SUstainable developmeNT Smart Agriculture Capacity
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SUN SpACe

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Table 1: List of Abbreviations

Term / Abbreviation	Definition
ICT	Information and Communication Technology
TV	Television
GAP	Good Agricultural Practices

1. Survey (questions and guideline)

1.1. The purposes of questionnaire

The purposes of this survey is to understand the farmers, their farming activity, and their ability and experience, to define their skills for construction an appropriate learning sets to improve farmer's skills on agricultural production enhancement.

1.2. Components of questionnaire

The questions of this survey includes seven parts comprising;

Part 1 - General information:

Part 1: General information

☐ Mr. ☐ Mrs. ☐ Miss Name ....

Country ....

Q1). What is your age?
     ☐ 20 - 30 years old.   ☐ 31 - 40 years old.   ☐ 41 - 50 years old.
     ☐ 51- 60 years old.   ☐ Over 60 years old.

Q2). What is your gender? ☐ Male   ☐ Female

Q3). What is your qualification?
     ☐ Undergraduate   ☐ Bachelor   ☐ Master
     ☐ Other, _____

Q4). Do you receive any other subsidies for your farming?
     ☐ Yes   ☐ No

     If "Yes" please specify_____

Q5). What is the main source of your family income? (choose the one where most of the main source)
     ☐ Agriculture (able to tick multiple answers)
         ☐ Grains   ☐ Fruits   ☐ Vegetables   ☐ Oil Seeds
         ☐ Sugarcane   ☐ Cotton   ☐ Other _____
     ☐ Livestock (able to tick multiple answers)
         ☐ Fishes   ☐ Pigs   ☐ Ducks   ☐ Chickens
         ☐ Cows   ☐ Buffalo   ☐ Other _____
     ☐ Agricultural labor
     ☐ Other (specify)_____

Q6). How much your income per year from doing farming?
     ☐ Lower than 2,000 Euros   ☐ 2,001 – 5,000 Euros   ☐ 5,001- 8,000 Euros
     ☐ Over than 8,001 Euros

Q7). How long have you do farming?
     ☐ < 1 - 5 years   ☐ 5 – 10 years   ☐ 10 - 15 years   ☐ > 15 years

Q8). What is your professional background?

     _____

     _____

Q9). What is the main driver for you to join this project?

     _____

     _____

Part 2 - Farm description:

Part 2: Farm description

Farm address _____
_____
_____

Phone number _____ Fax _____

Mobile phone no. _____ E-mail _____

Q1). How would you describe your farm area (choose the one where most of the relevant)?
☐ Flat   ☐ Hilly   ☐ Mountainous

Q2). What is total area of your farm?
☐ < 50 acres   ☐ 50 – 199 acres   ☐ 200 – 499 acres   ☐ > 500 acres

Land owned (acres or %)_____

If Owned, please specify type of ownership _____

Land rented (acres or %)_____

If Rented, please specify who you rent from? _____

Q3). What are the crops that you produce? (able to tick multiple answers)
☐ Grains   ☐ Fruits   ☐ Vegetables   ☐ Oil Seeds
☐ Sugarcane   ☐ Cotton   ☐ Fishes   ☐ Pigs
☐ Ducks   ☐ Chickens   ☐ Cows   ☐ Buffalos
☐ Other _____

Q4). What is the nature of your farming?
☐ Individual
☐ Contract farming
☐ Joint family (jointly with sibling(s)/other relatives)
☐ Cooperative farming (is a cooperative where farmers pool their resources in certain areas of activity.)
☐ Corporate farming (the practice of large-scale Agriculture on farms owned or greatly influenced by large companies.)

Q5). What is the technique of your farming?
☐ Traditional (do not use any smart technology) explain _____
_____

☐ Modern (using smart technology i.e. using machinery, IT, etc.) explain _____
_____

Q6). Land is of which type?
☐ Irrigated area   ☐ Non-Irrigated area

If irrigated area, what is the source of water?
☐ Well   ☐ River   ☐ Canal

☐ Tube well   ☐ Other _____

If non-irrigated area, how do you irrigate your crops?

_____
_____

Q7). Does your farm is a learning and demonstration site for other farmers?
☐ Yes   ☐ No

If Yes, please specify _____

And How often other farmers visit your farm per month?
☐ Less than 2 times   ☐ 3 - 5 times   ☐ 6 - 8 times
☐ 8 - 10 times   ☐ more than 10 times

Part 3 - Technology usage:

Part 3: Technology usage

Q1). Please tick your ICT devices that you have from the following list (able to tick multiple choices):
☐ Computer   ☐ Tablet   ☐ Smartphone
☐ Smart watch   ☐ I do not have any technology devices.
☐ other, (specify) _____
_____
_____

If you use ICT device, what do you use it/them for? (Tick all that apply)
☐ Agricultural applications (far monitoring)
☐ Weather application (monitoring weather and weather forecasting)
☐ Taking Photos
☐ Send/Receive/Check an Emails
☐ Internet surfing
☐ Social media from other farmers, demonstrations, etc.
☐ Communication with other farmers/cooperative/association (phone or message)
☐ Other (specify)_____

Q2). Do you have an internet access (e.g. GSM, WIFI) in your farm?
☐ Yes   ☐ No

If "Yes" please describe _____
_____

If "No" Do you want to have an internet in your farm?
☐ Yes (Why ?) _____
☐ No (Why ?) _____

Q3). Do you have any experiences in using precision farming technique? (precision farming technique is a farming management concept based on observing, measuring and responding to inter-field and intra-field variability in crops using smart technologies likes internet of things, smart devices, etc.)
☐ Yes   ☐ No

If "Yes" please describe _____

Q4). Usually electronically communication between different brands of machinery with precision farming technique is difficult due to 'language problems'. Do you have 'language problems'?
☐ Yes   ☐ No (go to the next question)

If Yes, How often have you had 'language problems' between different farm equipment or between your farm equipment and a software program?
☐ Never   ☐ Seldom   ☐ Sometimes
☐ Often   ☐ Always

Q5). Which channel do you get information on weather forecasts? (able to tick multiple choices)
☐ No information   ☐ Radio/TV   ☐ Word of mouth (friends/neighbors)
☐ Newspapers   ☐ Self-judgment   ☐ Traditional knowledge sources
☐ Other (specify) _____

Q6). Where do you get the information (market, knowledge, agricultural news, etc.) you needed for getting it?
☐ Radio/TV   ☐ Word of mouth (friends/neighbors)
☐ Self-judgment   ☐ Traditional knowledge sources
☐ Other (specify) _____

Q7). Do you use any smart technology into your farm? (Smart technology is technologies that allow sensors, databases, and wireless access to collaboratively sense, adapt, and provide for users within the environment.)
☐ Nothing to use
☐ Sensors and sensing technologies for _____
☐ Automation technology for _____
☐ Robotics technology for _____
☐ Other (specify) _____

If you are using smart technology, what kind of help do you need?

Please specify _____
_____
_____

Part 4 - Digital literacy:

Part 4: Digital literacy (Please tick only one appropriate answer to indicate your ICT attribute)

Category 1: Information processing

Q1). In terms of information processing category, which one of the following would describe you the best:

☐ I can look for information online using a search engine.
☐ I can use different search engines to find information.
☐ I can use advanced search strategies to find reliable information on the internet such as using web feeds (like RSS).
☐ My skill is below the qualify, please specify _____

_____

☐ My skill is above the qualify, please specify _____

_____

Q2). In terms of information processing category, which one of the following would describe you the best:

☐ I know not all online information is reliable.
☐ I use some filters when searching to compare and assess the reliability of the information I find.
☐ I can assess the validity and credibility of information using a range of criteria.
☐ My skill is below the qualify, please specify _____

_____

☐ My skill is above the qualify, please specify _____

_____

Q3). In terms of information processing category, which one of the following would describe you the best:

☐ I can save or store files or content and retrieve them once saved or stored.
☐ I classify the information in a methodical way using folders. I backups of information or files I have stored.
☐ I can save information found on the internet in different formats. I can use cloud information storage services.
☐ My skill is below the qualify, please specify _____

_____

☐ My skill is above the qualify, please specify _____

_____

Category 2: Communication

Q4). In terms of communication category, which one of the following would describe you the best:
☐ I can communicate with others using Skype or chat –using basic features (e.g. voice messaging, SMS, text exchange).
☐ I can use advanced features of several communication tools (e.g. using Skype and sharing files).
☐ I actively use a wide range of communication tools (e-mail, chat, SMS, instant messaging, blogs, micro-blogs, social networks) for online communication.
☐ My skill is below the qualify, please specify _____

_____

☐ My skill is above the qualify, please specify _____

_____

Q5). In terms of communication category, which one of the following would describe you the best:
☐ I can share files and content using simple tools.
☐ I can use collaboration tools and contribute to e.g. shared documents/files someone else has created.
☐ I can create and manage content with collaboration tools (e.g. project management systems, online spreadsheets).
☐ My skill is below the qualify, please specify _____

_____

☐ My skill is above the qualify, please specify _____

_____

Q6). In terms of communication category, which one of the following would describe you the best:
- ☐ I know I can use online services (e.g., e-banking, e-governments, e-hospitals...etc.).
- ☐ I use features of online services (e.g. public services, e-banking, online shopping ...etc.).
- ☐ I actively participate in online spaces and use several online services (e.g. public services, e-banking, online shopping...etc.).
- ☐ My skill is below the qualify, please specify _____
  _____
- ☐ My skill is above the qualify, please specify _____
  _____

Q7). In terms of communication category, which one of the following would describe you the best:
- ☐ I am aware of social networking sites and online collaboration tools.
- ☐ I pass on or share knowledge with others online (e.g. via social networking tools or in online communities).
- ☐ I can use advanced features of communication tools (e.g. video conferencing, data sharing, application sharing).
- ☐ My skill is below the qualify, please specify _____
  _____
- ☐ My skill is above the qualify, please specify _____
  _____

Category 3: Content creation

Q8). In terms of content creation category, which one of the following would describe you the best:
- ☐ I can produce simple digital content (e.g. text, tables, images, audio files) in at least one format using digital tools.
- ☐ I can produce complex digital content in different formats (e.g. text, tables, images, audio files). I can use tools for creating web pages or blogs.
- ☐ I can produce complex, multimedia content in different formats, using a variety of digital tools and environments. I can create a website using a programming language.
- ☐ My skill is below the qualify, please specify _____
  _____
- ☐ My skill is above the qualify, please specify _____
  _____

Q9). In terms of content creation category, which one of the following would describe you the best:
- ☐ I can make basic editing to content produced by others (e.g., adding and deleting).
- ☐ I can apply basic formatting (e.g. insert footnotes, charts, tables) to the content I or others have produced.
- ☐ I can use advanced formatting functions of different tools (e.g. mail merge, merging documents
- ☐ My skill is below the qualify, please specify _____
  _____
- ☐ My skill is above the qualify, please specify _____
  _____

Q10). In terms of content creation category, which one of the following would describe you the best:
- ☐ I know that content can be covered by copyright.
- ☐ I know how to reference and reuse content covered by copyright.
- ☐ I know how to - and when is necessary to - apply licenses and copyrights.
- ☐ My skill is below the qualify, please specify _____
  _____
- ☐ My skill is above the qualify, please specify _____
  _____

Q11). In terms of content creation category, which one of the following would describe you the best:
- ☐ I can modify simple functions of software and applications as changing default settings.
- ☐ I know the basics - principles- of one programming language.
- ☐ I can use several programming languages. I know how to design, create and modify databases with a computer tool.
- ☐ My skill is below the qualify, please specify _____
  _____

☐ My skill is above the qualify, please specify _____

_____

Category 4: Safety

Q12). In terms of safety category, which one of the following would describe you the best:
    ☐ I can take basic steps to protect my devices (e.g. using anti-viruses and passwords).
    ☐ I have installed security programme on the device(s) that I use to access the Internet (e.g. antivirus, firewall).
    ☐ I frequently check the security configuration and systems of my devices and/or of the applications I use on a regular basis to access the Internet.
    ☐ My skill is below the qualify, please specify _____

          _____

    ☐ My skill is above the qualify, please specify _____

          _____

Q13). In terms of security category, which one of the following would describe you the best:
    ☐ I am aware that my credentials (username/password) can be stolen. I know I should not reveal private information online.
    ☐ I use different passwords to access equipment, devices and digital services and I modify them on a periodic basis.
    ☐ I know how to react if my computer is infected by a virus. I can configure or modify the firewall and security settings of my digital devices.
    ☐ My skill is below the qualify, please specify _____

          _____

    ☐ My skill is above the qualify, please specify _____

          _____

Q14). In terms of safety category, which one of the following would describe you the best:
    ☐ I know that using digital technology extensively can affect my health.
    ☐ I understand the health risks associated with the use of digital technology (e.g., risk of addiction).
    ☐ To avoid health problems (physical and psychological), I can make use of information and communication technology.
    ☐ My skill is below the qualify, please specify _____

          _____

    ☐My skill is above the qualify, please specify _____

          _____

Q15). In terms of safety category, which one of the following would describe you the best:
    ☐ I take basic measures and actions to save energy.
    ☐ I understand the positive and negative impact of technology on the environment.
    ☐ I have an informed stance on the impact of digital technologies on everyday life and the environment.
    ☐ My skill is below the qualify, please specify _____

          _____

    ☐ My skill is above the qualify, please specify _____

          _____

Category 5: Problem solving

Q16). In terms of problem solving category, which one of the following would describe you the best:
    ☐ I find support when a technical problem occurs or when using a new program.
    ☐ I can solve most of the frequent problems that arise when using digital technologies.
    ☐ I can solve almost all problems that arise when using digital technology.
    ☐ My skill is below the qualify, please specify _____

          _____

    ☐ My skill is above the qualify, please specify _____

          _____

Q17). In terms of problem solving category, which one of the following would describe you the best:
    ☐ I know that digital tools can help me in solving problems.
    ☐ I can use digital technologies to solve (non-technical) problems.

☐ I can frequently choose the right tool, device, application, software or service to solve (non-technical) problems.

☐ My skill is below the qualify, please specify _____

_____

☐ My skill is above the qualify, please specify _____

_____

Q18). In terms of problem solving category, which one of the following would describe you the best:

☐ When confronted with a technological problem, I can use tools I know to solve it.

☐ I can solve technological problems by exploring the settings and options of programme or tools.

☐ I am aware of new technological developments. I understand how new tools work.

☐ My skill is below the qualify, please specify _____

_____

☐ My skill is above the qualify, please specify _____

Q19). In terms of problem solving category, which one of the following would describe you the best:

☐ I am aware that I need to update my digital skills regularly.

☐ I regularly update my digital skills. I am aware of my limits and try to fill my gaps.

☐ I frequently update my digital skills to decrease my limits and increase my digital knowledge.

☐ My skill is below the qualify, please specify _____

_____

☐ My skill is above the qualify, please specify _____

_____

Part 5 - Farming practice and agricultural standards:

Part 5: Farming practice

Q1). What are your knowledge/skills about agriculture norms and standards? (which one(s) do you know/use?)

☐ Organic standards : _____

☐ Occupational Health and Safety standards : _____

☐ Quality norms and standards

☐ Good Agriculture Practices

Q2). What is type of your farming practice?

☐ Chemical farming   ☐ Organic farming

☐ Mixed farming (both chemical and organic)

Q3). Do you have any agricultural certificate for your agricultural products?

☐ Yes   ☐ No

If Yes, please specify _____

If No, Do you want to get agricultural certificate for your farm and your products?

☐ Yes (Why?) _____

☐ No (Why?) _____

Q4). What factors affect your yield? (multiple answers is possible)

☐ Lack of finances   ☐ Lack of knowledge

☐ Unavailability of resources   ☐ Diseases

☐ Natural calamities _____   ☐ Other _____

Q5). Which farming practices do you prefer/plan to do in the future? (please select only one answer)

☐ Chemical farming (Why ?) _____

☐ Organic farming (Why ?) _____

☐ Mixed farming (both chemical and organic) (Why ?) _____

_____

For Agricultural farming (If you do agriculture farming please answer the questions)

Q6). How do you preserve soil fertility?
  □ Fertilization (Chemicals, animal manure, green manure etc.)
  □ Crop rotation (Cultivation of a series of dissimilar types of crops in the same area in sequential seasons)
  □ Intercropping (Cultivation of two or more dissimilar types of crops in the same area in the same season)
  □ Tillage
  □ Other (specify): ....

  In case fertilizers are applied, which kinds do you use?
    □ Chemical fertilizers
    □ Organic fertilizers (non-chemicals like animal manure, green manure, compost, etc.)
    □ Both

    In case chemical fertilizers, what is the main reason for using Chemical/Uria fertilizers? (able to choose multiple choices)
      □ Quick cultivation   □ Good impact on the plant health
      □ Good production   □ Low cost
      □ Works according to the soil   □ Lack of availability of organic fertilizers
      □ No need for crop rotation for this □ Useful even for low productivity soil
      □ Easy to mix   □ It has become a compulsion for production
      □ Other (Specify)_____

    In case organic fertilizers are used, can you specify the type? (able to choose multiple choices)
      □ Livestock manure
      □ Poultry manure
      □ Green manure (Type of crops cultivated primarily to enrich the soil with nutrients and organic matter through ploughing it into the soil when flowering begins)
      □ Other (specify) : ....

    In case that crop rotation, and/or intercropping and/or green manure are practiced, do you integrate legumes?
      □ Yes   □ No

Q7). How often do you use pesticides in your farming?
  □ Always   □ Occasionally   □ Rarely   □ If need arises   □ Never

Q8). How do you control pests and diseases?
  □ Biological & organic control methods (non-chemical control methods)
  □ Integrated pest management (IPM) methods
  □ Chemical pesticides (treatment), specify what do you use ?
    _____
  □ Other methods (specify) _____
  In case of non-chemical methods for plant protection are used. Can you specify that?
    □ Mechanical ways   □ Physical and pheromone traps
    □ Biological enemies of pests □ Other (specify) _____

Q9). How do you control weeds? (able to choose multiple choices)
  □ By burning plant residues after harvesting.
  □ By grazing through animals.
  □ By mechanical weeding (tillage, mowing and/or manual).
  □ By crop rotation and/or intercropping
  □ By chemical herbicides, specify what do you use ? _____
  □ Other (specify) _____

Q10). In case of drought situation, how do you irrigate your crops to mitigate drought impact?
  □ Use less water consuming crops
  □ Change traditional irrigation practices to sprinkler, drip irrigation, etc.
  □ Save water by reducing wastage during drought year
  □ Do nothing

Q11). How often do you register your field tasks (sprayings, fertilizer applications etc.) after you have carried them out?
  □ Never   □ Seldom   □ Sometimes
  □ Often   □ Always

Q12). What format you use to keep records of herbicides, insecticides, fungicides or other pesticides applied to your crops?
  □ Written   □ Electronic/computer file   □ No record kept

If No record, why don't you record? _____

_____

Q13). What information is kept in your logs/files?
- ☐ Date of application   ☐ Product applied   ☐ Temperature at application
- ☐ Identification of orchard   ☐ Rate of application   ☐ Targeted weed, insect or disease
- ☐ Total area treated   ☐ No record kept   ☐ Other, specify _____

If No record, why don't you record? _____

_____

Q14). In your opinion, how harmful the chemical (synthetic) pesticides are for the environment and health? If yes, please specify
- ☐ Not harmful   ☐ moderately harmful   ☐ Very harmful

Specify if harmful: _____

Q15). Do you make detailed plans for your working tasks before you go to the field?
- ☐ Never   ☐ Seldom   ☐ Sometimes
- ☐ Often   ☐ Always

For Livestock farming (If you do livestock farming please answer the questions)

Q16). Identify the general components of your animal health management program (able to choose multiple answers):
- ☐ Selective breeding   ☐ Raise own replacement stock
- ☐ Isolation for purchased/diseased animals   ☐ Culling
- ☐ Vaccinations good sanitation   ☐ Access to outdoors
- ☐ Dry bedding   ☐ Good ventilation in housing
- ☐ Good quality feed   ☐ Pasture rotation
- ☐ Nutritional supplements   ☐ Probiotics
- ☐ Other _____

Q17). Do flies are a problem in your operation?
- ☐ Yes   ☐ No

If Yes, what do you do to prevent or control them?

_____

_____

_____

Q18). Do internal or external parasites are a problem in your operation?
- ☐ Yes   ☐ No

If Yes, what are they and how do you prevent or control them?

_____

_____

_____

Q19). Do you have problem with predators?
- ☐ Yes   ☐ No

If Yes, check which predators you have problems with (multiple answers are possible):
- ☐ Hawks   ☐ Feral   ☐ Cats   ☐ Raccoons/Skunks, etc.
- ☐ Dogs   ☐ Foxes   ☐ Coyotes   ☐ Other _____

Q20). What forms of manure do you use?
  ☐ Liquid   ☐ Semi-solid/piled   ☐ Fully composted

Q21). Does the manure from your livestock is used on your fields?
  ☐ Yes   ☐ No

  If Yes, please describe how it is used:
  _____
  _____

  And Acres of land available for manure application: _____

Q22). Are records of all animal movements into and from your farm up to date and reported?
  ☐ Yes   ☐ No

  If Yes, please describe how:
  _____
  _____
  _____

Q23). Are all animals marked, branded, tagged and registered in accordance?
  ☐ Yes   ☐ No

  If Yes, please describe how:
  _____
  _____

Part 6 - Marketing skill:

Part 6: Marketing Skill

Q1). How do you sale your agricultural products?
  ☐ Direct   ☐ Through middle men   ☐ Though cooperative group
  ☐ Private companies   ☐ Export   ☐ Other _____

Q2). Do you have a web page for selling your agricultural products?
  ☐ Yes   ☐ No

  If Yes, how long have you had this webpage?
      ☐ Less than 1 year   ☐ 1 – 3 years   ☐ More than 3 years

  If No, do you want to have a web page for selling your agricultural products?
      ☐ Yes   ☐ No
  Why? _____

Q3). How do you get information about different methods of sales?
  ☐ Other famers   ☐ Traders   ☐ Company Persons   ☐ Radio
  ☐ TV   ☐ Telephone   ☐ Internet   ☐ Commodity market
  ☐ Other _____

Q4). Do you have your business model? (Planning for making a profit i.g plan to growing products, to harvest, to sell products, to transport products, etc.)
  ☐ Yes   ☐ No

  If Yes, please specify _____

  If No, do you want to have the business model?
  ☐ Yes   ☐ No
  Why? _____

Q5). Do you use any software/technique helping you to plan your business?
☐ Yes   ☐ No

If Yes, please specify _____

If No, do you want to have software/technique helping you to plan your business?

☐ Yes   ☐ No

Why? _____

Part 7- Smart Farming practices/training experience:

Part 7: Smart Farming Practices/Training Experiences

Q1). Have you ever been trainer for training other farmers?
☐ Yes   ☐ No

If Yes, please specify _____

_____

And How often per month?
☐ Less than 2 times   ☐ 3 - 5 times   ☐ 6 - 8 times
☐ 9 - 10 times   ☐ More than 10 times

Q2). Have you ever joined training relevant to farming practices and/or technology?

☐ Yes   ☐ No

If Yes, please specify _____

_____

If No, do you want to join training relevant to farming practices and/or technology?

☐ Yes   ☐ No

Why? _____

Q3). Do you know the word 'Smart Farming'?
☐ Yes   ☐ No

If Yes, what is smart farming for you? (in general)
☐ Use of sensors (temperature, hygrometry…) to help you make the best decisions
☐ Use of sensors and actuators to perform operations automatically without your input
☐ Total / Partial automation of health threatening tasks (diffusion of pesticides, heavy lifting…)
☐ Total / Partial automation of tasks with a low added value (repetitive asks…)
☐ Use of technologies to detect issues and act more quickly
☐ Other (specify) _____

Q4). Are you far advanced in the path of smart farming?
☐ Nothing is done at the moment
☐ Existing, but limited use of technology (specify) _____

☐ We are already using smart farming (specify) _____

_____

Q5). Which kind of farming data are you familiar with? (multiple answers are possible)
☐ Data from sensors and smart technology
☐ Knowledge relevant to farming practices
☐ Information
☐ Other (specify) _____

Q6). How have you improved your knowledge on smart farming previously? (multiple answers are possible)
- ☐ Nothing has been done previously
- ☐ Reading (books and/or websites)
- ☐ Training courses with a teacher
- ☐ MOOCS (Massive Open Online Courses)

1.3. Survey guideline

This part explains the direction of each part of the survey. The survey consists of seven parts to understand farmers' behaviours, their cultivation skills, and including their requirements for their future farming practices.

Part 1 - General information: to understand the basic information relevant to farmers. The questions in this part include name, country, age, gender, qualification, subsidies(s) received, family income per year, source(s) of family income, professional background, and the reason to join this project.

Based on the question in this part, we will understand farmer's general information and their background and their experiences relevant to farming.

Part 2 - Farm description: to understand the details of farm area and farming activity of farmers. The questions in this part include topography of their farm area, their total area (they are owner or rent that area for farming), agriculture produce, nature and technique used of farming, and experience to be learning and demonstration site.

Based on the question in this part, we will understand the topography of each farm area that we will know the advantage and limitation of each farm area. Additional, we will know the nature and technique used for their farming practice so that we can understand their skills and limitations. Furthermore, we will know their training skills that farmers who have training skills can be the trainers of this project.

Part 3 - Technology usage: to understand farmers' experience of using technology. The questions in this part include three main aspects comprising the ICT device(s) farmers used and the reason of usage, experiences of using smart farming technique, and method to get any information relevant to agriculture production.

Based on the question in this part, we will know most type of ICT device(s) used and the purposes of using including their experience relevant to smart farming technology.

Part 4 - Digital literacy: to understand the level of farmers' understanding and ability relevant to information and communication technology. There are five areas of digital competence including Information processing, Communication, Content-creation, Safety, and Problem-solving as described in Table 2.

Table 2: Framework for the development of digital competence

Aspect	Description
Information processing	Measures users ability to 'identify, locate, retrieve, store, organise and analyse digital information, judging its relevance and purpose'.
Communication	Measures users potentiality to 'communicate in digital environments, share resources through online tools, link with others and collaborate through digital tools, interact with and participate in communities and networks, cross-cultural awareness'.
Content-creation	Measures users' talent to 'create and edit new content (from word processing to images and video); integrate and re-elaborate previous knowledge and content; produce creative expressions, media outputs and programming; and deal with and apply intellectual property rights and licenses'.
Safety	Measures learners' skills regarding 'personal protection, data protection, digital identity protection, security measures, safe and sustainable use'.
Problem-solving	Measures users' ability to identify digital needs and resources, make informed decisions as to which are the most appropriate digital tools according to the purpose or need, solve conceptual problems through digital means, their creative use of technologies, solve technical problems, and update one's own and others' competences.

These five areas of digital competence have been developed into a self-assessment grid according to three proficiency levels: basic, intermediate and advanced.

Part 5 - Farming practice and agricultural standards: to understand the level of farmers' knowledge and practices on farming, and their understanding of agricultural standards. There are three areas of this part including agriculture norms and/or standards, cultivation practice, and livestock farming practice. Agriculture norms and/or standards aspect helps to know farmers' skills and experience regarding agriculture norms and/or standards. Cultivation practice aspect helps to know farmers' skill and experience relevant to crops cultivation including their limitations. And livestock farming practice aspect, helps to know farmers' skill and experience relevant to animal raising including their limitations.

Part 6 - Marketing skill: to understand the methods that farmers used for selling their productivities. In this part we will know farmers' experience about the method and/or media that they use for selling their products including their technique to plan their business.

Part 7- Smart Farming practices/training experience: to understand farmers' experiences relevant to smart farming practices and/or training. There are two main areas of this part comprising an experiencing of training and trainer, and smart farming understanding. In experiencing of training and trainer aspect, we will know trainer skills of farmers who are used to train other people relevant to farming practices based on their experiences. In smart farming understanding aspect, we will know farmers' understanding and skills relevant to smart farming practices and technologies.

Respondents, which are farmers, need to answer all questions relevant to themselves, farm area, their actual farming activities and their behaviours during farming practices. This information helps us to understand and define the knowledge level of farmers in each aspects including we can understand their requirements for improving their farm production process.

2. Survey feedback by country

This part illustrates the farmers' feedback of each country including Thailand, Nepal, and Bhutan. The total of respondents is summarized in Figure 1.
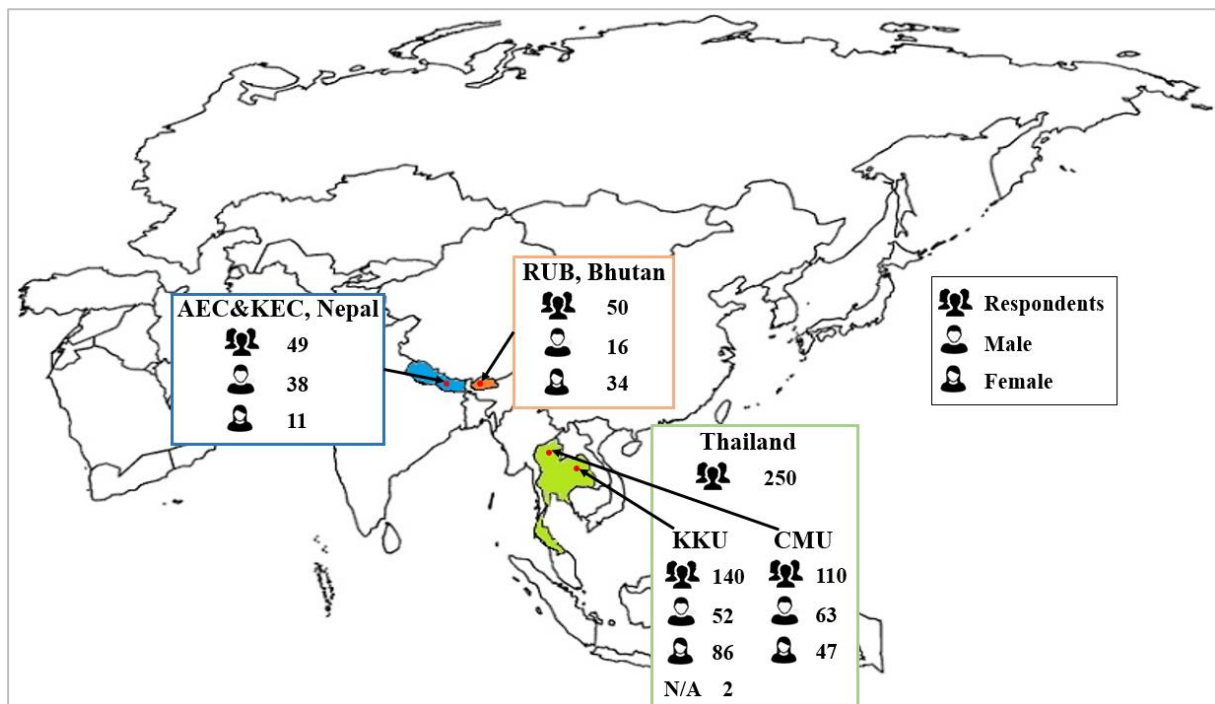
Figure 1: The total of respondents of each country

Figure 1 illustrates the survey feedback by country. In Thailand, there are two university participation this project including Chiang Mai University (CMU) and Khon Kaen University (KKU) and the total respondents (farmers who answered the survey) of survey from both university is 250 farmers. In Nepal, there are two university participation this project including ACME Engineering College (AEC) and Kantipur Engineering College (KEC). The total respondents of survey from both university is 49 farmers. And in Bhutan, there is one university participation this project which is Royal University of Bhutan (RUB). The total respondents (farmers) of survey from both university is 50 farmers.

3. Analysis results

This part describes the analysis model in each part of the survey and the analysis results of each partners.

3.1. Analysis model

To analyse the survey results, we need to create the model to make an analysis for each part of the survey. Based on questions of the survey, there are both multiple choices and answer the questions in the blank. Therefore, we need to create two ways for collecting data.

- *Multiple choices:* For the multiple choices, we will assume number 0 to represent 'do not select this answer' and number 1 to represent 'select this answer', see Figure 2(a). Therefore, we will know which choice is selected in each question. Then we do for all questions and all respondents. These data collection is put in an excel file. After that, we analyse each question in each part that how many respondents select each choice and calculate in percentage, see Figure 2(b).

(a)   (b)

Figure 2: Data collection for multiple choices

- *Answer the questions in the blank:* For this type of answer, we will put the answer as a note of each question (see Figure 3). After that, we will summary all answer of each part to analyse their answers.

Figure 3: Data collection for answer the questions in the blank

After data collection, we will analyse these data to understand knowledge and skills of farmers (respondents). The analysis model of each part comprises;

- Part 1 General information:

  Criterias:
    - The trend of age gender, and qualification of farmers.
    - The main source of farmers' family income and the subsidies for farming
    - Income per year and farming experiences of farmers

Analysis method:
- *Q1) – Q4) and Q6) - Q7)*: To see the average of age, gender, qualification, and income of farmers by plotting graph.
- *Q5*: Plotting graph to see the trend of each source of income. Therefore, we can see trend of farmers' sources of income.

- Part 2 Farm description:

Criterias:
- The farm area, type of farm area, and total farm area of farmers
- The productivities are produced
- The farming techniques of farmers

Analysis method:
- Plot a graph to see the most answer in each question

- Part 3 Technology usage:

Criterias:
- The smart devices used by farmers and the purpose of using them in agricultural field
- The experience and ability of farmers of using internet
- The experience of farmers relevant to using smart farming technologies for farming

Analysis method:
- Plot a graph to see the most answer in each question
- You can see the skills of farmers in terms of technology usage

- Part 4 Digital literacy:

Criterias:
- The level of ICT literacy of farmer in Asian   countries
- The difference in level of ICT literacy among farmer in Asian countries?

Analysis method:
- In this part, we use the analysis method from *Al Khateeb et al., 2017*.
- Those five areas of digital competence have been developed into a self-assessment grid according to three proficiency levels:
    - Choice 1 is *a basic level*,
    - Choice 2 is *an intermediate level* and
    - Choice 3 is *an advanced level*.

Q8). In terms of information processing category, which one of the following would describe you the best:
- I know not all online information is reliable. ← **Basic Level**
- I use some filters when searching to compare and assess the reliability of the... **Intermediate Level**
- I can assess the validity and credibility of information using a range of criteria. ← **Advance Level**

Figure 4: Analysis method for Digital literacy part

Based on the analysis results, the majority of farmer in Chiang Mai are basic users in information processing (40%), see Table 3.

- They can use different search engines to find information.
- They know not all online information is reliable.
- They can save or store files or content and retrieve them once saved or stored.

Table 3: Example of analysis results of CMU, Thailand

Aspect	Items	below	Basic	Intermediate	Advance	Above	Total
Information processing	Q1	40	22	43	2	0	107
		37%	21%	40%	2%	0%	100%
	Q2	52	38	17	0	0	107
		48%	36%	16%	0%	0	100%
	Q3	7	67	33	0	0	107
		6.5%	62.5%	31%	0%	0	100%

- Part 5 Farming practice:

Criterias:
- The farming knowledge/skills relevant to farming used and farming standard of farmers
- The farming types used
- The plan of farming practice in the future
- Knowledge of farming practice relevant to agricultural farming and livestock farming

Analysis:
- Plot a graph to see the most answer in each question
- You can see farmers' skills relevant to farming practice

- Part 6 Marketing skill:

Criterias:
- The method of selling
- The market/target group of farmers for selling
- The business plan

Analysis method:
- Plot a graph to see the most answer in each question
- You can see the market of farmers and their business plan to increase income

- Part 7 Smart Farming practices/training experience:

Criterias:
- Trainer and trainee experience of farmers

- The understanding, skills, and experience on smart farm technology
- The preference of farmers on training channel

Analysis method:
- Plot a graph to see the most answer in each question
- You can see farmers experience, skills, and understanding on smart farming practice and technology.
- You can get the preference of farmers on training channel, which one they prefer most.

3.2. Analysis results

3.2.1. Chiang Mai University (CMU), Thailand

The total number of respondents is 110 farmers. The survey was applied in several areas of Chiang Mai province both paper based survey and computer based survey (we created survey via google document and shared the link to our respondents to answer the survey via internet). Farmers participated in this survey are crop production farmers. The results are separated into seven parts.

Part 1: General information
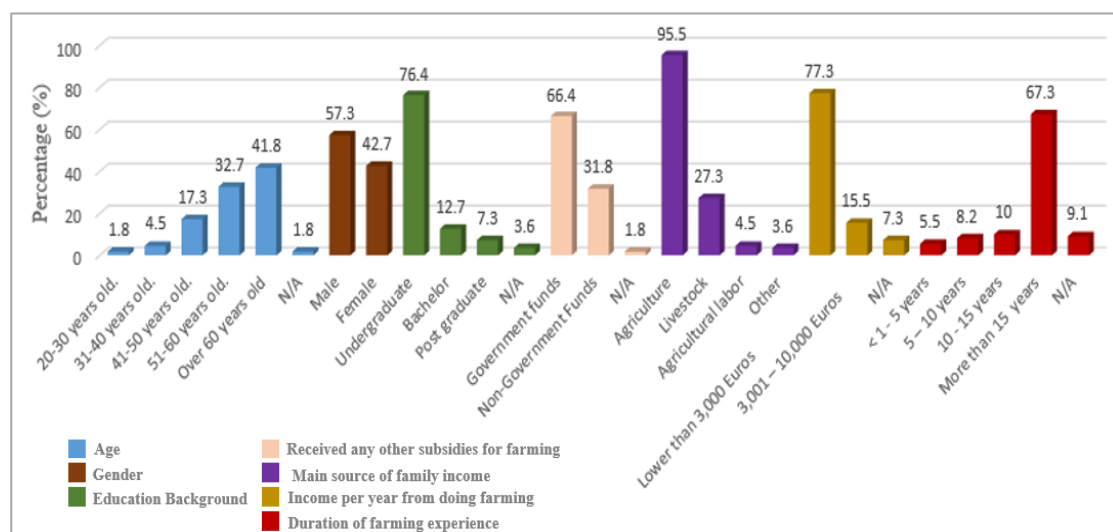
Figure 5: Results of general information (CMU, Thailand)

Figure 5 illustrates the results of farmer's general information part. The interpretation of results in this part are separated into six aspects comprising;

- *Age:* 74.5 percent of respondents is aging people which are over 51 years old. Therefore, building young farmers is significant for future farming industry in Chiang Mai province.
- *Education:* 76.4 percent of farmers is under-graduate level. However, they are willing to learn new things.

- *Farming experience:* 67.3 percent of respondents has more than 15 year of farming experience. Consequently, they have the ability to produce and maintain their crops based on their experience.
- *Income per year:* 77.3 percent of respondents get income less than three thousand Euros per year because they cannot control yield in each year due to environmental conditions. However, they will be able to increase their income, if they use an appropriate practice on crop production.
- *Main source of family income:* agricultural farming is the main source of their family income which is 95.5 percent. Fruits and vegetables are the main products.
- *Subsidy:* 66.4 percent of respondents used to received some subsidies from the government and/or local organization.

Part 2: Farm description
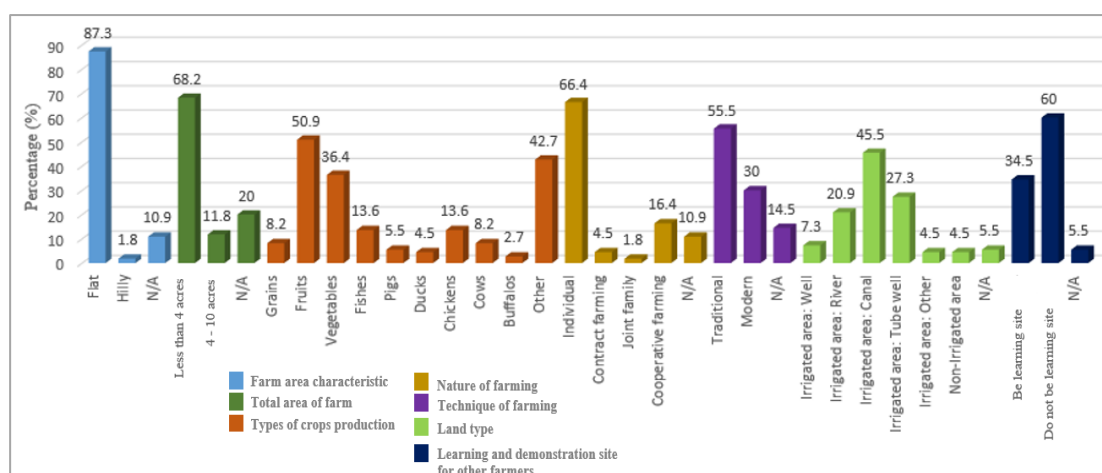
Figure 6: Results of farm description (CMU, Thailand)

Figure 6 illustrates the results of farm description part. The interpretation of results in this part are separated into six aspects comprising;

- *Farm characteristics:* 87.3 percent of farm area is flat land which is appropriate to crop production.
- *Total area of farm:* 68.2 percent of farm are small and medium farms which the total farm area is less than 4 acres and farmers are farmland owners.
- *Types of crops production:* Main products of respondents are fruits (50 percent) and vegetables (36.4 percent). And 42.3 percent are other products including coffee, mushroom, rice, cotton, and sugarcane.
- *Nature and techniques of farming:* 66.4 percent is an individual farming. There are two main natures of farming including family farming with traditional farming method (55.5 percent), and cooperative farming (16.4 percent) that farmers sell their agricultural products to supermarkets or other vegetable shops.

- *Land type:* 90 percent is irrigated land which the main sources of water are from canal (45.5 percent) and tube well (27.3 percent). However, farmers are notability to control the quantity and quality of water.
- *Learning and demonstration:* 34.5 percent of farm is the learning and demonstration site. Therefore, farmers have the ability to teach visitors relevant to their professional experience.

Part 3: Technology usage
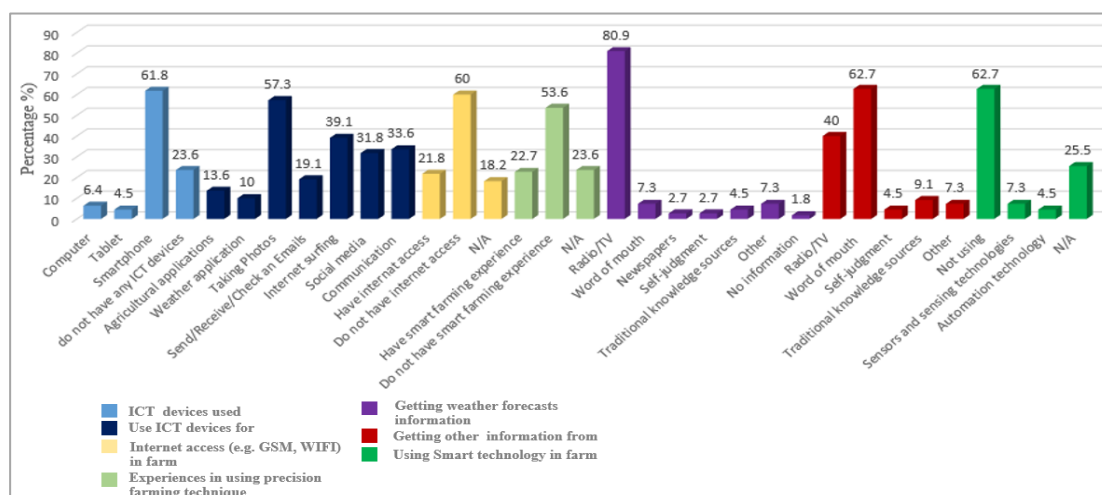
Figure 7: Results of farmer's technology usage (CMU, Thailand)

Figure 7 illustrates the results of farmer's technology usage part. The interpretation of results in this part are separated into four aspects comprising;

- *Information and Communication Technology (ICT) device usage:* 72.7 percent of respondents uses ICT device(s) in daily life. Most of them have a smartphone (61.8 percent) that they use it for taking photos (57.3 percent), *surfing* the internet (39.1percent), social media (31.8percent), and communication (33.6 percent). Some of farmers uses ICT device(s) for agricultural and weather forecast applications (13.6 and 10 percent respectively).
- *Internet access in farm:* 21.8 percent of respondents has internet access in their farm for internet surfing and network communication. However, most of them do not have internet access in their farm (60 percent) because it is not necessary in their perspective.
- *Sources of weather and other information:* 80.8 percent of respondents get weather information from radio/television. So, they are able to plan the crops maintenance processes. For other information (fertilization method, diseases control, etc.), most of them get information from word of mount and radio/TV (62.7 and 40 percent respectively).
- *Using smart technology in farm:* 4.5 percent of respondents have adopted smart technology device(s) into their farm for monitoring and irrigation control. Meanwhile, 7.3 percent of farmers adopted some

smart technology device(s) into their farm but they do not know how to use data collected. Moreover, 62.7 percent of respondents are not adopted any smart technology device(s) in farm due to lack of technology knowledge and financial limitation.

Part 4: Digital literacy

Table 4: Results of farmer's digital literacy (CMU, Thailand)

Aspect	Items	Below qualify	Basic	Intermediate	Advance	Above qualify	Total
Information processing	Q1	32.3%	52.1%	11.5%	4.2%	0%	100%
	Q2	35.4%	44.8%	6.3%	13.5%	0%	100%
	Q3	41.7%	46.9%	6.3%	5.2%	0%	100%
Communication	Q4	15.6%	51%	21.9%	11.5%	0%	100%
	Q5	33.3%	45.8%	16.7%	4.2%	0%	100%
	Q6	41.7%	28.1%	22.9%	7.3%	0%	100%
	Q7	27.1%	32.3%	25%	15.6%	0%	100%
Content Creation	Q8	30.2%	65.6%	4.2%	0%	0%	100%
	Q9	40.6%	51%	6.3%	2.1%	0%	100%
	Q10	30.2%	61.5%	8.3%	0%	0%	100%
	Q11	52.1%	44.7%	3.2%	0%	0%	100%
Safety	Q12	52.1%	45.7%	2.1%	0%	0%	100%
	Q13	41.5%	56.4%	2.1%	0%	0%	100%
	Q14	31.8%	34.1%	18.2%	15.9	0	100%
	Q15	30.7%	14.8%	50%	4.5%	0%	100%
Problem solving	Q16	60.2%	29.5%	8%	2.3%	0%	100%
	Q17	37.5%	51.1%	2.3%	7.3%	0%	100%
	Q18	50%	42%	4.6%	3.4%	0%	100%
	Q19	14.8%	75.3%	4.9%	4.9%	0%	100%

Table 4 illustrates the results of farmer's digital literacy part comprising five aspects: Information Processing, Communication, Content Creation, Safety, and Problem solving. The interpretation of results of farmer's digital literacy part are shown in Table 5. Based on the survey results, farmers have skills at below basic level

on safety aspect only. For the rest, they have skills at a basic level. However, they can improve their skills.

Table 5: Interpretation of results of farmer's digital literacy (CMU, Thailand)

Aspect	Level	Interpret
Information processing	Basic (47.93%)	• Farmers only look at the content without any interactions • Farmers are able to select the content without search ability.
Communication	Basic (39.00%)	• Farmers can communicate by using LINE, Facebook, WhatsApp. • Farmers are able to use basic communication feature in applications. • Farmers are able to share content in applications.
Content-creation	Basic (55.71%)	• Farmers are able to create simple content. • Farmers are able to modify simple functions of software and applications as changing default setting. • Farmers do not have any programming skills.
Safety	Below Basic (30.09%)	• Farmers are able to manage basic security in devices. • Farmers are awareness of personal protection. • Farmers do not know how to use security program.
Problem-solving	Basic (49.48%)	• Farmers are able to solve problem from setting guideline. • Farmers are able to follow the instruction manual. • Farmers are unable to configure the program.

Part 5: Farming practice and agricultural standards
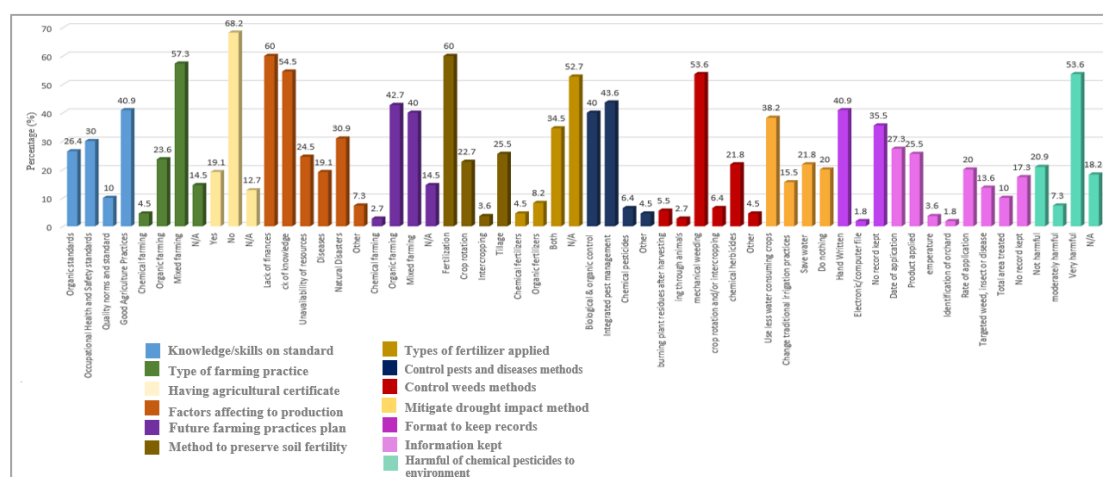
Figure 8: Results of farming practice and standard of farmers (CMU, Thailand)

Figure 8 illustrates the results of farming practice and standard of respondents' part. The interpretation of results in this part are separated into eight aspects comprising;

- *Agricultural standard and certificate:* 67.3 percent of respondents knows the name of Good Agricultural Practices (GAP) and Organic standards. However, the only 19.1 percent of farmers got GAP standard certificate. Most of them do not get any agricultural standard certificate which is 68.2 percent. Nevertheless, they require getting agricultural standard certificate (45.5 percent) to improve the quality of productivity.
- *Type of farming practice)* there are three types of farming practices including mixed farming (57.3 percent), organic farming (able to reduce harmful to their health and consumers' health, 23.6 percent), and

chemical farming (easy to control pests and diseases, 4.5 percent). Based on survey, farmers require to reduce crops chemical residue due to reducing chemical residue and improving quality of productivity.

- *Future farming practice plan:* 42.7 percent of respondents want to do organic farming due to higher demand currently and getting higher income. Meanwhile, 40 percent of respondents still want to do mixed farming because in their perspective, only organic farming is hard to control farm production.
- *Soil fertilization methods*: 60 percent of respondents uses fertilization method to preserve soil fertility which use both organic and chemical substances (34.5 percent). Because farmers are able to control pests and disease, and to reduce chemical residue in crops and environment.
- *Information recording:* 40.9 percent of respondents do some record of their farming activities by writing because it is easy and they do not have any computer. Most data recorded are product applied (25.5%), and the Date of application substances (27.3%). The rest of farmers do not record any information because it is complicated and it is not necessary in their perspective (35.5 percent)
- *Weed control:* there are two main methods that farmers use for weed control including using mechanical weeding (53.6 percent), grazing through animals (feeding animals and control weeds at the same time, 2.7 percent). However, farmers try to reduce burning plant residues after harvesting due to awareness on soil fertility impact after burning.
- *Mitigation drought method:* 38.2 percent of respondents try to reduce water consumption during drought situation. Additional, some of them try to change from traditional irrigation to drip irrigation helping to reduce water consumption (15.5 percent).
- *Pests and disease control:* non-chemical substances usage is very significant for farming practices presently which is 83.6 percent of non-chemical use of farmers based on the result. Because farmers aware on environmental impact, and consumers and farmers' health.

Part 6: Marketing skills
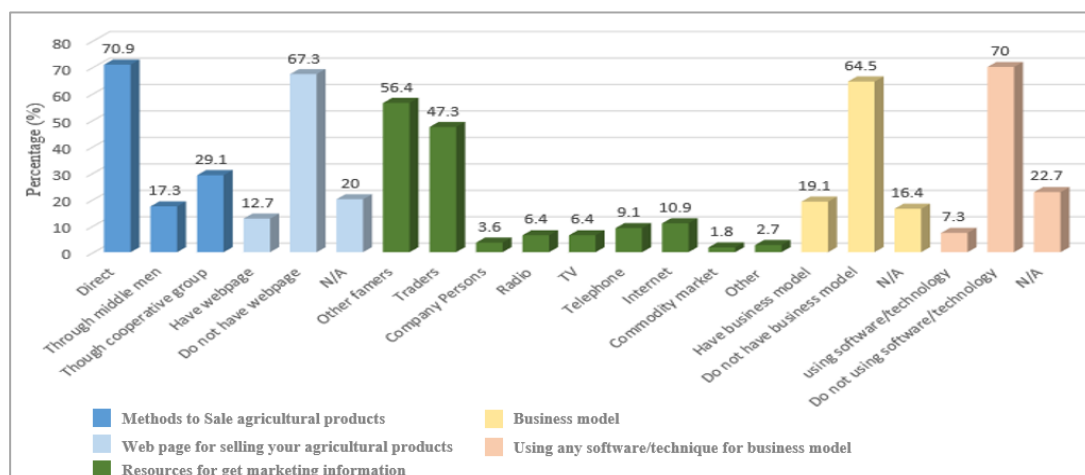
Figure 9: Results of Marketing of farmers (CMU, Thailand)

Figure 9 shows the results of farmers' marketing skills part. The interpretation of results in this part are separated into five aspects comprising;

- *Selling methods:* there are two main selling methods of respondents comprising sell their crops directly to consumers (70.9 percent), and sell their crops through cooperative group (29.1 percent). Therefore, they can get higher income because they do not under price by middle man.
- *Webpage:* 67.3 percent of respondents does not have a web page so that they are unable to expand their consumer base. Meanwhile, 12.7 percent of respondents has a web page for selling their crops so that they can sell their crops directly to consumers.
- *Marketing information resources*: three main resources of marketing information of respondents include discussion with other farmers (56.4percent), getting from traders (47.3 percent), internet and commodity market (12.7 percent).
- *Business Model:* 64.5 percent of respondents do not have a business model and they want to have it (90 percent).
- *Using software for business model:* 70 percent of respondents do not use any software for business model and they require it for helping to plan their business (55.2 percent). However, 44.8 percent of respondents do not require because it is difficult for them.

Part 7: Smart farming practice

Figure 10: Results of smart farming practices of farmers (CMU, Thailand)
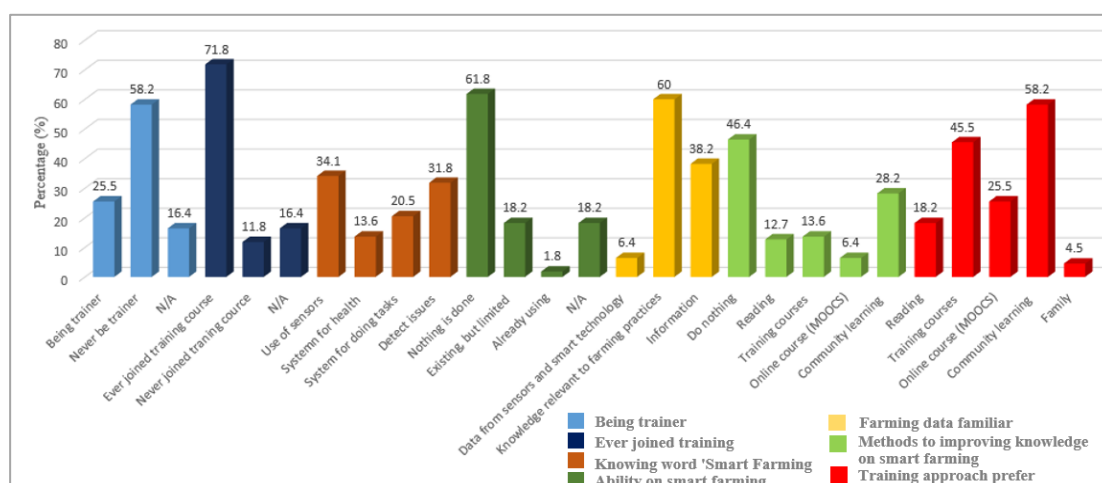
Figure 10 shows the results of farmers' smart farming practices skill. The interpretation of results in this part are separated into six aspects comprising;

- *Ability to be trainer:* 25.5 percent of respondents are used to be trainer so that they have the ability to teach other people based on their professional experience (can be the trainer of our project).

- *Training attendance:* 71.8 percent of respondents are ever to attend the training courses relevant to farming practices and/or technology. Therefore, they can enhance their crops production skills and improve crops production processes.
- *Knowing word 'Smart Farming':* 40.9 percent of respondents know the word 'Smart Farming'. Some farmers can use sensor technology for farming (34.1 percent). Some of them knows concept of automatic/Semi-automatic system for doing agricultural tasks (24.1 percent). And some of them know the technology to detect and solve issues (31.8 percent).
- *Smart farming practice experience:* 61.8 percent of respondents are not able to use smart farming technology because it is difficult for them and they lack of financial support. However, some of them have adopted some technologies for data collection but they do not know how to use the collected data (18.2 percent). Meanwhile, some of them have already used smart farm technology for monitoring and automatic irrigation controlling (1.8 percent).
- *Methods for Improving skill:* 46.4 percent of respondents do nothing for improving their skills. Therefore, they are unable to improve the quality of productivity affected by environmental issues. However, some of them share their knowledge and experience with other farmers in the community (28.2 percent). Consequently, they can enhance their knowledge on crop production.
- *The preference of training approach:* 58.2 percent of respondents prefer to learn via community learning for sharing and asking questions relevant to crop production and selling directly. Meanwhile, some of them prefer learning by physical training courses to enhance their knowledge and meet other farmers for extending their community (45.5 percent). Additional, some of them prefer online courses to learn via smartphone/computer/tablet and easy to access (25.5 percent).

3.2.2. Khon Kaen University (KKU), Thailand

The survey was applied in Khut Chaing Me village, Ubonrat, Khon Kaen (30 farmers), Nong Hoi, Kosum Phisai, Mahasarakham (30 farmers), and other Farmer Network Around KKU (North Eastern Region, 80 farmers). The total number of respondents is 140 farmers. Two groups of farmers participated in this survey are both crop production farmers and livestock raising farmers. The results are separated into seven parts.

Part 1: General information
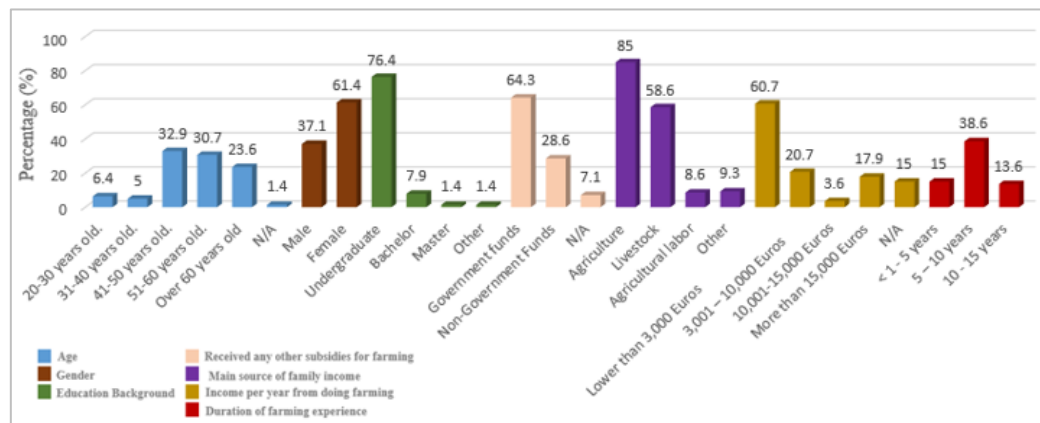
Figure 11: Results of farmer's general information (KKU, Thailand)

Figure 11 illustrates the results of farmer's general information part The interpretation of results in this part are separated into six aspects comprising;

- *Age:* the age of most respondents is over 51 years old which is about 54.3 percent that they are aging farmers.
- *Education:* the education level of farmers is under-graduate level (76.4 percent). However, they are willing to learn new things.
- *Farming experience:* 52.2 percent of farmers has more than 5 year of farming experience. Therefore, they have the ability to produce and maintain their crops based on their experience.
- *Income per year:* 60.7 percent of respondents get income less than three thousand Euros per year.
- *Main source of family income:* agricultural farming is the main source of their family income which is 85 percent. And Livestock farming is their second main source of income, 58.6 percent. Most farmers both grows crops and raises livestock.
- *Subsidy:* Most farmers got some subsidies from the government and non-Government, 92.9 percent. They spent those funds to improve their cultivation and/or livestock farming.

Part 2: Farm description
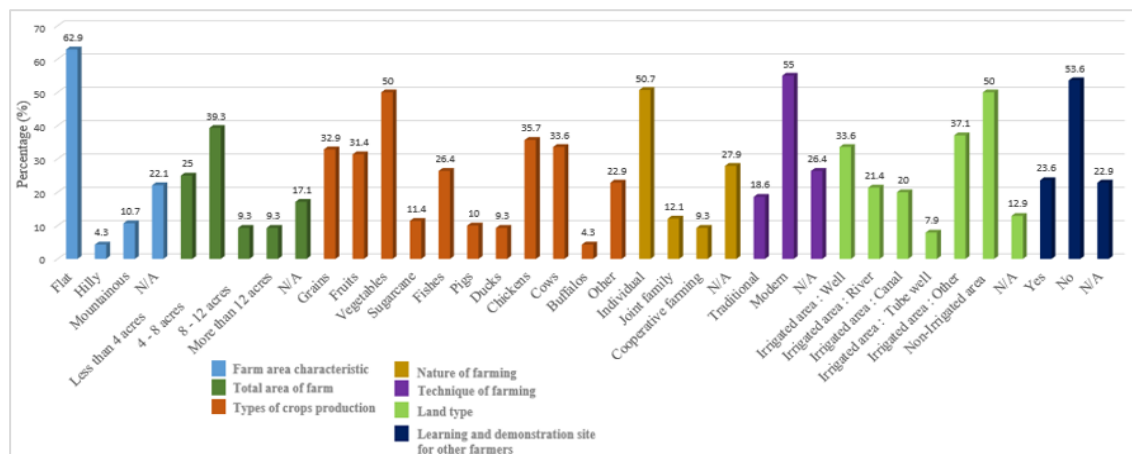
Figure 12: Results of farm description (KKU, Thailand)

Figure 12 shows the results of farm description part. The interpretation of results in this part are separated into six aspects comprising;

- *Farm characteristics:* 73.6 percent of farm area is flat and mountainous areas. In case of mountainous area, farmers have their method to cultivate their crops which is proper with their farm area.
- *Total area of farm:* 64.3 percent of farm are small and medium farms which the total farm area is between less than 4 to 8 acres. Additional, farmers are farmland owners.
- *Types of crops production:* three main crops produce includes vegetables, grains, and fruits (59.3, 32.9, and 31.4 percent respectively). Additional, three main livestock produce include chickens, cows, and fishes (35.7, 33.6, and 26.4 percent respectively). Some farmers use the dung of their animal as a manure for growing their crops.
- *Nature and techniques of farming:* 49.3 percent are an individual farming, joint family, and cooperative farming. There are two main natures of farming including cooperative farming with traditional farming method (55.5 percent) that they sell their products to shops or market.
- *Land type:* 82.9 percent is irrigated land which the main sources of water are from well, river, and canal. However, farmers still get some problem relevant to water resources especially in Summer.
- *Learning and demonstration:* 53.6 percent of farm do not be learning and demonstration site. However, farmers are willing to train to be the trainer.

Part 3: Technology usage
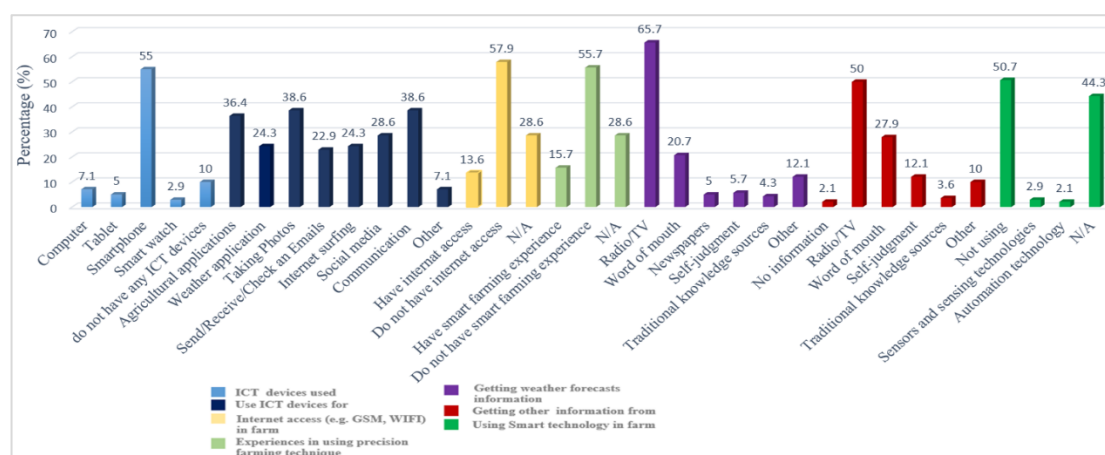
Figure 13: Results of farmer's technology usage (KKU, Thailand)

Figure 13 shows the results of farmer's technology usage part. The interpretation of results in this part are separated into four aspects comprising;

- *Information and Communication Technology (ICT) device usage:* smartphone is mostly used with 55 percent of respondents. The main purposes are for communication with other people and weather application (57.9 and 38.6 percent respectively). Therefore, most farmers can learn new things relevant to smart technology.
- *Internet access in farm:* 28.6 percent of respondents has internet access in their farm for internet surfing and network communication. However, most of them do not have internet access.
- *Sources of weather and other information:* most of respondents get weather information and other information from word of mount (50 and 50.7 percent respectively).
- *Using smart technology in farm:* 50.7 percent of respondents do not have adopted any smart farm technology into their farm because it is too expensive. On the other hand, some of farmers adopted some technology for monitoring and automation system, 2.9 and 2.1 percent respectively.

Part 4: Digital literacy

Table 6: Results of farmer's digital literacy (KKU, Thailand)

Aspect	Items	Below qualify	Basic	Intermediate	Advance	Above qualify	Total
Information processing	Q1	47.0%	28.9%	4.8%	19.3%	0%	100%
	Q2	51.3%	18.8%	12.5%	17.5%	0%	100%
	Q3	55.3%	18.4%	11.8%	14.5%	0%	100%
Communication	Q4	24.7%	22.2%	40.7%	12.3%	0%	100%
	Q5	32.5%	25.3%	30.1%	12.0%	0%	100%
	Q6	48.8%	15.0%	17.5%	18.8%	0%	100%
	Q7	33.8%	18.2%	14.3%	33.8%	0%	100%
Content Creation	Q8	31.3%	58.8%	6.3%	3.8%	0%	100%
	Q9	51.3%	28.8%	13.8%	6.3%	0%	100%
	Q10	42.9%	31.2%	11.7%	14.3%	0%	100%
	Q11	76.6%	14.3%	5.2%	3.9%	0%	100%
Safety	Q12	63.3%	21.5%	6.3%	8.9%	0%	100%
	Q13	39.7%	39.7%	15.4%	5.1%	0%	100%
	Q14	26.3%	22.4%	31.6%	19.7%	0	100%
	Q15	35.1%	26.0%	29.9%	9.1%	0%	100%
Problem solving	Q16	66.7%	17.3%	10.7%	5.3%	0%	100%
	Q17	35.1%	29.9%	22.1%	13.0%	0%	100%
	Q18	59.2%	14.5%	11.8%	14.5%	0%	100%
	Q19	28.0%	26.7%	13.3%	32.0%	0%	100%

Table 6 illustrates the results of farmer's digital literacy part comprising five aspects: Information Processing, Communication, Content Creation, Safety, and Problem solving. The interpretation of results of farmer's digital literacy part are shown in Table 7. Based on the survey results, farmers who participated in this survey have digital literacy skills at below the quality in all aspects. That means, they have little skills on digital literacy part. However, they can improve their skills.

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Table 7: Results of farmer's digital literacy (KKU, Thailand)

Aspect	Level	Interpret
Information processing	Below Basic (51.20%)	• Farmers are unable to use search engine to find information. • Farmers are unable to save the content or information found on the internet.
Communication	Below Basic (34.95%)	• Farmers can use a wide range communication tools (e-mail, chat, SMS) • Farmers are unable to use basic communication feature in applications. • Farmers are unable to share content in applications.
Content-creation	Below Basic (50.53%)	• Farmers are able to create simple content. • Farmers are unable to modify simple functions of software and applications as changing default setting. • Farmers do not have any programming skills.
Safety	Below Basic (41.10%)	• Farmers are unable to manage basic security in devices. • Farmers are awareness of personal protection. • Farmers do not know how to use security program.
Problem-solving	Below Basic (47.25%)	• Farmers are unable to solve problem from setting guideline. • Farmers are unable to follow the instruction manual. • Farmers are unable to configure the program.

Part 5: Farming practice and agricultural standards
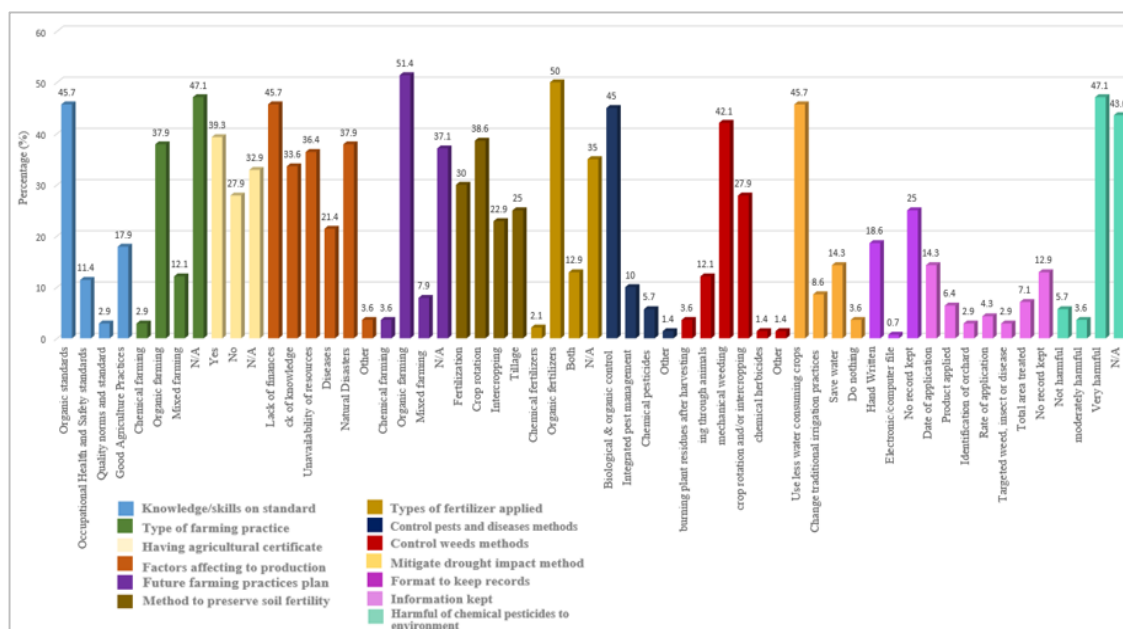
Figure 14: Results of farming practice and standard of farmers (KKU, Thailand)

Figure 14 shows the results of farming practice and standard of respondents. The interpretation of results in this part are separated into nine aspects comprising;

- *Agricultural standard and certificate:* 63.6 percent of respondents knows the name of Organic standards and Good Agricultural Practices (GAP). Some of them get an agricultural standard certificate which is 39.3 percent. On the other hand, 27.9 percent of farmers who do not get any certificate require getting agricultural standard to improve their products.
- *Type of farming practice:* there are two main types of farming practices including mixed farming (12.1 percent), and organic farming (37.9

percent). Based on survey, farmers require to reduce crops chemical residue due to reducing chemical residue of agricultural products.

- *Future farming practice plan:* 51.4 percent of respondents want to do organic farming due to get higher income and to secure their health.
- *Soil fertilization methods:* to reduce the effect to yield, farmers try to maintain and control the production comprising preserving soil fertility, controlling pests and weeds. Farmers mostly use tillage and intercropping methods to preserve soil fertility. Furthermore, farmers mainly use biological substances to control pests and mainly use mechanical to control weeds.
- *Information recording:* during practice agricultural activities, 57 percent of respondents are recorded their activities and all information relevant to cultivation by writing on notebook (18.6 percent) because it is easy for them to keep the record. Temperature is the main information that they kept the record (55 percent) and the date is the second information kept (14.3 percent).
- *Weed control:* there are two main methods that farmers use for weed control including using mechanical weeding (42.1 percent), and crop rotation (27.9 percent). However, some farmers (1.4 percent) still use chemical substance due to easier to eliminate weed.
- *Mitigation drought method:* 60 percent of respondents try to save water during drought situation. Additional, some of them try to change from traditional irrigation to modern irrigation method helping to reduce water consumption (8.9 percent).
- *Pests and disease control:* non-chemical substances usage is very significant for farming practices presently which is 55 percent due to awareness on farmers' health.
- *Livestock farming:* several methods are used for animal health management as shown in Figure 15 which the main method is drying animal bedding (32.1 percent).
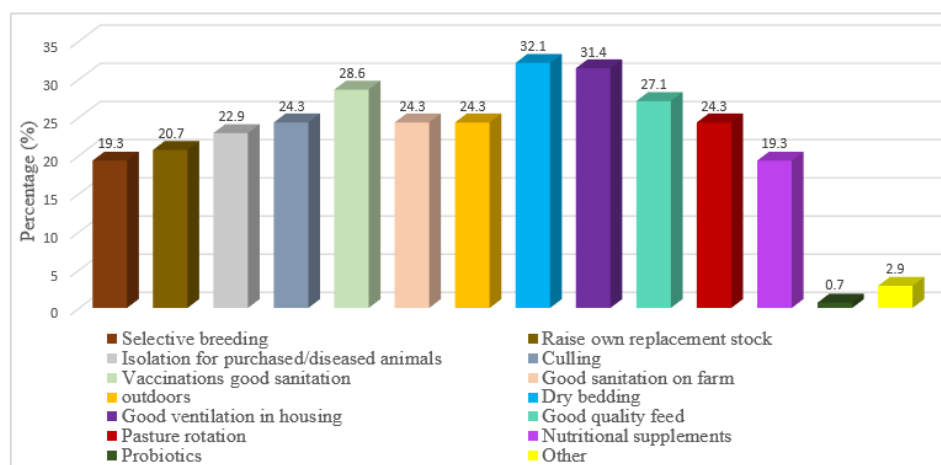

Figure 15: General components of animal health management (KKU, Thailand)
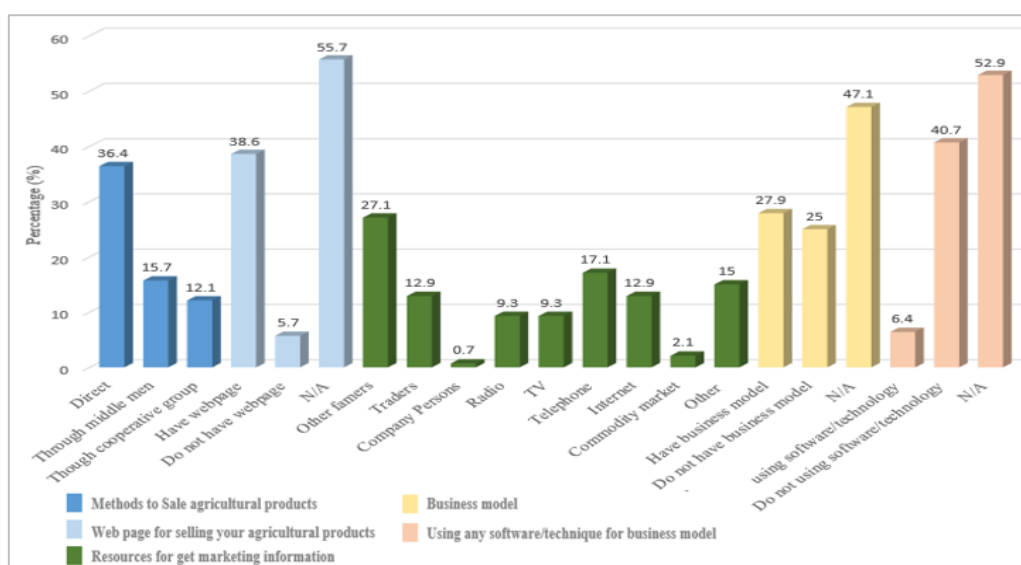
Part 6: Marketing Skills

Figure 16: Results of Marketing of farmers (KKU, Thailand)

Figure 16 illustrates the results of farmers' marketing skills. The interpretation of results in this part are separated into five aspects comprising;

- *Selling methods:* from the results, they also sell their products directly to consumers by themselves (36.4 percent). And 27.8 percent sell their products through middle man and cooperative group.
- *Webpage:* 38.6 percent of respondents have a web page so that they are able to expand their consumer base. Meanwhile, 5.7 percent of respondents do not have a web page for selling their crops, however they prefer to have their own webpage.
- *Marketing information resources:* before selling agricultural products, farmers get marketing information mainly from other people (40.7 percent). And 50.7 percent of farmers get information by using technology (radio, TV, internet).
- *Business Model:* based on the results, some farmers (29.7 percent) have their business model to manage their production processes and selling.
- *Using software for business model:* 40.7 percent of farmers do not use any software for business model and they require it for helping to plan their business (69.2 percent).
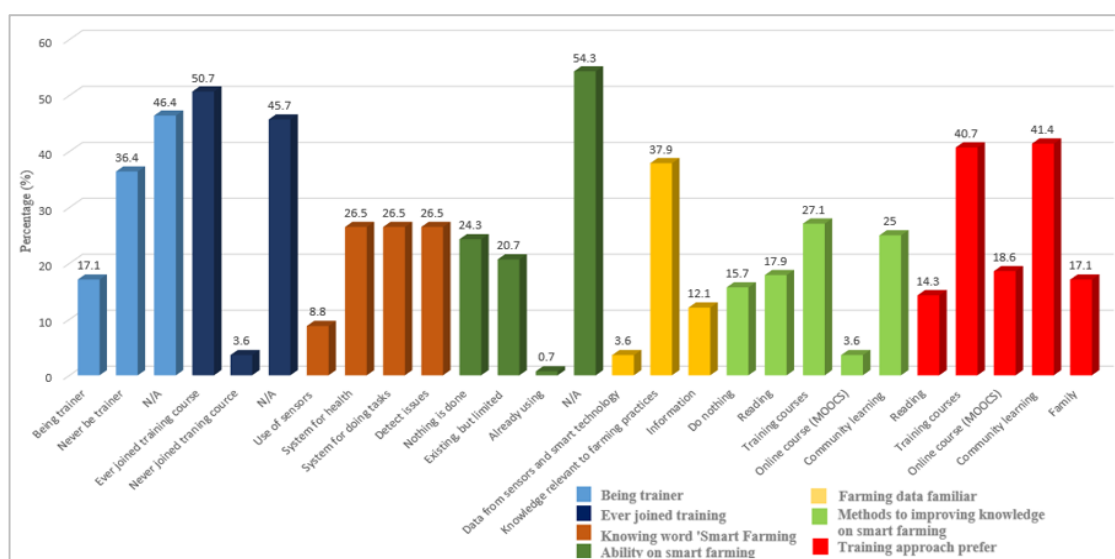
Part 7: Smart farming practice

Figure 17: Results of smart farming practices (KKU, Thailand)

Figure 17 illustrates the results of smart farming practices. The interpretation of results in this part are separated into six aspects comprising;

- *Ability to be trainer:* The 17.1 percent of respondents has an experience to be trainer for training and/or sharing their experience and knowledge to other people who visited their farm.
- *Attending training:* most farmers used to participate training courses relevant to smart farming practice (50.7 percent) because they want to improve their farming skills.
- *Knowing word 'Smart Farming':* the most of respondents understand the concept of smart farming which are adopted smart sensors for making decisions and automatic system.
- *Smart farming practice experience:* in terms of smart farming experience, 24.3 percent of respondents does not have any experience presently. However, 21.7 percent of respondents adopted smart farming technologies into their farm for monitoring and automatic irrigation.
- *Methods for Improving skill:* 15.7 percent of respondents do nothing for improving their skills. However, most of them always try to improve their skills (73.6 percent). Consequently, they can enhance their knowledge.
- *The preference of training approach:* in the future, farmers prefer to improve their knowledge by attending the training course and joining the community learning (40.7 and 41.4 percent respectively). However, some farmers prefer to learn via online channel because they can learn anywhere and anytime by using their smartphone (18.6 percent).

3.2.3. ACE and KEC, Nepal

The Team from ACME Engineering College (AEC) and Kantipur Engineering College (KEC) jointly visited the farms and had met the farms in person. The total number of respondents were 49 farmers. We interviewed all and filled the form ourselves.

Part 1: General information
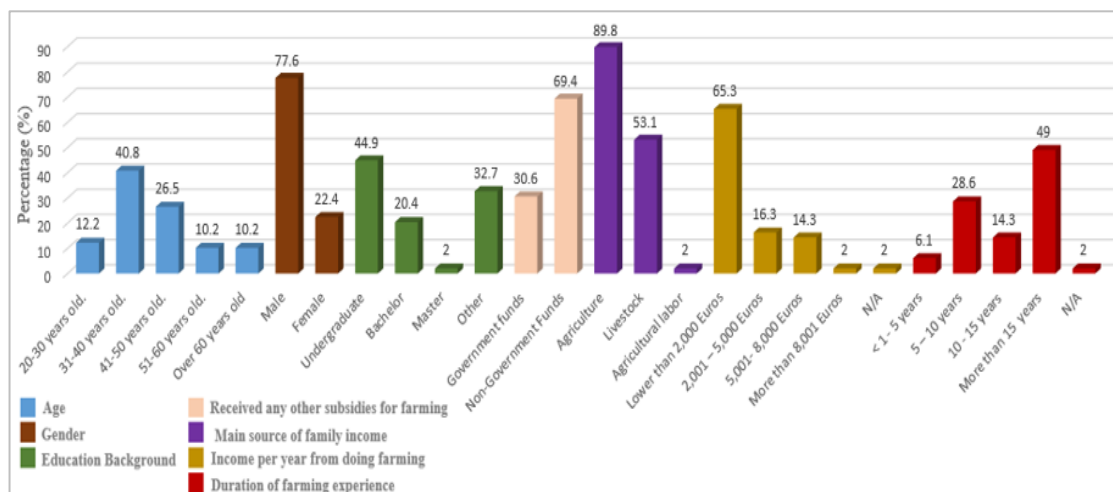
Figure 18: Results of farmer's general information (Nepal)

Figure 18 illustrates the results of farmer's general information. The interpretation of results in this part are separated into six aspects comprising;

- *Age:* significant number of respondents are in between age 31-40 years (40.8 percent) and majority of farmers are male (77.6 percent).
- *Education:* majority of them are either undergraduate or have general level of education (44.9 and 32.7 percent).
- *Farming experience:* 91.9 percent of respondents has more than 5 years of farming experience. Therefore, they are able to produce their crops based on their experience.
- *Income per year:* 65.3 percent of respondents get income less than two thousand Euros per year. On the other hand, some of them get income per year more than two thousand Euros.
- *Main source of family income:* agricultural farming is the main source of their family income which is 89.8 percent that vegetables is the main product.
- *Subsidy:* the non-government organizations are main subsidy sources of farmers which 69.4 percent of respondents used to receive some subsidies.

Part 2: Farm description
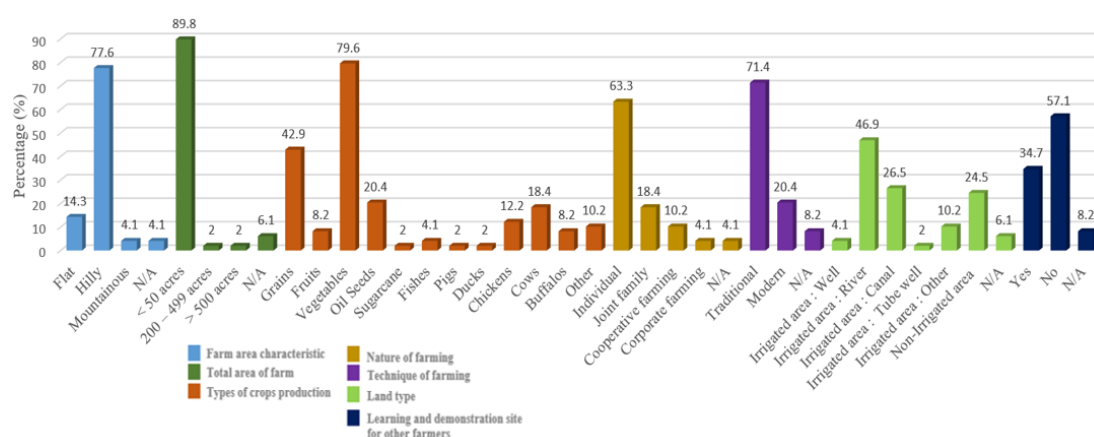
Figure 19: Results of farm description (Nepal)

Figure 19 shows the results of farm description. The interpretation of results in this part are separated into six aspects comprising;

- *Farm characteristics:* the land type is mostly hilly (77.6 percent). Therefore, most farmers do terraced fields.
- *Total area of farm:* 89.8 percent of total farm area is less than 50 acres and farmers are farmland owners. On the other hand, 4 percent of farmers have their total farm area more than 200 acres.
- *Types of crops production:* majority of them are concentrated on fruits and vegetable farming (87.8 percent).
- *Nature and techniques of farming:* most nature of farming is an individual (63.3 percent) with traditional farming (71.4 percent).
- *Land type:* 89.7 percent is irrigated land which the main sources of water for irrigation is mainly from river (46.9 percent).
- *Learning and demonstration:* 57.1 percent of farm does not used to be the learning and demonstration site. But, some farms are being, 34.7 percent.
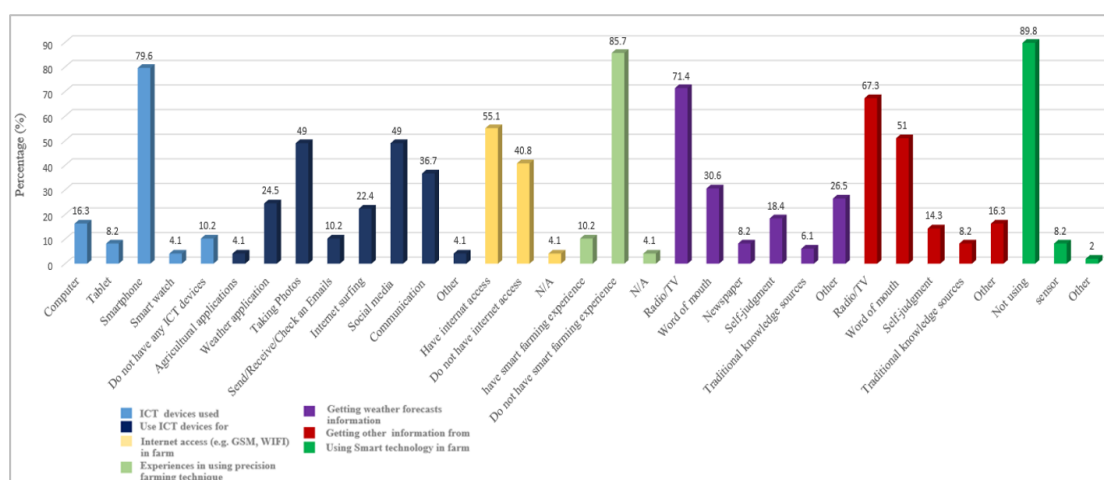
Part 3: Technology usage

Figure 20: Results of farmer's technology usage (Nepal)

Figure 20 shows the results of farmer's technology usage. The interpretation of results in this part are separated into four aspects comprising;

- *Information and Communication Technology (ICT) device usage):* most farmers do not use any technology for farming (75.5 percent). However, farmers use smartphones in daily life (79.6 percent). Smart phone is sometimes used to have weather forecast but mostly for browsing and taking pictures and social media.
- *Internet access in farm:* 55.1 percent of farmers have internet access in their farm for surfing the internet and communication.
- *Sources of weather and other information:* more than 50 percent of respondents get weather information and other information from radio/television. On the other hand, most farmers also get information from human which is more than 50 percent as well.
- *Using smart technology in farm: 89.8* percent of respondents have not adopted any smart technology device(s) into their farm because it is expensive and they have not knowledge for using it. Meanwhile, 10.2 percent of farmers adopted some smart technology device(s) into their farm for controlling and monitoring.

Part 4: Digital literacy

Table 8: Results of farmer's digital literacy (Nepal)

Aspect	Items	Below qualify	Basic	Intermediate	Advance	Above qualify	Total
Information processing	Q1	55.3%	34.0%	8.5%	2.1%	0%	100%
	Q2	51.1%	21.3%	12.8%	14.9%	0%	100%
	Q3	62.8%	20.9%	14.0%	2.3	0%	100%
Communication	Q4	55.3%	27.7%	0%	17.0%	0%	100%
	Q5	58.7%	34.8%	6.5	0%	0%	100%
	Q6	69.6%	17.4%	10.9%	2.2%	0%	100%
	Q7	66.7%	6.7%	24.4%	2.2%	0%	100%
Content Creation	Q8	68.9%	28.9%	2.2%	0%	0%	100%
	Q9	63.0%	23.9%	8.7%	4.3%	0%	100%
	Q10	73.9%	23.9%	0%	2.2	0%	100%
	Q11	75.6%	22.2%	2.2%	0%	0%	100%
Safety	Q12	58.7%	37.0%	4.3%	0%	0%	100%
	Q13	54.3%	34.8%	10.9%	0%	0%	100%
	Q14	58.7%	23.9%	8.7%	8.7%	0	100%
	Q15	52.2%	23.9%	21.7%	2.2%	0%	100%
Problem solving	Q16	65.2%	21.7%	13.0%	0%	0%	100%
	Q17	61.7%	29.8%	6.4%	2.1%	0%	100%
	Q18	68.9%	17.8%	13.3%	0%	0%	100%
	Q19	66.7%	22.2%	6.7%	4.4%	0%	100%

Table 8 illustrates the results of farmer's digital literacy part comprising five aspects: Information Processing, Communication, Content Creation, Safety, and Problem solving. The interpretation of results of farmer's digital literacy part are shown in Table 9. Based on the survey results, farmers who participated in this survey have digital literacy skills at below the quality in all aspects. That means, they have little skills on digital literacy part. However, majority of them (56 percent) knows how to operate smartphone and others. But smartphones are used only for social media or communicating with other farmers through phone not through emails, skype etc. Very few of them have knowledge about the safety of their device. Very few of them have knowledge about repairing their device.

Table 9: Results of farmer's digital literacy (Nepal)

| Aspect	Level	Interpret
Information processing	Below Basic (56.40%)	• Farmers are unable to use search engine to find information. • Farmers are unable to save the content or information found on the internet.
Communication	Below Basic (62.58%)	• Farmers are unable to use basic communication feature in applications. • Farmers are unable to share content in applications.
Content-creation	Below Basic (70.35%)	• Farmers are unable to create simple content. • Farmers are unable to modify simple functions of software and applications as changing default setting. • Farmers do not have any programming skills.
Safety	Below Basic (55.98%)	• Farmers are unable to manage basic security in devices. • Farmers do not know how to use security program.
Problem-solving	Below Basic (65.63%)	• Farmers are unable to solve problem from setting guideline. • Farmers are unable to follow the instruction manual. • Farmers are unable to configure the program.

Part 5: Farming practice and agricultural standards
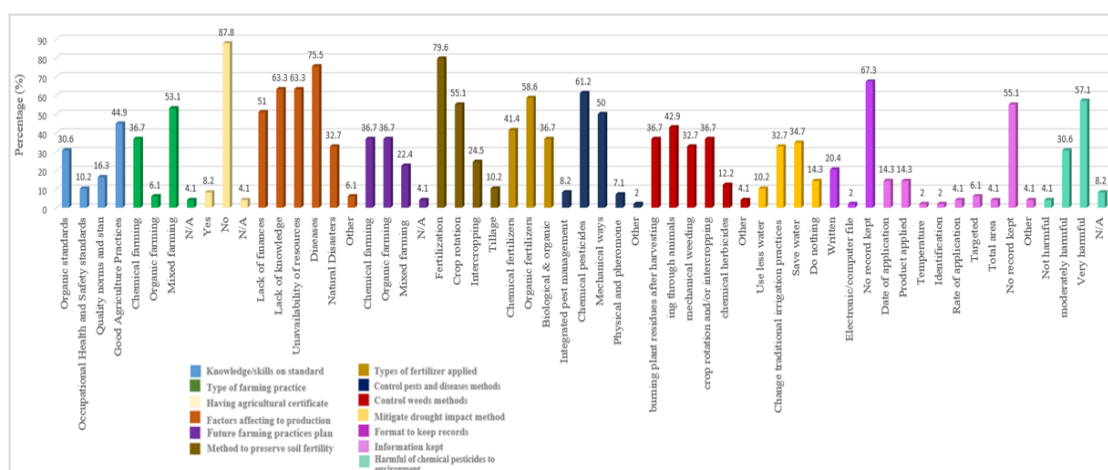
Figure 21: Results of farming practice and standard of farmers (Nepal)

Figure 21 shows the results of farming practice and standard of respondents. The interpretation of results in this part are separated into nine aspects comprising;

- *Agricultural standard and certificate:* maximum of them (75.5 percent) knows about the organic standards and GAP but in implementation level they do chemical farming and mixed farming.
- *Type of farming practice:* maximum of them (53.1 percent) do mixed farming both chemical and organic. Additional, most of them do not get any agricultural certificate but they also require to get some certificate (44.9 percent). The 67.7 percent of farmers do not know the capability of ICT that can help them to enhance their farming practices and skills.
- *Future farming practice plan:* 36.7 percent require to do organic farming due to save their health. Meanwhile, 36.7 percent of respondents want to do chemical farming because it is a quick cultivation and good production.

- *Soil fertilization methods*: they (87.7 percent) aware of preserving the soil fertility. They are awareness of the use of chemical affecting health (78.8 percent). Maximum of them (around 78 percent) use organic manure for fertilization.
- *Information recording:* most data recorded are date of application and product applied. On the other hand, most of farmers do not record any information relevant to cultivation.
- *Weed control:* there are three main methods that farmers use for weed control including grazing through animals, crops rotation, and burning plant (42.9, 36.7, and 36.7 percent respectively).
- *Mitigation drought method:* most of *farmers try to save water and change the irrigation method from traditional to modern method likes drip irrigation (67.4 percent) especially during summer season.*
- *Pests and disease control:* chemical substances usage is widely used for farming practices which is 61.2 percent. Because it easy for them to control the productivity.
- *Livestock farming:* most methods used for caring their animal are Selective breeding, Vaccinations good sanitation, and Good ventilation in housing as shown in Figure 22. During farming practice, farmers do not record any information because it is not necessary.
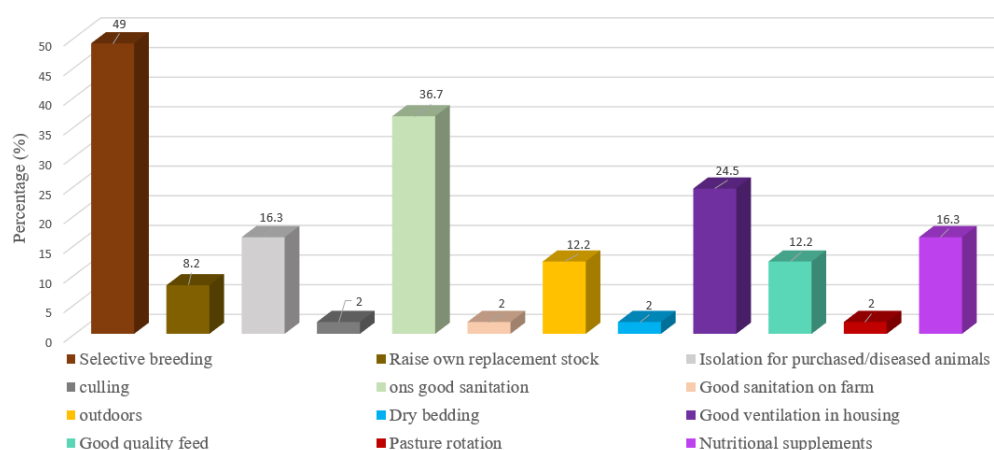

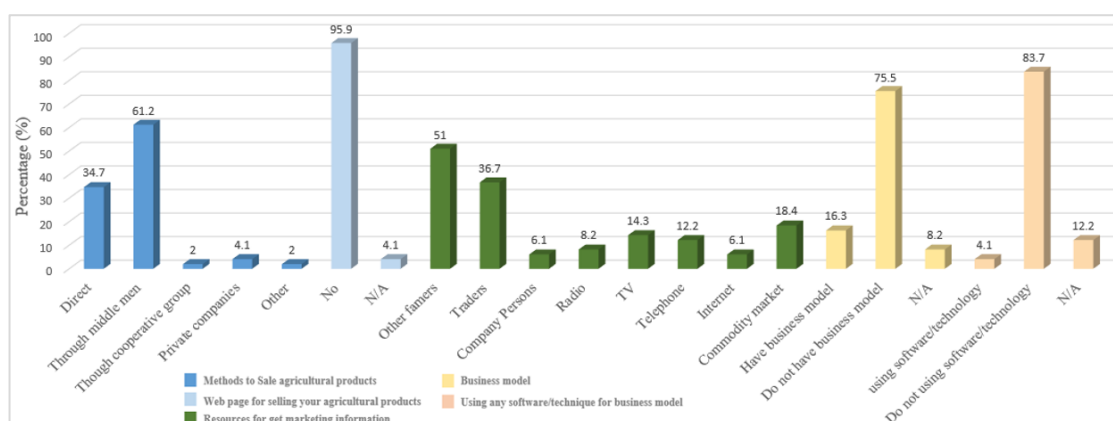**Figure 22:** Results of methods of animal health caring (Nepal)

Part 6: Marketing Skills

Figure 23: Results of Marketing of farmers (Nepal)

Figure 23 illustrate the results of farmers' marketing skills. The interpretation of results in this part are separated into five aspects comprising;

- *Selling methods:* most of them (61.2 percent) do marketing through middleman.
- *Webpage:* 95.9 percent of respondents does not have a web page. However, some of them requires to have webpage for selling to their consumers, 30.6 percent.
- *Marketing information resources*: three main resources of marketing information of respondents include discussion with other farmers (51 percent), getting from traders (36.7 percent), and commodity market (18.4 percent).
- *Business Model:* most of farmers do not have a business model and some of them want to have it.
- *Using software for business model:* 83.7 percent of respondents do not use any software for business model and they require it for helping to plan their business (66.7 percent).
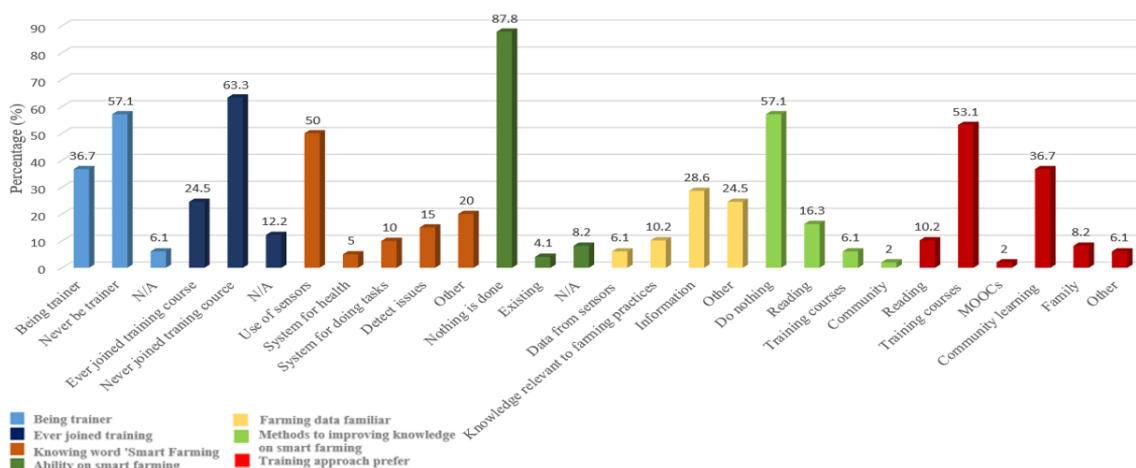
Part 7: Smart farming practice

Figure 24: Results of smart farming practices (Nepal)

Figure 24 shows the results of smart farming practices of farmers. The interpretation of results in this part are separated into six aspects comprising;

- *Ability to be trainer:* most of farmers is never be trainers (57.1 percent). However, they are willing to learn the new things.
- *Attending training:* only 24.5 percent of farmers is ever to attend the training courses relevant to farming practices and/or technology. On the other hand, the rest of farmers are not ever to attend any training but they require to join if they have an opportunity.
- *Knowing word 'Smart Farming':* around 50 percent of respondents know the word 'Smart Farming'. Most of farmers use sensor technology for farming. Some of them knows concept of automatic/Semi-automatic system for doing agricultural tasks and to detect and solve issues.
- *Smart farming technology experience:* 87.8 percent of respondents are not able to use smart farming technology. However, some of them have adopted some technologies for data collection but they do not know how to use the collected data.
- *Methods for Improving skill:* 57.1 percent of respondents do nothing for improving their skills. However, some of them read from other knowledge sources, attend some training course, and share their knowledge and experience with other farmers in the community.
- *The preference of training approach:* most of farmers prefer to learn via training course, 53.1 percent. Meanwhile, some of them prefer learning with family members and community learning. On the other hand, less of them prefer to learn via online courses like MOOCs.

3.2.4. Royal University of Bhutan (RUB), Bhutan

The survey site is in Barp Gewog (Block), Punakha, Bhutan. The total number of respondents is 50 farmers. The results are separated into seven parts.
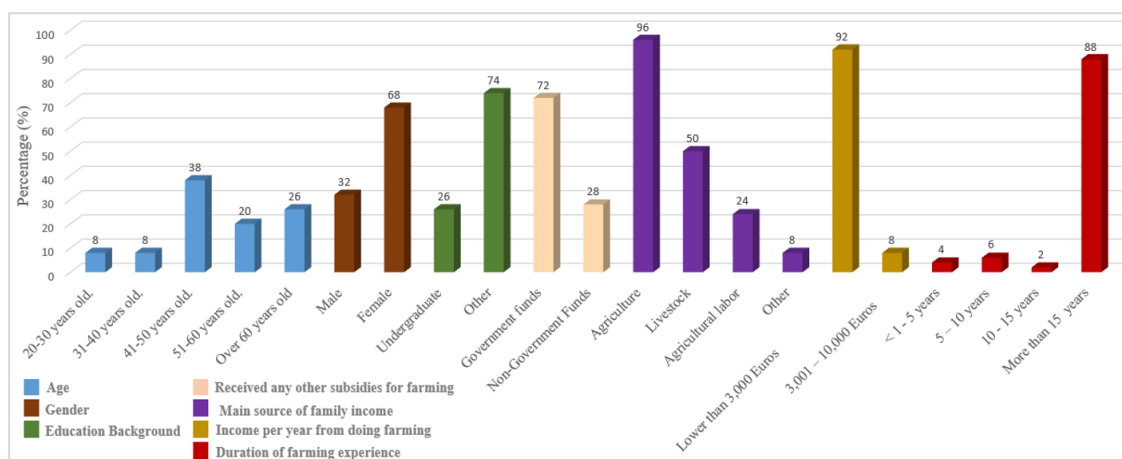
Part 1: General information

Figure 25: Results of farmer's general information (Bhutan)

Figure 25 illustrates the results of farmer's general information. The interpretation of results in this part are separated into six aspects comprising;

- *Age:* the age of most respondents is more than 41 years old (84 percent). And majority of respondents is female (68 percent).
- *Education:* the majority of respondents is ungraduated (74 percent).
- *Farming experience:* most of farmers has farming experience more than 15 years, 88 percent.
- *Income per year:* most of farmers get income less than three thousand Euros per year (92 percent). However, few of farmers get income per year between 3,001 – 10,000 Euros.
- *Main source of family income:* most of farmers get income mainly from agriculture and livestock farming.
- *Subsidy:* 72 percent of respondents used to receive subsidies from government and/or non-government department.
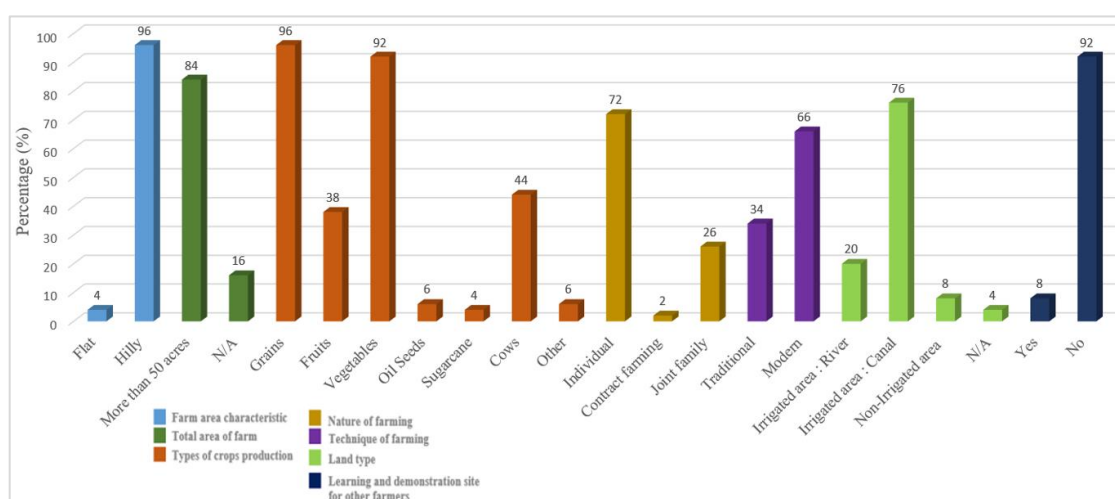
Part 2: Farm description

Figure 26: Results of farm description (Bhutan)

Figure 26 shows the results of farm description. The interpretation of results in this part are separated into six aspects comprising;

- *Farm characteristics:* majority characteristic of farm area is hilly area, 96 percent, that farmers can cultivate mainly vegetables, grains, and fruits, and cows raising.
- *Total area of farm:* most farmers has total farm areas less than 50 acres. They are doing the small and medium farms.
- *Types of crops production:* Main products of respondents are grains, vegetables, cows, and fruits.
- *Nature and techniques of farming:* the individual modern farming is the main farming practices of respondents. For modern farming techniques, they have used some mechanical device(s) helping for farming activities.

- *Land type:* most of land areas are irrigated areas that the main resource of water is from the river and canal to irrigate their crops.
- *Learning and demonstration:* some of the farmers have ever been the trainer to share their experience and their farm is used to be the demonstration site for agricultural learning. On the other hand, most of them have not ever been trainer.
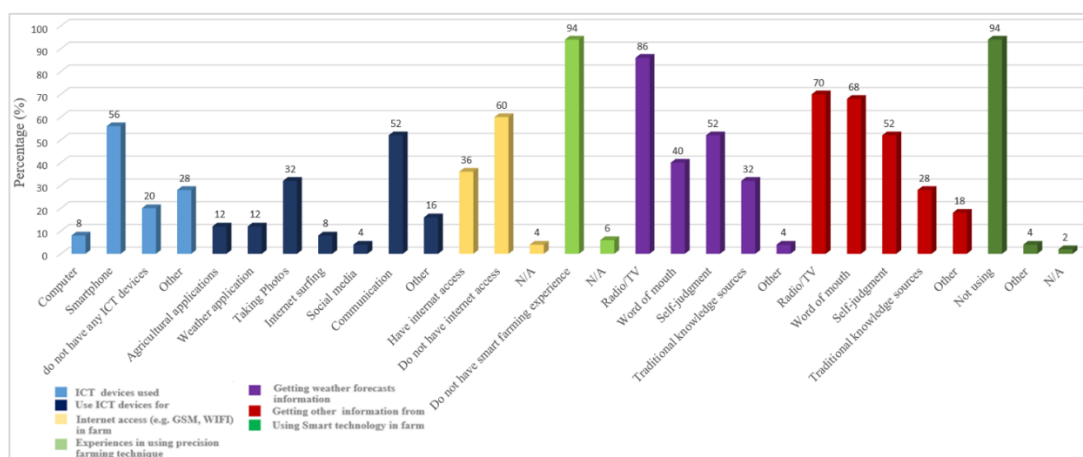
Part 3: Technology usage

Figure 27: Results of farmer's technology usage (Bhutan)

Figure 27 illustrates the results of farmer's technology usage. The interpretation of results in this part are separated into four aspects comprising;

- *Information and Communication Technology (ICT) device usage:* smartphones are the major ICT device that they use in daily life for communication with other people and taking photos mainly.
- *Internet access in farm:* most of the respondents do not have internet access in their farm. However, they require to have internet in their farm for communication to other people and surfing the internet.
- *Sources of weather and other information:* the majority sources of weather forecast information and agricultural knowledge and marketing information are from radio/TV, 86 and 70 percent respectively.
- *Using smart technology in farm:* most of farmers do not have any experience of using technology in farm. That means, farmers do not adopt any smart technology into their farm.

Part 4: Digital literacy

Table 10: Results of farmer's digital literacy (Bhutan)

Aspect	Items	Below qualify	Basic	Intermediate	Advance	Above qualify	Total
Information processing	Q1	86.7%	13.3%	0%	0%	0%	100%
	Q2	86.7%	13.3%	0%	0%	0%	100%
	Q3	86.7%	4.4%	0%	8.9%	0%	100%
Communication	Q4	64.4%	26.7%	0%	8.9	0%	100%
	Q5	86.7%	8.9%	4.4	0%	0%	100%
	Q6	91.1%	0%	0%	8.9%	0%	100%
	Q7	82.2%	4.4%	13.3%	0%	0%	100%
Content Creation	Q8	86.7%	4.4%	4.4%	4.4%	0%	100%
	Q9	91.1%	0%	8.9%	0%	0%	100%
	Q10	100%	0%	0%	0%	0%	100%
	Q11	100%	0%	0%	0%	0%	100%
Safety	Q12	86.7%	4.4%	4.4%	4.4%	0%	100%
	Q13	86.7%	4.4%	8.9%	0%	0%	100%
	Q14	95.6%	0%	4.4%	0%	0%	100%
	Q15	91.1%	8.9%	0%	0%	0%	100%
Problem solving	Q16	95.3%	4.7%	0%	0%	0%	100%
	Q17	90.7%	4.7%	4.7%	0%	0%	100%
	Q18	100.0%	0%	0%	0%	0%	100%
	Q19	95.3%	4.7%	0%	0%	0%	100%

Table 10 illustrates the results of farmer's digital literacy part comprising five aspects: Information Processing, Communication, Content Creation, Safety, and Problem solving. The interpretation of results of farmer's digital literacy part are shown in Table 11. Based on the survey results, farmers who participated in this survey have digital literacy skills at below the quality in all aspects. That means, most of them are incompetent to use any digital technology for information processing. Some of them can only use WeChat and Facebook for communication.

Table 11: Results of farmer's digital literacy (Bhutan)

Aspect	Level	Interpret
Information processing	Below Basic (86.70%)	• Farmers are unable to use search engine to find information. • Farmers are unable to save the content or information found on the internet.
Communication	Below Basic (81.10%)	• Farmers are unable to use basic communication feature in applications. • Farmers are unable to share content in applications.

Aspect	Level	Interpret
Content-creation	Below Basic (94.45%)	• Farmers are unable to create simple content. • Farmers are unable to modify simple functions of software and applications as changing default setting. • Farmers do not have any programming skills.
Safety	Below Basic (90.03%)	• Farmers are unable to manage basic security in devices. • Farmers do not know how to use security program.
Problem-solving	Below Basic (96.50%)	• Farmers are unable to solve problem from setting guideline. • Farmers are unable to follow the instruction manual. • Farmers are unable to configure the program.

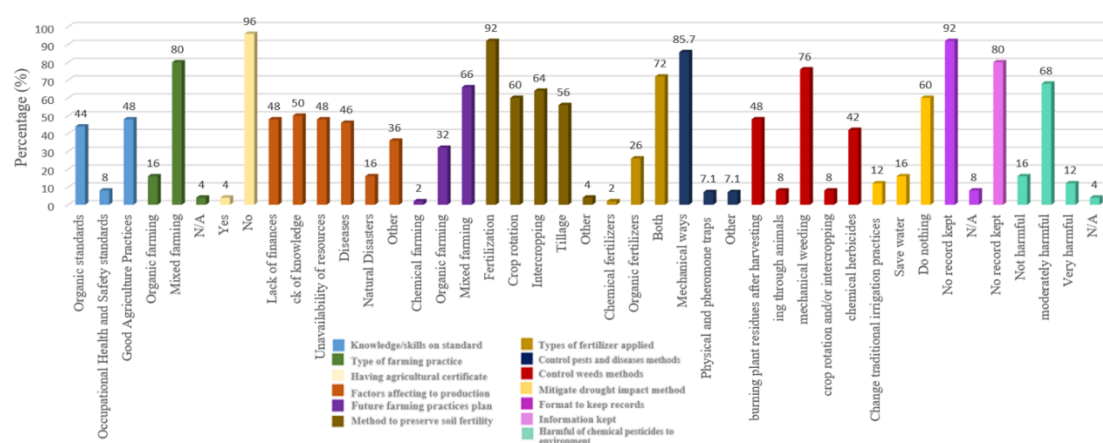*Part 5: Farming practice and agricultural standards*

Figure 28: Results of farming practice and standard of farmers (Bhutan)

Figure 28 shows the results of farming practice and standard of respondents. The interpretation of results in this part are separated into nine aspects comprising;

- *Agricultural standard and certificate:* organic standards and Good Agricultural Practice (GAP) standards are the major of agricultural standards that the respondents have knowledge and skills relevant. However, most of farmers do not get any certificate.
- *Type of farming practice:* the mixed farming (using both chemical and organic substances) is the main farming method that farmers are preferred both currently and in the future. Farmers prefer to do mixed farming because it is quick cultivation and good production.
- *Future farming practice plan:* farmers want to increase organic farming practices in the future comparing with the current farming practices.
- *Soil fertilization methods*: farmers use the fertilization method to maintain their crops by using both the chemical fertilizers substances and organic substances. However, farmers realized that the chemical pesticides are really harmful to the environment but they still require to use it because it is more effective to control disease and maintain crops in their perspective. Furthermore, the livestock manure is mainly used to be an organic fertilizer.
- *Information recording:* farmers do not record any information relevant to their cultivation production.

- *Weed control:* the mechanical weeding machine is mostly used to control weeds. On the other hand, grazing through animal and crops rotation methods are few used to control weeds.
- *Mitigation drought method:* only 28 percent of farmers try to reduce water consumption during drought situation. Additional, some of them try to change from traditional irrigation to drip irrigation helping to reduce water consumption (12 percent).
- *Pests and disease control:* farmers have applied both chemical and non-chemical methods by using mechanical way.
- *Livestock farming:* most methods used for caring their animal are dry bedding, Vaccinations good sanitation, and Good quality feed that percentage of usage these method is more than 50 percent as shown in Figure 29. During farming practice, farmers do not record any information because it is not necessary in their point of view.
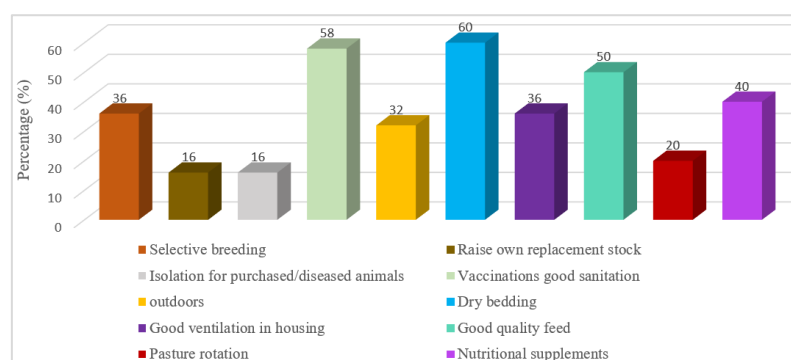

Figure 29: Results of methods of animal health caring (Bhutan)
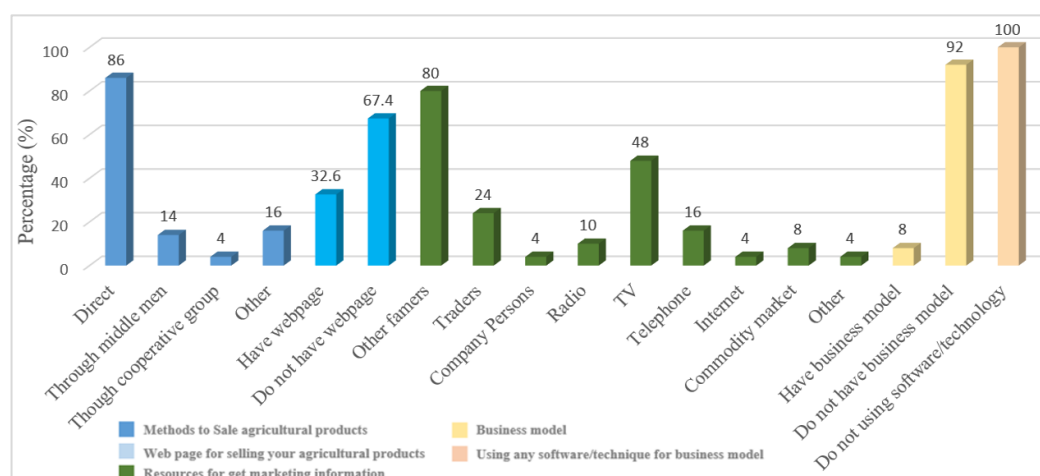
Part 6: Marketing Skills

Figure 30: Results of Marketing of farmers (Bhutan)

Figure 30 illustrates the results of farmers' marketing skills. The interpretation of results in this part are separated into five aspects comprising;

- *Selling methods:* most farmers sell their agricultural products direct to their consumers by selling at the market. On the other hand, some of

them sell their products to middle man and through cooperative group (18 percent).

- *Webpage:* most of farmers do not have an online webpage to sell agricultural produce. However, some of farmers want to have a web page.
- *Marketing information resources*: two main resources of marketing information of respondents include discussion with other farmers (80 percent), and TV (48 percent).
- *Business Model:* most of respondents do not have a business model and they want to have it (92 percent). However, few of them have their business model to cultivate and sell their products.
- *Using software for business model:* none of the respondents uses software/technique to plan their business.
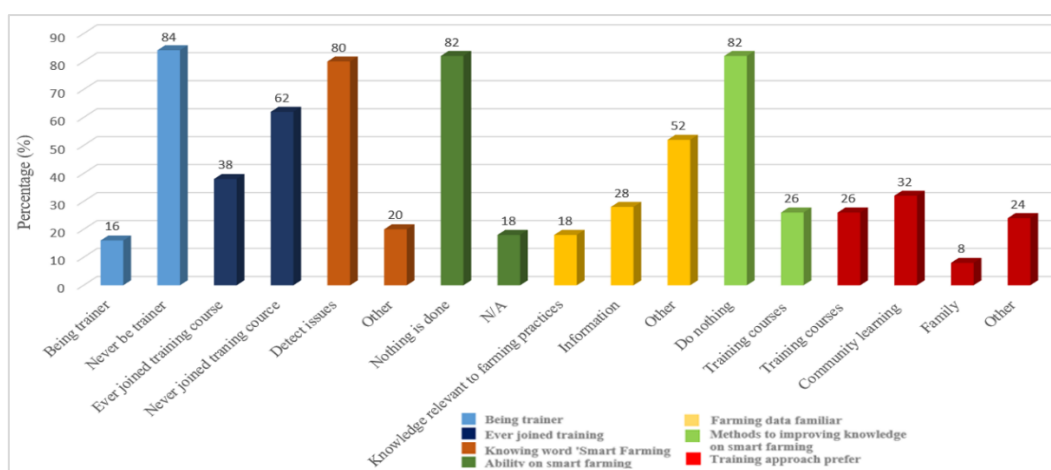
Part 7: Smart farming practice

Figure 31: Results of smart farming practices (Bhutan)

Figure 31 shows the results of smart farmer practices of farmers. The interpretation of results in this part are separated into six aspects comprising;

- *Ability to be trainer:* farmers have been a trainer for other framers which is less than 2 times a month.
- *Attending training:* 38 percent of farmers used to join training course relevant to farming practices and/or technology. For the rest of farmers are never attend any training course but they would like to join these types of training.
- *Knowing word 'Smart Farming':* only 12 percent of farmers know the word 'Smart Farming' as the use of technologies to detect issues and act more quickly. Advancement in smart farming would be a question since nothing is done at the moment. Although 18 percent and 28 percent of farmers are familiar with the farming data from knowledge relevant to farming practices and information respectively, 52 percent of farmers have others (extension agents) as the most reliable source.

- *Smart farming technology experience:* 82 percent of farmers are not able to use smart farming technology because it is difficult for them and they lack of financial support.
- *Methods for Improving skill:* 26 percent of farmers has improved their knowledge on smart farming by training courses with teacher.
- *The preference of training approach:* most of farmers prefer to learn via community learning for sharing and asking questions relevant to crop production and training course.

3.3. Comparision among all partners (Chiang Mai, Khon Kaen, Nepal, and Bhutan)

Regarding the survey results, it underlined the following elements

- 82.5 percent of respondents are over 40 years old, including 27,8% over 60.

- 63.8 percent of respondents are undergraduate.

- 37.8 percent of respondents have language problems

- 71 percent of respondents earn less than 2000€ per year from doing farming, mainly correlated with the size of the farms (56,2% are smaller than 50 acres). This situation differs in Khon Kaen, where the size of the farms is more diversified.

- 60.5 percent of farmers are working alone in their farms. The nature of farming (individual, joint family, cooperative or corporate farming) varies slightly depending on countries (see Figure 32 Nature of farming).
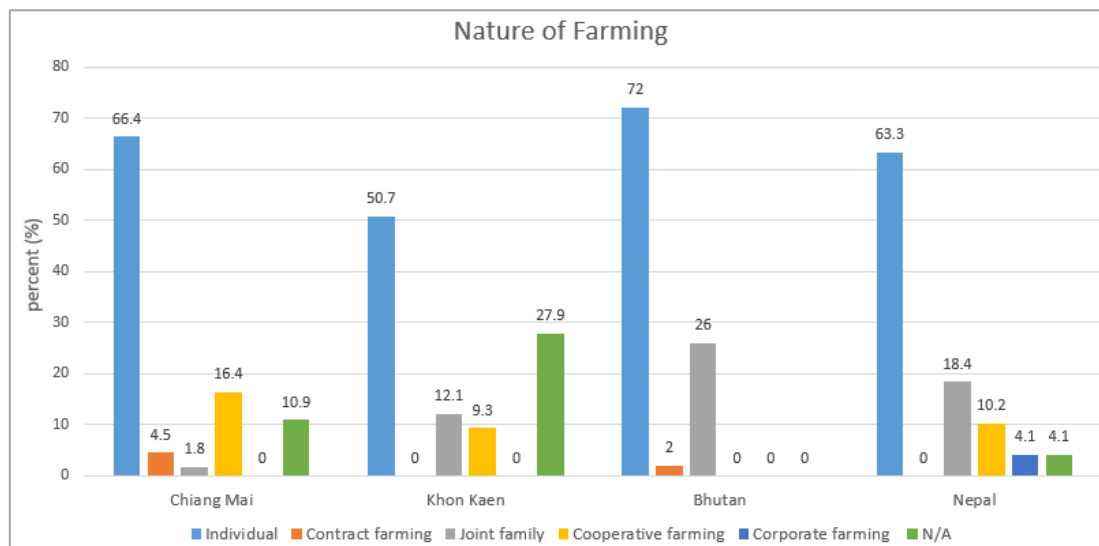

Figure 32: Nature of farming (All partners)

- 25.2 percent of respondents have Internet access in their farm, and less than half of those no do want to change this situation, preferring to stay without Internet access. This situation differs in Bhutan, where the Internet is more widespread (see Figure 33 Access to Internet).
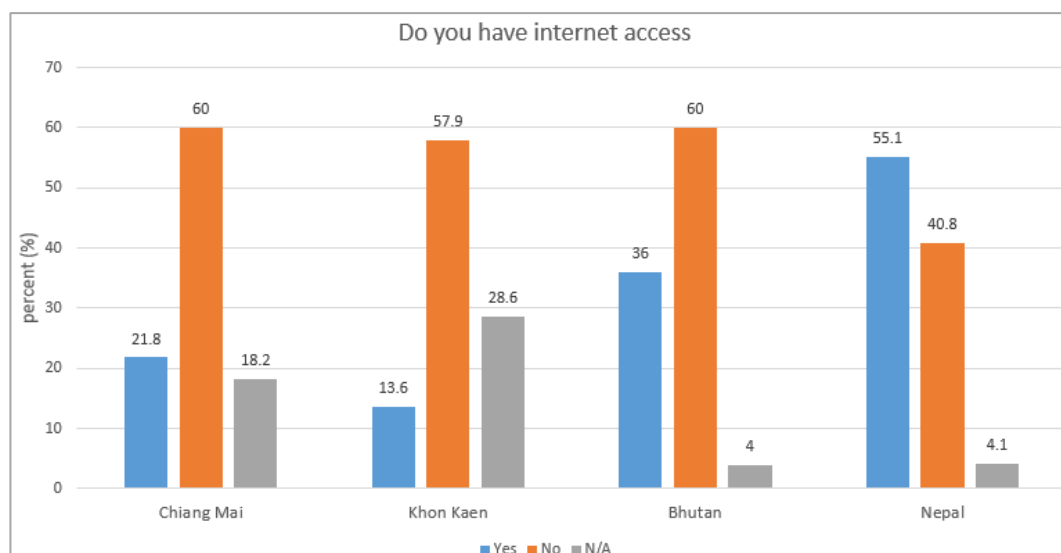
Figure 33: Access to Internet (All partners)

Statements: *These first elements on farmers' profiles impact the choice of the most adapted training method. Indeed, Without Internet Access, MOOCS are irrelevant for instance. No Internet access also means no possibility to consult a web based platform. The same issue arises with language problems. When farmers cannot read, they need oral and practical training. Written training material (paper or online) will have difficulties to be understood by farmer if their reading capabilities are limited.*

Therefore, special attention must be put on the interface. It needs to be user friendly, and easily understood by farmers with limited reading capabilities.

Nowadays, the digital technology is adopted for farming production. Based on the survey results, most farmers lack of digital literacy skills as shown in Table 12. Therefore, improving farmers' digital literacy skill is significant because they need to understand the usage of smart technology applying into their farm.

Table 12: Results of farmer's digital literacy (All partners)

Aspect	CMU, Thailand	KKU, Thailand	Nepal	Bhutan
Information processing	Basic (47.93%)	Below Basic (51.20%)	Below Basic (56.40%)	Below Basic (86.70%)
Communication	Basic (39.00%)	Below Basic (34.95%)	Below Basic (62.58%)	Below Basic (81.10%)
Content-creation	Basic (55.71%)	Below Basic (50.53%)	Below Basic (70.35%)	Below Basic (94.45%)
Safety	Below Basic (30.09%)	Below Basic (41.10%)	Below Basic (55.98%)	Below Basic (90.03%)
Problem-solving	Basic (49.48%)	Below Basic (47.25%)	Below Basic (65.63%)	Below Basic (96.50%)

The pedagogical approach usually differs depending on the level of expertise of the attendants. In our case, only 51,9% of respondents have previously joined a training relevant to farming practices and/or technology. This situation is country dependant: less than one fourth of Bhutanese farmers have been trained whereas nearly ¾ of farmers in Chiang Mai have been trained (see Figure 34 Previous training experience). The disparity is less obvious

regarding the percentage of farmers, that have acted as a trainer for other farmers (see Figure 58 Previous experience being a trainer).
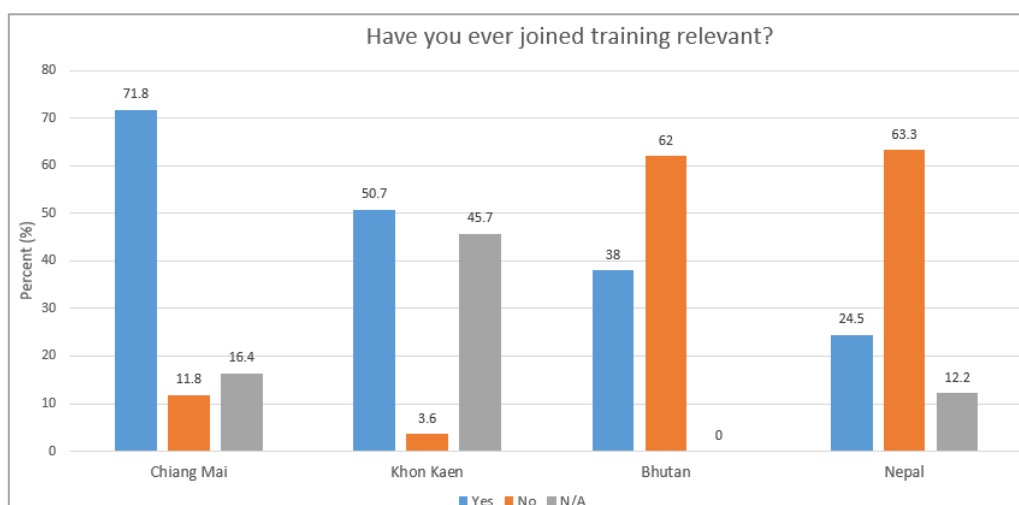

Figure 34: Previous training experience (All partners)

The methodologies previously selected by the farmers for their training are varied. Out of the 349 respondents, we count:

- 47 reading books

- 58 followed a course with a teacher (including only 2 in Bhutan)

- 12 used MOOCS

- 67 learned with pairs (community learning)

When asked about the preferred method, respondents' choices are mainly community learning and classical training, with a teacher. Then follows an online platform and reading materials. (see Figure 35 Preferred training methodologies according to respondents).
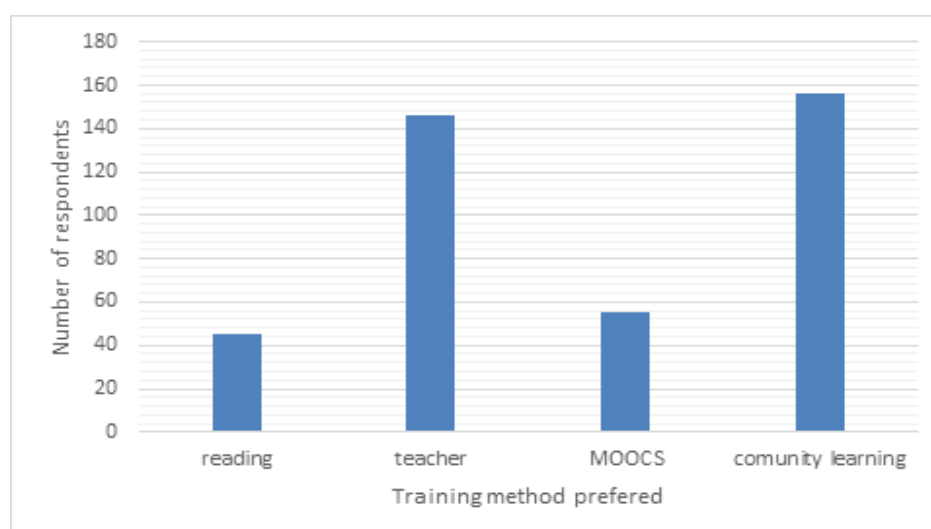

Figure 35: Preferred training methodologies according to respondents (All partners)

A last element to take into account is the experience and willingness of respondents to act as a trainer. Indeed, for community learning to be applicable, we need to train first a small group of farmers, that will then act as a trainer for other groups. Some have already acted as such (see Figure 36 Previous experience being a trainer)
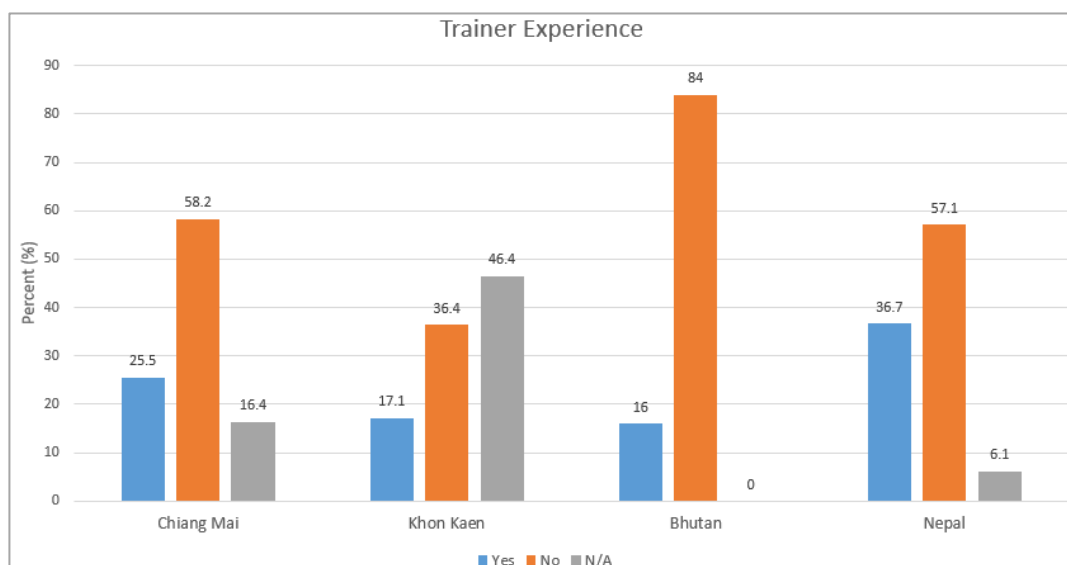

Figure 36: Previous experience being a trainer (All partners)

Statement: *For the training to be relevant, we need to create groups of farmers with similar profiles. The training methodologies and contents will be adapted to fit the needs of the groups, depending on the level and expectations of group members.*

4. Group of farmers' classification

4.1. Context and global profiles

After analyzing the survey, we are classified group of farmers to define farmer's profiles because training methodologies need to fit with farmers' profiles. It depends on various criteria, from local context and accessibility to farmers' profiles and current knowledge in the use of technologies.

To define the most relevant training approach, a first step was therefore to include in the survey a part on farming practices and training experiences. The objective is to know farmers' experiences relevant to smart farming and/or training. Three criteria have been used:

- Trainer and trainee experience of farmers

- Understanding, skills and experience on smart farming technologies

- Farmers' preferences on training channel

This survey has been filled by a total of 349 respondents (110 in Chiang Mai, 140 in Khon Kaen, 50 in Butan, 49 in Nepal).

4.2. Definition of farmer's groups

Farmer's groups were classified based on five aspects including Technology usage, Digital literacy, Farming practices and standards, Marketing skills, and Smart farming practices and training experiences. Based on the survey results, farmer's groups were defined into three groups comprising Group 0, Group 1, and Group 2 as shown in Figure 37.

Technology Usage	Digital Literacy	Farming Standard	Marketing	SF Practice /Training	Total	
✗	✗	✗	✗	✗	68	
✗	✗	✗	✗	✓	14	**G0 = 122**
✗	✗	✗	✓	✗	26	
✗	✗	✗	✓	✓	14	
✗	✗	✓	✗	✗	0	
✗	✗	✓	✗	✓	1	
✗	✗	✓	✓	✗	0	
✗	✗	✓	✓	✓	0	
✗	✓	✗	✗	✗	9	
✗	✓	✗	✗	✓	2	**G1B = 20**
✗	✓	✗	✓	✗	3	
✗	✓	✗	✓	✓	6	
✗	✓	✓	✗	✗	0	
✗	✓	✓	✗	✓	0	
✗	✓	✓	✓	✗	0	
✗	✓	✓	✓	✓	0	
✓	✗	✗	✗	✗	46	
✓	✗	✗	✗	✓	6	**G1A = 80**
✓	✗	✗	✓	✗	11	
✓	✗	✗	✓	✓	17	
✓	✗	✓	✗	✗	0	
✓	✗	✓	✗	✓	0	
✓	✗	✓	✓	✗	0	
✓	✗	✓	✓	✓	2	
✓	✓	✗	✗	✗	20	
✓	✓	✗	✗	✓	10	**G2 = 121**
✓	✓	✗	✓	✗	20	
✓	✓	✗	✓	✓	71	
✓	✓	✓	✗	✗	0	
✓	✓	✓	✗	✓	0	
✓	✓	✓	✓	✗	0	
✓	✓	✓	✓	✓	3	
*SF = Smart Farming					349	

Figure 37: Farmer's groups classification

However, in this project, we defined one more group to be the trainers which are made from government representatives and researchers called Group 3.

Three target groups are foreseen, with an additional "group 0" composed of farmers that cannot be included in our project:

Group 0 – digitally illiterate farmers, who do not want to change their practice

Group 1 – mostly digitally illiterate farmers, but they are willing and able to learn

Group 2 – having some expertise in agricultural and/or ICT and/or business management domain (academics also are part of this group)

Group 3 – experts in agricultural and/or ICT and/or business management domain

Figure 38 provides an overview of these target groups.

Group 0 is traditional farmers (see Figure 39). They do not use any ICT devices, and do not have internet access in their farm, but they have a basic level of digital literacy. They cultivate their crops based on their experience and do it as a routine for a long time. They reject to adopt any technology for farming because it is very difficult and complicated for them and they do not want to learn new things. Consequently, this group is not included, as farmers' profiles make the training of these farmers irrelevant for our program.

Group 1 is the less advanced farmers. They do not have Internet access in their farm, and sometimes also have difficulties to write and read. As long as they are willing to learn, farmers can be included in this group (100 farmers). Due to the diversity of profiles, two sub groups are foreseen. Group 1B (Trained farmers) with the intermediate level in terms of digital literacy, Group 1A (Practitioner farmers) with those who have some basic understanding in it detailed in Figure 40 and Figure 41.

Group 2 is non-standard farmers. Farmers do the modern farming practices. They are more advanced, may already have some technology. They also are entrepreneurs, which means that they are able to change their practices. (121 farmers, see Figure 42 Details of group 2).

Group 3 is made from government representatives, junior technical assistant, academic staff or administrative. (36 academics and technical assistants + 16 admin).
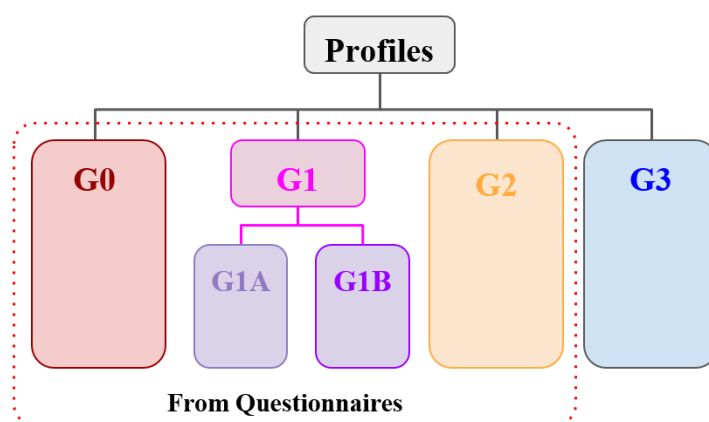

Figure 38: Overview of target groups

Figure 39: Details of Group 0

Group 1B (G1B): Trained Farmers

- ❖ *Age range 31 - 60 years old* (65% of group)
- ❖ *Traditional farming practice, do not use any machinery* (49% of group)
- ❖ *Using of some ICT devices usage, but not relevant to agricultural purposes* (50% of group)
- ❖ *An intermediate digital literacy skills* (51.8% of group)
- ❖ *None of agricultural certificate for crops* (50% of group)
- ❖ *None of webpage for selling crops* (40% of group)
- ❖ *None of business model* (30% of group)
- ❖ *Never been trainer* (45% of group)
- ❖ *Never known about smart farming concept* (25% of group)

Farm Description
- ✓ **Traditional farming practice** (49% of group)
- ✗ **Modern farming practice**
- ✗ **A learning and demonstration site** (45% of group)

Technology Usage
- ✓ **Using ICT devices** (50% of group)
  - ✓ Smartphone (45% of group)　✗ Computer　✗ Tablet
  - ✗ Smart watch　✗ Other
- ✓ **The purpose(s) of using ICT device(s)**
  - ✓ Taking Photos (30% of group)　✗ Social media from other farmers, demonstrations, etc.
  - ✗ Internet surfing　✗ Send/Receive/Check an Emails
  - ✗ Communication with other farmers/cooperative/association (phone or message)
  - ✗ Weather application (monitoring and weather forecasting)
  - ✗ Agricultural applications (farm monitoring)
- ✗ **Experiences relevance using precision farming techniques** (55% of group)
- ✗ **Using smart technologies in farm** (45% of group)

Digital Literacy Skills
　Basic (.........% of group)　✓ Intermediate (51.8% of group)　Advance (.........% of group)

Farming Standard
- ✗ **Knowledge/skills relevant to agricultural standards, GAP, Organic, etc.** (50% of group)
- ✗ **Agricultural certificate for crops** (50% of group)
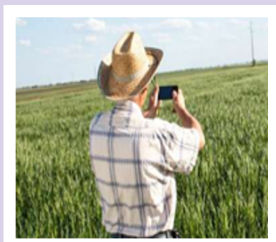- ✗ **Production plan** (30% of group)

Marketing
- ✗ **Webpage for selling crops** (40% of group)
- ✗ **Business model** (30% of group)

Smart Farming Practices/Training
- ✗ **Being trainer** (45% of group)
- ✗ **Participation of training relevant to smart farming practices and/or technologies** (50% of group)
- ✗ **Know about smart farming concept** (25% of group)
- ✗ **Experiences relevant to smart farming practices** (25% of group)

Figure 40: Details of Group 1B

Group 1A (G1A): Practitioner Farmers

- ❖ *Age range 31 - 60 years old* (64% of group)
- ❖ *Traditional farming practice, do not use any machinery* (49% of group)
- ❖ *Using of some ICT devices usage, but not relevant to agricultural purposes* (91.3% of group)
- ❖ *A basic digital literacy skills* (23.2% of group)
- ❖ *None of agricultural certificate for crops* (63.8% of group)
- ❖ *Using of webpage for selling crops* (4% of group)
- ❖ *Using of business model* (14% of group)
- ❖ *Never been trainer* (59% of group)
- ❖ *Knowing about smart farming concept* (17.5% of group)

Farm Description
- ✓ **Traditional farming practice** (49% of group)
- ✗ **Modern farming practice**
- ✗ **A learning and demonstration site** (65% of group)

Technology Usage
- ✓ **Using ICT devices** (91.3% of group)
  - ✓ Smartphone (79% of group)　✓ Computer (5% of group)　✓ Tablet (2.5% of group)
  - ✗ Smart watch　✗ Other
- ✓ **The purpose(s) of using ICT device(s)**
  - ✓ Taking Photos (61.3% of group)　✓ Social media from other farmers, demonstrations, etc. (32.5% of group)
  - ✓ Internet surfing (13.8% of group)　✓ Send/Receive/Check an Emails (11.3% of group)
  - ✓ Communication with other farmers/cooperative/association (phone or message) (48.8% of group)
  - ✗ Agricultural applications (farm monitoring)
  - ✗ Weather application (monitoring and weather forecasting)
- ✗ **Experiences relevance using precision farming techniques** (80% of group)
- ✗ **Using smart technologies in farm** (76.3% of group)

Digital Literacy Skills
- ✓ Basic (23.2% of group)　Intermediate (.........% of group)　Advance (.........% of group)

Farming Standard
- ✗ **Knowledge/skills relevant to agricultural standards, GAP, Organic, etc.** (34% of group)
- ✗ **Agricultural certificate for crops** (64% of group)
- ✗ **Production plan** (41% of group)

Marketing
- ✓ **Webpage for selling crops** (4% of group)
- ✓ **Business model** (14% of group)

Smart Farming Practices/Training
- ✗ **Being trainer** (59% of group)
- ✓ **Participation of training relevant to smart farming practices and/or technologies** (37.5% of group)
- ✓ **Know about smart farming concept** (17.5% of group)
- ✓ **Experiences relevant to smart farming practices: Existing but limited use of technologies** (7.5% of group)

Figure 41: Details of Group 1A

Group 2 (G2):
Non-Standard Smart Farmers

❖ *Age range 20 - 50 years old* (47.1% of group)
❖ *Modern farming practice* (56% of group)
❖ *Using of ICT devices* (94.2% of group)
❖ *An intermediate digital literacy skills* (42.5% of group)
❖ *None of agricultural certificate for crops* (58% of group)
❖ *Using of webpage for selling crops* (12.4% of group)
❖ *Using of business model* (35.5% of group)
❖ *Being trainer* (32.2% of group)
❖ *Knowing about smart farming concept* (60% of group)

Farm Description
✗ **Traditional farming practice**
✓ **Modern farming practice** (56.2% of group)
✓ **A learning and demonstration site** (36.4% of group)

Technology Usage
✓ **Using ICT devices** (94.2% of group)
  ✓ **Smartphone** (93.4% of group)   ✓ **Computer** (20% of group)   ✓ **Tablet** (8.3% of group)
  ✓ **Smart watch** (4.1% of group)   ✓ **Other** (1.7% of group)
✓ **The purpose(s) of using ICT device(s)**
  ✓ **Taking Photos** (76% of group)   ✓ **Social media from other farmers, demonstrations, etc.** (57% of group)
  ✓ **Internet surfing** (61.2% of group)   ✓ **Send/Receive/Check an Emails** (37.2% of group)
  ✓ **Communication with other farmers/cooperative/association (phone or message)** (39% of group)
  ✓ **Weather application (monitoring and weather forecasting)** (34% of group)
  ✓ **Agricultural applications (farm monitoring)** (37.2% of group)
✓ **Experiences relevance using precision farming techniques** (30% of group)
✓ **Using smart technologies in farm** (16% of group)

Digital Literacy Skills
  Basic (........% of group)   ✓ **Intermediate** (42.5% of group)   **Advance** (........% of group)

Farming Standard
✗ **Knowledge/skills relevant to agricultural standards, GAP, Organic, etc.** (43% of group)
✗ **Agricultural certificate for crops** (58% of group)
✓ **Production plan** (31.4% of group)

Marketing
✓ **Webpage for selling crops** (12.4% of group)
✓ **Business model** (35.3% of group)

Smart Farming Practices/Training
✓ **Being trainer** (32.2% of group)
✓ **Participation of training relevant to smart farming practices and/or technologies** (70% of group)
✓ **Knowing about smart farming concept** (60% of group)
✓ **Experiences relevant to smart farming practices: both Existing but limited use of technologies and already using smart farming technologies** (27.3% of group)

Figure 42: Details of Group 2

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