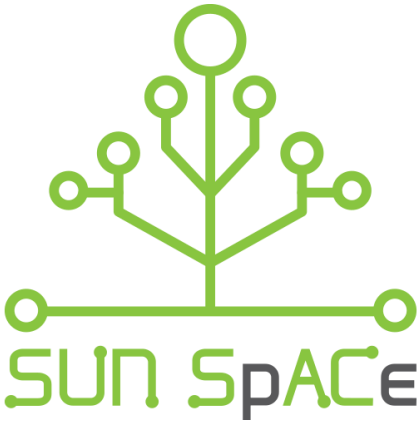

G1A

SUstainable developmeNT Smart Agriculture Capacity « SUNSpace »

Project Reference No	598748-EPP-1-2018-1-FR-EPPKA2-CBHE-JP (2018-3228/001-001)
Nature	Working documents
Dissemination Level	Restricted
Date	2019.12.03
Status	D1.4 Final version - Closed
Editor(s)	ULL SUNSpACe team
Document Description	The purpose of this document is to present an overview of possible learning approaches and their relevance in the project's context as a deliverable for WP1 T4 : "Investigate and identify an appropriate and adaptive learning approach for smart farmers"

1. Table des matières

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Table 1: List of updates

date	Author	Modifications
2019.06.14	ULL	First draft based on literature review, proposal and collaborative work during the meeting in Lyon
2019.08.22	ULL	First shared draft, including feedback from questionnaire (T1.2)
2019.09.12	ULL	Second shared draft, including additional work on past approaches
2019.10.10	ULL	Update of the content
2019.11.11	ULL	Pre-Final version, including comments from partners and additional details regarding the steps of the approach proposed for SUNSpACe
2019.11.21	CUB	Update CUB
2019.12.05	ULL	Third shared document with additional details on the constitution and validation of groups

Table 2: List of Abbreviations

Term / Abbreviation	Definition
T&V	Training and Visit Program First Program set to form Asian farmers, from mid-1960s until the end of the 1980s, also known as BIMAS
FFS	Farmer Field School Program Program used from the early 1990s to train Asian farmers

2. Overview of literature and past experiences

1.1 Approaches used in the past to train Asian farmers

Training of farming communities in Asia has evolved over the years. Different approaches have been tested. One of the first approach consisted in "organized seminar with classroom lectures or field demonstrations or both that required registration of participants. Training was provided by research units of agricultural institutes or by major agrochemical companies." (Damalas and Koutroubas 2017)
This approach, often referred to as the "Training and Visit (T&V) Extension Program or The Massive Guidance (BIMAS) Program", took place from the mid-1960s until the end of the1980s. It has been replaced by Farmer Field School (FFS) Programs, during the 1990s. (Resosudarmo and Yamazaki 2011)

The Farmer Field School (FFS) is a learning process based on groups discussions, where 3 to 5 farmers from the same area and having similar productions exchange on their findings. The group discussions are moderated by a "facilitator". As Barlett describes, "during the FFS, farmers carried out *experiential learning* activities that helped them understand the ecology of their rice fields. These activities involve simple experiments, regular field observations and group analysis. The knowledge gained from these activities enables participants to make their own locally specific decisions about crop management practices." FFS educational methods are "experiential, participatory, and learner Centred" (Bartlett 2005) As such, the FFS program "encouraged and stimulated farmers to make their own decisions." (Resosudarmo and Yamazaki 2011). See Figure 1 for the detail of FFS steps.

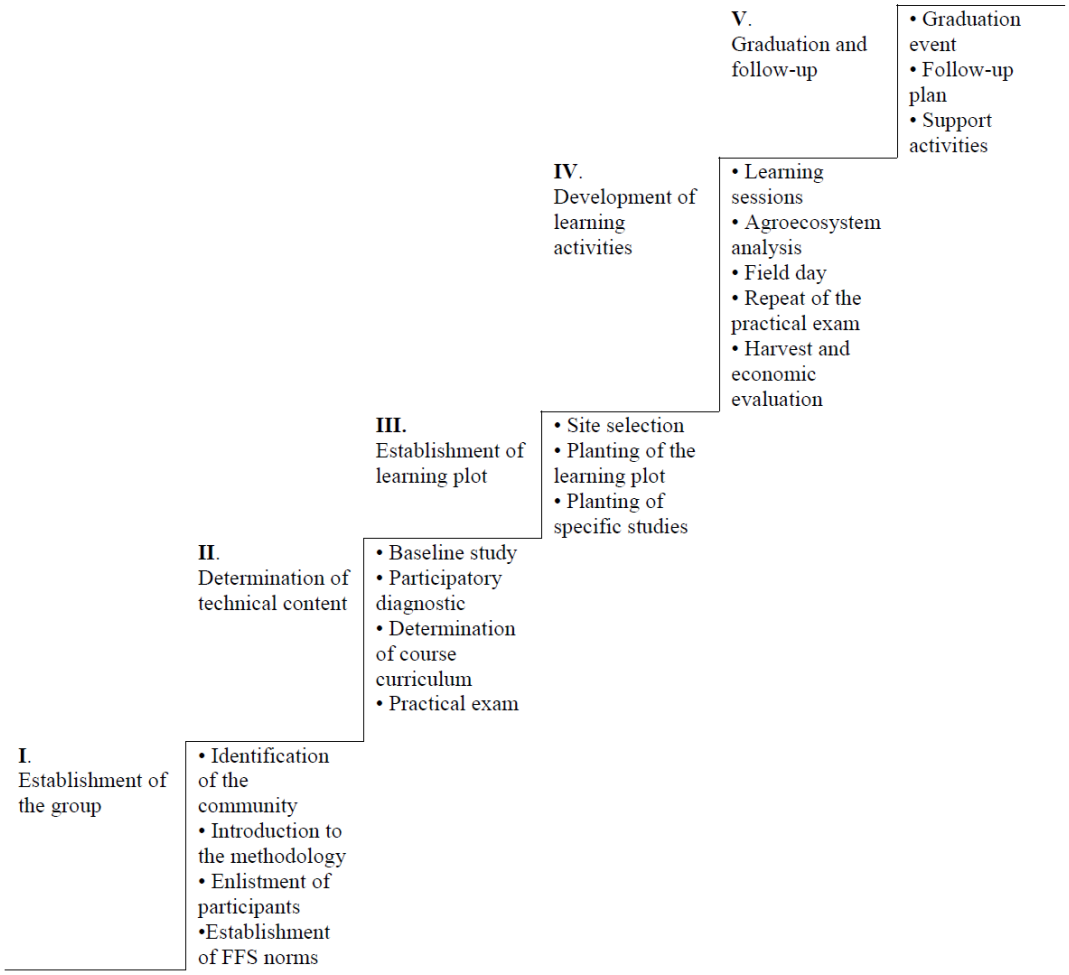


Figure 1 FFS methodological process (Luther, Harris et al. 2005)

1.2 Reflection on those approaches and REX

In many cases, researchers observed that farmers used media and community sharing to reinforce their competences. As Feder summarized, "this is confirmed by survey data showing **that farmers cite other farmers as their main source of information regarding agricultural practices** (Feder and Slade 1985, Rees, Momanyi et al. 2000). However, the data indicate that on technical matters entailing greater complexity or high cost, farmers have a preference for first-hand, or specialised sources of information such as extension experts" (Feder and Slade 1984, Howell 1984, Feder, Murgai et al. 2004)

To this purpose, **innovation platforms can be used to bring different actors together to exchange information**, compare and benchmark, and also negotiate collective or coordinated action.(Posthumus and Wongtschowski 2014)

Another point to take into account is underlined by Luther, who insist **that the training of trainers should not be overlooked, as is a key element for a successful training program**. Indeed, according to him, "without an adequate Training of Trainers (ToT) program, the subsequent FFS program will fall far short of its potential." (Luther, Harris et al. 2005). **The value added of a trainee becoming a**

trainer is underlined by many authors (Burt 2004, Isaac, Erickson et al. 2007, Frank, Zhao et al. 2011, Brown and Sonwa 2015, Prell and Lo 2016, Pratiwi and Suzuki 2017). According to Prell et al., "acquiring new knowledge is a complex process which is mediated through establishing mutual ties with knowledge experts, even though challenges may still exist with respect to an actor's ability to receive knowledge" (Prell and Lo 2016). To offset lacking capabilities on knowledge gains, actors tend to pursue others with more knowledgeable expertise than themselves (Frank, Zhao et al. 2011), who mostly come from external links such as government institutions (Isaac, Erickson et al. 2007). Hence, for successful knowledge transfer, **we also expect that farmers with more ties to extension officials will accrue advantages from reciprocal knowledge exchange with experts** (see, e.g., (Burt 2004, Brown and Sonwa 2015), which will translate into better learning outcomes. (Pratiwi and Suzuki 2017)

The original scope (reducing pesticide usage) is also pointed out as too narrow. To cover this issue, a way of improvement is proposed by Walter, who insists that "ICT and data management can provide novel ways into a profitable, socially accepted agriculture that benefits the environment (e.g., soil, water, climate), species diversity, and farmers in developing and developed countries." (Walter, Finger et al. 2017).

***Statement**: As a conclusion, we should develop training modules on various elements, from agricultural knowledge to business models.*

Reflections on past programs also concluded that FFS program needed improvement to widen their geographical scope of action and to be more cost effective. They should be **followed by a new program to maintain farmers' knowledge.** Whatever the choice, "strong local research with links to international communities, a national political will and administrative breakthroughs are most likely needed" (Resosudarmo and Yamazaki 2011).

***Statement**: The sustainability of the FFS approach is therefore limited. This should be taken into account in our proposition.*

Based on this statement, Luther proposes five options to improve the training approach:

- "First, improve the flow of information and technology from FFS participants to non-participants.
- Second, work with new partners, such as groups based in the communities and municipalities, in order to increase the number of FFS in various countries.
- Third, develop FFS for farmer promoters who can then organize and train other groups of farmers.
- Fourth, further develop self-financing opportunities in order to cover FFS' cost.

- Fifth, complement the FFS, using mass media methods to reach a greater number of farmers." (Luther, Harris et al. 2005)

***Statement**: Which technologies are (or not) possible for each partner, adapted to his revenues and capability. The structure of the program and the economic/business model linked to smart farming for farmers should be addressed.*

Last point that can be learned from previous experiences is that for a training program to be relevant, **the trainees should be sorted in groups with homogeneous backgrounds**. Indeed, Hashemi's findings underline that there are "different needs of farmers for future training as a result of differences in age along with other background characteristics" (Hashemi, Hosseini et al. 2009).

***Statement**: To propose a relevant and adaptive training program, two steps are therefore required:*

1. *Understand farmers' profiles and requirements, to build homogeneous groups;*
2. *Propose an adapted and continuous training program for each of these groups, to train farmers who will then become trainers and insure the sustainability of the diffusion of knowledge.*

All of these statements are taken into account in the teaching and learning approach we construct in the following paragraphs.

SUNSpACe is dedicated to the training of Asian farmers on specific fields of expertise. It comes after a number of training programs and should therefore be built based on their feedbacks. This first paragraph has provided an overview of the lessons learnt from past experience. The following paragraph will provide more details with regards to the situation and the profile of the farmers targeted by SUNSpACe. Paragraph 3 provides more details regarding the pedagogical approach proposed in SUNSpACe. Paragraph 4 focuses on the setting up of the program.

3. Overview of the diversity of farmers' profiles and requirements

3.1 Context and global profiles

Training methodologies need to fit with farmers' profiles. It depends on various criteria, from local context and accessibility (Internet access…) 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 Bhutan, 49 in Nepal).

Task T1.2 presents this survey in detail. The present deliverable focuses only on information relevant for the choice of the training methodology.

Regarding Farmers profiles, the survey underlined the following elements

- 82,5% of respondents are over 40 years old, including 27,8% over 60.
- 63,8% of respondents are undergraduate.
- 37,8% have language problems
- 71% 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% 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 2 Nature of farming).
-

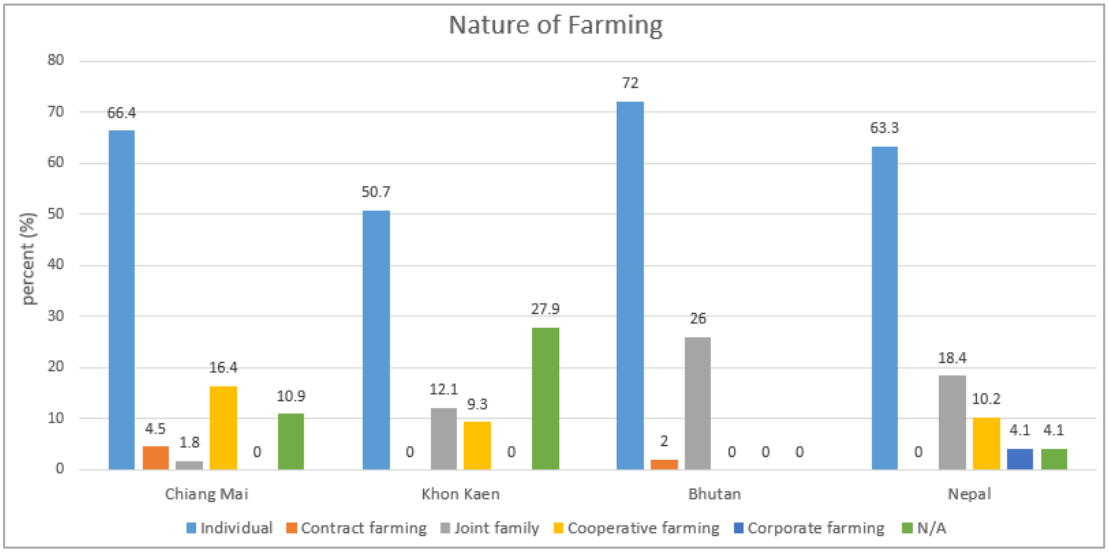


Figure 2 Nature of farming

- 25,2% 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 Internet is more widespread (see Figure 3 Access to Internet)

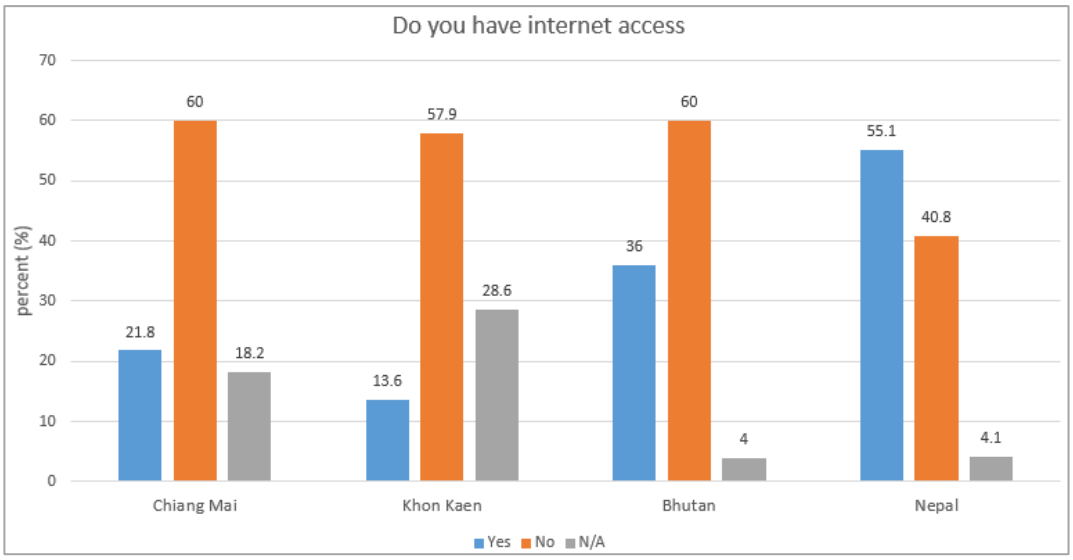


Figure 3 Access to Internet

***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 with a computer. More farmer have a phone, in most of the cases smartphone. Adding to this, they have an Internet connection on their smartphone, hence the New Spectrum is suggested. 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.

3.2 Specific elements regarding previous and desired training methodologies

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 4 Previous training experience). The disparity is less obvious regarding the percentage of farmers, that have acted as a trainer for other farmers (see Figure 6 Previous experience being a trainer).

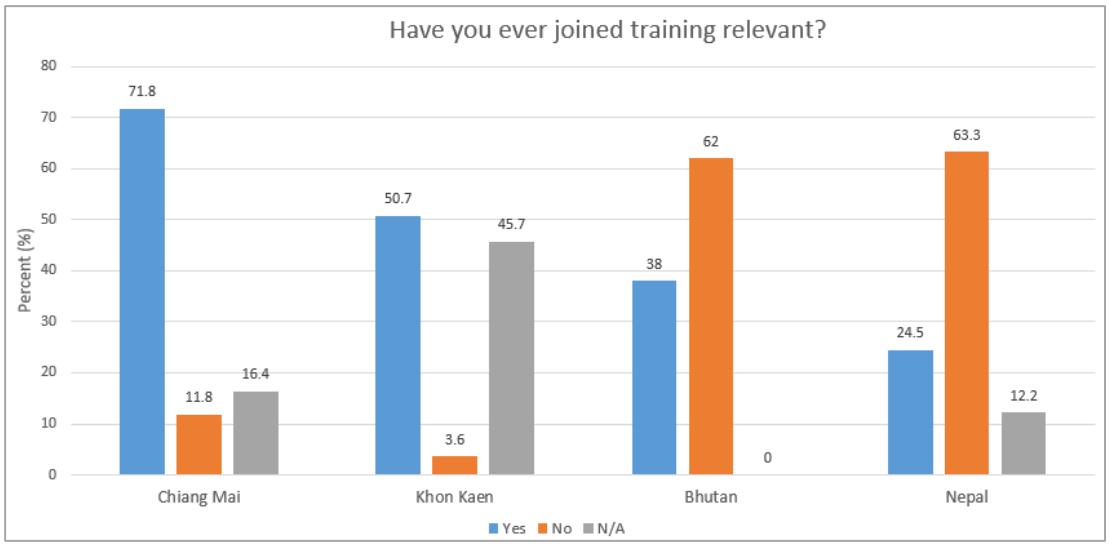


Figure 4 Previous training experience

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 prefers method, respondents' choices are mainly community learning and classical training, with a teacher. Then follows an online platform and reading materials. (see Figure 5 Preferred training methodologies according to respondents)

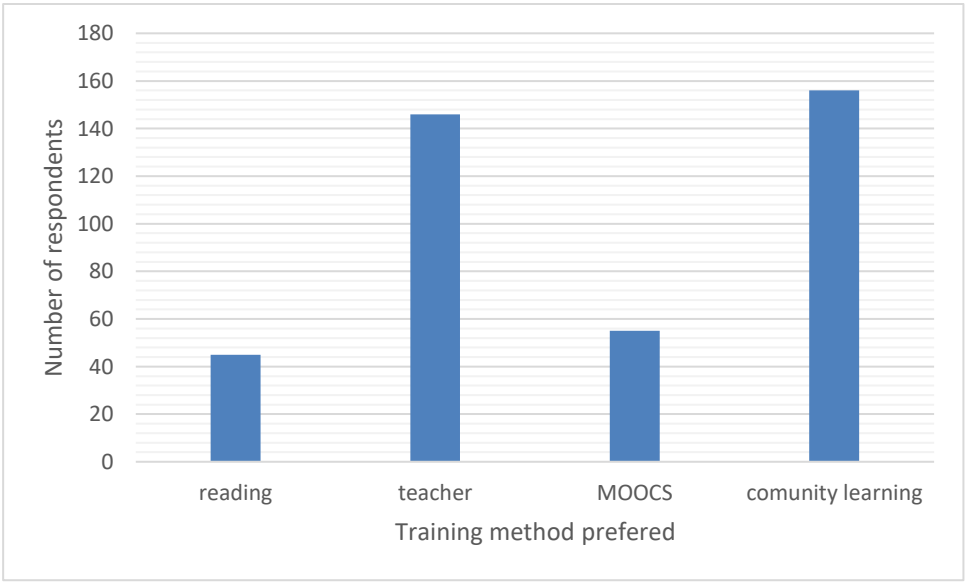


Figure 5 Preferred training methodologies according to respondents

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 6 Previous experience being a trainer).

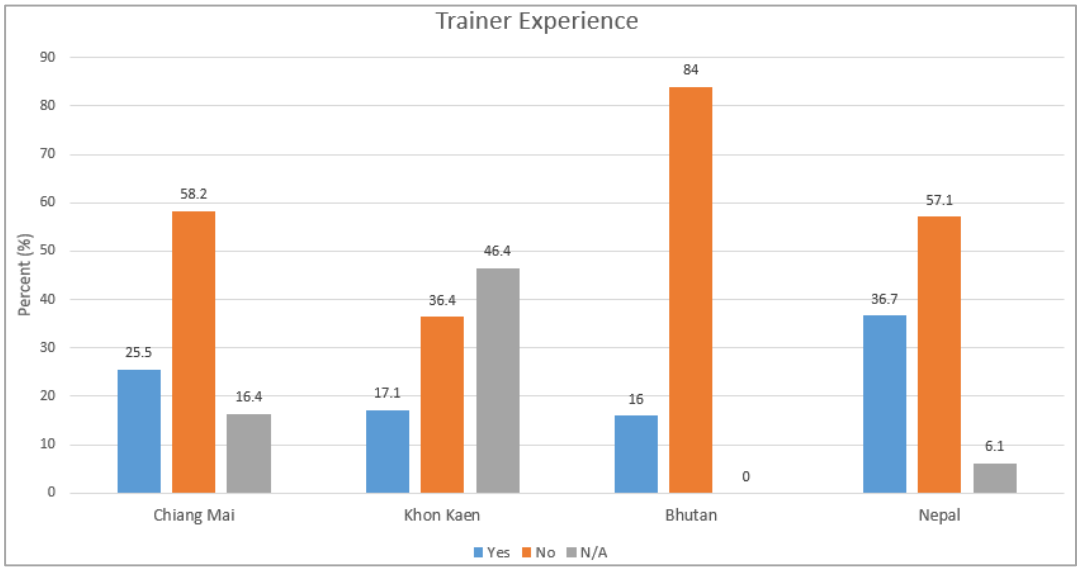


Figure 6 Previous experience being a trainer

***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.*

3.3 Definition of groups

Based on the survey, 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 7 Overview of target groups. Group 0 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, and sometime 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 subgroups are foreseen. Group 1A with the less advanced in terms of digital literacy, Group 1B with those, who have some basic understanding. In it detailed in Figure 9 Details of group 1B Figure 10 Details of group 1A.

Group 2 is made from practitioners, farmers with their own farms. 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 11 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)

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

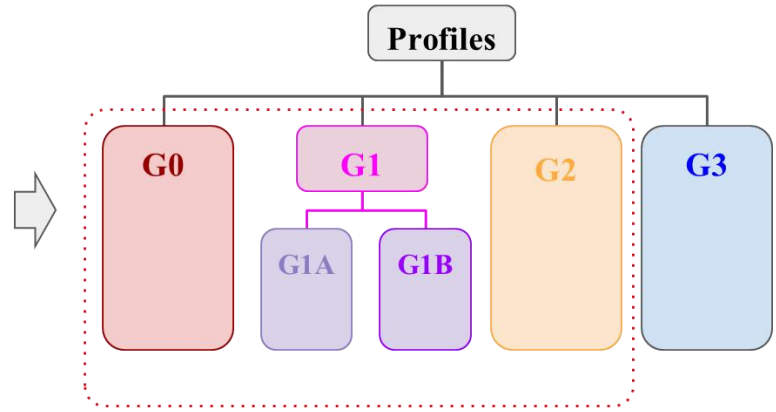


Figure 7 Overview of target groups

Group 0 (G0): Traditional Farmers

- *Age over 51 years old* (64% of group)
- *Traditional farming practice, do not use any machinery* (40% of group)
- *None of ICT devices usage* (42% of group)
- *A basic digital literacy skills* (91.2% of group)
- *None of agricultural certificate for crops* (60% of group)
- *None of webpage for selling crops* (62% of group)
- *None of business model* (51% of group)
- *Never been trainer* (46% of group)
- *Never know about smart farming concept* (45% of group)

Farm Description
- ✓ Traditional farming practice (40% of group)
- ✗ Modern farming practice
- ✗ A learning and demonstration site (66% of group)

Technology Usage
- ✗ Using ICT devices (42% of group)
  - Smartphone, Computer, Tablet
  - Smart watch, Other
- ✗ The purpose(s) of using ICT device(s)
  - Taking Photos
  - Social media from other farmers, demonstrations, etc.
  - Internet surfing
  - Send/Receive/Check an Emails
  - Communication with other farmers/cooperative/association (phone or message)
  - Agricultural applications (farm monitoring)
  - Weather application (monitoring and weather forecasting)
- ✗ Experiences relevance using precision farming techniques (54% of group)
- ✗ Using smart technologies in farm (54% of group)

Digital Literacy Skills
- ✓ Basic (91.2% of group) Intermediate (.....% of group) Advance (.....% of group)

Farming Standard
- ✗ Knowledge/skills relevant to agricultural standards, GAP, Organic, etc. (27% of group)
- ✗ Agricultural certificate for crops (60% of group)
- ✗ Production plan (40.2% of group)

Marketing
- ✗ Webpage for selling crops (62% of group)
- ✗ Business model (51% of group)

Smart Farming Practices/Training
- ✗ Being trainer (46% of group)
- ✗ Participation of training relevant to smart farming practices and/or technologies (% of group)
- ✗ Know about smart farming (45% of group)
- ✗ Experiences relevant to smart farming practices (46% of group)

Figure 8 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 9 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 10 Details of group 1A

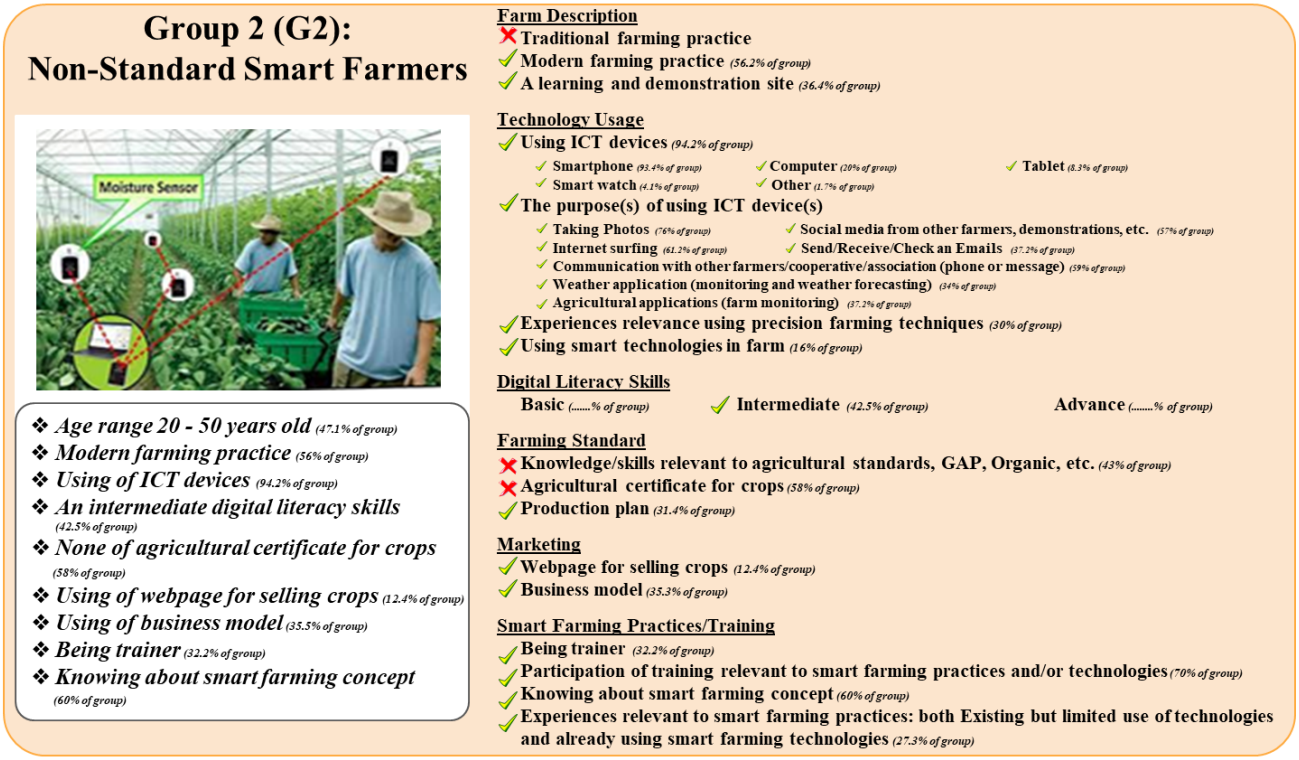


Figure 11 Details of group 2

Based on these elements, we can conclude that **both the content and the pedagogical approach need to be aligned with farmers' profiles and requirements**. The content designed for SUNSpACe will have various levels available, to better fit with farmers' skills regarding agriculture, but also digital literacy, marketing and technology usage This element is detailed in Task 1.3 focused on the content of the program.

The skill set for this project is divided in four subjects:

1. Digital agriculture (overview, components, data processing and decision models)
2. Smart Farming (objectives, cultivation farming, livestock farming, smart monitoring, smart controlling)
3. Standardization (food safety and standards/norms)
4. Agro business (business modelling, sales and marketing)

Figure 12 Adaptation of the content to the targeted groups illustrate the need to adjust the content to farmers groups.

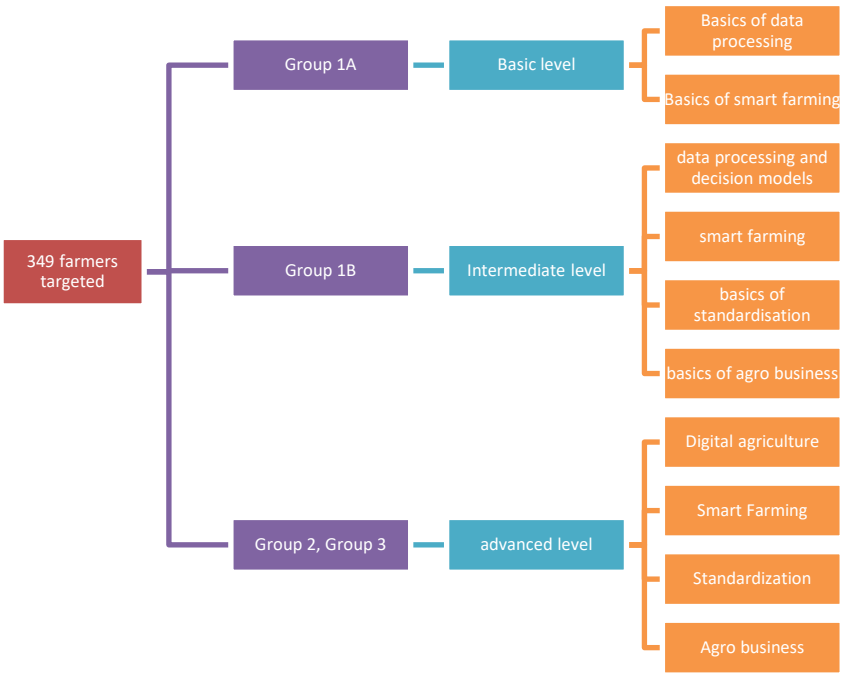


Figure 12 Adaptation of the content to the targeted groups

The pedagogical approach also needs to be adapted to the heterogeneity and diversity of profiles. The choice of the pedagogical approach is developed in the following paragraph.

4. Identification and selection of the appropriate methods

Because of clustering target audience, the learning materials and the learning approaches should be different but compliant with the needs and constraints of specific groups. Based on the surveys and earlier experiences we identified the following learning approaches:

- *courses / classroom sessions*
- *online training*
- *blended learning*
- *MOOCS*
- *community learning*
- *workshops*
- *learning by doing*
- *peer learning*

4.1 Courses / classroom sessions

This classical form of training involves the training of a group by a teacher, who explains in details theoretical elements. It generally occurs regularly. At the end of the teachings, students are supposed to achieve a given level of understanding.

4.2 Online training

Online training is the most general form of the advanced and technologically up-to-date form of distance learning. It may consist of filmed lectures, text/videos, hypermedia, descriptions of best practices, potentially they may use chatbots and/or wiki motors combined with social media features. Any of the target groups can use, as any member of any groups can contribute, too. Online learning can be implemented in several ways, depending on the training purposes: formal, informal or non-formal training. Another selection criterion is whether the content is licensed, free (OER) or the provider asks for tuition fee. Different types of video include documentary (describing events), institutional (promoting a project or organisation), instructional (developed by researchers with limited input from farmers), farmer-learning (made with farmers), and participatory (made by farmers). (GFRAS, Davies, 2018)

4.3 Blended learning

Blended learning is on-line learning combined with regular or occasional F2F meetings, consultation. Blended learning gives very good opportunity for optimizing the trainees' resources, learning space and at the same time capitalizing on the trainers' personal educational capacity. However, the online training does not exclude the interactivity, it is restricted in the virtual space. If the interactions are automated, then it loses the personal communication surplus, which is still a valuable ingredient of teaching and learning. If it is not automated, then it needs enormous teacher-trainer resources. The blended learning fits to all forms of training, amongst them the to the non-formal one. From the project's point of view the most appropriate choice. The ratio between the online content and F2F consultation can be fine-tuned according to the target group features, the content type, place and time.

4.4 MOOCS

It is difficult giving an exact definition of MOOCS (Massively Open Online Courses). It is somewhere in the middle of Gartner's hype curse. There are many forms exist, originally leading universities (e.g. MIT) made the educational content open, then some more content became available free. In most cases MOOCS providers offer degree programs, hence MOOCS fit to the criteria of online learning with the focus on formal training. As in the beginning MOOCS was popular, many courses were developed and bring to the market aiming corporate and non-formal training.

4.5 Community learning

"Community learning's approach builds on the foundation of collaborative learning where students learn best from one another by working together to answer questions and solve problems. Each course is developed in consultation with subject area experts and includes experience and age appropriate lessons integrated around a unique theme." (http://www.commlearning.com/about-community-learning/). This form

seems to be appropriate to Group 1, and it may work well. The disadvantage from the project's perspective is that difficult to maintain and sustain, also the content is hardly portable.

4.6 Workshops

Workshop can be anything where the participants actively discuss one topic. The aim of the workshop can be equally knowledge transfer or collaboration for coming out with some solution, does not matter the workshop has technical or awareness raising taste. The F2F element of blended learning also can be organized and implemented in a form of workshop, it fits very well to the non-formal training, in our case Group 2 and Group 3 will make the best use of it.

4.7 Peer learning

Experts (Group 2 & 3) prefer peer learning methods, as they change experiences, best practices, or reasons failures among each other's. From the project's perspective it has low priority.

4.8 Learning by doing

This type of learning is very much connected to the everyday practical work. Novel trainees work under the guidance of an experienced co-worker and learn what cannot be learnt from books. Theoretically knowledge conversion goes on, internalizing explicit knowledge, also learning by doing is a proper vehicle establishing hard and soft skills. This method fits to the requirements of Group 1; however, it is out of scope of the project.

Depending on the profiles of farmers one or a combination of these approaches is possible (see Table 3 : Adaptability of learning approaches depending on farmers profiles)

Training approach	Ok for trainers?	Ok without Internet connection ?	Ok without computer ?	Ok for non-farmers ?	Ok for illiterate farmers ?	User friendly ?	Long term Validation ?
Courses/classroom sessions	xx	xx	xx	xx	x		x
Learning by doing, manipulate the equipment (training center)	xx	xx	xx	xx	xx	xx	
Online resources/guides (platform)	xx			xx		x	
Regular workshops, members' meetings	xx	xx	xx	xx	xx	xx	xx

Online courses (MOOCS) with social networking	**x**		**xx**		**x**	**x**
Mentorships, advising and counselling by trained peers		**x**		**xx**	**xx**	**xx**

Legend: x for method that can fit, xx for methods that definitively fit, nothing when not applicable in the context.

Table 3 : Adaptability of learning approaches depending on farmers profiles

The choice of the appropriate teaching methodology is made based on the relevance to the target group. It needs to be

- accessible offline for those who do not have Internet access,
- user friendly, with colours and audio to allow those with allow digital literacy level to use it
- differentiated depending on the group and its level of experience.

Group 1 will benefit more from community learning, mentorship, and basic training courses. Training on a field (technology / business models…) where there have little to no expertise may be difficult. Therefore, the choice of the pedagogical approach is of the outmost importance. According to the survey, community learning and basic teaching are the two most cited approached desired by farmers. They also fit better in their context (low internet access/digital illiteracy). They will be taught by their peers, most advanced farmers from group 2.

Group 2 and 3 will be trained thanks to the pilots/excellence centres, as well as advanced teachings and e-learning on an online platform to be designed during the project. They are to be involved in the design of the training material. Indeed, the content of the teaching material should be co-constructed to combine the knowledge of experienced farmers with the knowledge of academics and ICT experts.

The long-term validation and qualification is an element that also needs to be addressed, as only 12% of the 349 respondents do not want to get an agricultural certificate.

5. Implementation of the training

5.1 Four steps, with a different mix of training approaches over time.

The training approach needs to be adaptive and responsible. To better fit with the diversity of profiles of farmers, we propose to proceed by steps, as illustrated by Figure 13 Four steps for our approach

5.2 Implement pilots at learning centres with G1 and G2

Four pilots are to be set up: one in Bhutan, one in Nepal, and two in Thailand (Chiang Mai CMU and Khon Kaen KKU). Each of them will host a learning centre, which will focus on specific areas:

1. Organic 1 (Rice production in Thailand - CMU)
2. Organic 2 (Beef housing system in Thailand - KKU)
3. Quality (off season vegetable production in Bhutan)
4. Work and health conditions (usage of chemicals and improvement of working conditions in Nepal)

The skill set is divided in four subjects:

1. Digital agriculture (overview, components, data processing and decision models)
2. Smart Farming (objectives, cultivation farming, livestock farming, smart monitoring, smart controlling)
3. Standardization (food safety and standards/norms)
4. Agro business (business modelling, sales and marketing)

	CMU / KKU (organic fruit, vegetable beef)	AEC / KEC (working and health conditions)	Bhutan (quality)
Digital agriculture	xx	x	x
Smart farming	xx	xx	xx
Standardization	x	x	x
Agro business	x	x	x

Table 4 : Relations between skill set developed and learning centres provides an overview of the skill sets that will be acquired by farmer in each of the learning centres. These learning centres will be co-constructed with local farmers and governmental representatives from groups 2 and 3. This will enable SUNSpACe to use the lessons learnt from previous projects, which explicitly state this close collaboration with local people and government representatives as a key success factor of farmers training programs.

	CMU / KKU (organic fruit, vegetable beef)	AEC / KEC (working and health conditions)	Bhutan (quality)
Digital agriculture	xx	x	x

Smart farming	xx	xx	xx
Standardization	x	x	x
Agro business	x	x	x

Table 4 : Relations between skill set developed and learning centres

5.3 Train the trainers

Each partner has to identify the members of G3 for their country (G3 in Nepal, G3 in Bhutan, G3 in Chiang Mai, G3 in Khon Kaen)

The teaching and learning activities will then be scheduled and organized in each of the learning centers. The content will be co-constructed by project members and G2/G3 members. Each partner will focus on its area of expertise (see D1.3 for details on the training content).

Each Asian partner has identified these first groups to train. The following paragraphs provide details to illustrate the diversity and relevance of the public trained here.

In Nepal (KEC and AEC), Trainees have been identified as follows:

For G2, KEC selected =18 farmers
For G2, AEC selected = 18 farmers
Figure 14 Selection process for farmers in Nepal illustrates the selection process that has been applied:

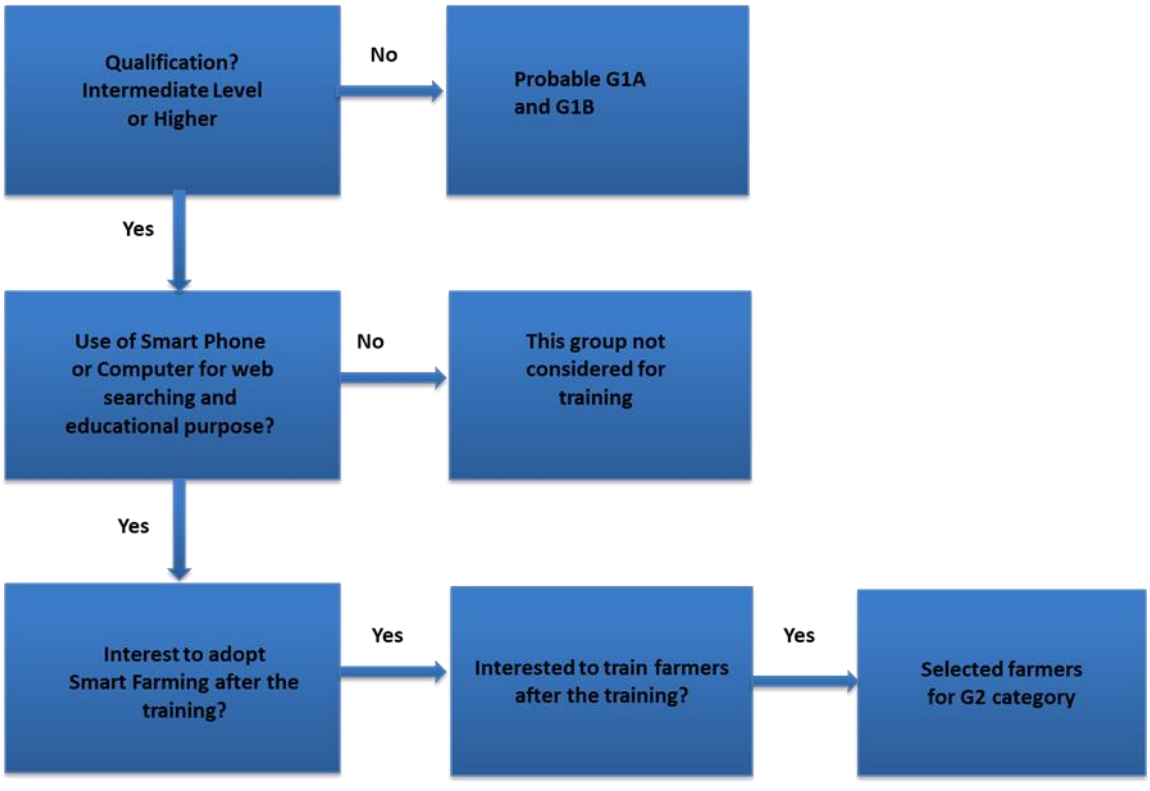


Figure 14 Selection process for farmers in Nepal

The Vegetable Crop Development Center, Khumaltar, Nepal (Government Agency) was contacted for obtaining the list of farmer needed for our G2 category. The farmers where contacted through telephone with the following questions:

1. What is your qualification?

Purpose: To find their proficiency in English. We assume that farmers with the qualification of intermediate level (12 grade) or higher have good proficiency in English and can understand our teaching & learning materials by their own.

2. Can you use smart phone, computer and Internet facility for educational purpose or for web searching?

Purpose: To find ICT proficiency of farmers.

3. Are you familiar with smart farming or involved in smart farming?

Purpose: To find the interest of farmers to adopt smart farming practice in their farm.

4. Are you willing to train other farmers after you receive the training?

Purpose: To find the interest of farmers to fulfil our requirement of training other farmers through them.

A total number of 50 farmers were contacted and only 36 farmers (KEC 18 and AEC 18) were selected as G2 category farmers from Nepal.

In Bhutan (RUB), the process is slightly different to take into account the specificity of the country. RUB has performed a consultation with local government agents, to locate potential smart farmers. They combined this approach with interviews of those farmers to get their feedback on the interest they have into the project and the validation of the applicability of our training methodologies (they all have smartphones and would therefore be able to use New Spectrum for example).

G3 – This group consist of academicians and researchers. There will be 8 academicians from Department of Agriculture, College of Natural Resources. They have good knowledge and experience with crop farming. While the researchers (4 nos) will be from the Research and Development Centre (RDC) of Department of Agriculture, Ministry of Agriculture and Forest (MoAF) in Bhutan. They have good knowledge and experience on crop farming.

After receiving the training on digital agriculture, smart farming, standardization and agro-business. These trained group will indeed train G2 (group 2). Here we follow the concept of ToT (Training of Trainer).

G2 - For Bhutan, we will train agriculture extension agents as G2. They work at Gewog level (Block) to assist the farmers in crop farming in Bhutan. They are part of the Department of Agriculture, Ministry of Agriculture and Forest. This group will receive same training inputs as that of ToT by G3. There will be 20 G2 participants from different blocks of Punakha and Wangduephodrang Districts. This group will train five farmers each from G1A and G1B from his/her block after receiving the training.

G1A (Practitioner farmer) – Farmers' who follow traditional agriculture practices. They uses ICT (mobile) but for non-agriculture purposes. They have basic digital literacy skills.

G1B (trained farmer) – Farmers' who follow traditional agriculture practices. They uses ICT (Mobile) but for non-agriculture purposes. They have intermediate digital literacy skills.

To transform G2 and G3 into trainers, the skill set developed in SUNSpACe has to include a module to train advanced farmers in pedagogics. Indeed, the transformation of a farmer into a teacher able to train less advanced farmers (G1A and G1B) needs to be facilitated. Therefore, a dedicated module is required not only to train G2 and G3 in how to use the platform, but also in how to teach with the platform.

5.4 Evaluate farmer levels to adjust content and pedagogical approach

5.4.1 Learning centres

Upon registration for the training program, farmers will be interviewed to assess their profiles and decide which group they should join (G0, G1A, G1B, G2 or G3, resp.). Figure 15 Group evaluation and repartition provide an overview of the minimum level required per group and per skill set.

	Digital literacy	Technology usage	Marketing	Smart farming
Group 0 Traditional farmers	None	None	None	None
Group 1A Practitioners, basic level	Basics	None	None	None
Group 1B Practitioners, intermediate level	Intermediate	Basics	Basics	None
Group 2 Smart farmers	Intermediate	Basics	Basics	Basics
Group 3 Academics and government representatives	Intermediate	Intermediate	Basics	Basics

Figure 15 Group evaluation and repartition

The target set here is as follows : 300 farmers for "willing and able to learn" G0 / G1A and G1B ; 60 for G2 and 36 for G3

Then G1A and G1B will be trained with a blended learning approach, i.e. a mix of theoretical teachings and practical training on the pilots' sites. The development of an online platform is also planned to accompany G0, G1A and G1B farmers, under the guidance of G2 and G3. The ratio between the online content and face to face consultation can be fine-tuned according to the target group features, the content type, place and time.

An evaluation is also planned, and will be developed within WP3.

5.4.2 The platform

The platform should be online, to enable unlimited participation and open access via the mobile application. It should also provide interactive courses with user forums to support learning community among students, adult learner, professors, field expert, and instructor. New Spectrum (see figure 13) is one example, that fit our specifications.

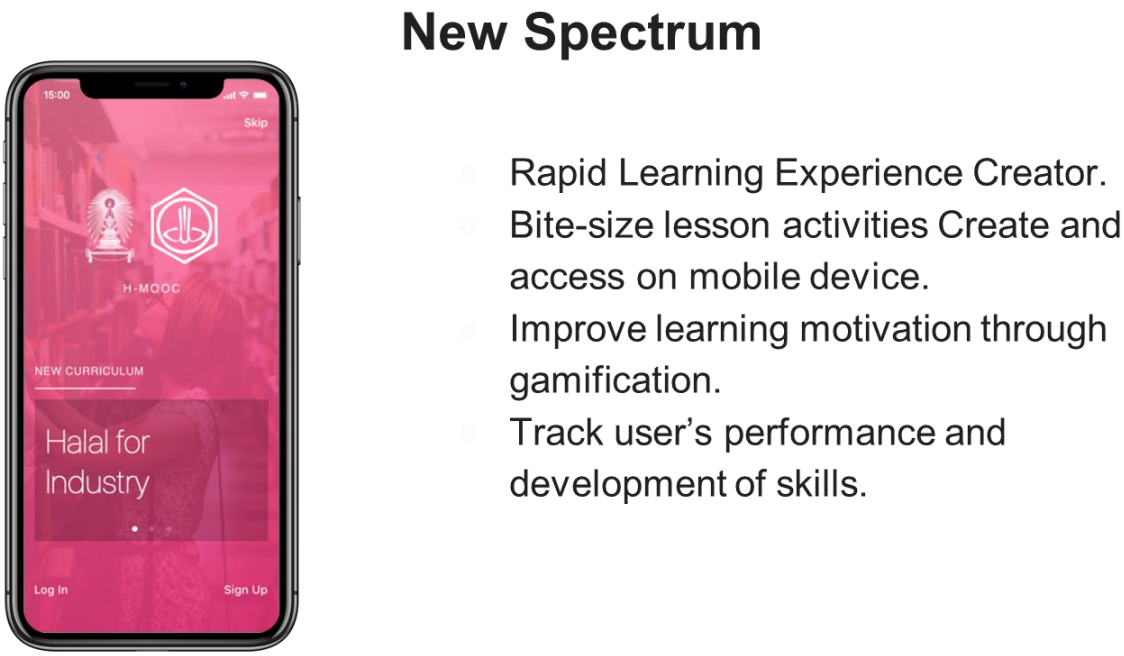


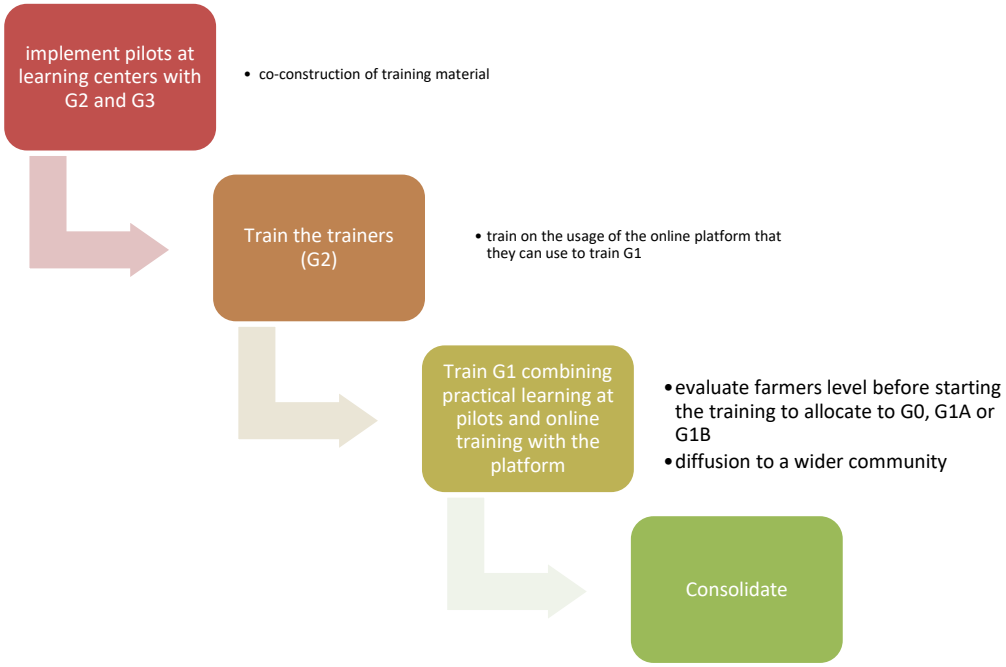
Figure 16 New Spectrum platform

At each of the previously described steps, farmers will be evaluated. This will enable a REX to be performed in parallel to the development of the learning centers to validate the achievement of projects objectives and insure that the training of farmers can continue after the end of SUNSpACe project

4.4 From theory to practice: barriers to take into account

Step 1: Implement training facilities and events around the pilots in dedicated learning centres

Step 2: Train the trainers (group 2 and group 3)
Step 3: Train the rest of the farmers (group 1)
Step 4: Consolidate the various training tracks and transfer knowledge



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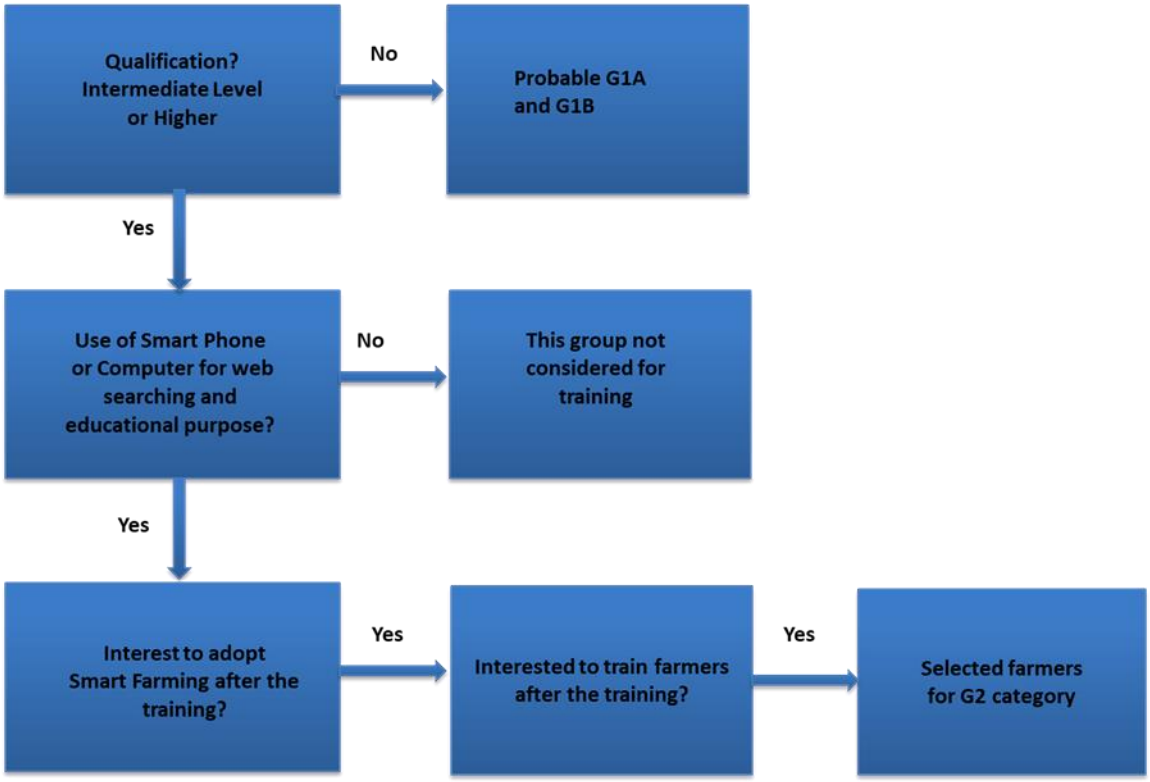

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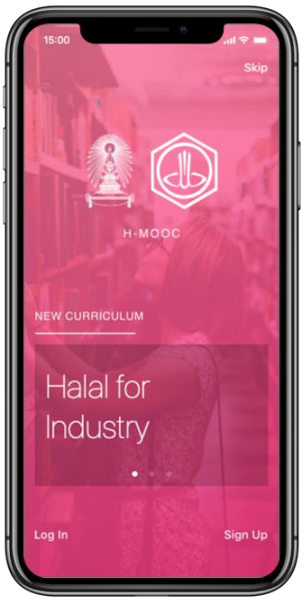

New Spectrum

- Rapid Learning Experience Creator.
- Bite-size lesson activities Create and access on mobile device.
- Improve learning motivation through gamification.
- Track user's performance and development of skills.

Figure 16 New Spectrum platform

At each of the previously described steps, farmers will be evaluated. This will enable a REX to be performed in parallel to the development of the learning centers to validate the achievement of projects objectives and insure that the training of farmers can continue after the end of SUNSpACe project

4.4 From theory to practice: barriers to take into account

Barriers - convincing, understanding and acceptance of farmers:

1. Mutual understanding - What is smart farming? What added value can it bring? As clearly appeared in the survey, smart farming is not commonly known and understood. Only 32,8% of respondent are familiar with this word.
2. Relevance of changing the way farmers have always worked? Only those who are WILLING to change are included in group 1.

Barriers – economic perspective:

1. Equipment to achieve precision agriculture, automation and robotics and dedicated systems to manage information are expensive. When will they really achieve efficiency with such an investment required? Can we analyze more precisely who could benefit from smart farming: Above a given size? On specific areas (kettle/crops… ?) other?
2. On the need for a business model: one way to achieve efficiency would be to reduce the number of actors in the supply chain. With many intermediaries, farmers have little to no margin on their products. How is it linked to smart farming and technology? but is is nevertheless required

Barriers – implementation and actions after training

1. Going from theory to practice requires a dedicated part in the training
2. Training on a field (technology / business models…) where farmers' experiences are little to no may be difficult => choice of the pedagogical approach is of the outmost important
3. Can we implement training programs based on continuous improvement or their practices need a rather radical re-engineering?

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