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Final report

Project full title

The Future of Food Systems in the Eastern Gangetic Plains

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Contents

1 Acknowledgments

We are thankful to Shahidur Rashid, Ajay Vir Jakhad, Devesh Roy, and Manavi Gupta for their intellectual inputs to this SRA. Jaweriah Hazrana analyzed the impact of government policies in India on farmers' crop choice and prepared a paper on intra-household differences in the consumption nutritious foods in Bangladesh. Shivendra Kumar prepared rich and interesting analysis of groundwater irrigation in Bihar and West Bengal using the latest high-resolution data on aquifer conditions and the cost of irrigation.

Participants from Bangladesh, India, Nepal, Australia, and the US enriched discussions on the current state and the future challenges for food systems in the Eastern Gangetic Plains (GP) of Bangladesh, India, and Nepal.

Jyotsana Dua and Neha Sharma from IFPRI and Huilqui Noriega from ACIAR helped us with project management and financial reporting.

The SRA received immense intellectual and managerial support from Kuhu Chatterjee, Tamara Jackson, Robyn Johnston, Eric Huttner, and Jim Woodhill.

2 Executive summary

The purpose of this SRA was to create greater policy awareness of the future issues and a greater collaboration between policy and research on using new approaches to support transformation of food systems. It builds upon two earlier SRAs. The first one, completed in March 2020, mapped the food systems in the EGP and explored the major trends, drivers of change, and uncertainties in the system in a series of 9 Status Reports for Bangladesh, India, and Nepal with a focus on the EGP region. It also created a coalition of national partners who are interested in the foresight process and organized participatory learning workshops to generate interest in and ideas for foresight for food activities at local and regional levels. The second SRA focused on carrying out participatory foresight activities with farming communities in Bangladesh, West Bengal, and Nepal Terai and modelling exercises to identify potential ways to build a more sustainable food-energy-water nexus in India. The current SRA sought to

- Analyze some of the key aspects of the food system of the EGP region that have been ignored in the existing literature and prepare status papers on each one of them highlighting the key facts, trends and patterns, and gaps in our understanding of the dynamics of each component.
- Carry out empirical assessment, using key informant interviews and phone surveys, to assess the impact of COVID-19 on farm households in Bangladesh, India, and Nepal with a focus on understanding the impact of the lockdowns on price realization of food grains and perishable high-value agricultural commodities and the main challenges farmers faced in harvesting, selling their produce, and the sowing of new crops.
- Organize a high-level regional workshop on foresight for a more sustainable food system in the EGP region to share the findings of the three SRAs and inform the agenda of the ongoing regional and global research and policy discussions on sustainable food systems.

The SRA started on **1st June 2020** and its outputs were to be delivered by **30th May 2021**. However, no-cost extensions were requested and granted due to the disruptions caused by the COVID-19 pandemic in Bangladesh, India, and Nepal.

The pandemic not only delayed the project activities, but also compelled us to change our plans. The repeated waves of COVID-19 and travel restrictions imposed by the state and

the national governments forced us to switch to a virtual dialogue on food systems. Similarly, we had to use phone surveys to assess the impact of COVID-19 in Bihar, India and delay the surveys by almost year in Bangladesh and Nepal.

Switching to a virtual dialogue and phone surveys saved resources. We used these savings to support and collaborate with young researchers from the National Agricultural Research and Education System (NARES) for impactful research on different aspects of food systems in Bangladesh and India. Dr. Jaweriah Hazrana collaborated with IFPRI to analyze the impact of public procurement of rice and wheat in India on farmers' crop choice and crop production. She also worked with Avinash to prepare a paper on intra-household differences in allocation of nutritious foods in Bangladesh. Dr. Shivendra Kumar, an economist at ICAR-NIAP analyzed the data on groundwater use and groundwater levels in Bihar and West Bengal and prepared an insightful report besides publishing a journal article on this theme.

IFPRI collaborated with the Pennsylvania State University to re-interview 1200 farmers in Bihar that they had surveyed earlier before the pandemic started and right after the pandemic. This collaboration enabled us to compare data on farmer incomes before and after the pandemic. The BAU team led by Dr. Jahangir Alam surveyed a random sample of 320 farmers from four districts in North Bangladesh who engaged in high-value agriculture. The resulting paper has been submitted for review to an international journal. The CGED team led by Dr. Madhav Karki interviewed 240 farmers from Province 2 of Nepal. They have also presented their paper in various forums in Nepal.

Thus, the project team working on this SRA collected, collated, and analyzed primary and secondary data to study different aspects of food systems in the EGP region like crop choices and response to public policies, groundwater use in agriculture, intrahousehold differences in food consumption, and the impact of the pandemic on farmers.

We highlight three key lessons from this SRA:

1. Farmers and the food systems in North Bangladesh, Bihar, and Nepal showed surprising resilience to the disruptions caused by the pandemic. The direct health impacts of the pandemic on rural households were relatively small, but the high level of dependence of smallholder families on non-farm incomes made them vulnerable to the shock. The pandemic illustrated why many smallholders in the region continue to hold on to their land even as they diversify to non-farming

occupations. Most non-farm jobs available in South Asia are in the informal sector and quite precarious. Agricultural land acts as an anchor during unemployment shocks.

2. Rapid electrification of pump sets has led to a sharp decline in the cost of groundwater irrigation in West Bengal and Bihar. However, pump owners have benefited more from cheaper energy than the water buyers, especially in West Bengal where electrification has not led commensurate decline in the irrigation charges. Also, while the average level groundwater development in EGP is low (~40%), seasonal decline in groundwater tables below 9-10 m is becoming more common in some of the agriculturally most productive regions of West Bengal. If water tables go down below 10 meters even for a few weeks/months before monsoon, farmers may be forced to switch to submersible pumps. Increasing dependence on submersible pumps for groundwater irrigation can maket water markets less competitive and access to groundwater more unequal.
3. Nearly half of all poor women in Bangladesh live in non-poor households. Using household level data ignores the discrimination in the allocation of resources against women and children in South Asian households. Collecting and individual level data on consumption, income, and bargaining power is critical for making food systems inclusive.

3 Objectives

The overall objective of the project is to encourage and support a core team of local partners in Bangladesh, India, and Nepal to study different aspects of the food system in EGP, analyze the impact of the pandemic on farming families in the region, and organize a regional dialogue on the opportunities and the challenges in food systems.

Specific objectives of the SRA are to:

1. To analyze the role of some of the key aspects of the food systems in the EGP that have been ignored in most of the existing academic and policy analysis.

2. To assess the impact of COVID-19 on farm households in Bangladesh, India, and try to answer the following questions:

    2.1. What were the main challenges farmers faced in harvesting, selling their produce, and the sowing of new crops?
    2.2. What formal and informal institutions helped farmers overcome these challenges and
    2.3. What were the differences in the experience and coping mechanisms of large and small farmers and women and men farmers?

3. To organize a high-level forum on the outlook for sustainable, healthy, and profitable food systems in the Eastern Gangetic Plains and the linkages with water and energy security attended by senior decision-makers from across government, business, farmer organizations, research, and civil society. The dialogue will engage participants in dialogue on practical transformation strategies to avoid risks and leverage opportunities for sustainable and healthy food production, improved livelihoods, and business innovation.

Key outputs of the project include:

1. Three publishable reports/articles on the impact of COVID-19 on the farming families in Bangladesh, Bihar (India), and Nepal. These papers are based on in-person or telephone interviews of farmers from the three countries.

2. An article in the *Economic and Political Weekly* (EPW) on the impact of the lockdown in India on different components of the country's food system. This paper was an output of an informal dialogue organized by IFPRI where representatives from agribusiness firms, financial institutions, NGOs, and academic institutions participated.

3. Eight journal articles on different aspects of the food system in the EGP including a) sustainable use of groundwater; b) farmers' response to public policies on price support in India; c) intrahousehold differences in the consumption of nutritious foods in Bangladesh; d) the consumption of blue foods in South Asia and the world; e) the future of food production and farmers' wellbeing in Asia and Africa; and f) the impact of COVID-19 on farming families in Bangladesh.

4. A regional workshop on the challenges and the opportunities in food systems in South Asia and a workshop report based on the proceedings of this event.

4 Methodology

We undertook the following steps to achieve the project objectives.

1. **Farmer surveys:** BAU, CGED, and IFPRI teams carried out three primary surveys with farmers and other stakeholders in the food systems of Bangladesh, Bihar, and Nepal to understand the effect of COVID-19 on farmers. The pandemic restrictions made it difficult to carry out these surveys. We, therefore, switched to a phone survey of farmers in Bihar. This primary survey was carried out with 1200 farmers in the state that had been surveyed earlier in a research project led by Pennsylvania State University, USA. The BAU team surveyed 320 farmers from 4 districts of North Bangladesh while the CGED team surveyed 240 farming households in Province 2 of Nepal. Both BAU and CGED teams conducted in-person surveys of farming households later after the easing of the travel restrictions.

2. **Analysis of secondary data:** IFPRI and its collaborators (ICAR-NIAP and Dr. Jaweriah Hazrana) used multiple secondary data sets, including data from household surveys conducted by other research groups (e.g, the Bangladesh Integrated Household Survey or BIHS) to assess different aspects of the region's food systems and prepare publishable articles.

3. **Collaborations with the global efforts to analyze foods systems futures:** Avinash Kishore from IFPRI joined different global networks and platforms engaged in research and policy communication on food systems like the Blue Foods Assessment (BFA) group, the Sustainable Development Solutions Network (SDSN), and the Environmental Change Institute (ECI) at the Oxford University to prepare a series of high-impact research papers, book chapters, and policy briefs to contribute to the global dialogue on this theme.

5 Achievements against activities and outputs/milestones

Table 1. Activities and Outputs/Milestones

No.	Activity	Outputs/Milestones	Comments
1	Preparation of status reports on different aspects of the food system in EGP	3 reports on: a) the contribution of small informal food businesses; b) role of occupational diversification away from agriculture in farm households of EGP region; and c) practical regulatory policies and incentives to promote production and consumption of safe foods.	The report on small food enterprises has been accepted for publication in the *Global Food Security* journal. The themes of the other two reports changed. Instead, we produced a report on a) intra-household differences in food consumption in Bangladesh; and another one on b) the response to output price supports on rice and wheat production in India. Since the project went longer than the original plan, we also used the extra time to produce other high-quality analytical reports/papers on i) sustainability issues in groundwater irrigation in Bihar and West Bengal and ii) the impact of employment shocks on consumption levels of rural and urban families of India. Plus we also co-authored papers and book chapters on the future of food production and farmers' wellbeing in Asia and Africa; and a global report on Blue foods consumption.
2	Preparation of short analytical reports on the impact of COVID-19 on on-farm operations and incomes in Bangladesh, Bihar, and Nepal	1 report each on Bangladesh, India, and Nepal	The report using data from Bangladesh is under review with an international journal. The other two reports are also being prepared for submission to journals.
3	Preparation of a report on the food systems in the EGP region using the food-energy-water nexus lens.	An analytical report on the food systems in the 3 countries that will highlight similarities and differences across the region and identify opportunities for regional cooperation	Given many other agencies have produced or are engaged in producing similar reports, we decided to focus on preparing a series of high-quality papers/publications on the different aspects of food systems in the region. We published 8 journal articles and 6 publishable papers under this SRA.

4	Organization of a high-level forum on the outlook for sustainable, healthy, and profitable food systems in the Eastern Gangetic Plains and the linkages with water and energy security.	A 2-day virtual conference was organized in June 2022. Participants from Bangladesh, Indi, Nepal, Australia, and the US attended the workshop and presented paper on food systems.	We had to switch to a virtual dialogue because of continuing uncertainties in international travel and meetings.

6 Key results and discussion

The project team conducted a range of studies including a) primary survey of farmers to assess the impact of the COVID-19 pandemic on farming families in Bangladesh, Bihar, and Nepal Terai; b) the situation of groundwater use and aquifers in Bihar and West Bengal (India); c) impact of public policies on the production of rice and wheat (India); d) analysis of the consumption of blue foods in South Asia and its potential contribution to the agricultural economy and nutrition; e) analysis of intrahousehold disparities in the consumption of nutritious foods (Bangladesh); and f) the future of food production and farmers in EGP and other parts of the developing world. In this section, we briefly discuss 6 key results from the range of studies we undertook in this SRA.

1. *Occupational diversification does not always lead to greater resilience to economic shocks*

The COVID-19 pandemic had a relatively small direct impact on morbidity or mortality of farm families in Bangladesh, Bihar, and Nepal. Food production also remained quite resilient to the various disruptions caused by the pandemic. Farmers could get access to the key inputs, complete farm operations on time, and even sell their output in the markets. However, profits from perishable crops declined. Also, incomes from non-farm employment plummeted. Families more dependent on non-farm incomes experienced larger decline in incomes. More than half of all migrant workers from the farming families lost their jobs and had to come back to their villages—at least for a short time. Most of these returning migrants intended to go back to their usual destinations.

2. *Groundwater depletion is emerging as a problem in some parts of West Bengal*

Decline in groundwater table is emerging as a problem in some parts of West Bengal, particularly, the highly productive central regions of the state. Secular decline in the depth to water table is limited only to a small area of the state, but seasonal declines in water table below 9-10 meters is a growing problem that may affect the structure, conduct, and performance of water markets. Farmers will be forced to switch to more expensive submersible pumps. The high capital cost of submersible pumps can make water markets less competitive and water less accessible to poorer farmers.

Water tables have remained stable across all parts of Bihar. However, farmers in the state have installed more than 300 thousand electric pumps since 2017. Unlike West Bengal,

electricity is very cheap in Bihar. Cheap electricity may lead to inefficient use of energy and water in the state, and it may even trigger decline in water tables in the flood free southern parts of the state.

3. *The impact of price support on the production of rice and wheat in India*

Indian farmers produce too much rice and wheat and not enough fruits and vegetables. Improving diet quality requires crop diversification. However, Government of India buys nearly one-third of the total rice and wheat produced in the country at assured prices. We showed that this price assurance incentivizes farmers to allocate more land and inputs to rice and wheat cultivation and contributes to the excessive production of the two grains. India's price support policy needs to become crop neutral to support a more diverse and environmentally sustainable agriculture.

4. *Blue foods can play a major role in the shift towards a healthy and sustainable food systems in EGP*

Fisheries is the fastest growing sub-sector of the agricultural economy of the EGP region. Both fish production and consumption are growing rapidly in the reason. However, we have very little credible data on the actual consumption of fish, especially, in India. The gap between the aggregate estimates of fish consumption and estimates based on household surveys is growing. The aggregate data shows rapid rise in the consumption of fish in India while household surveys show the average per capita fish consumption has remained stagnant between 1981 and 2011.

More than milk, chicken, or eggs, the consumption of fish is influenced by the geography and the local food culture. The per capita consumption of fish does not necessarily increase with increasing incomes in parts of India where fish has not been a major part of the food plate. Furthermore, even in traditionally fish-eating areas, like Bangladesh, there is a significant difference between the average per capita fish consumption of women and men. Women get to consume smaller quantities of fish than men in their families and the gap increases when the household income goes down.

5. *Smallholder agriculture will continue to be the mainstay of food production in South Asia*

The average landholding size is very small in the EGP region even by the South Asian standards. For example, the average landholding size of the 90% of the farmers in Bihar is just 0.24 hectares. The holdings are not only small, but also fragmented into even smaller parcels and plots. More and more farming families are struggling to eke out a living from their small and shrinking farms. Their dependence on non-farm income sources is growing. However, most of these families are not exiting agriculture. They continue to hold on to their land and farming as an anchor against shocks in their precarious off-farm employment. As a result, automatic consolidation of land holding is not happening in the region. Very small farms and animal husbandry units will continue to produce the bulk of the food in the region in the foreseeable future.

7 Impacts

7.1 Scientific impacts – now and in 5 years

The research on food systems in the EGP region has directly contributed to a large one-CGIAR project in South Asia called 'Transforming Agrifood Systems in South Asia' (TAFSSA). TAFSSA's work plan is influenced by learnings from the three SRAs. Avinash is leads one of the 5 work packages of TAFSSA. Among other things, TAFSSA will take forward the agenda of building a coalition of researchers and policymakers who are intensively engaged in research and policymaking on the future of the food system in South Asia. TAFSSA is also seriously pursuing research on themes highlighted by this and the earlier two SRAs like groundwater irrigation in EGP, food economy beyond farms, and understanding intrahousehold dynamics and disparities in rural South Asia.

The SRA has also contributed to at least half a dozen publications in peer-reviewed international journals and regional and global scientific collaborations for research on food systems.

7.2 Capacity impacts – now and in 5 years

IFPRI and BAU involved nearly half a dozen young researchers to work on different aspects of food systems. Under SRA-2, we had supported a Ph.D. candidate, Vartika Singh with her research on using modelling techniques for policy analysis. Vartika used the MAgPIE model to assess the potential impacts of different kinds of electricity tariffs and subsidies on water use in agriculture in India. A revised version of her paper will become one of the chapters of her Ph.D. thesis. In SRA-3, we supported Dr. SK Srivastava from ICAR-NIAP, Mr. Jaspal Singh a young researcher earlier associated with the NITI Aayog of India, and Dr. Jaweraih Hazrana—a recent PhD who was working as an independent consultant at the time. All three of them have gone on to carry out independent research on food systems in the region.

7.3 Community impacts – now and in 5 years

Our research has highlighted new ideas and perspectives on the region's food systems and its future course. Specifically, we have generated evidence that will motivate researchers, donors, and governments to focus more on the issues of i) the food economy beyond the

farm; ii) policies to leverage electrification of irrigation for sustainable intensification of agriculture in the EGP region; iii) the need to collect and analyze intrahousehold data on consumption and control over productive resources and decisions; and iv) the impact of increasing dependence on off-farm occupations of smallholder families on their resilience to economic shocks.

7.3.1 Economic impacts

This SRA did not have any direct impact on the region's economy. We highlighted intrahousehold disparities in the allocation of nutritious foods and how weather shocks can worsen these disparities. We hope that this evidence will inform future social safety net programs in the region. We also showed the higher vulnerability of urban poor to economic shocks like COVID-19 and rising unemployment. This evidence will contribute to greater interest in creating effective safety nets for increasingly urbanising populations in the EGP.

7.3.2 Social impacts

We do not expect any direct social impacts of this project.

7.3.3 Environmental impacts

Our report and papers showing that intensive groundwater irrigation is associated with seasonal decline in water tables in some parts of West Bengal may lead to more balanced and informed discussion on potential benefits and challenges from the rapid electrification of groundwater irrigation in the EGP region in India and Bangladesh.

7.4 Communication and dissemination activities

- IFPRI co-organized and participated in a series of e-dialogues on food systems in South Asia and the global South in partnership with Sustainable Development Solutions Network (SDSN) and the University of Oxford's Environmental Change Institute (Dr. Jim Woodhill). Avinash and Dr. Jim Woodhill also created a video module to analyze the impact of COVID-19 on food systems in South Asia. Dr. Jim Woodhill published a blog based on this discussion.
- Three papers prepared for SRA-3 were selected for full presentation in the 31st International Conference of Agricultural Economists held in August 2021. It is the flagship event of the International Association of Applied Economists (IAAE). Dr.

Jaweriah Hazrana, Avinash Kishore, and Devesh Roy presented these papers at the conference.

- Avinash Kishore of IFPRI contributed to a series of high-profile peer-reviewed papers and a report that integrates key findings for decision-makers[1]. The report and the policy brief were shared by the UN Food Systems Summit.
- IFPRI organized a 2-days regional conference on Challenges and Opportunities in Food Systems Across the Eastern Gangetic Plains on June 22 and 23, 2022. 20 papers were presented by the scientists from the region and more than 50 leading researchers, policymakers, and farmers' representatives took part in the virtual conference.

[1] *Building Blue Food Futures for People and the Planet. The Report of the Blue Food Assessment. September 2021. DOI: 10.25740/rd224xj7484*

8 Conclusions and recommendations

Research on different components of food systems in the EGP region underlines many similarities and common patterns across the three countries. We briefly discuss five key findings from our collaborative work here. Our conclusions and recommendations cover multiple themes where we can work on in the future.

8.1 Conclusions

a. The value added by the post-farmgate food enterprises that act as bridge between the farmers and the consumers is growing much faster than the value added on farms. This may also be true for Bangladesh and Nepal. The rapid growth in the post-farmgate value chains have significant impacts throughout the agri-food systems including farmers, agribusiness firms producing and selling agricultural inputs, health and nutritional outcomes of consumers, and opportunities for off-farm employment in rural areas. However, despite the large and growing importance of the firms in the mid-stream segments of the food value chains, academic research and policy debates on agri-food systems (AFS) and food security often ignore what happens between the farm and the final consumer and focus *excessively* on farmers and consumers (Barrett et al., 2022).
b. Intensive groundwater irrigation in the pre-monsoon season in the EGP region helps capture and store large volumes of water in the porous aquifers. This process has been called the Bengal Water Machine (Shamsuddhua et al., 2022) or the Ganges Water Machine (Revelle and Lakshminarayana, 1975). The existence of BWM or GWM phenomenon suggests that the EGP region can sustain intensive groundwater irrigation without any secular decline in groundwater levels. However, our research shows that even seasonal declines in the water table below the 9–10-meter threshold can lead to less competitive water markets and more unequal access to groundwater. There is a need to understand the impact of the seasonal decline in water tables in the EGP. Rapid electrification of irrigation pumps has made this research more urgent.
c. The economic impacts of COVID-19 affected farmers and farm households much more than the direct health impacts. The food system in the region

showed a high degree of resilience to the pandemic but farmers' profits took a hit. Farm households relying on non-farm employment and remittance incomes suffered more. The pandemic underlined one of the reasons why farmers with very small landholdings continue to hold on to agriculture: farming is their anchors in times of crisis as employment in non-farm sector is mostly informal, casual, and vulnerable to economic disruptions.

8.2 Recommendations

- *Need to collect intra-household data:* Much of the empirical research on food systems collects and analyses household level data. Key policies targeting poor and marginalized families are also based on household averages of consumption, income, or asset ownership. However, there is a lot of disparity within households in the EGP region. Future projects should emphasize on the need to collect and analyze intrahousehold data. Covering poor households alone is not enough. Future research needs to identify and reach poor individuals who reside in poor and non-poor households. Collecting intrahousehold data is more resource and time intensive, but it is necessary to make food systems research and policies truly inclusive.
- *Understanding the impact of more affordable irrigation in EGP:* Rapid electrification of irrigation pumps started in West Bengal about 10 years ago. Now, it is happening in Bihar and Bangladesh too. What kind of policies will help ensure that electrification leads to equitable access to all farmers in the region? How can farmers use access to affordable irrigation to sustainably intensify agriculture and make it more resilient to drought and high degree days? Finally, how do we ensure that electrification of irrigation does not lead to the unsustainable use of groundwater? These are important questions that remain unanswered. Supporting research and policy engagement that can generate evidence on these issues will have a very high payoff for EGP.
- *Looking beyond the farm:* As economies grow, the contribution of the mid-stream of the value-chain—firms, activities and entrepreneurs that link farmers to the ultimate consumers—in the overall food economy and employment created by it

increases faster than the on-farm value creation. Smallholders also increasingly engage in occupational diversification to increase household incomes and reduce risks. Therefore, research and policies on food systems need to look beyond farms to the larger food economy.

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9.2 List of publications produced by the project

Journal Articles

1. The vital roles of blue foods in the global food systems (with Michelle Tigchelaar et al.). *Global Food Security.*

2. Blue food demand across geographic and temporal scales (with Roz Naylor, Sumaila Rashid, et al.). *Nature Communications.* https://doi.org/10.1038/s41467-021-25516-4

3. SK Srivastava, Avinash Kishore, and Jaspal Singh. (2022). Economic access to groundwater irrigation under alternate energy regimes in Bihar. *Agricultural Economics Research Review*.

4. Jim Woodhill, Avinash Kishore, Jemimah Njuki, Crystal Jones, and Saher Hasnain. (2022).Food Systems and Rural Wellbeing: Challenges and Opportunities. *Food Security.* [A longer version of the paper was published as a chapter in a report produced by the IFAD.]

5. The future of farming: Who will produce our food? (With Ken Giller, et al.) *Food Security* (2021). https://doi.org/10.1007/s12571-021-01184-6

6. Manavi Gupta, Avinash Kishore, Devesh Roy, and Sunil Saroj. (2023). Post-Farmgate Food Businesses in India: The Enterprises, The Entrepreneurs, and The Employees. *Global Food Security (forthcoming).*

7. Manavi Gupta and Avinash Kishore. (2022). Unemployment and household spending in rural and urban India: evidence from a panel data. *Journal of*

Development Studies.[2]
https://www.tandfonline.com/doi/10.1080/00220388.2021.1983171

8. Alam, Jahangir et al. (2022). The Impact of COVID-19 on Livelihoods: A case Study of High-Value Crop Farmers in North-West Bangladesh. *Under review at the International Journal of Agricultural Sustainability.*

Conference Papers and Pre-publication Papers and Reports

1. A report on The Challenges and Opportunities in Food Systems Across the Eastern Gangetic Plans. *Report based on the proceedings of the regional online conference organized on 22nd and 23rd June 2022.*

2. Madhav Karki, Sushil Goit, and Dinesh Panday. (2022). Impact Assessment of the COVID-19 Pandemic on Farmers in Nepal using a Cross-Sectional Survey.

3. SK Srivastava, Avinash Kishore, and Jaspal Singh (2022). Sustainability Issues in Groundwater Irrigation in Bihar and West Bengal. An ICAR-NIAP and IFPRI collaborative study.

4. Jaweriah Hazrana and Avinash Kishore (2022). Fish Consumption and Exogenous Shocks - Results from an Intra-household Data from Rural Bangladesh.

5. Jaweriah Hazrana, Avinash Kishore, Devesh Roy, and Pratap Birthal (2021). Market Intervention and Supply Response in Indian Agriculture. *Paper presented in the 31st ICAE Virtual Conference, the flagship conference of the International Association of Agricultural and Applied Economists (IAAE).*

6. Avinash Kishore and Roz Naylor. (2022). Fish consumption in India. *Unpublished Working Paper.*

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[2] The work on this paper started under SRA 2. Resources from SRA3 were used to Avinash's time to revise and submit the paper to the journal.

10 Appendixes

10.1 Appendix 1:

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