

# Acton Plan Report Guideline

All trainees are requested to prepare and submit an Action Plan individually. The Action Plan is intended to help participants to address and identify each organization's current issues and major challenges, and make an attempt to provide alternatives and solutions to the identified issues and problems.

Trainees are encouraged to develop the Action Plan by incorporating the observations and findings from the Academy Program from the lectures. A session for developing and building the Action Plan will be held.

## 1. Topic

Based on the observations and findings from the lectures, participants will be asked to create an Action Plan in accordance with the Action Plan Guidelines. You should select the Action Plan topic from the below policy lectures (14):

Policy Lectures
[Policy Lecture 2] Rural Specialized Business Development Policy in Korea
[Policy Lecture 3] Livestock Quarantine Policy Direction in Korea
[Policy Lecture 4] Protected Horticulture Policy in Korea
[Policy Lecture 5] Policy of Quality Grades Standardization and Sanitation Management of Agri-foods
[Policy Lecture 6] Agricultural Technology Development & Extension in Korea
[Policy Lecture 7] Korea's Development Experience of the Food Processing Industry
[Policy Lecture 8] Smart Agricultural Policy in Korea
[Policy Lecture 9] Animal Quarantine and Hygiene Management in Korea
[Policy Lecture 10] Rural Development Policy of Korea
[Policy Lecture 11] The Korean Agricultural Cooperatives
[Policy Lecture 12] Korean Agricultural Mechanization: History and Situation
[Policy Lecture 13] Agricultural Marketing Policies in Korea: focused on Fruit & Vegetables
[Policy Lecture 14] South Korea's Experience in Agricultural Production Infrastructure Development
[Policy Lecture 15] Agricultural Water Development and Management Policy in Korea

## 2. Scope of the Action Plan

The scope of the Action Plan is needed to be your organizational level. Please do not deal with national policy which is less feasible with the Action Plan. Since the feasibility has high priority among evaluation standard, please consider the Action Plan that you can actually implement in your organization such as information sharing workshop, improvement of policy in your organization and research implementation, etc.

### 3. Submission

- Submission Date : **November 26<sup>th</sup>, 2021 (Fri)**
  - ※ The submission date is subject to change.
  - ※ Failure to submit within deadline will result in no score.
- Word file (about 10 pages)

### 4. Evaluation

As such, the Action Plan should provide practical, applicable, and feasible alternatives and solutions based on real situations. It is also suggested that trainees explore the applicability of development experiences gained in the Program into the Action Plan on numerous policy initiatives. The Action Plan aims to prepare practical, specific, and creative public policy initiatives and alternatives in an effort to improve and bring innovation to the current organization's policy, system, and governance with a focus on target areas.

Since trainees submit the Action Plan individually, the Action Plan should be practical and realistic at the trainee's organizational level that can be realized by improving individual's capability. Please do not deal with national policy as a whole since it is too general and broad so that it is not feasible and practical.

KREI will evaluate Action Plans based on below evaluation standards:

Evaluation Standards	
Feasibility	- Is this Action Plan feasible?
Relevance	- Is it designed rational way? (Objective, current status analysis, strategy, concept, components, etc.)
	- Is the way to address the problem appropriate?
Innovativeness	- Is the way to address the problem innovative?
Impact	- Impact of Action Plan on the organization

### 5. Outstanding Acton Plan Reports

KREI will select outstanding Action Plan based on the evaluation standards. The trainees who are selected as outstanding Action Plan should take a self-video on acceptance speech (3-5 minutes) and presentation about Action Plan (5-10 minutes) which will be shown at closing ceremony. Also, the incentive for outstanding Action Plan will be given.

- Submission date : **December 7<sup>th</sup>, 2021 (Tue)**
- PPT : 6~7 slides
- The allotted time: Max. 10 min

# Promoting Climate Change Mitigation and Adaptation through Animal Productivity and Welfare Improvement in Cambodia

(Cambodia)

Nov, 2021

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## A. Action Plan Topic

### 1. Action Plan Title

*Promoting climate change mitigation and adaptation through animal productivity and welfare improvement in Cambodia*

### 2. Action Plan Topic

*[Policy Lecture 6] Agricultural Technology Development & Extension in Korea*

### 3. Related work in your organization

*I work for Faculty of Veterinary Medicine, RUA, the agricultural educational institution that provide education, research and degree for veterinary students. While have the background of livestock environmental health, I also have one of my subjects I teach at my faculty as Animal welfare and Ethology. Therefore this action plan is consistently related to what we have here and it is the first action plan that combine between Climate Change issues and animal farming technology.*

*The new research just done by a PhD candidate at Graduate School, RUA is also about probiotic. Therefore, it is the confident that we can do the experiment and isolate the Lactic Acid Bacteria (LAB) to produce probiotic in order to mix with our feed for the animal under technical training from the candidate. However, we can just connect what he did to check the growth and meat quality of pigs to our objective in detecting the GHG emission and animal welfare responding to CC issues. Moreover, we have good opportunity to collaborate with RUA animal Farm Research Station existing in the university including a cattle house and a dairy cow house. So, in case they do not use the blank house we can negotiate to use for our research. In case the existing houses at RUA will be busy during the period of our project action, we still have land to build the new and house and/or apply our research at SRU, our partner university. Our final research product is a modelling for raising cattle with both a good practice of reduction of GHG emissions and good welfare for cattle raising design. This innovation will be used in national plans in relevant ministries such as MOE, MAFF and so on.*

## B. Action Plan Description

### 1. Background and Purpose

*Agriculture is an important sector to be considered as both impacts climate change (CC) as well as is influenced by CC (Musalia, 2015). The livestock industry is the main source which mostly produce the form of carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), and ammonia (NH<sub>3</sub>) (Russell, 2014; Leytem et. al., 2011) that impacts on the environment (Ilea, 2009).*

**Purpose:** *The action plan aims to innovate suitable technologies to improve productivity and welfare of large animals in response to the climate mitigation and adaptation in Cambodia.*

## 2. Current Status and Issues

### 2.1. Current Situation

*Responding to the rise of the populations, the global demand for animal source food (ASF) will also increase and become more affluent and the change of eating habits. Therefore, animal production plays a key role in the food supply chain which is in line with the Cambodia climate change strategic plan 2014-2023 to increase the livestock productivity aiming to promote climate resilience.*

### 2.2. Issues and Problems


*While increasing demand for livestock products offers market opportunities and income for small, marginal, and landless farmers, livestock increase negative environmental implications, particularly because of greenhouse gas (GHG) emissions (Musalia, 2015).*


### 2.3. Relevant Policies and Programs

*Besides the Cambodia climate change strategic plan 2014-2023, there are also some relevant studies show that the strategy to sustain the both livestock productivity and reduce the environmental implication from the livestock is to consider on housing to improve livestock health, welfare and impact from the climate to animals, and livestock feed that could reduce GHG to the environment. It is reported that feeding probiotics (e.g Latic Acid Bacteria) can be an effective methane mitigation for ruminant livestock (Doyle et al., 2019) and also increase body weight gained of ruminant livestock (Mebrate and Ayele, 2020). However, the authors conclude that more research is needed especially in in-vivo livestock model. Brouk et a., elaborated since 2003 about the useful of placing cattle into the constructed barn with a good condition of air flow (natural ventilation) (Ohnstad, 2010) and shading to minimize the heat stress in animal; while the water spray is recommended to apply into the cattle barn environment.*

## 3. Proposed Goals

### <Gap Analysis>

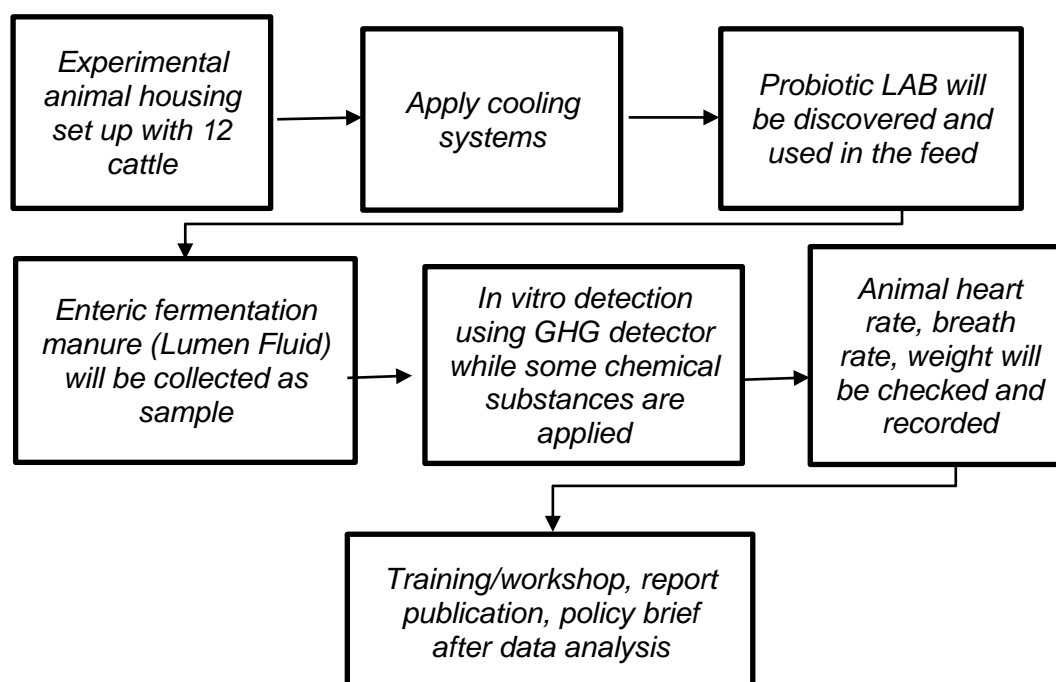
“As Is” vs. “To Be”	
 <b>To Be</b>	<ol style="list-style-type: none"><li><b>1. To identify animal productivity and welfare of large animal through feeding with probiotics.</b></li><li><b>2. To identify animal productivity and welfare of large animal through barn cooling systems.</b></li><li><b>3. To calculate the GHG emission using the combination technologies of probiotics feeding and barn cooling systems</b></li></ol>

 <b>As Is</b>	<ol style="list-style-type: none"> <li>1. As the combine study between animal productivity and the use of probiotics in cattle have not yet been applied in Cambodia.</li> <li>2. As cooling systems are not popular to be known by the Cambodian people for improve the welfare and productivity of their cattle.</li> <li>3. As the data of greenhouse gas emission per animal raising in Cambodia has not been published yet and some relevant ministries including Ministry of Environment and Ministry of Agriculture,</li> </ol>
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- Describe AS IS –TO BE analysis

One cattle house will be constructed in animal research station at Royal University of Agriculture, Phnom Penh, Cambodia. Cattle will be running an experimental with the barn cooling systems and the feed. The cooling systems consist of 1) Natural Cooling System (NCS) – [Figure 1] and Mechanical Cooling System (MCS) – [Figure 2] that will be allocated for both control and experimental group. These systems will be running to obtain data on the animal heat stressed followed by physiological measuring animal CC adaptation and welfare respond. The animal feed will be using the Lactic acid bacterial (LAB) – [Figure 3] that will be produced from the cattle rumen at the Microbiology Laboratory of the Faculty of Veterinary Medicine, RUA. Then this LAB will be used in cattle feeding as supplement with the local available feed (grass, straw, concentrate etc.). Biodigester will be designed and put into the experiment with feeding with probiotics and non-probiotics to measure the GHG that remained in the cattle manure. This data from the Biodigester and data from the objective 1 and 2 will be combined to calculate the GHG reduction which is correspond to the objective 3.

### **Monitoring & Evaluation of the Action Plan**



## 4. Strategy and Action Plan Concept

- Describe strategy
  - **Approach and key activities**
    - *Establish a model experiment for the measurements of GHG and Welfare response of small-scale cattle: Lead partner – SRU; Co-lead partner - RUA*
    - *Measure and calculate the emission reduction from the applied technologies (feedings - probiotic, natural cooling system/housing system, mechanical housing system, biogas) Lead partner – RUA; Co-lead partner - SRU*
    - *Analyze animal welfare and productivities of experimental small-scale cattle: Lead partner – RUA; Co-lead partner - SRU*
    - *Writing research journal, report for policy-making of governmental institution on how to improve animal welfare and productivities along with mitigation methods for small scale cattle farming in Cambodia: Lead partner – RUA; Co-lead partner – Korea Programme on International Agriculture (KOPIA).*
- Describe Action Plan Concept
  - **Household:** *Adaptation models innovated for their animal welfare and production.*
  - **Gender:** *Both Female and female farmers will be able to use the technology easily, adaptation capacity-building resources, impacts on their livelihood activities and household well-being.*
  - **Women and Children:** *the action plan has given high priority to women. In fact, at the project management and consultant level, there are two women, one of them is an advisor and another one is a member. This action plan project will encourage women to contribute at least 30%. Furthermore, this research action plan project will create jobs with productivity in the livestock sub-sector on which women and children are highly dependent.*
  - **University and partner:** *capacity building of students, staff, lecturers, and researchers in CC adaption and mitigation technologies. Faculty of Veterinary Medicine and Faculty of Animal Science will be beneficial. Strengthen collaboration between RUA and Partners (Svay Rieng University and Korea Programme on International Agriculture).*
  - **Sub-national level:** *local authorities (village and commune) will use these technologies to continuously disseminate other people.*
  - **National Level:** *Policy brief and technical cattle farming/research model will be used in Ministry of Environment (MoE) and Ministry of Agriculture, Forestry and Fisheries (MAFF). The result of this research will respond to Cambodia climate change strategic plan 2014-2023 in order to reduce vulnerability of animal sectors, regions, gender and health to climate change impacts. Once the found technology being included into the policy brief, these will be recommended and applied into the national level implementation for animal sectoral development with the vulnerable cattle farmers. Moreover, this study model will be the future hypothesis for other researchers who want to focus their studies with different animal species.*

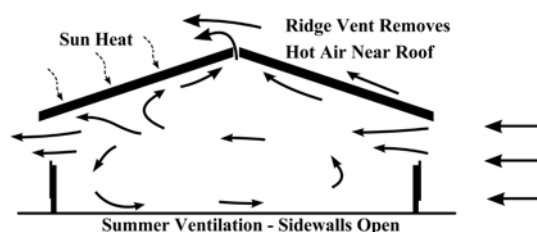
## 5. Outline of the Action Plan

### 5.1. Outline of the plan

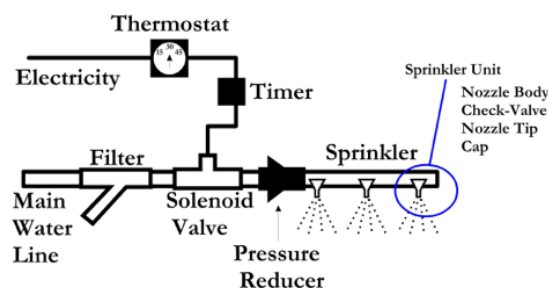
- Implementing Organization: *Faculty of Veterinary Medicine, Royal University of Agriculture*
- Duration of the Project: 2 years

### 5.2. Action Plan Components

- Component 1
  - Natural Cooling System (NCS): the cattle house will be designed as air enters into the barn via the open eaves and sidewalls, it interacts with the air already inside of the barn differently depending on the time of year and wind conditions, and eventually exits through an open ridge. Moreover, some fast-growing local trees will be used to grow around the house. This can remove bad smell and create acceptable environment for cattle inside the house.



- Component 2
  - Mechanical Cooling System (MCS): Cooling System will be used for the experiment by connecting the automatic sprinkler system with solar system. We plan to use the automatic sprinkler because it can stabilize the temperature surround the barn or the house of the cattle. And solar system can help to reduce the expenses while the small amount of the spray can save the water use.



- Data collection: Physiological measurement will be recorded for animal CC adaptation and welfare respond following the component 1 and 2.



- Component 3

- Feeding: the treatment Group 1 and 2 will be fed with the grass inoculated with probiotic contain with Lactic Acid Bacteria obtaining from Laboratory Isolation.

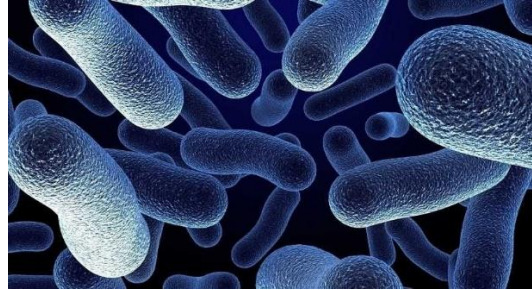


Figure 3

- Data collection: Gas volume was read from the collection bottles directly after 24 & 48 hours. CH<sub>4</sub> % in the gas were measured using a Crowcon infra-red analyser for the separate incubations. Gas from collection bottle was drawn into the measuring apparatus. At the end of each incubation time, residual insoluble substrate in incubation bottle was determined by filtering the contents through several layers of cloth that retained particle sizes to at least 0.1mm & then they were dried in micro-oven for 100°C and weighed. Moreover, physiological measurement will be recorded for animal CC adaptation and welfare respond.

- Component 4

- Biodigester: We include biodigester in this study too, since it can share good benefit of mitigate the greenhouse gases from cattle manners and produce useable gas for the farmers. The gases collected by Biodigesters will be also measured and the results will be translated and concluded.

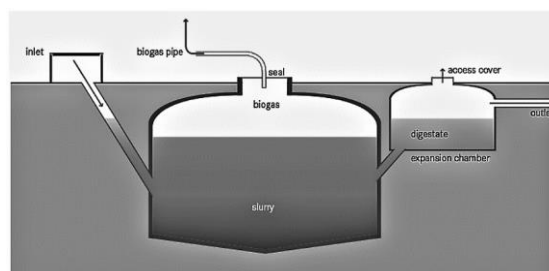


Figure 4

- Gas detection in the laboratory: Rumen fluid was collected from cattle stomach in the experiment into an insulated flask & used immediately. The flasks for incubation contained 1.2 l of diluted rumen fluid (240 ml of rumen fluid plus 960 ml of buffer solution made according to Tilly and Terry 1963). The substrate was put in the incubation flask containing the diluted rumen fluid which was then gassed with CO<sub>2</sub> & the flasks were incubated at 38 °C in a water bath for 24 and 48h.

## 5.3. Expected Outcomes

### 1. Expected Outputs

- The use of probiotics in cattle feeding will be scientifically proved and use by the cattle producer.
- The combined or either single cooling system would be technically designed and use by the cattle producer.
- The increasing use of Biodigester for cattle producer.
- The initiative policy brief on how to improve animal welfare and productivities for cattle farming in Cambodia will be conducted responding to the National Climate Change Strategic Plan or other relevant governments offices.

### 2. Impacts

- Mitigation modelling and adapting technologies including feeding probiotics, using the cooling system, and Biodigester can be applied for cattle producers in Cambodia.
- Could be a good model for other countries where the condition may similar to Cambodia including Thailand, Vietnam, and Laos etc.

## 5.4 Action Plan Time Table

Activities	2022												2023											
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Train research team																								
Purchase laboratory equipment and consumables for collecting Lactic Acid Bacteria to be used as probiotic in cattle feed																								
Collect Lactic Acid Bacteria in Lab																								
Cattle house building for the experiment, equipped with NCS and MCS																								
Purchase cattle																								
Purchase feed and necessary material use																								
Set up house management team and monitoring																								
Build biodigesters																								
Monitor and collect gas sample from biodigesters for lab detection																								
Detect GHG from sample collected from biodigesters																								
Purchase laboratory equipment and consumables																								



## Reference:

- Brouk, M.J., Smith, J. F., Harner, J. P. 2003. Effectiveness of cow cooling strategies under different environmental conditions. Proceedings of the 6th Western Dairy Management Conference March 12-14, 2003 Reno, NV—146
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