Chairman Oshibe : Thank you, Ms. Takada. I hope everybody is refreshed by coffee and please stay here until lunchtime. Now I would like to open the session A, the theme of this session is "Researches for Climate-Resilient and Sustainable Agriculture." My name is Oshibe, Director of Environment and Natural Resources Management Program in JIRCAS, and he is Dr. Nagumo, Project Leader of Africa Savanna Agriculture Project in our program. He will share the latter half of this session. Our program has been conducting research works to cope with grand change through sustainable resource management for five years from year 2011. The resources that we targeted are five resources, genetic resources, nitrogen, carbon, water, and soil. And we conduct—we carried out projects in Africa, Latin America, and Pacific Island and resulted in many tangible outputs. In the first half part of this session some of outputs of projects carried out in Asia will be introduced. In order to cope with global ground change, management of soil and water becomes a more and more important issue. We are making plans for research work for the next five years from the year 2016 now. Best one is a viewpoint of protection of environmental degradation and stabilization of agriculture in Asia and Africa. In the latter half part of this session we can get a variable instance and information to consider the plan.

Now I would like to move to the first part of this session. The speaker is Dr. Yasukazu Hosen. He is the Leader of Climate Change Project in our program. He's a soil scientist. He was awarded a doctorate degree by the University of Tokyo, and he has experience in working in the International Rice Research Institute IRRI and also in the Ministry of Agriculture Forestry and Fishery of Japan. The title is "To Establish an Agricultural System Which Harmonizes Human Life With the Environment Through Smart Use of Rural Resources in a Regional Environment ." Dr. Hosen, ready to start? Please.

Dr. Yasukazu Hosen : Thank you very much, Mr. Chairman, and still good morning, ladies and gentlemen. I will start. Today I will pick up an activity of JIRCAS being conducted in Vietnam, to discuss an agricultural system, which harmonizes human life with the environment through the smart use of rural resources in a regional environment. JIRCAS is not very big institute, but we are acting worldwide. We have many collaborative research works. And to conduct research work we have research programs and projects. We have four research programs and many, about 20, research projects. And one of them is the development of agricultural technologies in developing countries to respond to climate change. We simply say Climate Change Project, usually.

I will introduce the some of the activities in the project. In that project, we have impact evaluation activities, climate change adaptation activities, and also mitigation activities, mainly in Asian countries but also in South America—in Africa also. And today, in the mitigation field, I will introduce three activities in Vietnam, in the Mekong Delta. In Vietnam, the proportion of agricultural greenhouse gas emissions is very high, especially with rice cultivation. This is about half of agricultural greenhouse gas emissions and also methane emissions from ruminants like cattle in the livestock industry. This percentage is not very high at present but is now dramatically increasing.

And our target place is in the Mekong Delta. We are currently working in three locations, two provinces, and one city. The first topic is greenhouse gas emission reduction from rice paddies.

This is our main experimental field. We are monitoring greenhouse gas emissions from that field. In the Mekong Delta we have very huge rice cropping areas.

In this figure the red-colored place is the rice cropping area in the spring/summer rice cropping season in 2015 of this year. And Mekong Delta produces 21 million tons of rough rice and this amount is equivalent to double the total amount of Japanese production. And it also produces a bit more rice straw.

Again the same photograph, this is a cropping season and this is the same place but under flooding conditions. Like this we have a one or two month flood season in central Mekong Delta and eventually after that we will have continuously, three croppings. In between the croppings we have only around one week preparation. So this means throughout a year the field is completely flooded and as you may know the greenhouse gas, one of the greenhouse gasses emitted from paddy fields is methane.

This can be produced much more when the soil is covered with water, when the soil is in reduced conditions. But in the Mekong Delta conditions, we can easily guess the methane emission should be high, but if we can reduce the use of water and supply much more oxygen to the field, if we can do that the methane emission can be reduced.

So, we adapted water a saving technology called “Alternate Wetting and Drying.” Under the continuous flooding, conditions normally we keep the flood water—standing water—on the soil surface, but under AWD management—water management—even after standing water disappears until the field water reaches to some extent, the deep soil, we will not apply any water. In our case, only when the field water reaches 15 centimeters below the soil surface, do we apply irrigation water. This is not very severe water stress, so normally we can reduce methane emissions, but yield can be kept in the traditional, conventional level.

But anyway, in the Mekong Delta, we have plenty of water, reaching water, but why water saving? As mentioned, this is to reduce methane emissions. This is most important target for us, but, at the same time, to reduce fuel cost for irrigation. They are normally using diesel for this, and we slightly guessed, here’s a slight possibility for the increase of rice yield itself. Because as mentioned that in rice fields in the Mekong Delta, the soil is completely covered with water throughout a year so that is also not so good for rice because oxygen is not enough and some harmful gasses will be produced in the soil, so we also slightly expected the yield increase.

This is our field, a very long field. Each farmer has such a long field because the water can be used from this canal, so each farmer has such a small area facing the canal and can then irrigate. This is a Google map and they already captured our field plots. We have a total of 18 plots here.

And we tested water conditions and also rice straw application. Okay, this is one of the results from the irrigation water. The blue color shows continuous flooding, similar to farmers’ conventional way, and the red colored one AWD, alternate wetting and drying—a kind of water saving technology.

This is a summary of three year experiment and, as a result we were able to reduce water use more than 30 percent. And most important result was reduction of greenhouse gas emissions. And actually it also depended on the straw application and also for example the green color shows, after rice cultivation, this is how rice straw effect the total amount from the rice product, but the most important thing is methane emission from paddy fields, and those emissions were able to be mitigated like this. Half or more we are able to be reduced.

And additionally this is really very nice result for us, well we became very happy, the yield increased. There was not only water use reduction but also greenhouse gas emission reduction. We successfully increased the yield.

This is a very special case, because the paddy field in the Mekong Delta was completely covered with water, and they need some more oxygen, and we added some oxygen by using that water saving technology. So this is a simple slide. By introducing alternate wetting and drying water saving irrigation technology, of course we reduce irrigation costs, and also reduce greenhouse gas emissions, but also we achieve high yield in that region. I think this is, the yield is a very important factor to disseminate our results because even if this technology is very effective for a global environment, if no merit for farmers they then won’t do that so we have those three good results, so I believe the farmers in the Mekong Delta can use this technology.

And the second topic is about mitigation of methane emissions from beef cattle.

We are trying to use locally available biomass resources as feed for beef cattle, but such local biomass normally produces very huge amount at once so we need some technology how to keep that biomass in available conditions. For that we developed fermented TMR, this is well-balanced forage with higher storage quality. And we tested how much methane was emitted from the beef cattle.

This is a picture of that. We made fermented TMR like this and there are the results. The blue color is one of the conventional feeds for cattle and this is our developed fermented TMR. The methane emissions per day were not very much different between the two treatments but the average body weight gain per day very much increased by fermented TMR.

As a result the methane emissions per one kilogram of body weight gain became much, much smaller than the conventional feeding.

The third topic, this is also mitigation measures about the biogas digester.

This is a simple diagram of the biogas digester system. We use livestock manure as a material of the methane

and in this kind of tube in the ground we add manure every day and the methane gas is gradually generated, that gas will be stored like this, and then mainly used for cooking for farmers.

This is a clean development mechanism project conducted in the three districts in Can Tho city. In this project, we introduce 1,000 units and we got more than 1,000 tons of carbon dioxide reduction per year.

And this project was registered with the UN, United Nations, and this became the first biogas CDM project which directly benefits low income households as well as the environment in Vietnam.

And after registering the project, we actually got the carbon credit this year in June. To get a carbon credit, of course, we need to monitor the activity of the project and this is one of the results of the project monitoring.

And more than 80 percent of households use the gas for longer than two hours a day. This means almost all the cooking fuel was used for 80 percent of farmers, but, at the same time, more than 4 percent of farmers did not use it. We also asked the reason why they don't use it, we found that—I'm sorry it's not easy to read—but absence of livestock. So at the beginning of project they had livestock but they lost the livestock because they were sold or died, something like this. This happens because our target farmers are very small farmers. So they have only a few, not so many, cattle or pigs so this happens. So how to do.

We also conducted this experiment. Normally we targeted just like pig dung or something but we tried to use some other very easily available local biomass like water hyacinth or including grasses on the ground and we got such results. The first time, the red color, the production rate was not so high, but after the second time, we were able to get very similar results from the pig dung. That means even if the farmers lost the livestock, we can use very easily available local biomass resources for this system.

The next challenge. As mentioned, we have developed each technology to some extent and achieved less greenhouse gas emissions from each activity. But if we can link up those three components in the same place, for example, if rice straw can be used for the fermented TMR, we don't need to use the feed from external systems. We can reduce it. And also if the excrement from cattle can be used for a biogas digester, there is less waste for the local environment and we can get fuel for farmers. And of course, if the waste water from the biogas digester system can be used as a fertilizer in paddy fields, we can reduce the waste, which means we can decrease the impact of such waste to the local environment.

Also, of course, we can use that waste for the rice field, and we can reduce fertilizer use. So the global environment is really important, and we have tried to reduce greenhouse gas emissions from the Mekong Delta. But, at the same time, the local environment is also very important, and we already have some hint from each activity. And farmers' interest, farmers' benefit, if they don't have any benefit from those activities, they don't participate. So our next challenge is to realize three at the same time at the same place to harmonize human life with the environment. And also, I believe, this makes the agriculture system very sustainable and also very resilient, and not only the agricultural system, but also the local system can become sustainable and resilient, I think. Thank you very much.

Chairman Oshibe : Thank you, Dr. Hosen. I think everybody in here could see your activities and output. Now I would like to open question and comment to the presentation. Please raise your hand who has a comment or question. Please. Dr. Hosen, your alternative wetting and drying method, AWD seems to be very smart method. And would you tell us the potential of AWD? Is there any possibility to apply AWD into the regions other than Mekong Delta?

Dr. Yasukazu Hosen : You mean just application with AWD itself?

Chairman Oshibe : Yeah.

Dr. Yasukazu Hosen : Okay. Originally that technology, AWD, was developed for water saving and some regions where they need to produce rice, but they don't have enough water—the usage is very high, I think. But the weak point of AWD is we need a good irrigation system. When the farmers need irrigation water, they should use it, otherwise it will decrease. So this is a normal way of using of AWD, but in our case this was a bit different from that. Normally the Mekong Delta has enough water for irrigation, but we introduced that to reduce methane emissions. So from that point of view I think in the other Delta regions in South-East Asia like Thailand or Myanmar, the climate is very similar in the same tropical savanna climate and they have

rainy season and dry season also. So I think they also have the potential to use, to introduce this technology. And also already triple rice cropping is conducted in places like Java or Bangladesh where the soil is very much submerged so if we introduce AWD the yield may be increased as same as in the Mekong Delta.

Chairman Oshibe : Okay, if there are no questions and comments, let's give a big hand to Dr. Hosen. Now Dr. Nagumo, ready to share next part?

Chairman Nagumo : Thank you, Chairman. I'd like to introduce Dr. Niino, the next speaker. Dr. Niino holds a PhD in soil science from Texas A&M University and is a Land Management Officer of the Food and Agriculture Organization of the United Nation Regional Office for Asia and the Pacific. He is a key person promoting Conservation Agriculture in Asia and the Pacific region. What is Conservation Agriculture? Now he will present what it is. Dr. Niino, please, the floor is yours.

Dr. Yuji Niino : Good morning, ladies and gentlemen. Thank you for introductions. First I'd like to extend our sincere appreciation to the organizers, particularly JIRCAS through Dr. Nagumo, for giving us the opportunity to introduce the Conservation Agriculture to the audience. As been introduced I best in the Regional Office in Bangkok, Thailand. Conservation Agriculture nowadays is well known but I'd like to introduce the Conservation Agriculture in general in the context of climate change.

First I'd like to start with the slides. This is the forecast for El Niño events in 2015. The forecast was in last May. As you can see that the some East Pacific and in also the Japan indicated that's unusually wet or more rains were received due to this El Niño impacts. The rest, as you can see, the severe to moderate impacts on the droughts. Actually this was a prediction in May, but actually it's happening already and currently we are dispatching missions to those countries already severely affected including Indonesia, Papua New Guinea, Mongolia, and the Philippines. The El Niño events are really affecting the agriculture sector.

The first introduction this morning said that there is a dispute where the climate change is happening or not. There seems to be no ground for denying that the record and evidence show that the climate change is really happening, like, in the form of the floods, droughts, typhoons, and other phenomena. How this the climate change affects the agriculture sector, mainly the crop productions and also in the livestock pest and disease infestations and in other natural resources impacts like salinization and in also the significantly loss of soil resources due to the mainly the erosions.

The climate change is severely linked to this food and agriculture system. The extended dry periods, or droughts, which are not disasters but are different from other types of disaster like earthquakes or typhoons because the slow onset of the drought events, although you can notice, but hardly little actions are takento mitigate the drought impact.

The drought not affects agriculture but also the environment and in also the socio-economic impacts such as the dust also affecting transportations more recently. As I already mentioned that the extreme precipitation of rainfall severely affect this mainly the erosions. Those vulnerable areas, or the regions, from this extreme climate impact are those who are already in food insecure and also the smallholder famers many distribute in the South Asia and also in Africa.

As you may have heard, recently the term call a Climate-smart Agriculture. There's a debates on this term but we still, I think it's about four years ago, this concept or terminology was introduced just to cope with this changing climate in agriculture sectors. There are three folds of the factors. The first one is to increase or continue to sustain the production of food crops, which contribute to the food security. And at the same time we address the adaptations and also the mitigations.

A little in the definitions as written in here, the Climate-smart Agriculture is not the specific technique or method, but it's more like an overall the concept or approach as you can see here. So the Conservation Agriculture I'm talking about is in the part of an approach under the different scales.

Now I'd like to shift and then the focus little bit on the soil properties, soil and ecosystem functions or healthy soil. The Conservation Agriculture is based on the principles I'm going to introduce in a minute. The traditional agriculture globally our perception is that tilling soil, that's agriculture. But the soil is considered as a very fragile resource on the surface of earth, which is very vulnerable to erosions and other degradations, while the soil formation process takes say 1,000s or more than 1,000 years to just to form a one centimeter of

soil, so the tilling itself is already contradictory or contributing to soil degradation. So it is not sustainable.

So the Conservation Agriculture is based on three principles. Conservation Agriculture is not the specific methods or practices but it's more based on three principles. The first one is minimum soil disturbance or we call ideally no-till. The second principle is permanent soil cover of the soil surface, as much as possible. Continuously cover—or protect—the soil surface from the impact from rainfall, temperature, and other extremes. The third one is rotations. As I said at first, the principle of disturbance—avoiding a disturbance because the tillage itself has not only become susceptible to the soil erosions but also to oxidation. I think a previous speaker mentioned about the oxygen in the soil. The current phenomenon—maybe since particularly the green revolution—that tillage together with the chemical inputs reduced the returning or inputs of organic matter to the soil, so the soil carbon was significantly decreased—almost nothing left—and then therefore we heavily rely on the chemical inputs. But the soil carbon contributes various benefits particularly to the soil is physical, chemical, and also biological properties. So second, maintaining permanent soil cover is not going to protect but also provide a source of carbon to the microbial, biological activities. And of course the third one is rotation because of its benefits, because the Conservation Agriculture is somehow mimicking these natural ecosystem based processes. So Conservation Agriculture is based on three principles, but is not quite a new approach which is based on the already identified good agricultural practices such as integrating water management, nutrient management, pest management, and then many other good agricultural practices, for example, like sustainable mechanization and then also system of rice intensification, I think that some of the factors introduced by the previous speaker are included in this system.

However, the Conservation Agriculture is a not the panacea. It doesn't solve all the problems but it's based on this ecosystem or agro ecosystem based the agricultural systems.

Why we adopt the Conservation Agriculture? As I mentioned in the beginning that climate change is significantly affecting the agriculture sector, particularly erosions and the drought. And the cost of production is getting higher and higher because we rely on external inputs, but by adopting this Conservation Agriculture, we can balance or we can reduce the production and costs labor. And it also contributes, as I said, it contributes to the overall ecosystem services such as water quality and also atmospheric pollution, etc.

The impact would increase the yield particularly under stressed conditions with climate change, and now as I just said, that the less inputs, particularly fertilizers and pesticides, are required because the overall soil system will be improved. And then the labor cost, it's a 70 percent is a probably little exaggerating but we have a evidence of reduction of about 50 percent of the labor time of course with a cost so the return for the farmers will be increased. The previous speaker introduced water use efficiencies. The Conservation Agriculture would contribute through increases in soil organic carbon and also the soil physical propaties, particularly soil structures. As I already mentioned that the reducing of runoff or erosions and also the water evaporation from the surface of the soil which will improve the water use efficiency particularly under drought conditions.

This just illustrates the some data on how the specific Conservation Agriculture conditions affect the drought—address the drought conditions. If you have about one ton of residue on the soil surface, it will significantly reduce the runoff and increase the infiltration. Which is... because of a physical barrier as well as improved soil structure particularly on the surface of the soil increased the infiltration and also the nutrient use efficiency as well.

As I said, this is some evidence showing particularly the soil surface. Because the residue is kept on the soil surface, biological activities actually improved the soil physical property particularly on the soil surface.

The Conservation Agriculture has been recognized or practiced for almost last 40 years or so. But the significant increase in terms of area under the Conservation Agriculture increase was about 20 years ago.

I think the keynote speakers from JICA introduced the Cerrado in Brazil productions. I feel honored as I was also involved in this the Cerrado development project through JICA and I think one of success factors of the Cerrado project was adopting the Conservation Agriculture among other support provided through the project. So now about 125 to 130 million hectares of the agricultural area are practicing the Conservation Agriculture. It started actually in North America and then in South America particularly in Brazil. The large area of farmland is already shifting to Conservation Agriculture in North America, US and Canada, while in Brazil and in other Central and South American countries are expanding, quickly expanding in this area under Conservation Agriculture. While Central Asia and China are more recently adopting Conservation Agriculture, but it's very rapidly developing. Australia, of course, is one of the leading countries under Conservation

Agriculture. In Africa, I think some of our colleagues are already doing some activities—research—on Conservation Agriculture over in Africa. As I said, ongoing expansion of Conservation Agriculture was led by the mid to large scale farmers because of the easiness of a mechanization and also capital inputs. But the small holders are in Africa and Asia is rather restricted.

As a little bit introduced in the case of Asia, Asia as far as we recognize, Conservation Agriculture practices are more or less restricted to research and then also the demonstration level. But this not really taking place at the farmer's level yet. So, as I said, in South East Asia, and South Asia, there are many Conservation Agriculture projects—activities—but to expand to the farm level we have several projects in the regions ongoing, I want to introduce a few cases. The first one is a Timor-Leste. The title of this the project is "Enhancing Food and Nutrition Security and Reducing Disaster Risk through the Promotion of Conservation Agriculture." It was practiced for the last two years and we are going to continue for two more years. This is funded by USAID.

And Timor-Leste, as you may know, this is a new country and is very small, the capacity is very limited, but therefore it's more vulnerable to climate risks, particularly drought. So we are taking this good opportunity of having a project, we decided to introduce the adopting of Conservation Agriculture. The Timor-Leste is small and then the most of the country is on steep lands, the rain fed system so these are the areas where we are conducting projects for demonstrations and some extent of experiments. We are taking the participatory, or we call famer field school approach, to increase the awareness—let the farmers know what Conservation Agriculture is. And in the first two years the farmer's impact is quite significant. We introduced several methods like seedling. This is the seeder developed by the Chinese universities.

We also continue adopting the traditional system and at the same time introducing the new system, which mostly manual, but we really need to introduce the machinery or mechanization into the system. And one specific activity we are introducing in Timor-Leste is the as I said at the, we maintain the residue on the soil surface, often competes with the other agricultural activities like a livestock feed so they often we started this Conservation Agriculture but we couldn't leave the residue on the surface because animals came and then ate this leguminous cover crops. So to control this, this is an already existing traditional local system, a lot like a land tenure system, they call Tara-Bandu so we initiate the traditional system in to control this animal free-grazing which prevents this Conservation Agricultural introduction so that's very successful and then we consider this is one of the system to be adopted in other countries. As I said, this is two years, only two years and this is not really a scientific research program, so as you can see this is not really a scientifically proven data but I just wanted to show some impacts, is ve… is very much is very much the Conservation Agriculture did not really improved the yield except the few cases but this is only two years result so I won't conclude that this is very beneficial but I want you to get your attention on this, the labor savings. As you can see all these sites uniformly showing that they are using the labor time into half. This is the key component of Conservation Agriculture farmers appreciate. If you have a chance please look at this the website, it's on the YouTube we prepare this the video how the farmers appreciate then make differences adopting this Conservation Agriculture practices.

Now in Indonesia we are doing in three provinces or three islands. But Indonesia somehow we introduced a different approach, this methodology is actually introduced in African environment, we call the planting hoes also the strips. This is not a commonly practiced system, but the soil, like in Africa and then also areas in Indonesia, the soil fertility is very low so you really cannot start this Conservation Agriculture and then shows the farmers the differences of adopting Conservation Agriculture.

So we take this approach and then putting the manuals into the hoes and then ditches in the rips so the farmers started observe the immediate impact of Conservation Agriculture. Of course we will shift to these proper Conservation Agriculture systems. Just to show that the cases in Indonesia resulting the impact of Conservation Agriculture is quite significant. This is the control and the old methods. Conservation Agriculture practically doubled the yield.

So very briefly the cases in Africa the FAO's project engaged in these countries and in many others including in Ghana in the past also. But all uniformly showing the impact or benefits of a Conservation Agriculture. Runoff was reduced and then the water infiltration has increased. Economic benefits of adopting Conservation Agriculture are quite remarkable. However with this system in Africa still requires a lot of labor because it's digging holes and the rippings so we need to address eventually to this whether it's mechanization or more an improved system in the Africa, also in the Indonesia.

Many cases already in Africa have been documented, we have manuals, methodologies, and even the Conservation Agriculture strategies, I think JIRCAS was also engaged in these activities.

So just to quickly summarize my presentation, Conservation Agriculture being discussed, still being discussed in contradictory or negative manners. There are questions. But we often say that Conservation Agriculture is not the solution but it's more an approach or a concept they call. And the local adaptation, I think a previous introductory this morning said very clearly that no methods are applicable uniformly, but we really need to identify the very specific—site specific—methods because it's the food crops the cereals grown are different, varieties are different, growing climate conditions. And then of course the farmer size and economic status are all different so we really need to identify that the system which fits into this the current status of farmers, the needs to see the overall benefits of climate change adaptations.

So I like to highlight here that Conservation Agriculture, we really need to understand that the concept of a Conservation Agriculture based on the three principles because as I said that good agricultural practices have been practiced and then introduced already and then the farmers make question that what's new. So they continue that the previous perception or understanding Conservation Agriculture is not really leading to the total Conservation Agriculture development.

Okay, so what we need to do to promote the scaling up of Conservation Agriculture in the region as well as in the global scale, we need to increase the investment in sustainable agriculture practices, particularly not only in the public sector but in the private sector because mechanization is involved and the seed, the improved seed and the genetic resources being emphasize that we really need to identify either it's a local or varieties or introduced variety, which suite the needs of a farming system in the specific sites. And then of course we need to influence the politician or decision makers so we need really clear understandable policies and regulatory frameworks. Of course we need to enhance, improve, or increase the research activities and the learning, and then the knowledge sharing on Conservation Agriculture practices in overall steps and the stages.

I think it's going to be a repeating a little bit but mechanization in different scale is really needed because one of a constraints why Conservation Agriculture is not taking place particularly like in South East and in South Asia because it's the availability of a machineries and then also the cover crops and other inputs. So I need to conclude this, we need to really integrate and coordinate overall initiatives, research, the policy makings and then also the information sharing, education, but the in one word we really need to increase the advocacy on Conservation Agriculture particularly in this opportunity of climate change or more El Niño events.

In 2013, we established to promote this Conservation Agriculture in the Asia and Pacific region, we established the alliance and network which could engage not only the government public sectors but also the private sectors, research institute, university, and academy. The current sector is best in China and we want to promote this movement rather quickly.

In conclusion, Conservation Agriculture is not the whole solution but will contribute to climate change adaptation, mitigation, and the food security in overall. Just last one word, 2015 is a special year, I think the previous speaker has mentioned that 2015 is, as you all may know, the International Year of Soils which would be concluding in a few months. In this month, we celebrated the 70 anniversary of the FAO establishment. Okay, just to share the information and I thank you very much.

Chairman Nagumo : Thank you, Dr. Niino. It was a very powerful presentation. Any question? Maybe time's passing so maybe one question if you have. Anything? Okay, I'd like to ask you one question. Among the world, the promotion of conservation agriculture maybe for example United States, South America, large scale farming when it where adopted but for how about your homeland, Asia? How is it going promoting to promote now?

Dr. Yuji Niino : You mean the approach we are trying to improve because as I said at the conservation, agriculture approach is the only solution to sustain the productivity and then conserve natural resources so the we approach the different level. The policy level that a this network or alliance contribute by engaging the public sectors, particularly the government, so raising awareness and then also create this sort of a not only awareness but the system or the framework they are going to introduce conservation agriculture to replace the conventional farming system. In the same time as I said that the involving academics research institutions and then also the private sector, of course research is needed it, so the national level research institute or government research institutions are actually jointly conducting a project to actually to verify and

then produce the data that the really the conservation agriculture makes sense. Also the private sectors as I said that because it's mechanization the various levels of mechanization are required, particularly in South East Asia, South Asia, we don't really need large scale machinery. But, in South East Asia more like a small scale machineries machinery like tool tractors so Bangladesh, India, and in China, they are leading sort of a developing the two-wheel tractor base or four-wheel tractor but the small size the direct seed planters so this is a very critical development. We are emphasizing and try to work with this private sectors in China, and then a we some of the machines I have shown here is actually introduced from China as well as from Bangladesh.

Chairman Nagumo : Okay, thank you very much. So let's give a big hand to Dr. Niino, thank you very much.

Chairman Oshibe : I'm convinced that presentation by Dr. Hosen and Dr. Niino have provided research for climate resilience and sustainable agriculture in Asia and Africa. Now I close this session. Please give big applause to the excellent two speakers. Thank you very much.