“Achievement of “Society 5.0” in agri-sector through its enhancement of machinery, facility and farm management system”

Review Report

General Comments of the Evaluation Committee

The research programs presented to the reviewer focused on the realization of Society 5.0 and are well organized. The scope covers the development of machinery for use in the open field and in the greenhouse. It includes research on automation, robotics (including electronic communications), mechanization in large-scale fields, testing of machinery, small-scale precision farming, and harvest prediction. The quality ranges from very good to fair.

1) What needs further work is the strengthening of the connection between the elements of the "machine", the "interaction between crops and machines", "cultivation", "crop management," and the "environment". In particular, few studies focus on environmental conservation. In the agricultural sector, the proper management of the application of chemicals contributes to improving both working conditions and product quality. The safe use of agricultural chemicals and fertilizers, as well as any countermeasures against water and soil pollution, are currently big issues in the agricultural sector.
2) In smart agriculture, optimal control and management of crop production is the goal. This requires multidisciplinary and cross-sectoral expertise. Agricultural machinery is an important tool here. Robots are indeed capable of doing good work; however, they still require the presence of a skilled worker whom the robot emulates. Farming is decision-based work. Researchers do not necessarily understand the situations farmers have to deal with, in order to things properly and concurrently. Research on the optimization of the situations confronting farmers is needed. Agriculture cannot grow without a healthy rural society. While this program focuses on agriculture-related industries, it is also important to develop technologies to support social life in rural areas. IAM can deepen and strengthen interaction between technology and crops through focusing on the automation and robotics expertise acquired to date in the crop production process itself. This highlights the importance of linking machine-based system management and the optimization of crop production. This requires focusing on the integration of automation and crop production management systems rather than on the automation of the machines alone.
3) Appropriate national policies, such as the extending of subsidies for young farmers, may address labor shortages in Japan. Foreign countries with similar policies also enjoy the same beneficial results. Young generations are familiar with the use of new technologies and will

help speed up the innovation process.

4) Therefore, all the institutes in NARO should be involved in this project to realize the smart agriculture that Society 5. 0 is aiming to achieve, through strengthening collaboration between IAMs, other internal NARO institutes, or other research institutes.

NARO Response to the Comments of the Evaluation Committee

1) We have been working on technology development for reducing usage of chemical substances (pesticides, fertilizers, etc.), such as spot application using data of crop monitoring by drones and yield map, development of smart agricultural technology for variable rate fertilization, and standardization of pest control by drones. In addition, research and development of weeding robots using mechanical weeding technology without pesticides is also being carried out. In the next step, further efforts will be made to evaluation method and reduction technology to environment from agricultural products, farmland, farms, such as developing technologies to reduce drift during spraying of pesticides, prevent penetration of chemical substances into groundwater. Then we will consider including the technologies on "reducing environmental load" into our R&D roadmap.
2) In order to respond the consumers' consciousness for healthy and/or safe foods, building a "smart food value chain" is indispensable, which strengthen the linkage between farmers and consumers utilizing "information-attached agricultural products". Given the situation, we will tackle further sophistication of smart-agriculture technologies which achieves "reduced environmental load", "handling consumers' demand" and "improved productivity & reduced production costs" simultaneously. We will take on the development of "group management method of small robotic agricultural machines suitable for the scale of individual farm management" utilizing the advanced ICT and/or robotic technologies as well.
3) In collaboration with the Ministry of Agriculture, Forestry and Fisheries, we are now planning to have a system for introducing smart agriculture to students at prefectural agricultural college. In addition to this, a political support to young people's entry to farming and an education system related to farm management and safe farming will be important.
4) We will continue to strengthen collaboration of R&Ds with different institutes both inside and outside NARO.

Section 1: R&Ds which achieve the precision farming and quality farm produce

Comments of the Evaluation Committee

Focus of this Section is on labor issues and work efficiency. Environmental conservation and rural revitalization should also be considered for future research. The proper and controlled use of chemicals can be very helpful to gain better work conditions and improved products.

1) The target of Section 1-1 should be expanded to upland farming. Most upland crops are produced in hillside farming with ridges and furrows. Machine turning at the border of a field and machine stability are challenging tasks.
2) The 1-1 Project can be expanded to collection and utilization of big data from robotic tractors.
3) Although GNSS is an important and critical tool for robotic tractors, the signals from the GNSS are not always reliable. Further research is needed to achieve defect-free geographic information collection before the distribution of machines.

NARO Response to the Comments of the Evaluation Committee

1) Research on smart technology development in upland farming, horticulture, and orchards has already shifted from technology development of "smart rice production." At the entrance between farm roads and fields, especially in the case of paddy fields, there is likely to be a slope. This is typically constructed from dirt and sand and may have deteriorated with age, causing machines to tip over and fall. We recognize that it is necessary to develop a proper infrastructure to safe and efficient specifications in order to achieve fully automated driving robots.
2) We recognize that it is necessary to make active use of big data and AI.
3) We are currently developing a dynamic path algorithm.

Project 1-1 Robot technology and map-based precision farming for tice cultivation

Rating and Comments of the Evaluation Committee

This project meets the ambitions of Society 5.0 because the development of smart-farm systems, such as automated rice transplanters or direct-seeding systems etc., is vital for Society 5.0. This project has a clear purpose and is well designed, focusing on paddy farming, where safety issues associated with the use of unmanned machines have also been considered. As smart agricultural machines have been developed for commercial use, their distribution to farmers will be accelerated along with progress in the consolidation of farmland. Several recommendations and suggestions to the project are listed below.

1) Smart farming should be made more advanced through its continued integration with existing technologies. For example, ISOBUS as a dialogue protocol between a tractor and its smart implements.
2) Considerations for the environment should be more focused. Research on the appropriate or

reduced use of chemicals, such as pesticides and chemical fertilizers (in particular nitrogen fertilizers), will not only contribute to sustainable agriculture through contributions to environmental protection but will also result in the improved management of individual farmers. The field data collected by robotic agricultural machines can be used as the basis for support of environmentally friendly agriculture.

3) Sufficient time should be allocated to develop technologies applicable to hilly and mountainous areas.
4) It is useful to provide farmers with "Guidelines for best utilizing Smart Agricultural Machines."
5) Full exploitation of the potential of robot technology also implies that the farming-concept must be adapted. Not every farmer will be an owner of a full robotic system or can be a specialist in the operation and maintenance of such equipment.
6) Shared use of such equipment and shared responsibility for keeping it operational must be considered.
7) Training for operators and for farmers must be organized either by IAM or by the manufacturers.
8) Pest control includes weed control. There is a world-wide tendency to explore mechanical weed control wherever possible or to have precision weed controls.
9) Since the robotic systems collect a lot of data about the crops in the fields as well as the crop's response to treatment, research is required to fully explore this data for smart farming in the context of Society 5.0.

The rating is: **S – high quality and no revision needed.**

NARO Response to the Comments of the Evaluation Committee

1) For the full-scale implementation of smart-farm machines, it is necessary to construct an advanced operating system to automatically manage robots transferring between fields, loading seeds, fertilizer, and pesticides into a bin and change the machine implements. In addition, we believe that more sophisticated precision agriculture will be realized by sharing information and better integration between tractors and robots. We would like to continue our research while also considering the standardization of information and communication technology.
2) We have been working on technologies for reducing the usage of chemical substances (pesticides, fertilizers, etc.), such as spot applications using crop monitoring data from drones and yield maps, development of smart agricultural technology for variable-rate fertilization, and standardization of pest control using drones. In addition, the research and development of weeding robots using mechanical weeding technology without pesticides is also being conducted. In the future, efforts will be made to further improve evaluation methods and

reduction technology for agricultural products, farms, and farmlands, such as the development of technologies to reduce drift during the spraying of pesticides to prevent the penetration of chemical substances into groundwater.

3) We have already begun full-scale development of various relatively small smart technologies for hilly and mountainous areas, including the development of specialized weeding robots for slopes, and we will continue to promote them in the future.

4) In addition to formulating guidelines for ensuring safety—for introduction under the leadership of the government—the preparation of manuals for the use of smart-farm machinery and systems is underway. At present, demonstration tests are being conducted by introducing smart-farm machinery and systems in packages at production sites throughout Japan, as national projects. Based on the findings obtained through these projects, manuals are scheduled to be compiled outlining the conditions for the introduction of smart-farm machinery, their correct scale, and the most efficient operating methods.

5) Smart-farm machinery and systems, including robots, are extremely effective tools in constructing future agricultural production systems; however, we believe that they should be just an option for farmers.

6) As for introducing agricultural robots, it is appropriate to assume large-scale production corporations in the flat regions. To broaden the use of agricultural robots, it will be necessary to consider measures such as joint use and rental use.

7) NARO experts (mainly IAM staff) are giving technical training to farmers and others, and at the same time, specialist training and information are being provided to local agricultural technical instructors such as extension workers or cooperative staff. In addition, teaching curriculums which include an introduction to robots for users has been provided by manufacturers.

8) The development of technology for physical weeding robots to be used in paddy fields and upland fields is in progress in Japan.

9) We recognize that the challenges for smart agriculture lie in the utilization of sensors and data and that it is necessary to make active use of big data and artificial intelligence (AI).

Project 1-2 ICT and agricultural mechanization for upland farming in Hokkaido

Rating and Comments of the Evaluation Committee

The objective of this project meets the ambitions of Society 5.0, as it aims to establish a sustainable rotation system for high-profit agriculture in Hokkaido, under its specific climate conditions, through the application of image analysis techniques in the agricultural field. By optimizing the harvesting time of wheat through image analysis of the field, improvements in the quality of harvested wheat and a reduction in their drying costs have been realized. The study on soil-frost control techniques for potatoes showed good results as did the image analysis system for the detection of virus infected potatoes. The optimization and rationalization of cultivation practices in large-scale fields in Hokkaido are possible through the introduction of new technologies such as high-performance smart-farming machines. Several recommendations and suggestions for the project are listed below.

1) Most countries, except for the United States and European Union member states, require compact, high-performance agricultural machines that are available for sloped or small-plot fields. Further research efforts toward the development of such machines are strongly recommended.
2) In order to realize more sustainable agricultural systems, this project should also focus on environmental conservation through the reduction in use of chemical substances.
3) Is there scope for 'precision agriculture technologies' in upland farming? There is research on detailed, individual plant inspection where the treatment can be adjusted according to the plant: Is the plant healthy? Is it weed?
4) Harvest scheduling according to wheat quality, ripeness, and moisture content is a good approach. Which quality parameters are taken into account? Can these also be measured during the harvest such that the logging of the data can be used for future farm management?

The rating is: **A – good quality and minor revision needed.**

NARO Response to the Comments of the Evaluation Committee

1) We have already begun research on smart technology for agricultural production on small farms in mountainous areas, such as the development of robotic vehicles that can move between fields unmanned and can work safely and efficiently even on steep slopes or in mountainous areas where trees thrive and the clear sky rate is low. We would like to continue promoting this research.
2) Using GNSS and tilt angle sensors, we have been developing a ridging implement capable of high accuracy fertilization irrespective of vehicle speed, even in fields with high tilt. We will continue to promote this machine. As a technology for the reduction of chemical substances (pesticides, fertilizers, etc.), spot applications and variable-rate fertilization technology using crop monitoring data from drones are also being developed. In addition, the research and development of mechanical weeding technology by weeding robots without pesticides is also being conducted. Further efforts will be made to develop evaluation methods and reduction technologies with respect to the environmental impact of agricultural products, agricultural land, and rural areas, such as measures to reduce drift during the spraying of pesticides, and

measures to prevent the penetration of chemical substances into the groundwater.

3) For example, research and development is underway on the use on onions, cabbages, and other vegetables, and there are possibilities for other applications.
4) For wheat, especially for its use in bread, the protein content is a major concern. Therefore, we are currently engaged with protein content estimation technology in order to contribute to the stabilization of product protein content by means of blending. Research is also underway on a method using satellite images, currently used to measure the water content of wheat in field. For paddy rice, combine harvesters that can estimate the protein content of the harvest itself, have been developed, and its application is also anticipated. Both solutions are, however, under development.

Project 1-3 Development of smart machinery and system for horticultural production

Rating and Comments of the Evaluation Committee

This project is aimed at the automated cultivation of strawberries and tomatoes in greenhouses, both of which are important to Japanese horticulture. It is a typical example of smart agriculture, which can drastically improve greenhouse cultivation. It fully meets the objectives of Society 5.0. The use of robots and the combination of existing and newly developed technologies can greatly reduce labor requirements. The combination of a yield prediction system and a harvesting robot in tomato culture can be extended to other crops through the monitoring of crop growth to predict their yield, control disease outbreak and optimize the application of fertilizer.

While high-quality fresh vegetable and fruit production is expected, this system provides a way to resolve the social challenges of labor-saving in greenhouse horticulture. Several recommendations and suggestions for the project are listed below.

1) In order to reduce the burden on employees and to improve their working quality in greenhouses with this new system, introducing a device for monitoring workers in the greenhouse will become essential.
2) Improve the overall system in a greenhouse and combine it with a complete traceability information protocol.
3) Research on improving the quality of fruits (harvested product) is also necessary.
4) Is there a selection of crop varieties that are more suitable for robotic harvesting?
5) Are criteria for successful harvesting established:
   for the machine?
   for the crop?
   economically?

6) Training and specialization requirements for farmers and operators also have to be defined (see also 1.1).

Not every farmer will be an owner of a full robotic system or can be a specialist in the operation and maintenance of such equipment.

Shared use of such equipment and shared responsibility for keeping it operational must be considered.

7) Training for operators and farmers must be organized by either IAM or the manufacturers.

The rating is: **A – good quality and minor revision needed.**

NARO Response to the Comments of the Evaluation Committee

1) Using the tomato fruit bearing monitoring technology that we introduced, we aim to develop a system to predict the time and number of workers required for work from the number of harvestable fruits, and to construct work plans efficiently by combining it with a work management system in the future. Currently, a work management system is being developed to monitor the working conditions in these facilities using wireless communication, bar codes, RFID, etc., and to monitor the progress of work in support of the work plan.
2) The work management system written above has a traceability function which can record the growing (harvesting site) harvesting time and the harvester by tagging for each vine.
3) In the future, we believe that it will be important to study ways to improve work efficiency while increasing the quality of horticultural crops, such as a system that automatically records fruit quality in robotic harvesting.
4) Strawberry harvesting robots are targeted at high-setting cultivation (table-top culture) in which fruits and shafts are hanging from beds. All varieties of strawberry will be suitable.
5) The cost of a strawberry harvesting robot is 5 million yen. It can be depreciated over 7 years in the case of 30a facility area, 7/24 robot operation, and where more than 50% of the total harvest is harvested by the robot.
6) Currently, we have asked the seller of strawberry harvesting robots to explain its operation to farmers. Eventually IAM should get involved in this process. It is possible for manufacturers to lease the robots to the farmer. Moreover, cooperatives can lend the robots of their own purchase. In this case, manufacturers and cooperatives may provide special programs for the maintenance of the robots.
7) Expertise in robotics can be conveyed from manufacturers to farmers under the supervision of NARO, in particular IAM. Furthermore, NARO (IAM) can convey this expertise to farmers through researchers at agricultural test stations and workers in the respective prefectures.

Section 2: Systematization of farm work technology which enables the advanced farming systems

Comments of the Evaluation Committee

1) Benefits from the introduction of precision farming systems and/or farm networks should be mentioned to the parties concerned before disseminating new farming technologies.
2) Agricultural machinery and agricultural facilities are core collaboration areas in Society 5.0, and their importance is increasing. Agricultural machinery will be the platform for future agriculture, and thus the mission of IAM should be expanded from the invention of agricultural machinery to the development of farm management systems.

NARO Response to the Comments of the Evaluation Committee

1) NARO prepares technical manuals and standard operating procedures for the technologies that we want to promote, and highlights the economic efficiency and the degree of profitability improvement the technologies afford. The inclusion of similar economic assessments are to be prepared and provided to farmers, for the distribution of automated farming machines and precision agriculture using them.

2) Farm Management Information Systems, which are now used widely, are being developed and improved for the operation and/or record of fields, cultivation items, work planning, and the management of agricultural machinery and facilities. This is closely related to precision farming and robotic farming equipment. IAM will not only develop and improve independent machinery, facilities, and information management technologies but will also integrate them as it seeks to continue developing technologies for the optimum operation and management of entire farms.

Project 2-1 Dry seeded rice production system in large-scale paddy field

Rating and Comments of the Evaluation Committee

Direct seeding in dry rice fields is an effective method of reducing rice production cost as well as labor input. The consolidation of larger paddy fields will stimulate the prospect of introducing high-performance automated machines. This project has demonstrated that one skilled person can operate more than one automatic tractor in parallel. This fact is closely related to project 1-1. Weed control is a big problem with direct-seeding cultivation. Although the application of herbicides appears to be the only measure against weeds, it should be noted that herbicides may cause surface water contamination. In fact, there have been much criticism in Europe on this point.

Several recommendations and suggestions for the project are listed below.

1) In the framework of Society 5.0, non-chemical weed control, autonomous vehicles, weeding robots, etc. need to be developed, as they may play significant roles.
2) Besides an energy efficiency, an environmental efficiency estimation method can be developed to evaluate progress in terms of the use of machines and other inputs such as chemicals, fertilizers etc.
3) Research for determining the best time for weeding and fertilizing with less effort by implementing a sensor network appears to be necessary.

The rating is: **A – good quality and minor revision needed.**

NARO Response to the Comments of the Evaluation Committee

1) Currently, full coverage weeding systems for paddy farming (100%) depend on herbicides in both dry field and flooded seasons. Research to reduce the amount of herbicide spraying, through the reduction of spraying quantity by means of spot spraying, lowered pesticide usage through the combination of shallow tillage before sprouting and use of the optimum cultivar for the robotic operation, and pesticide-free cultivation, will also be examined.
2) Until now, an evaluation of economic efficiency has been primarily required, but challenges with respect to energy efficiency have not. In the near future, we would like to refer to the LCA research conducted to date in the agricultural sector.
3) An application has been developed for Japanese millet "Hie" to predict the leaf age from accumulated temperature data after sprouting. It is in the trial stage. Research is also underway at various laboratories to evaluate the amount of additional fertilizer required by means of the leaf color measured using a multi-spectrum camera mounted on an automated drone. In the near future, technology to observe the leaf age, etc. of Hie using automated drones is planned.

Project 2-2 Production forecasting systems for stable supply of cabbages and lettuces

Rating and Comments of the Evaluation Committee

The project constitutes an important part of smart agriculture, as it enables the optimal production forecast of leafy vegetables, with the aim of providing a stable supply to retailers and their customers while at the same time avoiding products wastage. The system is based on a cumulative temperature model that estimates the leaf age and leaf number of leafy vegetables. With the improved accuracy of this model, a prediction of the quantity of products to be shipped to market with an accuracy of one week, can be done. This project fully supports the concept of

Society 5.0. Several recommendations and suggestions for the project are listed below.

1) From the model graph (Fig. 2), it appears that less information is available in the initial stages of cultivation. Further refinement of the prediction model is needed.
2) What countermeasures are possible when the model predicts delayed crop growth (causing supply shortages) or excessive crop growth (causing oversupply and wastage).
3) It is necessary to implement the project with a view to developing a method to measure the performance of the forecasting system itself.
4) Special care is necessary for the management of information because incorrect handling of it can lead to misuse as the prediction of prices and financial assets might penalize farmers. The production forecasting system can cause severe price fluctuations if access to the information is dominated by one group at the expense of others (monopoly problems in the futures market).

The rating is: **A – good quality and minor revision needed.**

NARO Response to the Comments of the Evaluation Committee

1) Indeed, our explanation was insufficient; however, Fig. 2 shows the results of validation of the previously developed lettuce growth models with the data of cultivation tests in the Nagano Prefecture. In another cultivation study, the accuracy of the same model was confirmed even during the initial stages of cultivation.
2) It becomes a problem when growth control cannot be easily carried out, even if the growth itself of open field vegetables can be predicted. Using production prediction information as a measure, supplier contract and shipment quantity changes can be carried out before shipment. Alternatively, in the case of a shortage, procurement from other production areas or markets can be made, or in the case of crop excess, other sales channels can be secured.
3) Accuracy verification of the growth model is continuously carried out in various places in Japan. Regarding verification of the effectiveness of the prediction system, simulations will be conducted with and without measures using production prediction information as shown in 2), and the sales and profits of each will be compared.
4) This has been pointed out to us, and we are paying attention in the development of a practical system. Specifically, it clarifies that the owner of the obtained production forecast information is the farmer, and the system assumes that each producer grants information access to a specific supplier in the market.

Section 3: Technical communalization under the circumstances of international standardization

Comments of the Evaluation Committee

1) Technological standardization and safety issues are important topics for farmers and related industries. As most of the agricultural machinery related to rice farming has been developed by Japan, and the experience of IAM is very important in Asia.
2) Simplified systems for data communication are very useful; however, in the future, there will be a need for the ISOBUS protocol, which has been adopted by all major manufacturers.
3) Society 5.0 is a Society of connection. Big data will play an important role in the future. Conformance with agricultural system standards is essential to harmonize with entities that collect and manage high-quality data from machines and facilities. Consequently, a large number of standards will be needed.
4) Cooperation toward standardization is proposed in the Asian Community, not limited to the ISO standards. Most Asian countries share agricultural background in crops, agricultural machinery, seeds, and fertilizers. Cooperation can develop standards for Asia-specific agricultural machinery.

NARO Response to the Comments of the Evaluation Committee

1) We believe that it is necessary to make further progress in agricultural mechanization while ensuring safety, and we would like to deepen our international collaboration, focusing on the Asian region.
2) Agricultural machinery that complies with the international standard ISO11783 is compatible and widespread not only in Europe and the U.S. but also in the Asian region. We believe that this is important from the viewpoint of data coordination, while collecting data on the size of agricultural machinery and the needs of its implements.
3) We believe that we need not only to aggregate and accumulate big data related to agriculture, but also to cooperate, share, provide, and utilize such data. We will strive to expand the area of cooperation based on the Infrastructure for Agricultural Data Collaboration (WAGRI).
4) We believe that it is fundamental to develop such standardization, from the viewpoints of diversification of agriculture including the management of food, its safety, and environmental protection. Based on these points, we will continue to promote the standardization necessary for agricultural machinery in the Asian region.

Project 3-1 Data communication for tractors and implements

Rating and Comments of the Evaluation Committee

The standardization of communication protocols ensures that farmers can use equipment produced by different manufacturers without excessive costs, use the acquired data in a farm management information system (FMIS), and enables the correct execution by machinery of management decisions. As such, the activities in the consortium to develop ISOBUS standards are critically important. This project is also addressing enhanced productivity and more efficient use of machinery. Therefore, this project meets the objectives of Society 5.0. The standardization work should be compatible with the global standard ISOBUS. Several recommendations and suggestions for the project are listed below.

1) Considering that there is no compatibility between AG-PORT and ISOBUS, what does this imply for the FMIS of a farmer who uses both AG-PORT and ISOBUS.

The rating is: **S – high quality and no revision needed.**

NARO Response to the Comments of the Evaluation Committee

1) Since the current AG-PORT does not include the concept of task controllers, there is no interface with the FMIS. As AG-PORT evolves in the future, we believe that FMIS utilization will be possible, if task controllers are implemented.

Project 3-2 Improving safety of small agricultural machinery adapted to Japanese farms

Rating and Comments of the Evaluation Committee

The project focuses on improving ROPS testing methods and on improving the safety of small agricultural machines. The data obtained through simulations for improving ROPS testing are very interesting not only because they are very useful to manufacturers but also may be utilized in other relevant studies. The project contributes to the realization of Society 5. 0 by improving the safety of relevant agricultural machines and reducing accidents. Several recommendations and suggestions to the project are listed below.

1) The relationships between IAM's task (the development or improvement of safe machines) and the manufacturers' role (the design and marketing of safe machines) remains unclear. This is especially so for small two-wheeled tractors.
2) The internationalization of Japanese agricultural robot test codes is subject to established certification procedures and should be adopted.
3) Appropriate ROPS should be installed in the specific type of tractor.
4) The attachability to the existing power tiller and the price of the device seems to be a concern for adoption of the device.

The rating is: **A – good quality and minor revision needed.**

NARO Response to the Comments of the Evaluation Committee

1) In a safety test conducted by IAM, in the case of an applied type of machine's safety device (developed by the manufacturer) being superior to the standard, we have a system to certify it as being effective for avoiding the targeted accident. Consequently, the role of IAM is to clarify the criteria upon which to judge the effectiveness of machine's safety system in crushed accidents while backing up, and to illustrate examples of effective equipment in such accidents.
2) We are proceeding with such efforts through the OECD tractor codes and other schemes.
3) Our standards for safety tests are operated as such. Naturally, we will proceed with simulations based on this assumption as well.
4) Development is being promoted to include such possibilities in the case of the equipment alluded to in 1) (above).

Project 3-3 Trends of standardization of testing on agricultural machinery in Asian Region

Rating and Comments of the Evaluation Committee

In the global market, it is important to use international standards for testing of agricultural machinery, which are common, well-established, and well- enforced (reliable).
Through this, farmers can compare the performances of machines and buy certified equipment.
NARO's efforts in the international market of relevant organization(s), contribute much to achieving the common global goal of supplying high-quality, safe agricultural machines. All the activities conducted by OECD tractor codes and ANTAM require qualified participation with experience in testing and research, just as NARO is doing. Participation in the network will lead to the realization of the goal of Society 5.0, which enables sharing of knowledge to establish the global standards and testing procedures, along with other countries.
Several recommendations and suggestions for the project are listed below.

1) It is important to provide a level technological playing field for global manufacturers through the sharing of standards, technology, and experience with other countries.
2) It is necessary to work together within Asia to establish unique standards for agricultural machinery in the region. (However, this needs time since it is a matter that involves the national government).

The rating is: **S – high quality and no revision needed.**

NARO Response to the Comments of the Evaluation Committee

1) IAM is currently conducting intensive standardization activities for the Asian region where

the current development of agricultural mechanization is remarkable. We are also aware of the importance of these issues, and we would like to work on them at the appropriate time in the near future.

2) We understand that the establishment of new and unique international standards is an interesting proposal, and we believe that it is necessary for IAM to study the basic ideas and development strategies based on these proposals in the near future.