identification Authority of India recommends subsidies are paid directly to farmers as cash transfers. A subsidy targeting approach is recommended considering criteria such as the size of land holding and subsistence versus commercial cropping. A cap on the amount of subsidy a single beneficiary may access was also established. There were early implementation challenges to this new approach. Small farmers often lack disposable income to purchase inputs up-front, while payment of the cash transfers is often delayed. Informal land tenancy and leasing arrangements inhibit access to subsidies as well as formal credit. There are real concerns that removal of the fertilizer subsidy will render farming uneconomic. Estimates by Sharma (2012) show that a wheat farmer's net income in Bihar could fall by 47.2%, and rice farmers in West Bengal could face a net loss of Rs. 3964 /ha (Sharma, 2012).

Electricity subsidies for agriculture are high, though they differ state by state. State Electricity Boards collect revenue from the sale of electricity and charge very low rates to farmers. In 1999, the agricultural sector used 29% of the electricity produced although the sector contributed only 3.4% to electricity sales revenue. In 2001, farmers were charged Rs. 0.284 per kilowatt-hour compared with an average supply cost of Rs. 3.04 per kilowatt-hour. Electricity subsidies have grown at an average annual rate of over 19% between 1966 and 1999, falling to 11.9% in the 1990s (Fan et al., 2008).

Access to electricity also differs significantly by state. In Bihar, on farms where irrigation does occur, it is dominated by tubewells followed by canal irrigation. Shallow tubewells are also the most prominent form of irrigation in West Bengal. In Bihar, only 5% of rural households have access to electricity (World Bank, 2007b). In Bihar, West Bengal, Orissa and Assam, 92% of groundwater pumps operate on diesel fuel compared to 41% in the northern states (Shreedhar et al., 2012). Consequently the cost of energy inputs to agriculture differs greatly by state (Jha & Viswanathan, 1999).

In West Bengal, policy restrictions and a perception of groundwater scarcity are major obstacles to increasing groundwater use with an estimated 42% of the groundwater potential in use. The 2005 Groundwater Act poses restrictions on the development of new wells and applications for new wells are often rejected. Permit requirements for electrical connections and high diesel costs also inhibit groundwater development. By a recent Government order, the West Bengal State Electricity Distribution Company will provide new electricity connections to farmers for a fixed connection fee. Previously, farmers were required to cover all costs related to electrical infrastructure. Furthermore, a November 2011 amendment to the Groundwater Act has reduced restrictions on 5 horsepower pumps in areas where groundwater is abundant. The amendment means that farmers are no longer required to seek permission for an electricity connection to power these smaller pumps. As some farmers cannot afford to purchase pumps, a pump rental market has emerged to meet increased demand. Increased rainwater harvesting also has good potential for increasing irrigation in the state (Evans et al, 2012).

Farm mechanization in India has a long history, increasing rapidly during the Green Revolution in the northern region to improve the timeliness of operations, increase input application efficiency, and

substitute for increasingly scarce and costly farm labour (Singh, 2005). India is the second largest tractor manufacturer in the world (Federation of Indian Chambers of Commerce and Industry, 2008). Tractor intensity in West Bengal and Bihar in 2003/04 was 4.6 and 16.2 tractors per 1000 ha of farmland, compared with 61 and 71 tractors per 1000 ha in Haryana and the Punjab, respectively (Singh, 2006). A number of Central Government managed subsidy programs exist, some of which are crop specific. One program subsidizes the purchase of tractors under 18 horsepower. At the state-level, subsidies are available for custom hiring of machinery, particularly for small farms (Federation of Indian Chambers of Commerce and Industry, 2008). Constraints to further mechanization include small farm size and farm fragmentation, the need for research and development for appropriate technologies for smaller farms, the high cost of diesel, a lack of investment capital, and the opportunity cost of idle machinery (Singh, 2005).

Agricultural credit is extended by State Cooperative Banks, District Central Cooperative Banks, Primary Agricultural Cooperative Credit Societies, State Cooperative Agriculture Rural Development Banks, Primary Cooperative Agriculture Banks, and Rural Development Banks. With declining credit to deposit ratios, many of these institutions suffered losses and reduced lending to small farmers. With cooperative banking institutions falling in importance, direct financing has increased, though mostly targeted to larger scale farming operations. The prominence of micro-credit and self-help groups as well as nongovernmental microfinance institutions has increased to fill this gap (Das, 2010; Shreedhar et al., 2012). The financing of self-help groups (SHGs) has increased markedly in West Bengal, while at a slower rate in Bihar (Das, 2010). By 2005 in Bihar, over 17,000 SHGs were financed by banks and this number continues to increase. Over 201,000 Kisan credit cards, card instruments designed to provide farmers with affordable and timely access to credit, were issued through banks (World Bank, 2007b). Credit subsidies in the form of below market interest rates for farmers also exist. This form of subsidy grew fastest during the 1970s at 22% per year, falling to less than 5% in the 1990s (Fan et al., 2008).

In the case of West Bengal, agricultural credit has improved over the past 6 years. In 2009, credit provision to the overall agricultural sector reached 93% of the Banks' targeted level. Small farmers tend to access short-term credit to maintain operations rather than invest in longer-term capital formation. This is in part a supply-side problem where financial institutions prefer less risky loans to large farmers who hold more collateral. It is estimated that 73% of rural farming households in West Bengal are excluded from both informal and formal credit markets (Nabard Consultancy Services PVT LTD, 2012). In Bihar, farmers were able to access only a 2% share of total agricultural lending by State Cooperative Banks in 2004 (World Bank, 2007b).

In the case of informal credit markets through private moneylenders, farmers can pay up to 48% interest per year (Haque, 2001). Village surveys by Erenstein and Thorpe (2011) indicate interest rates as high as 58% in Bihar and 98% in West Bengal (Erenstein & Thorpe, 2011). In Bihar, 44% of farmer-led households contracted their debt from money lenders, the second highest proportion in the country, though they maintained the lowest value of outstanding loan per farm household in India (World Bank, 2007b).

A key issue in value chain integration relates to farm size. At a national level, 88% of land holdings in India were < 2 ha and accounted for 44% of the total cropped area (Gulati, 2009). Land holdings in West Bengal are highly fragmented with 88% of holdings cultivated by small farmers with an average farm size of 0.82 ha. Land is dominated by large absentee land holders (ex-zamindars). This situation is similar in Bihar where the average farm size was 0.75 ha. Small farm size and fragmentation constrains the types of technological innovations possible.

In Bihar in 2000, 58% of cultivated plots less than 1 acre in size (0.4 ha) were leased; and 27.6% of cultivated plots between 1 and 2.5 acres (0.4-1 ha) were leased (World Bank, 2007b). Leasing land is illegal in most Indian states except under special provisions, though leasing does occur through various loopholes or in a concealed manner (Haque, 2001). Consolidating the holdings of small farmers through the organisation of farmer groups or cooperatives is a key challenge necessary to reach economies of scale. India's dairy industry provides a good example of successful producer consolidation (Gulati, 2009).

A major centralized support system to agriculture is the Government's National Food Security Mission which aims to increase the output of rice, wheat and pulses through demonstration of best practices and the provision of subsides and other incentives. Bihar has the largest number of districts targeted for rice

and the second largest number of districts targeted for wheat under the Mission. A second centralized agricultural support program is the Rashtriya Krishi Vikas Yojna (RKVY) program. Launched in 2007, RKVY is designed to leverage state agricultural growth and investment plans, focusing on integrated agricultural development considering both the productivity and marketing food subsystems. East India is a focal region for RKVY (Shreedhar et al., 2012). RKVY aims to contribute to the achievement of 4% agricultural growth over the Governments 11th five year planning period (Nabard Consultancy Services PVT LTD, 2012).

Initiated in 1998 and extended to the entire country in 2007, India's public sector district-level Agricultural Technology Management Agency (ATMA) provides market-driven extension services to farmers in a decentralized, participatory and bottom-up approach (World Bank, 2007b). ATMA was established to integrate extension programs across states, linking research and extension within districts and to decentralize decision making (Glendenning & Babu, 2011; Singh & Swanson, 2006; Swanson & Rajalahti, 2010). Farm Information and Advisory Centres located at the block level are the interface or innovation platform for farmers, the private sector and extension staff, where programs are designed and implemented (Shreedhar et al., 2012). The design of strategies for targeting extension activities is governed by four axioms: (i) only promote crops for which markets exist; (ii) if the good cannot be transported to market, do not produce the good; (iii) only plant crops that are suited to the agro-ecological conditions of the region, and; (iv) diversify production to mitigate risk (Singh & Swanson, 2006).

In Bihar's Patna district, the ATMA model was implemented in 2002. Within two years, 750 farmer self-help groups were organized, many of them by non-government organizations under contract, to explore high value crops and other agricultural industries. Although not all projects were successful, Swanson and Rajalahti (2010) report the program is having a significant impact on household income and livelihoods. Nonetheless, in 2003 only 10% of Bihari farmer's accessed information from extension workers, which is the lowest in the country. Farmers were more reliant on input dealers and other progressive farmers for their information. In the case of West Bengal, 52% of farmers accessed information from extension officers, 26% from input dealers and 24% from other progressive farmers (World Bank, 2007b).

In West Bengal, Additional Directors of Agriculture and Joint Directors of Agriculture under the Department of Agriculture lead extension at the state level. The Deputy Director of Agriculture is the district-level extension authority while Sub-divisional Agricultural Officers provide services at the subdivision level. Block level extension is undertaken by Agricultural Development Officers while Krishi Proyukti Sahayaks are connected with the Development Officer providing direct assistance to farming communities. Two State Agricultural Universities and four National Research Institutions operate in extension in association with the State Agricultural Department. Krishi Vigyan Kendras (KVK) Centres offer training to farmers through 16 centres in West Bengal's various agro-climatic regions. The state also has six ATMA centres offering extension services (Nabard Consultancy Services PVT LTD, 2012).

A key challenge for India's extension system is budgetary. Extension services are funded at the state level, though much of this funding is used to pay for salaries and employment benefits. With growing budgetary constraints and retiring workers, the ratio of extension workers to farmers has been deteriorating, down to 1:4,600 overall (Swanson & Rajalahti, 2010).

8.3 Estimated rice and wheat margins

Farmers receive a relatively low share of the final price of their agricultural output. In the case of West Bengal, farmers receive between 15% and 20% of the retail price, with the remainder captured by intermediaries. Table 3 provides an overview of paddy and wheat cultivation cost shares in Bihar. Fixed costs account for 34% of cultivation costs while operational costs account for the remaining 66%. Irrigation charges are higher for wheat cropping (9% of cultivation cost compared with 1% for rice). Rice cropping uses a larger share of human and animal labour (45% compared with 23% for wheat).

Table 3 Cultivation cost share of paddy and wheat in Bihar

Cost of cultivation		Paddy	Wheat
	Cost of cultivation (Rs./ha)	12369	14574
	Cost of cultivation (Rs./quintal)	455	546
Percent cultivation cost			
Fixed cost	Land	26%	27%
	Depreciation, interest on capital	8%	7%
	Subtotal	34%	34%
Operational cost	Human and animal labour	45%	23%
	Machine labour	6%	13%
	Seed, fertilizer and insecticide	13%	18%
	Irrigation charges	1%	9%
	Subtotal	66%	66%
Total		100%	100%

Source: World Bank (2007b), from Reports of the Commission for Agricultural Costs and Prices (several issues)

An important stage in the rice value chain is the processing or milling of paddy into rice. It is often the case that farmers sell paddy to rice millers who are also wholesalers in the value chain. In the case of both rice and wheat, wholesalers pay approximately 11.5% of the paddy purchase price in the form of a statutory charge which consists of a purchase tax, surcharge, market fees, a contribution to the rural development fund (RDF), and commission. The remaining costs incurred by rice wholesalers and millers are charged on a per bag basis (60 kg of paddy). Costs include bag filling and stitching, weighing, loading and transport to the rice mill, a gunny bag and processing costs. Wholesalers receive intermediate income from selling the rice bran and husk that is a by-product of milling. Processors have milling arrangements with the Food Corporation of India which affects their profit margins. Table 4 describes these costs, excluding transport fees for surplus states. These costs were based on data for 1996-97 to 1998-99 with West Bengal considered a surplus state in rice, though deficit for wheat. Bihar was a deficit state in both rice and wheat. The Punjab was taken to represent surplus regions with farm harvest and wholesale prices obtained from the Punjab's Khanna market.

Table 4 shows that purchase taxes, market fees, wholesale margins and interest charges are the greatest cost components. Once processed and transported, milled rice is then sold to consumers at the retail price. Wheat is typically traded in the form of grain and purchased directly from the farmer. Marketing margins between harvest and wholesale wheat price, excluding transport fees, for surplus states is shown in Table 5.

Again in the case of wheat, purchase tax, market fees, commission, interest and traders margins are the greatest cost components.

Table 4 Rice marketing margins in surplus states, 1999–2000

	Rate	Cost (Rs/quintal)	Share
Statutory charges			
Purchase tax	4%	20.8	13.4%
Surcharge	1%	5.2	3.4%
Market fees and rural dev fund	4%	20.8	13.4%
Commission	2.50%	13	8.4%
Material costs – bag	20	10	6.5%
Labour			
Bag filling/stitching	3.85	3.85	2.5%
Weighing	1.54	1.54	1.0%
Labour and transport from mandi to seller	5.77	5.77	3.7%
Miller cost and margins			
Processing cost 1 quintal	6.4	6.4	4.1%
Interest on working capital/month	16%	12.02	7.8%
Miller margin	6.6	6.6	4.3%
Packing and stocking	2.5	2.5	1.6%
Cost of bag	23	11.5	7.4%
Storage cost/month	1	1	0.6%
Forwarding charges	1	1	0.6%
Interest on working capital/month	16%	12.71	8.2%
Wholesaler margin per quintal	20.27	20.27	13.1%
Transport cost	247		
Total		154.96	100%

Following Chand (2003)

Farm harvest price, paddy, fine: 520 Rs./quintal

Reference wholesale price for 1.5 quintal of paddy: 952.97 Rs./quintal

Excludes transport fees

Table 5 Marketing margins in surplus states, 2000–2001

		Rate	Cost (Rs/quintal)	Share
Statutory charges				
	Purchase tax	4%	23.28	18.7%
	Surcharge	1%	5.82	4.7%
	Market fees and rural development fund	4%	23.28	18.7%
	Commission	2.50%	14.55	11.7%
Material costs - bag		20%	10	8.1%
Labour				0.0%
	Bag filling/stitching	2.5	2.5	2.0%
	Weighing	1	1	0.8%
	Labour and transport from mandi to seller	3.99	3.99	3.2%
Storage cost/month		1	1	0.8%
Forwarding charges		1	1	0.8%
Interest on working capital/month		16%	17.77	14.3%
Trader margin		20	20	16.1%
Transport cost				
Total			124.19	100.0%

Following Chand (2003)
Farm harvest price 582 Rs./quintal
Wholesale price in surplus state: 666.42 Rs.
Excludes transport fees

8.4 Input output markets and the rice value chain in Bangladesh

Information dealing specifically with the North West Bangladesh is often patchy. Consequently, this section provides an overview of input output markets and the rice value chain in the country as a whole.

Bangladesh had a similar food policy to India due to the nations' common origins in colonial India, but liberalization in the 1990s opened up trade, including that of food imports, and greatly down-scaled the operations of the PFDS. Domestic procurement of grains in Bangladesh has been voluntary since the 1980s. While India has maintained a large procurement and distribution system and has been much slower to liberalize it, Bangladesh's greater down-sizing was reportedly due to greater fiscal constraints which demanded more effective targeting of distribution (Dorosh, 2008).

The significance of the Great Bengal Famine in 1943 cannot be overlooked in explaining the strong, forward thinking policy response to the agricultural sector with heavy investment in agricultural research, irrigation and infrastructure such as roads. Latest data show that rice yields grew at 2.7% on average between 1980-1981 and 2010-2011 and production increased from 13.9 million tons to 34.5 million tons over the same period. This was achieved with relatively small increases in the cropped area (Dorosh and Rashid, 2012). Overall, gains in output are largely attributed to a greater share of area planted to HYVs and investment in boro rice that is more easily insulated from climatic variability.

Driven by market liberalization, Bangladesh achieved food self-sufficiency in cereal production around the second half of the 1990s, with rapid expansion of both ground and surface water which enabled adoption of HYVs, modern inputs and improved crop management (Jaim and Akter, 2012). Indicative of this growth, in the 1980s, just 8% of the total area suitable for irrigation was irrigated compared with 53% in 1999-2000. A key driver of this growth in irrigation was the liberalization and privatization policy for irrigation equipment including pumps which saw the use of STWs grow at 14% per annum from the beginning of 2000.

Overall, 95% of the food grain market is dominated by private agents. Although generally food self-sufficient, supply shortfalls do occur, for example following the 1998 flood and the 2007-08 world food crisis. In these instances, private sector imports are an important component of Bangladesh's food security. Imports also serve the function of stabilizing prices, though there is contentious debate as to the extent that Bangaldesh should rely on imports for this stability (Dorosh and Rashid, 2012). India has been the main source of rice imports for Bangladesh mostly in the first half of 2000, India exported rice at the Below Poverty Line (BPL) price of rice which was less than the regular wholesale price. With the 2007-08 global food crisis, India ceased exports to Bangladesh raising questions to the reliability of imports (Dorosh and Rashid, 2012). Following a domestic rice real price spike of 45% compared with the previous year and temporary disruption to imports, India and Bangladesh came to an agreement on a fixed quantity of rice imports to Bangladesh, though at a price higher than the original BPL price.

As a member of the World Trade Organisation (WTO), Bangladesh is committed to the trade rules which pertain to agriculture. It is argued that Bangladesh is one of the South Asian nations that provide the lowest domestic support to agriculture, far below what WTO rules allow it to. Furthermore, the privatization of input markets has reportedly had a positive economic and equity impact (Centre for Policy Dialogue, 2000).

Demand for rice and wheat are driven primarily by population growth and growth in incomes. The demand for rice has a much lower elasticity of demand and therefore a 10% increase in income for example may see only a 2% increase for cereals and a 15% increase in demand for meat and milk. The low price of cereal grains in part is explained by these factors. Faster growth in production compared with demand growth therefore serves to push cereal prices downwards. While rice, potatoes and vegetables have grown in production, the output of all other crops has declined in absolute terms. Therefore, instead of diversification away from rice and wheat to the production of other crops, Bangladesh's agricultural sector has concentrated more on the production of rice and wheat (Centre for Policy Dialogue, 2000). This trend contradicts the logic of the higher income elasticity of demand for other crops and other agricultural products such as meat and milk.

Prior to liberalization in the 1980s and 1990s, the Bangladesh Agriculture Development Corporation (BADC) was responsible for agricultural inputs including seed, fertilizer and irrigation equipment. Subsidy-based policies were not favoured due to the structural adjustment measures imposed by the International Financial Institutions such as the International Monetary Fund (IMF) as well as the World Bank. There has been an historical tightening and loosening of control on input markets in Bangladesh. Issues have arisen with regards to price spikes in fertilizers, quality and their timeliness, as well as a lack of quality seed. Minten et al (2011) find that chemical fertilizers, followed by pesticides and the cost of irrigation are the greatest contributors to input costs.

The availability of quality seed is a serious issue in Bangladesh. Through the Seeds Act (2005), the National Seed Policy (1993) and the Seed Rules of 1998, the government regulates public and private produced seed sold in markets. The National Seed Policy (1993) enabled the private sector to produce seed which has resulted in a steady increase in the supply of quality, though still insufficient to meet current demand (Jaim and Akter, 2012). Bangladesh's Seed Certification Agency was instituted to implement the Act responsible for seed quality control, produced by both the private and public sector.

Demand outstrips demand for quality rice seed of which only 40% is met. BADC and the Department of Agricultural Extension (DAE) supply approximately 84% of quality seed. In the case of wheat, supply meets approximately 55% of total demand with the BADC and DAE supplying almost all of this seed. While the BADC is subsidized and is able to produce seed at a lower cost, it is the marginal farmers that lack access to this seed. Consequently, marginal farmers often have to rely on seed from the private sector at higher cost and of uncertain quality. Public private partnerships are lacking in the production and sale of seed, and the basic capacity required to produce seed.

With regards, to irrigation, in some regions of Bangladesh, small farmers have organized themselves into user groups where they pay a fee or payment in kind for access to STW or DTW irrigation water. These groups also have formed around surface water schemes in Khal (a body of water moving to a lower level) excavation or by building across bunds (Hussain, 2004).

Between 1983-84 and 1995-96, the number of farm holdings has grown at 1.3%. Cultivable land, however, has declined over the same period indicating that the average size of land holdings has fallen from 1.7 ha in 1960 to around 0.68 ha in 2000. This suggests a contraction of agricultural land on the order of 82,000 ha per year. Rapid urbanization is the leading cause of this decline (Centre for Policy Dialogue, 2000). Nonetheless, there remains significant opportunity to expand irrigated areas as 84% of cultivable land is suitable for irrigation, though groundwater availability for dry season irrigation may be limiting (Hussain, 2004).

Minten et al (2011) analyse data on surveys of the rice value chain including producers at the village level, midstream wholesalers who purchase rice from households, urban wholesale traders, millers and retailers. A number of findings are of particular interest. First, the share of small mills in farmer and wholesaler trade has declined significantly between 1999 and 2009. Second, the authors find that there is a decline in consumption of less expensive lower quality rice in favour of finer grained rice. This change in quality appears to be associated with an increase in the share of automatic and semiautomatic mills which have higher quality standards and more reliable weighing and bagging (Minten et al., 2011).

Modern retail, although in its infancy in Bangladesh, is growing rapidly, having tripled between 2006 and 2009. Survey results show that 98% of the rice sold by modern retailers is of the fine variety compared with 50% sold by traditional retailers. It appears, however, that farmers are not benefitting from the price premiums associated with higher quality rice. Since higher-yielding varieties of fine rice are in limited supply, lower quality rice is converted to higher qualities higher up in the value chain. Farmers may be able to capture more of this price premium as higher-yielding varieties of better quality rice become available (Minten et al., 2011).

Minten et al. (2011) examined retail prices for rice in 2009; coarse rice was sold at BDT26/kg, BDT30/kg for medium rice and BDT44/kg for fine rice. As for rural paddy traders, they received BDT19.1/kg, BDT19.7/kg and BDT22.8/kg for coarse, medium and fine rice, respectively (in rice equivalent price units). It is the post-paddy production stages of the processing and marketing chain that capture the greatest share of this price premium. The share of the rural paddy traders price in final retail was 73% for coarse rice, 65% for medium

rice and only 52% for fine rice. Mills and retailers were found to benefit the most in the price premium for finer rice. Furthermore, Minten et al. (2011) found that the quality premium for medium and fine rice, over that of coarse rise was BDT4.2/kg and BDT17.7/kg, respectively.

Increased producer prices accounted for a relatively small proportion of this increase or 14% and 20% for medium and fine rice, respectively. It was the urban retail margin (49% and 30% for medium and fine rice, respectively) and the rural trader and miller margins (44% and 18% for medium and fine, respectively) that captured the greatest share of the premium. In summary, returns to labour for producing a lower value versus higher value product are similar. In the case of Bangladesh it appears that labour and input outlays are similar for the production of different qualities of rice. Increasing production of higher yielding varieties of fine rice seed could increase both producer and consumer surplus. Furthermore, increasing attention on mid and downstream processors is warranted given their role in affecting price (Minten et al., 2011).

A number of studies on the Bangladesh rice value chain have been undertaken including Haq et al. (2010), Rahman (1998) and Murshid et al. (2009). Haq et al. (2010) for example describes the rice value chain as perfectly competitive and a relatively deep market. Other authors have questioned the efficiency of the market with syndicates at the mid level of the value chain exerting market control by creating scarcity to affect prices (Rahman et al., 1998). Tasnoova and Iwamoto (2005) found that retailers earned the highest net margins with the millers earning the highest marketing margins. A soon to be published report prepared by the Bangladesh Institute of Development Studies under the International Food Policy Research Institute – Policy Research and Strategy Support Program provides a comprehensive analysis linking value chain management with food security to evaluate if value chain management concepts could improve the competitive advantage of the rice sector in Bangladesh. The study seeks to identify points where improved coordination and value creation by value chain members could improve competiveness.

8.5 Input output markets and the rice value chain in Nepal

Nepal's agricultural development policy follows from the 20 year Agriculture Perspective Plan (1995 to 2015). The National Agricultural Policy (NAP; 2004) and the Three Year Interim Plans echo the strategic framework outlined in the APP. The NAP is currently the official agricultural development policy framework, supplemented with sector and commodity specific policies (IFPRI, 2010).

Approximately 16% of Nepal is under agricultural production (including grasslands), 50% of which is located in the Terai. Landholdings are small with 75% of farms < 1 ha in size and 47% of farms are < 0.5 ha. In the Terai, it is estimated that a typical farming family of six would require about 0.42 ha in order to be food secure. With high population pressure, there is little scope to bring new areas into cultivation (Joshi et al., 2012).

Land reform has been a contentious issue on the government agenda with a High Level Scientific Land Reform Commission established to abolish feudal land ownership regimes and production relations. Moving from feudal land relations and modern property rights has been slow, however due to various reasons including lack of participation and unclear land ownership.

Little investment in research and production of improved seed has occurred in Nepal. Breeder and foundation seed in 2009/2010 was estimated at 31.7 tons and 429 tons, respectively, which falls short of the demand for breeder seed of 340 tons and demand for 3,300 tons for foundation seed. The Ministry of Agriculture and Cooperatives reports only 5.4% of paddy seed and 5.6% of wheat seed are improved varieties. The government does not report the use of hybrid maize seed, however, hybrid maize is being used by farmers, likely sourced through unofficial means in India. There is significant scope to increase yields through improved seed; where improved paddy seed has been used and irrigated, yields have been shown to be up to 41% higher (Pullabhotla et al., 2011).

The Seed Act of 1988 and the 2000 National Seed Policy regulate seed in Nepal while it is the National Seed Board (NSB) that serves as the implementing agency. All seed distributed in Nepal must be approved by the NSB. The Nepal Agricultural Research Council (NARC) is the nation's public sector research agency responsible for supplying seed. Both the International Maize and Wheat Improvement Center (CIMMYT)

and the International Rice Research Institute (IRRI) maintain partnerships with NARC (Pullabhotla et al., 2011). It is reported that 90% of the seed used by farmers is supplied through informal channels (Joshi et al., 2012).

Prior to input market deregulation in the 1990s, both seed and fertilizer were produced and distributed at subsidized prices by the state monopoly, Agricultural Inputs Company. Since then, the seed supply section was re-established as the National Seed Company (NSC) in 2002. Some seed is also supplied by the private sector, though many of these are seed dealers trading primarily vegetable and flower seeds with the cereal seed market dominated by the NSC. Scaling up public research and production facilities, increasing imports, increasing cooperation with other research agencies and encouraging private sector involvement are suggested paths to increasing the supply of improved seed (Pullabhotla et al., 2011).

Nepal does not produce chemical fertilizer and is therefore wholly dependent on fertilizer imports and subject to world prices. As with seed, unofficial cross-border supply from India is an important source of fertilizer. Official estimates of fertilizer use do not report unofficial supply and therefore actual use is likely underestimated by official information sources (Pullabhotla et al., 2011). Fertilizer supply was also managed and subsidized by the state monopoly the Agricultural Inputs Company up until 1997. Policy shifts with liberalization in 1997 were aimed at encouraging private sector involvement in fertilizer trade. Private supply of fertilizer is vulnerable to price shocks, such as those that occurred in 2000 and 2008-09. It is the Fertilizer Control Order (1999) and the National Fertilizer Policy (2002) that are the main legislative mechanisms for ensuring fertilizer supply and use (Pullabhotla et al., 2011). Between 1997 and 2008, the government withdrew its subsidy on fertilizer only to reinstate it in 2009 for a limited amount of fertilizer. Demand for fertilizer is largely unmet with current demand around 586,000 tons per year compared with supply from the National Fertilizer Company Limited of 100,000 tons in 2009-10. As a result, Nepal's fertilizer use is the lowest of the South Asian countries (Joshi et al., 2012).

Unofficial trade in fertilizer with India, small trade volumes resulting in high transaction costs, lack of transport infrastructure and disincentives related to high costs of maintaining a distribution network were identified as key constraints to improved fertilizer supply (Pullabhotla et al., 2011). While connectivity has been improving, some areas remain isolated with 9 districts and 11 district headquarters not accessible by road (IFPRI, 2010).

Nepal has a high potential for both ground and surface water irrigation. The total cultivated irrigated area in 2008-09 was 32%. The area irrigated has been increasing at a rate of 1.9% between 2000-01 and 2008-09. The Terai has low levels of utilization with only 58.5% of the irrigable area irrigated according to statistics from the Department of Irrigation. Groundwater development is particularly promising given the high initial costs of infrastructure required for surface water use, issues related to sedimentation, as well as issues around regional cooperation and water sharing. Rural access to electrification is poor with only 50% of rural households reporting they used electricity for lighting in 2008. Access to electricity is important for groundwater irrigation, enabling cold storage, as well as value-added agricultural activities including food processing. There is immense opportunity for hydropower development and the potential to supply both domestic and regional electricity markets (IFPRI, 2010).

Both shallow and deep tube wells were subsidized in Nepal by between 30% and 60% for shallow tube wells and up to 84% in the case of deep tube wells. These subsidies were terminated, however under conditions associated with an Asian Development Bank Agricultural Program Loan (Pullabhotla et al., 2011).

Legislature related to water in Nepal includes the Water Resource Act (1992), the Water Resources Strategy (2002), the Irrigation Policy (2003) and the National Water Plan (2005). The Ministry of Irrigation is the main agency governing water resources and irrigation which has two main departments, the Department of Irrigation and the Department of Water Induced Disaster Management. It is the Department of Irrigation that is responsible for irrigation-sector development (Pullabhotla et al., 2011).

The use of machinery in Nepal is very limited with 8.2% of farm operations using a tractor in 2001-02. The use of machinery is reportedly on the rise, particularly in the Terai with custom hiring arrangements becoming more common. Outmigration resulting in labour shortages is one of the drivers of increased uptake (Joshi et al., 2012, Pullabhotla et al., 2011). The small size of landholdings is one factor influencing

farm mechanization as is a lack of investment constrained by ability to secure affordable credit. Domestic manufacturing of farm machinery is also very limited (Pullabhotla et al., 2011).

The largest source of institutional credit is the Agricultural Development Bank Ltd (ADBL), though savings and credit cooperatives are also important. The ADBL is increasingly financing off-farm activities for agricultural value-addition. The informal credit sector remains important with 38% of Nepalese holding a loan from the informal sector in 2006 (Pullabhotla et al., 2011). Informal moneylenders can charge from 35-60% per annum in interest (Tiwary, 2005:142).

Nepalese agriculture is dominated by smallholders, which coupled with low yields limits the marketable surplus of most farms, amounting to survey estimates of 21% and 26% for paddy and wheat, respectively. Marketing of output is further complicated by physical accessibility and transport infrastructure, and trade with India where minimum support prices and subsidies are in effect. Nepal's food trade deficit in 2007 was 31% in 2007 and was 3.5% in the case of cereals (Pullabhotla et al., 2011).

The Agriculture Marketing Corporation (AMC) was established in 1971-72 to manage the public food distribution system to ensure food and input supply. With liberalization in the 1990s, its role has been very much reduced and since the country's Tenth Plan, it procures cereals from the open market at prevailing prices. Cereals procured in addition to food aid are destined to 30 districts in the country that lack road access. Overall, its activities are limited, now accounting for less than 1% of the total production of key crops (Pullabhotla et al., 2011, IFPRI, 2010).

The cereals market is dominated by private traders and millers with 70% of rice purchased by wholesalers directly from millers. Local traders in the villages connect farmers with millers. To increase private sector involvement in agriculture, the Agro Enterprise Centre was established to strengthen agro enterprises and increase the output of high valued agricultural output. Cooperatives have also been growing in Nepal, particularly for higher value agricultural output. The number of cooperatives grew from 830 in 1990 to 9,362 in 2007. The National Cooperative Federation (NCF) is the representative organization at the national level, composed of over 1.2 million members (Pullabhotla et al., 2011).

The Nepal Agricultural Research Council (NARC) is the country's main agricultural research institute. NARC collaborates closely with CGIAR Centres for plant breeding (Joshi et al., 2012). Agricultural extension is undertaken through the Department of Agriculture and the Department of Livestock Services, offering extension support through service centres (District Agriculture Development Offices) covering between two and four village development committees. Extension services are, however, strained with one extension worker per 2,606 ha of cropped area or one extension worker per 3,204 households in 2007 (Pullabhotla et al., 2011). Once a 'training and visit' system, due to capacity constraints, the extension model has developed into one of 'service on demand'. Farmers are able to access extension services, but are required to visit their local service centre which may be hours away from their homes (Joshi et al., 2012).

Shrestha (2012) studied the farm-retail rice price spread in Nepal to assess the potential existence of unfair pricing, and to understand the factors influencing marketing margins and profits at different stages of the value chain. A cross section of 4 districts, 100 farmers, 100 wholesalers and 100 retailers were surveyed for market price information in 2008. In analysis of the movement of rice from farm to wholesale markets, Shrestha found three explanatory variables to have a significant impact on farm wholesale marketing margins: wholesale price, marketing cost and market information. A 1 rupee/kg increase in marketing cost increased marketing margins by 0.616; a wholesale price increase of 1 rupee/kg increased marketing margins by 0.455, and; market-related information tended to reduce marketing margins and enhance efficiency. In addition, the quantity of rice traded in the wholesale market and the wholesalers' share of the market did not have a significant influence on marketing margins (Shrestha, 2012).

From wholesale to retail markets, retail price and wholesale to retail marketing cost had a significant and positive effect on wholesale to retail marketing margins. A 1 rupee/kg increase in marketing cost increased marketing margins by 1.09 rupees and a 1 rupee/kg increase in retail price increase marketing margins by 0.20. The quantity of rice and the retailer share of the market had an insignificant effect on marketing margins (Shrestha, 2012).

Finally, in evaluating movement of rice from the farm to retail markets, retail price and marketing cost were shown to have a significant impact on marketing margins. The retail price of rice increasing by 1 rupee/kg, increased marketing margins by 0.47 rupees/kg while a 1 rupee/kg increase in marketing cost increased marketing margins by 0.84 rupees/kg. Again, the market share of the retailer did not have a significant impact on marketing margins (Shrestha, 2012).

8.6 Key differences and implications for food security interventions

Both Bangladesh and Nepal began liberalizing their markets and reducing domestic support for agriculture in the 1990s, though Nepal has been less successful. Bangladesh offers a low level of domestic support to agriculture while in India, large subsidies are offered, particularly for fertilizer. The penetration of subsidies in Bihar and West Bengal is less than in other regions of India while the dysfunctional PFDS in Bihar and West Bengal offer further disincentive for producing foodgrains.

Bangladesh is ahead of the curve with regards to HYV seed, but could still achieve productivity improvements with greater supply. In West Bengal and Bihar, limited improvements in yields, grain quality and taste, the price of seed, farmgate price of HYV paddy and farmer awareness all partially explain a lack of uptake. Legislation in favour of the patenting of seed has been shown to be effective in increasing private sector investment in the case of maize in Bangladesh. Research into the development of HYV and in innovative ways of getting seed to farmers when demand is greatest is important in all regions.

Investigating the potential for farmers to add value to their product can enhance food security. Bangladesh's experience in this regards is interesting, where lower quality rice is being processed by mills and transformed to higher quality fine rice. Since the value added is created by the processors, farmers do not capture these margins. The Bangladesh experience indicates that it appears that labour and input outlays are similar for the production of different qualities of rice, increasing production of higher yielding varieties of fine rice seed could increase both producer and consumer surplus.

A low ratio of the number of extension agents to farmers is symptomatic of the EGP. Fostering linkages between research universities and institutes and NGOs can be a viable model to getting appropriate technologies to farmers as well as generating awareness with regards to their entitlements. In the case of Nepal, farming is a relatively recent activity. Knowing what basic capabilities are required and developing delivery options could generate significant gains at low cost.

Low levels of irrigation in West Bengal, Bihar and Nepal partially explain their poor agricultural performance. Access to electrification is a significant barrier to increasing irrigation and as a result, ground water pumps are largely diesel-operated in the EGP, exposing farmers to international price fluctuations which would have a significant impact on agricultural profitability. In North West Bangladesh and in West Bengal in particular, there is concern around groundwater depletion. What is the reality of groundwater supply in the EGP? How can research be designed to inform ground water extraction policy?

Overall, why is rice production an economically viable proposition in the North West of Bangladesh, but much less so, and often only a subsistence activity, in West Bengal, Bihar and the Nepalese Terai? Does the answer lie in relative input-output prices? Variable yields, cropping strategies, number of crops per year? Differing availability of infrastructure and transport margins? A systematic comparative cost benefit and value chain analysis of key agricultural commodities conducted in each country of the EGP region would shed light on potential intervention points to enhance food security. Comparative studies of this nature do not exist in the literature. Cost benefit and value chain analyses that do exist are for a single country or region, are often out-dated, and employ methods that render the results incomparable.

What has been the impact of market liberalization on agricultural development in the EGP? Both Bangladesh and Nepal liberalized significantly in the 1990s, though Nepal is lagging behind in terms of productivity. India on the other hand has maintained tight controls on trade and provides substantial support to its agricultural sector in the form of subsidies (the PFDS, while relatively small in Bangladesh and Nepal, is a behemoth in India and results in significant distortions; market liberalization resulted in the

downsizing of the PFDS in Bangladesh and Nepal). What sorts of trading arrangements could leverage comparative advantages and enhance food security in the EGP?

In Bihar and West Bengal's regime of agricultural market distortions, what role can conservation agriculture play? What are the relative gains between research that serves to correct market failure and that which aims to deliver productivity increases?

9 Nature and role of Public Food Distribution Systems

9.1 India

The GOI established the Food Corporation of India (FCI) and Agricultural Prices Commission (APC) in the 1964 to 1965 financial year. The FCI is a large parastatal trading corporation responsible for procurement, storage, transportation and distribution of foodgrains, while the APC provides advice on agricultural commodity pricing. Since the mid-1960s, India's PFDS pursues three policy goals: cope with emergencies e.g. drought; distribute fairly priced food to the poor; and guarantee remunerative prices to farmers. The FCI dealt with 10-15% of total Indian foodgrain production in the 1980s by procuring in surplus production areas. However, foodgrain distribution is very uneven with the all India average during the 1990s being only 14 kg per household per year (Mooj, 1999:115).

There is agreement among authors that the PFDS in Bihar has been particularly dysfunctional – corrupted and politicised by the appointment of local level politicians. Reporting during the Yadav reign in Bihar, Mooj compares the all-India average diversion of PFDS foodgrain of 31% of rice and 26% of wheat with Bihar's loss of 64% of rice and 44% of wheat. Less than 25% of foodgrain was procured from Bihar in 1995 to 1996, but since foodgrains have become cheaper, Bihar's off-take increased to 75% in 1998 (Mooj, 1999:115). The reasons for this poor performance were attributed to the fact that the sole PFDS wholesale agent in the state, the Bihar State Food and Civil Supplies Corporation (BSFCSC), lacked adequate infrastructure (e.g. godowns, trucks, fuel, drivers etc). Mooj found that the corporation was in such poor financial shape, dealers were relying upon informal moneylenders to advance money every month to purchase foodgrain, and some BSFCSC staff had not received a wage for 18 months (Mooj, 1999:117; 2003:4).

Through structural adjustment programs in the 1990s, international agencies induced the idea of targeting public food distribution towards the most food insecure so as to reduce PFDS expenditure.

> *The broad policy approach of market liberalisation has been to enhance the role of the markets while deploying supplementary safety nets to ensure food security (Ganesh-Kumar et al, 2010:3).*

In this policy climate, the PFDS came under increasing critique as too costly, leaky and insufficient to ensure food security. However, the critique is framed in terms of fiscal performance rather than the food security of the poor, and considerable popular opposition to targeting occurred on the latter basis. Nonetheless, targeting was introduced in 1997 by distinguishing between Above Poverty Line Households (APL) and Below Poverty Line Households (BPL). Below Poverty Line censuses were conducted by India's state governments in 1997 and repeated in 2002 (Khera, 2011:39). Antyodaya cards were introduced in 2001 to provide a larger foodgrain subsidy to the poorest of the poor. The proportion of BPL households the GOI is willing to subsidise in each state is fixed with the National Planning Commission's poverty estimates.

Targeting has had some serious perverse effects in the Indian context:

> *... the number of ration cards handled by each fair price shop dealer shrank with the introduction of the targeted PDS. Low commissions combined with fewer cards made most Fair price Shops financially unviable, a strong incentive (if not compulsion) to cheat (Khera, 2011:46).*

The combination of rice volatility and state government policies has made targeting variable throughout India. APL households lost their subsidised foodgrain entitlements in 2001 when the GOI raised the foodgrain price above the market price, but re-entered system when market prices rose against the Government Issue price. The GOI raised foodgrain retail prices several times between 1990 and 1995 without lowering foodgrain procurement prices which not only lowered sales but added to a huge public foodgrain stockpile (Mooj, 1999:114-115). In 2010, the Supreme Court ordered that these stocks by reduced by increasing PFDS entitlements (Khera, 2011:38).

Bihar is described by Khera as a 'languishing state' along with Jharkhand and Rajasthan in terms of implementing targeting (Khera, 2011:36). Below poverty line household lists in these states were found to be very patchy, with enormous 'exclusion errors', including entire hamlets and younger households. No arrangements to update the lists existed to compensate for the inflexibility of centrally imposed caps (state governments cannot alter these caps; they can only issue additional cards). Despite a Supreme Court interim order directing vulnerable subgroups to be included compulsorily on the Antyodaya list, landless widows and tribal groups were found to be excluded. The proportion of full entitlement purchased by households remained low in Bihar. Only 18% of below poverty line households reported obtaining their full foodgrain quota, corruption in kerosene and sugar distribution was reported, and 33% reported getting poor quality grain at last purchase (Khera, 2011:40-42).

Targeting meant that the Bihari fair price shop traders' foodgrain allotment fell by 50%, while leaving their commission, comparable to landless labourer wages, unchanged (Mooj, 1999:117; 2003:4). Private transport contractors benefited hugely: 'For a long time, transportation of PDS commodities was not a lucrative job. But since the introduction of targeting, the price difference between PDS foodgrains and open market foodgrains is huge' (Mooj, 2003:10). Whereas the PFDS Guidelines state that Gram Panchayets and Sabhas are responsible for identifying eligible families, no elections have been held since 1978 (Mooj, 2003:8). In order for dealers to pay for a PFDS fair price shop license and monthly bribes to the BSFCSC, they retain ration cards and divert part of the commodities for sale on the open market (Mooj, 2003:4). He concludes:

> *In short, many of the intended effects did not materialise. The Public Distribution System did not become less costly; in several states, the governments did not even seriously begin identifying the real beneficiaries; and many of the poor in a poor state like Bihar did not benefit (Mooj, 1999: 116).*

However, enforcement of the PFDS is still poor in the state of Bihar where Khera's respondents complained that the Fair Price Shop was only open two to three days a month. All fair price shops are run by private dealers In Bihar and Uttar Pradesh. However, Andhra Pradesh is the only state where the PFDS is working well in spite of large scale involvement of private dealers in its implementation (Khera, 2011:42-45).

However, the PFDS was perceived by Khera's Bihari research respondents as having improved: 'The increase in implicit subsidy has had the effect of enhancing voice, and no one seems willing to forego their ration anymore'. Households generally knew what they were entitled to and price reductions and use of round figures made it easier for people to calculate and prevent overcharging (Khera, 2011:41). The Bihari respondents were more interested in cash transfers than respondents from the other five states studied, a reflection of their relatively high rates of financial inclusion, with 46% of households possessing bank or Post Office accounts.

However, food security was a palpable concern for single (often widowed) women, the elderly and very poor who were apprehensive about financial institutions, scarred by bitter experience with NREGA payments delayed by up to a year. For these households, the PFDS is more flexible as any member of the household can undertake this task (Khera, 2011:44-45). Also worth noting is the interest by Khera's respondents in public foodgrains other than rice: '... a majority of respondents (79%) said that they would buy millets or maize should they be provided at subsidised prices under the PDS'. As such grains are more nutritious than the fine grains of wheat and rice, are more popular among the poor, and are suited to dryland farming, their procurement could be cheaper (Khera, 2011:43).

Since 2003 many Indian states felt that the caps on who could receive subsidised foodgrains was too stringent and have initiated state schemes to issue more BPL cards and reduce PFDS prices further than the central government. Most notably, Tamil Nadu has offered free grain and distributes pulses and edible oils at subsidised prices since 2011. Similarly, Andhra Pradesh does not employ the BPL category at all such that close to 80% of its population is entitled to PFDS commodities. Himachal Pradesh has a universal scheme but offers a less generous subsidy to households above the poverty line (Khera, 2011:36-38). Simple and effective reform measures have also been employed by state governments to reduce program leakage:

> *Most state governments have now instituted a system of pre-announced and fixed dates for distribution of Public Distribution System rations ...Regularity and predictability in opening days and*

hours is a major convenience for rural households, and also important to prevent diversion of Public Distribution System quotas (Khera, 2011:42).

Bihar's recent experience with the PFDS may provide insight into the potential gains from improving the PFDS. A bench of justices in 2011 was appointed to develop a plan for the computerisation of India PFDS to enable tracking subsidized food grains from storage facilities to ration card holders, whose cards would be replaced with smart cards. This system had already been implemented successfully in Chhattisgarh. The impetus for the development of such a scheme was to curb leakage along the supply chain to the poor (Mahapatra, 2011).

In October of 2012, the Supreme Court Order to implement computerization had Bihar fast catching up with the rest of India in implementation (Chaudhary, 2012). The system, or ePDS, is composed of an integrated weight management system, a Management Information System, inventory management, GPS-tracked fleet for foodgrain transportation, and mobile SMS-based information and grievance system. Through the SMS system, citizens are advised of the availability of grains and Panchayat vigilance committee are informed of the distribution of grains to dealers. While these changes are targeted at the distribution of grains to beneficiaries, government procurement of grains should also have to adjust to meet this demand. While correlation is not causation, rice production in the state of Bihar nearly doubled between 2010-11 and 2011-2012. Furthermore, the USDA (2013) reports that government procurement of rice between 2010-11 and 2011-2012 in Bihar increased from 0.88 million tons to 1.53 million tons; in West Bengal, the increase over the same period was from 1.31 million tons to 2.04 million tons (USDA, 2013).

9.1.1 RICE AND WHEAT SUPPLY AND PROCUREMENT DEMAND IN INDIA

Figure 33 shows the share of rice from West Bengal and wheat from Bihar compared to the Punjab which accounts for the greatest share of procured rice and wheat. In 2012, Bihar contributed 1% of Indian procured wheat compared with 39% in the Punjab while West Bengal in 2011 contributed 3% of procured rice compared with 27% in the Punjab.

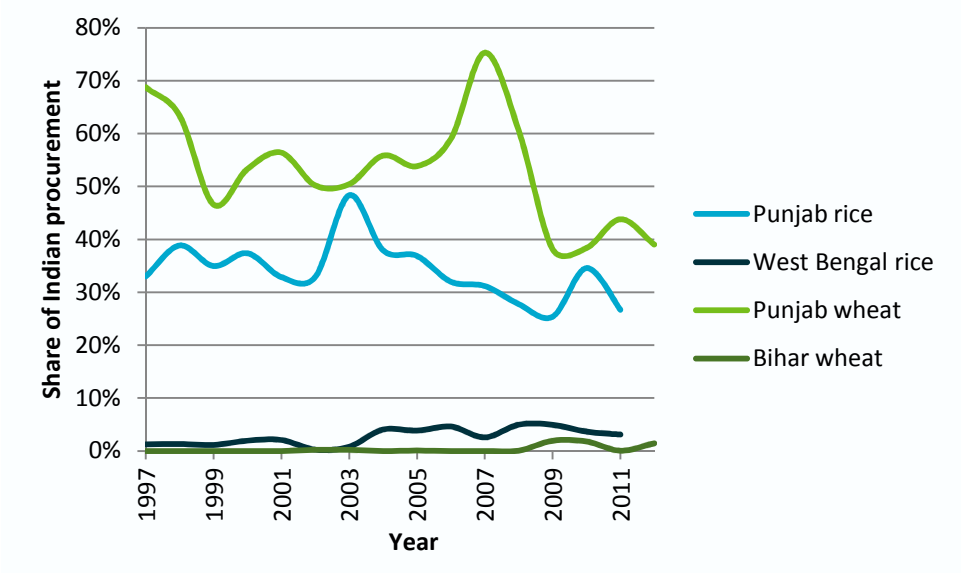

Figure 33 Share in India's procurement

Source: Ministry of Agriculture (2012)

Over 404,000 tonnes of wheat were procured from Bihar in 2011 compared to 9.6 million tonnes in the Punjab. In 2011, 1 million tonnes of rice were procured from West Bengal compared with over 8.6 million in the Punjab.

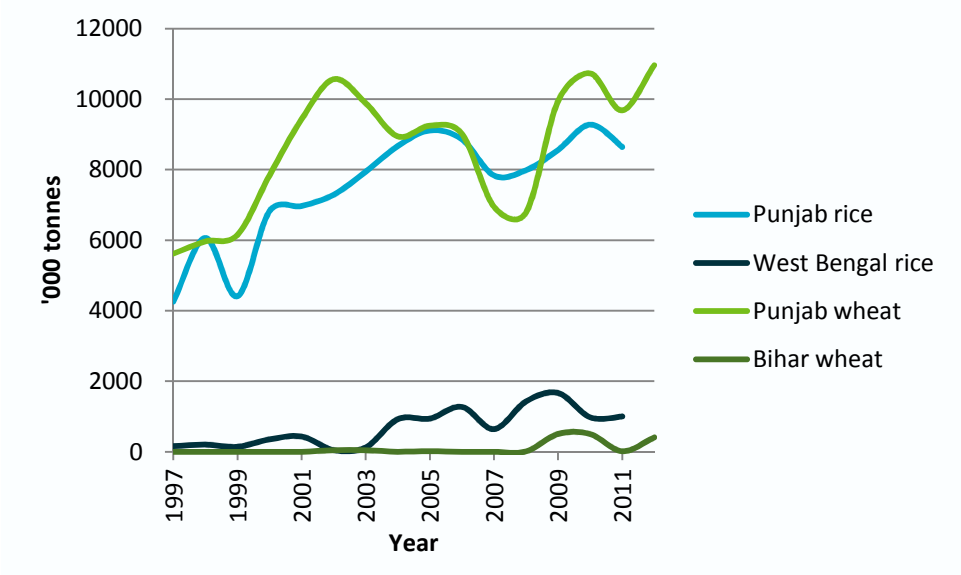

Figure 34 Volume of rice and wheat procured

Source: Ministry of Agriculture (2012)

In 2008/09, 48.4% of cultivated rice in West Bengal was irrigated while 57.2% of the rice paddy in Bihar was irrigated. The national average of irrigated to cultivated rice was 58.7%. As for wheat for the same year, 91.7% was irrigated in Bihar and 74% in West Bengal, compared with the national average of 91.3%. Agriculture's share of total electricity consumption in 2008/09 was 16.0% in Bihar, 3.0% in West Bengal, 31.9% in the Punjab and 38.2% in Haryana, compared with the national average of 20.4% (Ministry of Agriculture, 2012).

9.2 Bangladesh

Bangladesh's Civil Supplies Department (CSD) was maintained virtually intact during Bangladesh's period as East Pakistan in order to guarantee urban rice and wheat supplies, but forced sales at low prices made procurement ineffective (Khan and Jamal, 1997:477-478). Modified rationing was introduced for the rural poor in 1949 with partial and variable coverage continuing throughout the 1950s and 1960s. Volatility in the Public Food Distribution System was due to the Bengali language movement of 1952 and opposition party win in the provinces in 1954. In 1955, West Pakistan dismantled the PFDS only to reverse that decision in early 1956 due to the rise in rice prices (Ahmed et al, 2000:215-8). Early PFDS programs employed minimal to no targeting of the food insecure. The 'grandfather program' of statutory rationing (1956) encompassed all residents of urban East Bengal by issuing ration cards to purchase a steeply subsidised weekly allotment of grain. The program was skewed towards the middle to upper income groups while dealers sold 95% of the grain on the open market. This subsidy was decreased through 1980s and the scheme discontinued altogether in 1994. The rural counterpart of statutory rationing, Pally (Rural) Rationing sold rice subsidised by 25% to administratively selected poor, and again had a high leakage rate of 70% (Ahmed, 2000:218).

Twenty years of steady expansion of the PFDS was mostly fuelled by imported food aid in the form of wheat. By the early 1970s, food aid shipments comprised 75% of total public foodgrain supplies, and formed a source of revenue for both the East Pakistan and West Pakistan Governments. The new government of Bangladesh continued expansion. By the mid- 1970s, the Bangladeshi PFDS was at its zenith with domestic rice procurement accounting for over a third of public food resources expenditure. Donors pushed for a re-orientation of policy and a new generation of poverty oriented, in-kind distribution

programs were introduced (Ahmed et al, 2000:215-131). This shift has changed the 'rules of the game' in terms of public foodgrain procurement and distribution in Bangladesh:

> *Because most resources in the form of food aid come from outside the country, external views have shaped the structure and focus of the PFDS ... [consequently] Recent large reductions in resource flows through the PFDS have greatly reduced the size and influence of key interest groups, particularly the ration recipients and the millers. Consequently, their interest and impact has waned markedly (Ahmed et al., 2000:135).*

The government share of foodgrain stocks ranged from 30% in the mid-1960s to 5% in 1998. Government foodgrain stocks dwindled to 400,000 tons in 1998 and private stocks now exceed government stocks by a factor of four. The government continues to be viewed as an unpredictable player and is closely observed despite the relaxing of anti-hoarding laws in the 1990s:

> *... production and trader confidence in non-confiscation have grown, so have private foodgrain stocks. Private rice and paddy stocks per capita have roughly doubled since the late 1960s... Perhaps most striking is the dominance of on-farm stocks, which throughout the year systematically account for more than three-fourths of all private stocks (Chowdhury and Haggblade, 2000:82).*

Furthermore:

> *Recent econometric estimates quantify what traders suggest – that public rice stocks crowd out private trader stocks, although they do not affect on-farm holdings (Chowdhury and Haggblade, 2000: 83).*

Crow, however, questions this widespread assumption that low margins and competitive efficiency now prevail in the private foodgrain trading system of Bangladesh. He provides examples of how vertical rice market integration provides opportunities for large margins and market segmentation to persist (Crow, 1990:16). He argues:

> *If ... urban and rural markets are not always competitive and integrated, but may instead be segmented, then the new policies may not achieve a greater degree of food security (Crow, 1990:41).*

Support for procurement at least is put forward by Khan and Jamal (1997) who point out that: '... the policy of keeping the procurement price below the wholesale price is fully consistent with the idea that food grains should be procured from small traders and actual growers.' These authors calculate that Bangladeshi smallholders would have received 10% less income without a support price. They state that because the rice sector constitutes 30% of the rural economy, the rural population's income should increase by 4% due to the procurement program alone (Khan and Jamal, 1997: 480-481).

While the 1960s saw a single deep rice price trough following the principal aman harvest, the emergence of dry season boro in the 1990s introduced a second price peak, which shortened the trough to four months (Chowdhury and Haggblade, 2000. 73-75). Seasonal price volatility correlates to the acuteness of hunger during the September to October lean season (monga) when food prices peak without programs available to target this gap (Ahmed, 2000:229). Noting that the need overwhelms available national resources (Ahmed, 2000:216), Ahmed summarises the relative efficiencies of the now targeted intervention programs as follows:

- Food for work (FFW) program was implemented after the 1975 famine and has a dual role of providing wage employment and developing rural infrastructure. Wages are in-kind (usually wheat) and the program leaks at the rate of 30-35%. Most expenditure (85%) occurs during the January to May dry season which competes with farm labour demand in irrigated areas. This program cannot address lean season needs as earthworks need to be conducted after the monsoon season;
- Vulnerable group development (VGD) was also initiated in 1975 and provides in-kind wages (wheat) to administratively selected poor women. A free monthly ration of wheat has been provided for two years since 1988 along with a package of development services (literacy, market skills, legal awareness, credit). Program leakage is estimated at 14%;

- Rural Maintenance Program (RMP) began in 1983 and employs poor women to maintain roads. Wages are paid in cash paid to a group account. This program suffers minimal leakage; and
- Food for Education (FFE) program has been in existence since 1993. Wheat is provided in exchange for school attendance. The program has been criticised for missing the ultra-poor and there are quality issues with the grain used for payment (Ahmed, 2000:218-221).

Because food transfers involve such bulky commodities, they immediately raise program costs by 25% due to handling and transporting. As pointed out by Chowdhury and Haggblade:

> *In Bangladesh monetization involves the sale of imported foodgrain at port followed by cash distribution to beneficiaries. Given pervasive evidence of large-scale de facto monetization by food-aid scheme managers and recipients, public monetization at port could reduce the double transport costs ... (2000:97).*

On the other hand, wheat is a less desirable grain than rice which has the advantage of a self-targeting characteristic: '... making it a preferred commodity for targeted food interventions in rural areas, where it has the potential to increase the cost-effectiveness of such programs.' (Ahmed, 2000:229). Ahmed argues that leakage can be reduced by strengthening the participation of local bodies, along with measures, to ensure entitlements are received:

> *FFE and VGD operate with low leakages by offering recipients standard, well-publicized entitlements; establishing group solidarity through regular monthly meetings; and physically gathering beneficiaries during distribution, which enables them to take collective action if necessary to ensure delivery of rations (Ahmed, 2000: 221).*

Khan and Jama's economic modelling suggests that an: '... effective price support program can be devised by reducing the governmental procurement by 50% and providing credit to farmers directly after the harvest in proportion to the marketable surplus of the farmers'. These authors calculate that this policy could reduce government spending by US$100,000,000/year (1997:485). However:

> *Episodes of production volatility have left many observers cautious about further reducing public involvement in foodgrain markets. As both government and private traders continue to digest the major downsizing in direct public foodgrain marketing initiated during the early 1990s, recent events suggest that future change in public involvement may be evolutionary rather than revolutionary (Chowdhury and Haggblade, 2000:97).*

9.3 Public Food Distribution System in Nepal

Nepal traditionally exported rice to India, especially to neighbouring towns from the rice surplus areas of the Terai while food deficits in the hills and mountains are longstanding (Rawal, 1984:46). Although there was public sector involvement as early as 1934 under the Rana regime it was not until 1965 that the Rana regime created the Food Management Corporation (FMC) in the famine year of 1965 (Rawal, 1986:3) to distribute subsidised rice to Kathmandu valley consumers, the police and army. Interest free loans were provided six months in advance to millers and traders to procure rice at 6% below the prevailing market price.

A food crisis in 1971 resulted in an Agricultural Marketing Corporation (AMC) being created by amalgamating the FMC with the Agricultural Supply Corporation (ASC). The AMC concentrated on supplying the Kathmandu valley and operating for two years, it couldn't do justice to both functions and in 1974 the Royal Government separated NFC and AIC and defined the NFC's mandate as to undertake procurement and distribution on the basis of a region's degree of food security. The Royal Government also established seven Rice Export Companies (RECs). Initially the RECs supplied NFC with 20-39% of their exports at 42% less than the export price. As exports declined so did levy based procurements and, lacking the financial resources to procure grain directly from farmers the RECs first resorted to the open market in 1977. The RECS were dissolved in 1980 (Rawal, 1984:44-51).

Using porters, aircraft, and pack animals to transport grain costs 2.6 times the open market procurement price and: 'Transportation costs often determine the level of support given to various deficit areas ...' (Rawal, 1984:50). The PFDS subsidy cost the Royal Government Rs 40 million annually making it increasingly difficult to fund and the subsidy was cut from R80 million to Rs 32 million in 1983-1984 (Rawal, 1986:15). The situation has not improved since democracy has been restored. Nepal's food aid programs have become ineffective due to the decrease in foodgrain production and corresponding increase in demand (Bhandari and Grant, 2007:18).The uniquely wide disparity between Nepal's three regions means that amenability to markets and access to food are regionally differentiated. Liberalisation appears to have reinforced the hierarchical ranking of regions and reflects the country's lack of spatial integration and lack of government investment in the infrastructure needed to achieve it.

Modelling undertaken by Pyakuryal et al (2010) using seven household categories and 16 commodity producing sectors disaggregated by location, suggests there is a strong rationale for managing food flows between food surplus and deficit regions and, further, that: 'Given these effects of liberalisation, with winners and losers, there is a clear basis for public safety nets' (Pyakuryal et al 2010:103). While: 'The incidence of poverty does not vary significantly between the hills and the Terai, but it is extremely high in the mountains', with the most food insecure residing in the far western mountains (Pyakuryal et al, 2010:93).

However, the NFC that is meant to be the conduit between surplus and deficit regions and despite having undergone several reforms since 2000, still mis-targets, is inefficient with marketing and transportation costs resulting in substantial accumulated losses (Pyakuryal et al, 2010:92-96). NFC's accumulated losses until 1990 = NR 884 million rising to 905 million by 1996 (Pyakuryal et al, 2010:106). Restructure of the NFC resulted in a reduction of depots from 135 to 67 (including two in Maoist affected areas) and of branch offices from 26 to 19. The open market was used for procurement and procurement declined as the still small, Nepali private sector offers a higher price than the NFC. The need to provide godowns in deficit areas, adhere to minimum quality standards as per the Food Grain Quality Act 1966, and the lack of increase in the transport subsidy since 2001 means the public sector has higher costs. The minimum support price (MSP) was discontinued. Sackings and redundancies reduced the NFC workforce by 430 before union pushback ended the policy (Pyakuryal et al, 2010:106-110).

Although the share of foodgrain to remote areas has increased, it is not targeted at needy households and leakages and inefficiencies occur. For example, foodgrain goes first to government employees and teachers. A large proportion of the subsidy is spent on the use of air transport whereas road transport via Tibet would be cheaper and also would provide employment. The World Food Program (WFP) runs a food-for-portering program, using the poor and landless as porters; an innovation that is yet to be replicated by the government (Pyakuryal et al, 2010:104).

Rawal recommends the use of proximity criteria to link procurement from surplus regions with distribution to adjoining deficit regions to save money and achieve a balance between procurement and distribution in each region by stopping cross-transportation of grain. He also suggests initiating procurement in hill areas where agricultural development projects are being implemented and an increase in yield are expected. A differential pricing policy could also be used to reflect the cost of transport and strengthen local production efforts. Greater reliance could be placed on transport using animals and porters (porters can carry 50 kg; sheep 15 kg and mules 80 kg) (Rawal, 1986:15-19). Finally, Rawal comments that: '... more important than the structure and type of organisation involved are the drive and energy with which such policies are executed' (Rawal, 1986: 19).

Pyakuryal et al, (2010) conclude that there is a strong basis for exploring public-private partnership to improve Nepal's PFDS. In the short to medium run, more involvement of the private sector could be encouraged with the use of incentives to share transportation costs and storage facilities and shift to ground transport to reduce costs and create employment, following the WFP example. In the long run, spatial integration of markets is needed using physical and marketing infrastructure to link remote regions to surplus regions and to provide entry points for international trade (Pyakuryal et al, 2010:110).

9.4 Key differences and implications for food security interventions

India has the largest PFDS in the world. Bangladesh's PFDS manages a small share of total grain production and is targeted through in-kind programs such as food for work. Nepal's system is also small, less targeted and suffers from logistical challenges. All systems are plagued with problems of leakages. Given the importance of the PFDS in influencing foodgrain supply in India, understanding how it works and why it doesn't is imperative for enhancing food security. In Bangladesh, reducing leakage through better governance, accountability and awareness is important while in Nepal, overcoming logistical challenges in getting food to the most marginalized is the key obstacle.

In India, the effectiveness of the PFDS in acquiring and distributing food differs regionally. In some states such as the Punjab and Haryana, farmers are able to access the procurement price. In Bihar and West Bengal, the system does not function as designed and in many cases, farmers are not paid the procurement price and often are forced to 'distress sell' their harvest to partially recover costs of production. As a result, the appropriate market signals which trigger farmers to produce are distorted in Bihar and West Bengal and farmers lack incentive to produce surplus. It may be argued that agricultural research for development which may serve to increase productivity by 10-20% will be insufficient to stimulate significant increases in output until the PFDS is corrected. Greater output will go to waste in the absence of procurement. Policy research aimed at understanding the PFDS in Bihar and West Bengal can help identify bottlenecks and potential intervention points.

The potential gains from improving the PFDS in Bihar and West Bengal may be significant. With the introduction of computerized public distribution or ePDS, citizens are advised of the availability of grains and the Panchayat are informed of the supply of grains to local dealers. Individuals are empowered with knowledge of their entitlements, while the Panchayat may provide a degree of oversight. While this mechanism will see to those that are entitled will have access to grains, government procurement will also have to keep pace in meeting demand. While correlation does not necessarily indicate causation, rice production in the state of Bihar nearly doubled between 2010-11 and 2011-2012 while government procurement of rice between 2010-11 and 2011-2012 in Bihar increased from 0.88 million tons to 1.53 million tons; in West Bengal, the increase over the same period was from 1.31 million tons to 2.04 million tons (USDA, 2013).

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