

# Consistency and persistence are key to success: Reflections from my Kakenhi Journey (2017-2022)

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# Before I start writing Kakenhi application in 2017-18

## Some hesitations

- Does previous academic and funding track record matter?
- Budget- Starting with Kiban C or Kiban B or Kiban A?
- Research Field Category (Economic Theory, Economic Policy, or Agricultural Economy and Society)
- Proposal (in English or Japanese)
- Abstract (English or Japanese)
- **With whom- I should submit** as PI or Co-I or Collaborator

# About me and my career

Born in late 1970s in marginalized rural community in **Bangladesh**.

1995-2000: Economics in **University of Dhaka**.

2001/05 – 2010/09: Bangladesh Academy for Rural Development (**BARD**), Comilla, known for its **Comilla approach to Rural Development**.

2005/10 to 2010/09:

Rural Economics, **Yamaguchi University and Tottori University**

2011/01 to 2016/09 :  
**BRAC** (World largest NGO)



ASAE International  
Conference 2014

2012-2015: **University of Bonn, Germany**  
Center For Development Research (ZEF)

2016/09 -2017/10: **The University of Tokyo**

2017/10-2018/11: **Kyoto University**

2018/12: **University of Tsukuba**

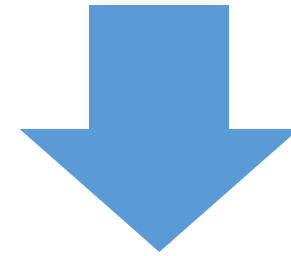
My research Interests:

**Field experiments (RCT) in Agriculture and Development Economics**, Natural Experiments, Econometrics and machine learning, Mixed Method, South/Southeast Asian Economics.

**Several requirements for Field Experiments:**

- Research design with coordination and consultation among all stakeholders (esp. **the investigators' team**, intervention team/organization, and survey implementer) **well in-advanced**
- Systematic selection of randomization units and random assignment of treatment and control groups
- Random selection of the survey and treatment samples
- Persistent coordination and follow-ups for quality treatment implementation, questionnaire design, and data collection
- Data cleaning, analyses, writing, etc...**

**Nobel Prize in Economics in 2019**



**Abhijit Banerjee, Esther Duflo and Michael Kremer**

**on  
Experimental Approach in Development  
Economics**

## Previous track record (~2017): Ended with successful achievements

1. Impact evaluation of credit program for tenant farmers. Worked as PI with funding from **International Initiative for Impact Evaluation (3ie)** with Mahabub Hossain, Narayan Das and others. (August 2011-April-2015). Grant amount: **USD 0.75 million**.
2. Economics of Micro Credit Intervention for the tenant farmers. Worked with Yasuyuki Sawada under **JSPS Postdoctoral Fellowship Program. Grant (Kakenhi No. 16F16311)**. (2016/10~2017/09). Amount: JYEN 2.9 million.

Reports, media reports, Blog, AJAE (2019, 2020) JDA (2019) Two more in progress

3. Technology adoption and food security in rural Bangladesh project funded by **International Growth Center (IGC)** worked as **Co-I** with Asad Islam (PI), Christopher Barrett, Marcel Fafchamps and Debayan Pakrashi. (Feb 2014-Dec 2015, Grant amount: **AUD 102,000**).
4. Technology adoption and diffusion: The System of Rice Intensification and food security in Bangladesh project funded by **IGC** worked as co-PI with Asad Islam (PI), Christopher Barrett, Marcel Fafchamps and Debayan Pakrashi (July 2015-June 2016, Grant amount: **AUD 110,000**).

Report, Blog, AJAE (2022), JDE and WBER (2021)

## Previous track record (~2017): Ended with successful achievements (!!!)

5. Improving educational outcomes of disadvantaged school students: Evaluation (RCT) of BRAC Chatrabondhu Programme-A project funded by **DFAT** worked with a project team (PI for Bangladesh study team) at Monash University (Asad Islam, Choon Wang and Sakiba Tasneem) (Aug 2014-July 2016), Grant amount: AUD 80,000.

**Output:** *Working paper*. Under review at American Economic Journal: Economic Policy

6. AG-WATSAN Nexus (RCT) Study Project funded by **BMGF**. Involved in a project team at ZEF, Bonn with Joachim von Braun and Nicolas Gerber and PI for the Bangladesh study team. (April 2014-Dec 2015). Grant amount: EURO 43,200.

**Output:** *Discussion paper, blog, etc.*

7. Technology (ex-ante) assessment and farm household segmentation for inclusive poverty reduction and sustainable growth in agriculture (TIGA) project funded by **BMGF**. Involved in project team at ZEF, Bonn with Joachim von Braun and Franz W. Gatzweiler and PI for Bangladesh study team. (May 2012-Dec 2014) Grant amount: USD 105,500.

**Output:** *Book chapters, working paper, manual and peer-reviewed Elsevier Journal (Technology in Society)*

## Previous track record (~2017): **Personal SWOT Analyses**

### **Strength:**

- I think**, I am good at research idea generation and implementation (Field experiment and survey) research
- Maybe I am good to bring collaborators

### **Opportunities:**

- Working with several well-known researchers/institutions

### **Weakness:**

- I am not good at writing and econometrics analyses

### **Threat**

- Not good at the Japanese language



My application in 2017-18  
(Kiban C: **succeeded but could not utilize the fund**)

ベンガルの小規模農家行動の経済合理性の再検討：稲作技術革新をめぐるミクロ経済分析 (with **Professor Nobuhiko Fuwa**, The University of Tokyo as PI and Professor Chieko Umetsu, Kyoto University as Co-I and **me as Collaborator**)

-Taking my SRI research from Bangladesh and Professor Fuwa`s research on West Bengal, India  
-I wrote my part in English, PI Professor Fuwa finalized the proposal in Japanese.

**Funding decision came in 2018/04, but PI passed away at Feb 16 2018.**

My application in  
2018-19  
(Kiban C as PI and  
Chieko Umetsu and  
Kazushi Takahashi  
as Co-Is, and Chris  
Barrett and Asad  
Islam as  
Collaborators:  
Not succeeded)

研究種目名	2019年度 基礎研究 (C) 一般
小 区 分	07010 理論経済学関連
研究課題名	Reexamination of Economic Rationality of Smallholders' Behavior in Bangladesh: Microeconomics of Rice Production Innovation

ご応募いただいた上記研究課題の審査結果は次のとおりでした。

		応募件数	採択件数	採択率
研究種目名	基礎研究 (C) 一般	45,758件	12,918件	28.2%
小区分	07010 理論経済学関連	101件	30件	29.7%

基礎研究 (C) 一般は、2段階書面審査を実施しており、4名の同一の審査委員が、個々の研究課題について2段階にわたり書面審査を実施し採択研究課題が決定されます。

記

1. 審査区分における採択されなかった研究課題全体の中での、書面審査の総合評価に基づくおおよその順位

おおよその順位は「A」でした。

(参考1) おおよその順位

A	審査区分における採択されなかった研究課題全体の中で、上位20%に位置していた
B	審査区分における採択されなかった研究課題全体の中で、上位21%～50%に位置していた
C	審査区分における採択されなかった研究課題全体の中で、上位50%に至らなかった

2. 書面審査における評価要素ごとの評価結果

1段階目の審査の各評価要素については、4段階の絶対評価により審査を行っています。あなたの評価要素毎の審査結果は次のとおりでした。

審査では、総合評価に基づき採否が決定されます。審査にあたり、高い総合評価を付す研究課題は、必ずしも、全ての個別要素において高い評価を得る必要はない旨、評価基準等で示されています。

(1) 【評価要素ごとの結果】

あなたの研究課題の平均点及び当該審査区分において採択された研究課題の平均点

評 定 要 素	あなたの平均点	採択課題の平均点
①研究課題の学術的重要性	3.00	3.13
②研究方法の妥当性	3.00	2.98
③研究遂行能力及び研究環境の適切性	3.00	3.31

※当該審査区分に採択課題がない場合は、採択課題の平均点は「0.00」と表示されます。

(参考) ①～③の評価基準

評点区分	評 定 基 準
4	優れている
3	良好である
2	やや不十分である
1	不十分である

(2) 【審査の際「2 (やや不十分である)」又は「1 (不十分である)」と判断した項目 (所見)】

評点「2 (やや不十分である)」又は「1 (不十分である)」が付された評価要素については、そのように評価した審査委員の数を項目ごとに「\*」

Overall Ranking A  
(In Top 20%)

Scores:

- 1) Academic Importance
- 2) Validity of Research Method
- 3) Ability to Conduct Research method and appropriateness of research environment

## My application in 2019-20- **Two applications**

### **First application:**

The long-run effects of technology adoption on productivity, resilience, and growth.

**Kiban B:** me as PI and Chieko Umetsu as Co-I, and Chris Barrett and Asad Islam as Collaborators: **Not succeeded**

### **Second application:**

なぜ一見有望な農業技術が広まらないか？大規模ランダム化比較試験からの知見

Why isn't the seemingly promising agricultural technology widespread? Findings from large randomized controlled trials

**Kiban A:** me as Co-I with Kazushi Takahashi (GRIPS) **as PI** and others as Co-Is (Yuko Nakano/University of Tsukuba, Yoko Kijima/GRIPS and Yukichi Mano/Hitotsubashi University): **Succeeded**

# My application in 2020-21

**Kiban b:** me as PI

with others as Co-Is (Kazushi Takahashi/GRIPS, Yuko Nakano/University of Tsukuba, Yoko Kijima/GRIPS and Yukichi Mano/Hitotsubashi University): **Not Succeeded**

研究種目名	2021年度 基盤研究（B）一般
小区分	07040 経済政策関連
小委員会名	第07040小委員会
研究課題名	Institutional Innovation for sustainable mechanical rental service for resource poor farmers

※各審査区分の応募件数が多い場合には、その区分の応募課題を機械的に分割し、それぞれ独立に審査を行いました。分割が行われた場合には小委員会名の後ろにローマ数字が表示されております。

ご応募いただいた上記研究課題の審査結果は次のとおりでした。

		応募件数	採択件数	採択率
研究種目名	基盤研究（B）一般	11,320件	3,396件	30.0%
小区分	07040 経済政策関連	57件	20件	35.1%

基盤研究（B）一般は、2段階書面審査を実施しており、当該小委員会では6名の同一の審査委員が、個々の研究課題について2段階にわたり書面審査を実施し採択研究課題が決定されます。

記

1. 審査区分における採択されなかった研究課題全体の中での、書面審査の総合評点に基づくおおよその順位

おおよその順位は「A」でした。

(参考1) おおよその順位

A	審査区分における採択されなかった研究課題全体の中で、上位20%に位置していた
B	審査区分における採択されなかった研究課題全体の中で、上位21%～50%に位置していた
C	審査区分における採択されなかった研究課題全体の中で、上位50%に至らなかった

**Overall Ranking A  
(In Top 20%)**

# My application in 2020-21

**Kiban b:** me as PI

with others as Co-Is (Kazushi Takahashi/GRIPS, Yuko Nakano/U of Tsukuba, Yoko Kijima/GRIPS and Yukichi Mano/Hitotsubashi University): **Not Succeeded**

評定要素	あなたの平均点	採択課題の平均点
①研究課題の学術的重要性	2.80	3.08
②研究方法の妥当性	2.60	2.97
③研究遂行能力及び研究環境の適切性	2.80	3.22

## a. On academic importance

Is it an important research topic that should be promoted from an academic point of view?

- Are the academic "questions" that form the core of the research subject clear, and are academic uniqueness and creativity recognized?
- Is the background to the idea of the research plan, related domestic and overseas research trends, and the position of the research clear?
- Is it possible to expect a ripple effect on a wider range of academic fields, science, and technology, or society by carrying out this research project?

## b. **Validity of res method**

- Are the research methods concrete and appropriate to achieve the research objectives? Also, are the research expenses consistent with the research plan?
- Is the preparation status appropriate for achieving the research objectives?

## c. **Ability and research environment**

Do you have sufficient ability to carry out your research plan in view of your research activities so far?

- Is the research environment in places, such as research facilities, equipment, and research materials necessary for carrying out the research plan?

## My application in 2021-22

**Kiban b:** me as PI

with others as Co-Is (Kazushi Takahashi/GRIPS, Yuko Nakano/UTsukuba, Yoko Kijima/GRIPS and Yukichi Mano/Hitotsubashi University): **Succeeded**

The proposal (not succeeded in the previous year) with some revisions was submitted.

**Let`s see some comparisons:**

2021-22

[1. Research Objectives, Research Method, etc. (continued from the previous page)]

**1. Research Objectives, Research Method, etc.**

This research proposal will be reviewed in the Basic Section of the applicant's choice. In filling this application form, refer to the Application Procedures for Grants-in-Aid for Scientific Research -KAKENHI-. Research objectives, research method, etc. should be described within 5 pages. A succinct summary of the research proposal should be given at the beginning. The main text should give descriptions, in concrete and clear terms, of (1) scientific background for the proposed research, and the "key scientific question" comprising the core of the research plan, (2) the purpose, scientific originality, and creativity of the research project, and (3) applicant's research development leading to conception of the present research proposal, domestic and overseas trends related to the proposed research and the positioning of this research in the relevant field, (4) what will be elucidated, and to what extent and how will it be pursued during the research period, and (5) preparation status towards achievement of the purpose of the research project. If the proposed research project involves Co-Investigator(s) (Co-I(s)), a concrete description of the role-sharing between the Principal Investigator (PI) and the Co-I(s) should be given.

[SUMMARY]

Given that world population has reached to 7.8 billion, we need to find a way to feed growing population. However, rural Asian economies have witnessed the labor shortage and increased wage rate in the agricultural sector, which prevent the spread of labor-intensive but potentially yield-enhancing agronomic practices. An induced innovation theory suggests an effective shift from manual labor to machinery use, but machine rental markets have actually not developed well in rural Bangladesh. We hypothesize the existence of the demand- and supply-side constraints associated with the uncertainty about the accessibility and profitability for both farmers and private machine service providers. To explore the potential of mechanization in rice farming, we formally examine the impact of combined interventions of providing rental machinery services by the private sector and agricultural training by the public sector on the profitability of both farmers and private service providers through a large-scale experimental approach. We use a promising agronomic practice, called the system of rice intensification (SRI), as a case.

[MAIN TEXT]

**(1) Scientific background for the proposed research, and the "key scientific question" comprising the core of the research plan,**

The world population has reached to 7.8 billion, and increased food production is needed to feed growing population. Since the 1960s, the Asian Green Revolution, the diffusion of modern varieties and chemical fertilizer, has enables Asian countries to increase food production. However, the agricultural sector in many Asian countries has experienced a drastic change from farm labor-abundant to farm labor-shortage economies. This change is mainly because the rural labor force, especially youth, is absorbed in lucrative local nonfarm jobs and also through out-migration within a country or aboard. The agricultural labor shortage has caused substantial increase at the peak season. Resource-poor farm households (RPFs) tend to be disproportionately affected by the hike in agricultural wage, finding it difficult to achieve timely crop

2020-21

**1. Research Objectives, Research Method, etc.**

This research proposal will be reviewed in the Basic Section of the applicant's choice. In filling this application form, refer to the Application Procedures for Grants-in-Aid for Scientific Research -KAKENHI-. In this column, research objectives, research method, etc. should be described within 4 pages. A succinct summary of the research proposal should be given at the beginning. The main text should give descriptions, in concrete and clear terms, of (1) scientific background for the proposed research, and the "key scientific question" comprising the core of the research plan, (2) the purpose, scientific significance, and originality of the research project, and (3) what will be elucidated, and to what extent and how will it be pursued during the research period. If the proposed research project involves Co-Investigator(s) (Co-I(s)), a concrete description of the role-sharing between the Principal Investigator (PI) and the Co-I(s) should be given.

[SUMMARY]

Rural Asian economies have witnessed the labor shortage and increased wage rate in the agricultural sector, which prevent the spread of labor-intensive, but potentially yield-enhancing agronomic practices. An induced innovation theory suggests an effective shift from manual labor to the machinery use, but machine rental markets have not been well developed in rural Bangladesh. We hypothesize the existence of both the demand- and supply-side constraints associated with the uncertainty about the accessibility and profitability for both farmers and private sectors. To explore the potential of mechanization in rice farming, we formally examine the impact of combined interventions of providing mechanization services by the private sector and agricultural training by the public sector on the profitability of both farmers and private service providers through a large-scale experimental approach. To do so, we use a promising agronomic practice, called the **system of rice intensification**, as a case. This research will be implemented along with another on-going Kakenhi project, and adds an important collaboration with a **people-private-public partnership** for sustainable institution building.

[MAIN TEXT]

**(1) Scientific background for the proposed research, and the "key scientific question" comprising the core of the research plan,**

The agricultural sector in many Asian countries has experienced a drastic change from farm labor-abundant to farm labor-shortage economies. This is mainly because the rural labor force, especially youth, is absorbed in lucrative nonfarm jobs through out-migration within a country or to aboard. The agricultural labor shortage is intensified within a particular period of time because of seasonality of the agricultural cycle, which induces the substantial increase in the agricultural wage rate at the peak season. Resource poor farm households (RPFs) tend to be disproportionately affected by the hike in the agricultural wage, finding it difficult to achieve timely crop establishment and

To solve this issue, the promotion of sustainable agricultural mechanization has emerged as a policy response (Mano et al., 2020). Since the ownership of agricultural machinery requires a lumpy investment that cannot be affordable by RPFs, a natural policy response was the provision of machinery to agricultural cooperatives. However, due to the poor performance of public mechanization provisions in the past, private sectors are expected to play an alternative role as providers of agricultural machinery rental services (AMRS) (Wang et al., 2016).

According to an induced innovation theory introduced by Hayami and Ruttan (1971), the market of AMRS should soon be developed to substitute for labor in the face of the relative increase in agricultural wages.

### Scientific Research (B) (General) 2

[1. Research Objectives, Research Method, etc. (continued from the previous page)]

However, this has not happened in many parts of rural Bangladesh, despite the decreasing agricultural labor force and increasing real wages for rice production (a main staple food in the country). This suggests that induced technical and institutional innovations do not automatically happen, and the institutions would be developed after some trials and errors.

We hypothesize that there are demand and supply constraints in the status quo that hamper the development of AMRS. From the demand side, farmers may not use machinery until they acquire enough knowledge about the profitability, which is determined by the rental price of machinery along with the required expertise of machinery usage and related agronomic practices. From the supply side, private companies may be reluctant at least initially to provide machinery rental services if they are uncertain about the demand for AMRS by farmers. Even when some machine service providers enter the market, due to the limited capacity, the providers may not necessarily pay close attention to appropriate agronomic practices and paddy environment, which can decrease farmers' profitability and thus the demand for AMRS. Moreover, given that the knowledge on agricultural technology spills over and is a public good, AMRS providers may not have incentive to provide any trainings on such technologies. This would cause a “coordination failure” in the development of AMRS market.

To circumvent this problem, we introduce a people-private-public (PPP) partnership institution, called the “mechanical yard system” (Figure 1), in collaborating with both the private and public sectors in Bangladesh.

To solve this issue, promotion of sustainable agricultural mechanization has emerged as a policy response (Mano et al., 2020, **Agricultural Economics**). Since the ownership of agricultural machinery requires a lumpy investment that cannot be affordable by RPFs, a natural policy response was the provision of machinery to agricultural cooperatives. However, due to the poor performance of public mechanization provisions in the past, private sectors are expected to play an alternative role as providers of agricultural machinery rental services (AMRS) (Wang et al., 2016, **World Development**).

According to an **induced innovation theory** introduced by **Hayami and Ruttan (1971)**, the

### Scientific Research (B) (General) 2

[1. Research Objectives, Research Method, etc. (continued from the previous page)]

market of AMRS should be soon developed to substitute for labor in the face of the relative increase in agricultural wages. However, this has not happened in many parts of rural Bangladesh, despite the decreasing agricultural labor force and increasing real wages for rice production (a main staple food in the country). We hypothesize that both the demand and supply factors matter. From the demand side, farmers may not use machinery until they acquire enough knowledge about the profitability, which is determined by the rental price of machinery along with the adoption of other appropriate agronomic practices. From the supply side, private companies may be reluctant at least initially to provide machinery rental services if they are uncertain about the demand for AMRS by farmers. Even when some machine service providers enter the market, they may not necessarily pay due attention to appropriate agronomic practices and paddy environment, which in turn can decrease the profitability of farmers, and thus the demand for AMRS. On the contrary, if the demand increases beyond the capacity of the number of machines each village, coordination among farmers (e.g., rotation order to use the machinery) becomes difficult and then the entire system may eventually collapse.

In such a backdrop, the key scientific question of our research is how to promote the development of AMRS market. In particular, we seek the way to coordinate RPFs and private sector AMRS providers. We will introduce an innovative peoples-private-public (PPP) partnership institution, called “mechanical yard system” (**Figure 1**), and formally examine its effectiveness. 6



2021-22

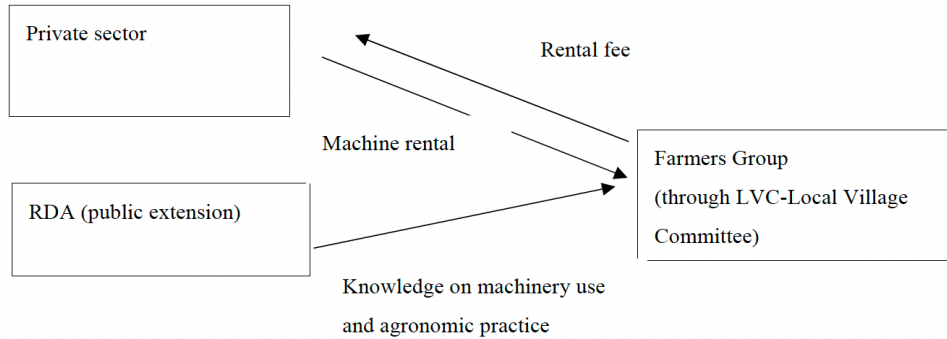


Figure 1: The Structure of “Mechanical Yard System”

In this “Mechanical Yard System”, local private service providers, including both individuals and small-or medium-scale enterprises, provide machinery rental services to the farmers to reduce labor demand of rice production. Rural Development Academy (RDA) provides technical training to farmers groups, including how to use machinery. Since our previous study reveals that improved agronomic practices are complements of the machinery use (Mano et al., 2020), RDA also provides training on those improved practices, such as rotation order to use the transplanting machine along with seedling preparation, weeding and water control methods, to facilitate the intensification of rice production. Farmers group decides to adopt improved management practices as well as agricultural machinery and will pay rental fee if they adopt them.

The “mechanical yard system” is expected to solve the coordination failure arising from the low demand for AMRS due to the lack of knowledge of farmers and the low supply of AMRS due to the uncertainty on demand for AMRS. The public sector bridges the gap by providing a necessary agricultural training to

### Scientific Research (B) (General) 3

[1. Research Objectives, Research Method, etc. (continued from the previous page)]

improve the knowledge and profitability of machinery use. We expect to see relaxing demand and supply constraints provide win-win relationships among all stakeholders (for example, farmers, transplanting machine service providers, tractor operators, irrigation operators, etc.). However, the increased demand for machinery, if

2020-21

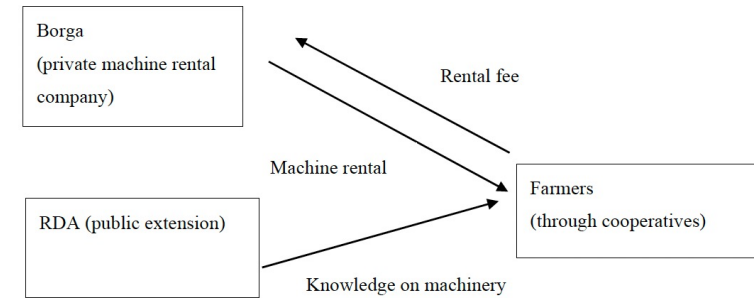


Figure 1: The Structure of “Mechanical Yard System”

Specifically, the important questions to be investigated include:

- 1) Can “mechanical yard system” increase the demand for agricultural machinery rental service?
- 2) Can “mechanical yard system” reduce the production cost and increase the profitability of rice farming and income of resource poor farmers?
- 3) Can “mechanical yard system” provide enough profit for the private rental machinery service providers?
- 4) Does “mechanical yard system” generate any general equilibrium in local agricultural inputs (especially wages) and rice market?

### (2) The purpose, scientific significance, and originality of the research project

Our research is the first experimental study to explore the development pathway of the

### Scientific Research (B) (General) 3

[1. Research Objectives, Research Method, etc. (continued from the previous page)]

AMRS market in collaboration with a **private sector entity** (*Borga* limited – newly established private sector start-up with a vision to provide rental machinery services). *Borga* collaborates with a public sector organization (Rural Development Academy: RDA), which plays a major role in

constraints provide win-win relationships among all stakeholders (for example, farmers, transplanting machine service providers, tractor operators, irrigation operators, etc.). However, the increased demand for machinery, if realized, will initially decrease the market wages that will hamper the welfare of landless labor households. Subsequently, the further increase in the demand for machinery will increase its rental fees, and thus decrease farmers' profits. Therefore, it is also important to investigate the general equilibrium (GE) effects of the mechanical yard system.

We empirically examine those questions and hypothesizes using a large-scale randomized controlled trial (RCT) in Bangladesh. The agricultural technology we investigate is a set of rice management practices, called the System of Rice Intensification (SRI). Our previous studies reveal that SRI is a yield-enhancing, but labor-using technology (Takahashi and Barrett, 2014; Nakano et al., 2018; Barrett et al., 2021). As such, the demand for agricultural machinery and contributions of this system to farmers' welfare improvement are potentially large.

More specifically, the critical questions to be investigated include:

- 1) Can “mechanical yard system” increase farmers knowledge, change social norms and practice for technology adoption, and the demand for agricultural machinery rental service?
- 2) Can “mechanical yard system” reduce the production cost and increase the profitability of rice farming and income of RPFs?
- 3) Can “mechanical yard system” provide enough profit for the private service providers?
- 4) Does “mechanical yard system” generate any general equilibrium effect in local agricultural inputs (especially wages) and rice market?

## (2) Purpose, scientific originality and creativity of the research project

Our research is the first experimental study to explore the development pathway of the AMRS market through a PPP partnership institution. This study would be complementary to and conducted along with our Kiban A project- 20H00075 titled “Why seemingly profitable technologies are not adopted: The evidence from large-scale randomized control trial”. In that Kiban A project, we investigate the impact of mechanized SRI (MSRI), which is developed as a solution for the labor-intensive feature of SRI. MSRI integrates primary SRI principles with a transplanting machine to reduce labor input. The largest difference between our Kiban A project and current project is that in Kiban A project, the machineries are provided by public organization, while in our current project, we will seek for the way to develop private market.

To the best of our knowledge, most experimental studies in development economics, including our previous studies, have focused exclusively on the role of the public sector in correcting market failure; little is

In this system, Borga provides machinery rental services to the farmers for transplanting, weeding, harvesting, etc. where farmers are in need (Figure 1). RDA provides agricultural training on the knowledge on SRI and agricultural mechanization. After obtaining knowledge, farmers are expected to rent agricultural machinery services from Borga. All the activities are supported by Deep Tube wells cooperatives (DTWs) at each village, which help to effectively deliver rental services and water distribution at each phase of rice production, following a strict calendar schedule. “Mechanical yard system” is expected to solve the coordination failure, arising from the low demand for AMRS due to the lack of knowledge of farmers and from low supply of AMRS due to the uncertainty on demand for the private companies, by providing both knowledge and AMRS at the same time.

Although “mechanical yard system” can potentially be an effective tool to solve the coordination failure between farmers and private companies, it is an empirical question if this scheme works or not. For example, it is not clear to what extent Borga can successfully exploit coordination among RPFs to deliver its rental services, and how much demand for AMRS would be created by the agricultural training provided by RDA. Also, since the machinery use and improved knowledge of agronomic practice induce changes in the demand for other factor markets (e.g., labor and land) and output prices, it is uncertain whether this system can bring harmonized benefits to both farmers and the private service providers. **To the best of our knowledge, most experimental studies in development economics have so far focused exclusively on the role of the public sector to correct market failure; little is known about how to promote the coordination among PPP institutions. Our research will fill this significant knowledge gap by conducting a large scale RCT in Bangladesh.**

**From the academic point of view, this study aims to make following three major contributions:** **Firstly**, this study will provide first experimental evidence on institutional innovation for the development of AMRS which involves both private sector and farmers organizations. **Secondly**, estimating general equilibrium effects for predicting the social consequences of scaling up interventions will create new evidence that has not been fully validated in previous studies (a rare exception is **Burke et al., 2019, QJE**). **Thirdly**, this study would provide empirical evidence that RPFs can utilize machinery, as long as there is coordination between private rental service providers and farmers' demand. If this is the case, the results would challenge to the argument that only large farms deserve the mechanization investment (**Otsuka 2012, Presidential Address, 27th IAAE Conference**)—and its implications for division of labor and mechanization.<sup>18</sup>

[1. Research Objectives, Research Method, etc. (continued from the previous page)]  
demand machinery services) and private firms (who supply them). Secondly, estimating GE effects for predicting the social consequences of scaling up interventions will create new evidence that has not been fully validated in previous studies (a rare exception is Burke et al., 2019). Thirdly, this study would provide empirical evidence that RPFs can utilize machinery if there is coordination between local individual/private rental service providers and farmers. If this is the case, the results will challenge the argument that only large farms deserve the mechanization investment (Otsuka 2012)—and its implications for the division of labor and mechanization.

From the policy perspective, it is expected that this project will contribute to developing a system that will engage local individual/private operators and empower farmers' organizations and promote sustainable agricultural mechanization. It is also expected that the project will contribute to the increased income of farmers and individual/private companies through better agronomic practices. Thus, the project will directly contribute towards a number of sustainable development goals (SDGs), such as Goals 1 (No Poverty), 2 (Zero Hunger), 3(Good health and Wellbeing), 8(Decent Work and economic Growth), 10 (Reduced Inequality), 12 (Responsible consumption and production), 15 (life on land) and 16 (Peace, Justice and strong institution).

### **3) Applicant's research development leading to the conception of the present research proposal**

All investigators are interested in agricultural development in developing countries. PI Abdul Malek, has conducted several RCTs with BRAC (World Largest NGO) on SRI, agricultural microfinance, etc., among others, in Bangladesh. Co-Is Kazushi Takahashi and Yuko Nakano studied SRI in Indonesia and Tanzania, respectively, and other Co-Is Yoko Kijima and Yukichi Mano extensively studied agricultural technologies including mechanization. Therefore, we formed the team to investigate why seemingly profitable technologies (SRI and MSRI) are not adopted and developed Kiban (A)- 20H00075 which is now currently under implementation in Bangladesh. While doing so, we realized the importance of private sector involvement for the expansion of the market, and it is often pointed out that under-development of the market is a problem in developing countries. There are very few studies which examine how to overcome “coordination failure” for the development of the machineries market. That is the reason why we developed this project.

### **Related research trends in Japan and overseas and the positioning of this research in the field**

This study may challenge Otsuka (2012) and others that only large farms deserve the mechanization investment. Additionally, previous large scale RCT with BRAC on SRI, by Abdul Malek and others, settled intense debates around SRI as a tool for boosting rice productivity and farmers well-being (Barrette et al AJAE 2021, Fafchams et al WBER 2021 and JDE 2020) and offers a great deal of promise for agronomy in global south. Thus, until now, together with those RCT based studies, other studies (Sheehy et al. 2004, Field Crop Res; McDonald et al., 2006, Field Crop Res; Uphoff et al., 2016, Environments) on SRI, have mainly focused on

### **(3) What will be elucidated, and to what extent and how will it be pursued during the research period.**

This research will be implemented in parallel with another on-going project funded by Kakenhi (A)- 20H00075. In that project, we investigate the impact of mechanized SRI (MSRI), which is developed as a solution for labor intensive feature of SRI, including careful transplanting, weeding and water management. To reduce labor inputs but follow the original SRI principle, MSRI introduces a transplanting machine for wide-space with single seedling per hill. **The important deviation in the current project is that unlike the Kakenhi A, we collaborate with the private sector for the rental machinery service in this study, not only for transplanting, but also for harvesting, weeding and water management.** This will augment our understandings of whether the private-led, packaged rental mechanism can be a suitable alternative for the public-led rental services.

We implement the project at two phases as follows: **The first phase (FYI 2021-22):** (1-1) Baseline survey, (1-2) Training intervention, (1-3) Mechanical yard system intervention, (1-4) Follow-up survey, (1-5) Preliminary analysis on the demand and profitability of the machine yard system. The outcome of interest includes the profits of rice cultivation and the cost-effectiveness of different interventions across SRI, MSRI and mechanical yard. We will also compare the demand for AMRS between MSRI and mechanical yard intervention, using the **Becker–DeGroot–Marschak action method**. **The second phase (FYI 2023-24):** (2-1) Re-intervention, (2-2) Endline survey, (2-3) Analysis and write up drafts. Re-intervention is conducted to analyze the general equilibrium effects. We will add an experiment to promote the spread of the best option among MSRI, SRI, and mechanical yard. The choice of the best option mitigates the off-setting impacts of manual labor and mechanization of different treatment groups in that SRI tends to increase labor requirements, while MSRI and the mechanical yard decreases them. By unifying the treatment group into one, we can estimate the clean general equilibrium effects on wages. Additionally, **a modified version of measuring social forms** (Institute for Reproductive Health. 2019) will be used to estimate the degree of collaboration among farmers and PPP stakeholders.

### **Role-sharing between the Principal Investigator (PI) and the Co-I(s):**

In this research, in addition to the PI and co-investigators, Professor Christopher B. Barrett of Cornell University who has studied SRI for many years and has collaborated earlier with PI (Malek) and Co-I (Takahashi, who is PI for Kakenhi A- 20H00075) will participate as a research collaborator. PI is a

know A projects continues to investigate why SRI and MSRI as seemingly profitable technologies are not widely adopted, this project will create experimental evidence on institutional innovation for sustainable AMRS market.

**(4) What will be elucidated, and to what extent and how will it be pursued during the research period.**

To examine the effectiveness of the mechanical yard system, we will select a total of 50 villages and randomly allocate them into villages with the system and those without it. In order to estimate the GE effects, we will change the intensity of mechanical yard systems within a district (with an assumption that the GE effect will be larger in villages with higher intensification). We also include landless, agricultural wage-labor households in

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[1. Research Objectives, Research Method, etc. (continued from the previous page)]

our sample that are more likely to be affected by the changes in market wages. A number of 20 farm households and 5 landless households are randomly selected each village.

In Bangladesh, there are three rice cropping seasons: Boro (December/January–April/May), Aus (April–August), and Aman (July–November/December). Of those, in recent years, Boro becomes major contributor both in terms of productivity and total rice production, which is cultivated during the dry season using irrigation. Since SRI requires effective water controls, our experiments will target the Boro season.

We implement the project in two phases as follows: The first phase (FYI 2022-24): (1-1) Baseline survey, (1-2) Training intervention, (1-3) Mechanical yard system intervention, (1-4) Follow-up survey (1-5) Re-intervention to recap the essence of training. The second phase (FYI 2024-25): (2-1) End line survey, (2-2) Analysis and writing drafts. The outcome of interest includes farmers' knowledge, (gender disaggregated) social norms and practice, LVC members personality trait, knowledge and practice, farmers adoption and profits, private machine providers profits and the cost-benefits of the mechanical yard system. We implement regression analyses to identify the impact of the mechanical yard system. Because of the randomized design, we can expect that our regression analysis does not suffer serious endogeneity bias. We estimate not only the direct effect for farmers adopting the mechanical yard system, but also the indirect (spillover) effect for non-adopting neighbor farmers. By combining total effects to farmers and profitability to the private sector in the short-term (based on follow-up information) and mid-term (based on end line information), we will examine the cost-effectiveness of our intervention and propose relevant policies based on lessons learned.

**2. Research Development Leading to Conception of the Present Research Proposal, etc.**

In this column, descriptions should be given within 1 page, of (1) applicant's research history leading to the conception of this research proposal and its preparation status, and (2) domestic and overseas trends related to the proposed research and the positioning of this research in the relevant field.

**Background and preparation status of the idea of this research**

PI and CO-Is have been conducting similar researches in developing rural Asia and Africa and already made significant achievements to be listed in next section. PI Abdul Malek has been conducting several RCTs on SRI and microfinance in Bangladesh so far, and worked with government and international organizations. He also has close connection with Borga limited and RDA, who are in charge of technical training and implementation of the experiments. Abdul Malek developed the proposed mechanical yard intervention with an enlightened team of Borga limited during April–September 2020) by a regular weekly consultation at ZOOM meeting which is now under pilot in one rural village in Bangladesh. RDA earlier piloted MSRI which is already in plan for RCT experimentation at Kakenhi (A)- 20H00075. Through the meetings with both Borga limited and RDA, the importance of conducting an impact assessment on both MSRI and mechanical yard was confirmed, and representatives also promised to participate in and collaborate with the study. It was confirmed that RCT focused on mechanical yard with SRI could contribute to both academic and practical aspects especially to create effective institution and market development for machineries rental services.

In order to carry out RCT for mechanization, advanced cooperation with related organizations is required for the acquisition of machines and the implementation of experiments/related surveys. In this study, Both Borga limited and RDA already provided cooperation on RCT and survey implementation, and preparations have been made. Regarding household surveys, data collection will be outsourced to local counterparts such as companies, but the representatives have extensive research experience in Bangladesh, and have already considered organizations that can be outsourced. There is a track record of joint research between the representative and the Co-Is/collaborators, and it is expected that the use of their collaborative strengths will produce results with high social impact.

**Related research trends in Japan and overseas and the position of this research**

Our project will create first experimental evidence on institutional innovation for sustainable machineries rental services in developing countries. This study may challenge to Otsuka (2012) and others on the argument that only large farms deserve the mechanization investment. Additionally, SRI is a rice crop technology that has attracted international attention and has been studied from the viewpoint of agronomy and agroecconomics, including research teams at Cornell University and the

farmers adopting the mechanical yard system, but also the indirect (spillover) effect for non-adopting neighbor farmers. By combining total effects to farmers and profitability to the private sector in the short-term (based on follow-up information) and mid-term (based on end line information), we will examine the cost-effectiveness of our intervention and propose relevant policies based on lessons learned.

#### **5) Preparation status towards achievement of the purpose of the research project**

On behalf of study team, PI Abdul Malek, a Bangladeshi origin agriculture and development economist, who also worked with the public sector, well-known Universities/think tanks, and international NGO (BRAC) and also connected with Borga limited (a private sector start-up for machineries market in Bangladesh), discussed mechanical yard system at ZOOM meetings and has piloted in one rural village in Bangladesh during 2020-21. Following virtual communication at the neo-normal context of post-Covid 19 worlds, RDA, Borga limited, Socio-consultant Limited (SCL)-a well-known survey company, and LVCs already provided cooperation on RCT and survey implementation, and preparations have been made. Since we have already experienced to collaborate with RDA and SCL in our ongoing Kiban A project, we can expect to continuously draw necessary cooperation from them. We also accumulated knowledge of how to develop effective LVCs. As for the partnership with the private sector, we have repeatedly discussed with private firms including Borga limited about the potential cooperation for the introduction of mechanical yard systems and obtained their consents. Given that we can reduce implementation costs to some extent that overlap with our Kiban A projects (such as travel costs), there is little concern about feasibility in terms of monetary and manpower constraints.

#### **Role-sharing between the Principal Investigator (PI) and the Co-I(s):**

In this research, PI (Abdul Malek) with Co-I (Takahashi) will implement the project, taking a contribution from other Co-Is (Co-Is: Kijima, Mano, and Nakano) at different project stages- finalizing the experiments/survey instruments and survey set-up, quality control of the data, and research uptake activities. In addition, Professor Christopher B. Barrett of Cornell University, who has studied SRI for many years and has collaborated earlier with PI (Malek) and Co-I (Takahashi, who is PI for Kakenhi A) will participate as a research collaborator. Chris Barrett and other Co-Is will contribute more in generating scientific outputs for top-ranking journals.

## 2. Applicant's Ability to Conduct the Research and the Research Environment

Descriptions of (1) applicant's hitherto research activities, and (2) research environments including research facilities and equipment, research materials, etc. relevant to the conduct of the proposed research should be given within 2 pages to show the feasibility of the research plan by the applicant (PI) (and Co-I(s), if any).

If the applicant has taken leave of absence from research activity for some period (e.g. due to maternity and/or child-care), he/she may choose to write about it in "(1) applicant's hitherto research activities".

### (1) Past research activities

All investigators specialize in agriculture and development economics and have collected their own data for micro-empirical research in rural areas of Asia and Africa, including RCT based studies as summarized below.:

- In Bangladesh, RCT of SRI, of microfinance (credit for the poor) and distribution of solar lamps to study the effects on adoption and farmers profitability, human capital investment performance, and household income [1][2][3][4] [5][6] [9] [10] [13]
- Impact analyses of new varieties of NERICA rice, SRI, and other improved rice cultivation techniques on productivity and poverty reduction (Achievements [4] [7] [8] [10] [11] [14] [15] [16] [18] [19] [20] [21])
- Verification of the effects of agricultural technology training and its ripple effects (Achievements [1] [2] [5] [9] [10] [15] [18])
- On agricultural Mechanization, rural micro-enterprises/employment and intuitional innovation [18] [21] - [24]

### (2) Research environment

All investigators are working full-time at national universities. The research environment, such as facilities (research laboratories) and equipment (computers and statistical software) for conducting research, is generally in place. Following the virtual setting in the neo-normal context of the post-Covid 19 world, the required collaboration and project management with partners in Bangladesh has also been established. Abdul Malek is an Executive Committee member for the Asian Society for Agr. Economists (ASAE), Takahashi, and Kijima are also organizers of the monthly study group on development economics held at the GRIPS. It is expected that researchers inside and outside the research organization/in the region will be able to disseminate the study findings.

#### [Major Peer-reviewed works related to this research: The representative is double underlined, the Co-Is is single underlined]

1. Barrett, C., Islam, A., Malek, M.A., Pakrashi, D. and Ruthbah, U. (2021). Experimental Evidence on Adoption and Impact of the System of Rice Intensification. American Journal of Agricultural Economics. Accepted at 2021/06/09 and published 04 July 2021. <https://doi.org/10.1111/ajae.12245>.
2. Fafchamps, M., Islam, A., Malek, M.A. and Pakrashi, D. (2021). Mobilizing P2P Diffusion for New Agricultural Practices: Experimental Evidence from Bangladesh. The World Bank Economic Review. 1146009, <https://doi.org/10.1093/wber/lhab009>.
3. Fafchamps, M., Islam, A., Malek, M.A., & Pakrashi, D. (2020). Can referral improve targeting? Evidence from an

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If the applicant has taken leave of absence from research activity for some period (e.g. due to maternity and/or child-care), he/she may choose to write about it in "(1) applicant's hitherto research activities".

### (1) Past research activities

PI (Abdul Malek) and the Co-Is (Takahashi, Kijima, Mano, and Nakano) both specialize in agriculture and development economics, and have so far collected their own data for micro-empirical research in rural areas of Asia and Africa including RCT based studies as summarized below.:

- In Bangladesh, RCT of SRI, of microfinance (credit for the poor) and distribution of solar lamps to study the effects on adoption and farmers profitability, human capital investment performance, and household income [1][2] [3][4] [7] [8] [11]
- Impact analyses of new varieties of NERICA rice, SRI, and other improved rice cultivation techniques on productivity and poverty reduction (Achievements [2] [5] [6] [8] [9] [12] [13] [14] [15] [17] [18] [19] [20])
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- On agricultural Mechanization, rural micro-enterprises/employment and intuitional innovation ([21] - [24])

### (2) Research environment

Both PI and Co-Is are working full-time at national universities, and the research environment, such as facilities (research laboratories) and equipment (computers and statistical software) for conducting research is generally in place. Abdul Malek is an Executive Committee member for Asian Society for Agr. Economists (ASAE), Takahashi and Kijima are also organizers of the monthly study group on development economics held at the National Graduate Institute for Policy Studies, and it is expected that researchers inside and outside the research organization/in the region will be able to disseminate the study findings.

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1. Fafchamps, M., Islam, A., Malek, M.A., & Pakrashi, D. (2020). Can referral improve targeting? Evidence from an agricultural training experiment. Journal of Development Economics, 144, 102436.
2. Takahashi, Kazushi, Rie Muraoka, and Keijiro Otsuka. Technology Adoption, Impact, and Extension in Developing Countries' Agriculture: A Review of the Recent Literature. Forthcoming in Agricultural Economics.
3. Kudo, Yuya, Abu Shonchoy, and Kazushi Takahashi. (2019). Short-term Impacts of Solar Lanterns on Child Health: Experimental Evidence from Bangladesh. Journal of Development Studies, 55(11): pp.2329-2346.
4. Kudo, Yuya, Abu Shonchoy, and Kazushi Takahashi. (2019). Can Solar Lanterns Improve Youth Academic Performance? Experimental Evidence from Bangladesh. World Bank Economic Review, 33(2): pp.436-460.
5. Takahashi, Kazushi, Yukichi Mano, and Keijiro Otsuka. (2019). Learning from Experts and Peer Farmers about Rice Production: Experimental Evidence from Cote d'Ivoire. World Development, 122: 157-169.
6. Kijima, Yoko (2019). Farmers' Risk Preferences and Rice Production: Experimental and Panel Data Evidence from

## Submission/success with Non-Kakenhi/Side job Projects (2017-2022)

- Kyoto University Hakubi Project to Foster and Support Young Researchers
- Research Institute for Humanity and Nature (RIHN)
- Waseda Institute for Advanced Study
- Grant-in-Aid for Early-Career Scientists
- **The Supporting Program for Interaction-Based Initiative Team Studies at Kyoto University AWARD YEAR 2018 (SPIRITS 2018)**
- Swedish Research Council on Development Research
- USAID Feed the Future Innovation Lab for Markets, Risk and Resilience
- **Challenges and Opportunities of Population Aging in Asia: Improving Data and Analysis for Healthy and Productive Aging (ADB TA-6556 REG). 2021/03~08).**
- **Impacts of Covid 19 on Rural Households in Bangladesh. Funded by ADBI (2020/04-2021/03).**

# Let`s sum-up (based on my experiences)

- Conduct your personal SWOT analyses and set your strategies accordingly
- Collaborate with Japanese Investigators as much as possible across the fields/Universities/Research Centers
- Don`t be concerned about writing the proposal in the Japanese language if you are not fully proficient instead write in good English
- Write/discuss your brief ideas with potential investigators and international collaborators well in-advanced and **decide your team**
- Let's decide your category and field, and check the format well in-advanced
- Share your proposal as per the format with the team of investigators well in-advanced, get feedback, revise and **decide your role (as PI/Co-I) in consultation with your team**

- Please continue submission to JSPS or other sources every year and revise based on the reviewer`s feedback for the following year.

- **Final remarks:** Only excellent proposals will get the funding, so prepare yourself efficiently.



Thank you very much