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MANUAL

Self-Sustained "Scaling Hubs" for Agricultural Technologies:

Definition of Concepts, Protocols, and Implementation

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We provide innovative, science-based solutions to improve the livelihoods and resilience of resource-poor smallholder farmers. We do this through strategic partnerships, linking research to development, and capacity development, and by taking into account gender equality and the role of youth in transforming the non-tropical dry areas.

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Introduction

The problem of low and slow adoption of agricultural research innovations by smallholder farmers is very complex and is slowing agricultural modernization processes in developing countries. This has significant impacts on farm productivity and farmers' livelihoods and affects the returns on investments of national and international agricultural research projects. The situation is further aggravated by changing and challenging climate and social contexts, and so system transformation and modernization has become urgent in order to produce more food, but in a sustainable way. To encourage scaling up and out of research outputs, 'research for development' (R4D) projects, which involve the design of appropriate 'impact pathways' for agricultural research projects, have become increasingly popular. Additionally, there is a greater focus on scalability, scaling processes, and analytical tools that help to track and monitor technology scaling through research projects. Within these frameworks, 'appropriate partnerships' for scaling, consideration of 'development impacts and outcomes' during the early stages of project design, 'demand-driven and response research', and engagement with private sector, are all important concepts.

These concepts are often developed separately from each other, rather than being brought together in a systematic and complementary way. It therefore remains difficult to find a comprehensive scaling framework in the literature, that is adapted to agricultural research projects and which includes all of the concepts (and perhaps others) together in a cohesive and systematic way, with guidance on practical steps for the co-design and implementation of scaling activities. Such a framework would need to carefully consider technology and other context-specific attributes, and position knowledge generation and management tasks into a broader systematic partnership for scaling. Such a framework would also need to provide information on how to scale context-specific pilot projects, including tools to target interventions. Further, scaling failures are known to be partly due to inappropriate enabling governance and institutional settings of innovation systems[1]. This is a critical factor that must be tackled by newly emerging scaling science. In fact, it is important to design appropriate governance settings of the scaling processes, so that they are led by the most capable local leadership while also ensuring inclusiveness of all stakeholders and satisfying the stakeholders' short- and long-term incentives. Developing business models for self-sustained scaling processes should also be part of governance design.

The objective of this manual is to provide an essay of conceptualization for effective scaling processes, starting with the design of demand-driven project activities, and ending with strong and appropriate partnerships for scaling, and self-sustained business models for continuous scaling after the project's end. The idea is to create Knowledge Hubs (KHs), which are rather a form of physical infrastructure, for specific agricultural technologies, and then connect them to four types of local and national partners to operationalize a scaling process that can be sustainable over time. A KH well designed and connected to different types of scaling partners will result in an operational and self-sustained scaling platform, which we call in this document "scaling Hubs". The remaining document is further divided into three parts.

The first presents the concepts, frameworks, and tools proposed to operationalize the scaling process through Knowledge and Scaling Hubs. A second part provides a set of practical steps (protocol) for the implementation of both Hubs, while the manual concludes with a 'Grantt Chart' for operationalizing the implementation of SHs in a 12-month timeframe.

Rationale for Self-Sustained Scaling Hubs

A different mindset is needed to design, coordinate and implement pilot research projects in a way that results in greater development impacts. Many debates are being undertaken in the literature on the best ways to design, coordinate, and implement tasks. One suggestion is to consider the pilot project as a component of a larger innovation system and think about how the pilot would further contribute in building the scaling capacity of the innovation system and contribute to generating transformation dynamics. When considering such a concept, the absence of an effective agricultural innovation system structure is a critical issue. Therefore, effort and investment need to be made in this regard first.

In many developing countries in which ICARDA operates, agricultural innovation systems do not exist. Knowledge generation is quite high in some of these countries, but knowledge management and dissemination remain problematic. In these cases, scientific knowledge is held by scientists, technical knowledge is held by extension system technicians, and resources to ensure that the knowledge reaches the final beneficiaries (farmers and others) in effective and appropriate forms are lacking. Poor knowledge

[1] An innovation system is a group of actors (farmers, enterprises, institutions) who are interacting to turn an idea (or a problem) into an innovation process, product, or service on the market.

management is causing many of the failures currently being observed in different extension systems in developing countries. Key areas of improvement of knowledge generation, management and dissemination perspectives include:

- Participatory learning with individuals, households, and communities to better understand the range of opportunities available to mitigate challenges to technology adoption;
- Capacity strengthening in areas related to knowledge generation, communications and shifting conventional wisdom in relation to the role of women and youth in agricultural innovation;
- The creation of platforms for sustainable dissemination of knowledge;
- Undertaking of monitoring and evaluation as a knowledge generation process, as opposed to a process solely focused on facilitating reporting against project outputs and outcomes;

Many of these aspects are missing in existing innovation systems in the countries in which ICARDA is operating and need to be considered in future conceptualizations of a self-sustained scaling mechanism.

Knowledge Hubs – Definition of the Concept

Knowledge management products developed by R4D projects should be created in such a way so that they are acceptable within existing social and cultural norms, adapted to fit specific contexts, and are relevant to a broad cross-section of individuals and households, in order to ensure wide and equal access to information.

In R4D, knowledge generation and management products and tools are usually developed and evaluated in terms of their effect on adoption decisions and processes, agricultural productivity performance (yields, water use efficiency, soil fertility, etc.) and equity. Being in a 'scaling mindset' means that the knowledge generated by a given research project must be placed into a dynamic dissemination/scaling process which goes beyond the R4D project and its resources, thus ensuring continuity of technology scaling even after the end of the project. In order for this to be successful, the concept of KHs needs to be defined and implemented.

A KH, as defined in this manual, refers to a physical structure, such as an informal training center owned by local leadership, that is accessible to farmers and other beneficiaries through (formal and informal) partnership agreements. All knowledge about the technology, which is generated and capitalized by the project research teams; should be transferred to these hubs in a simplified and extension-friendly manner. These centers will then provide key knowledge products about a promoted technology, which are carefully designed by communication and extension specialists using data from researchers. KH are currently being tested in some ICARDA countries, including Algeria and Tunisia. **Figure 1** illustrates the generic pillars of a KH, which should be based on a sound and clear selection of the technology, region, leadership, and existing capacities. Criteria for the selection of a suitable KH are also presented in **Table 1**.

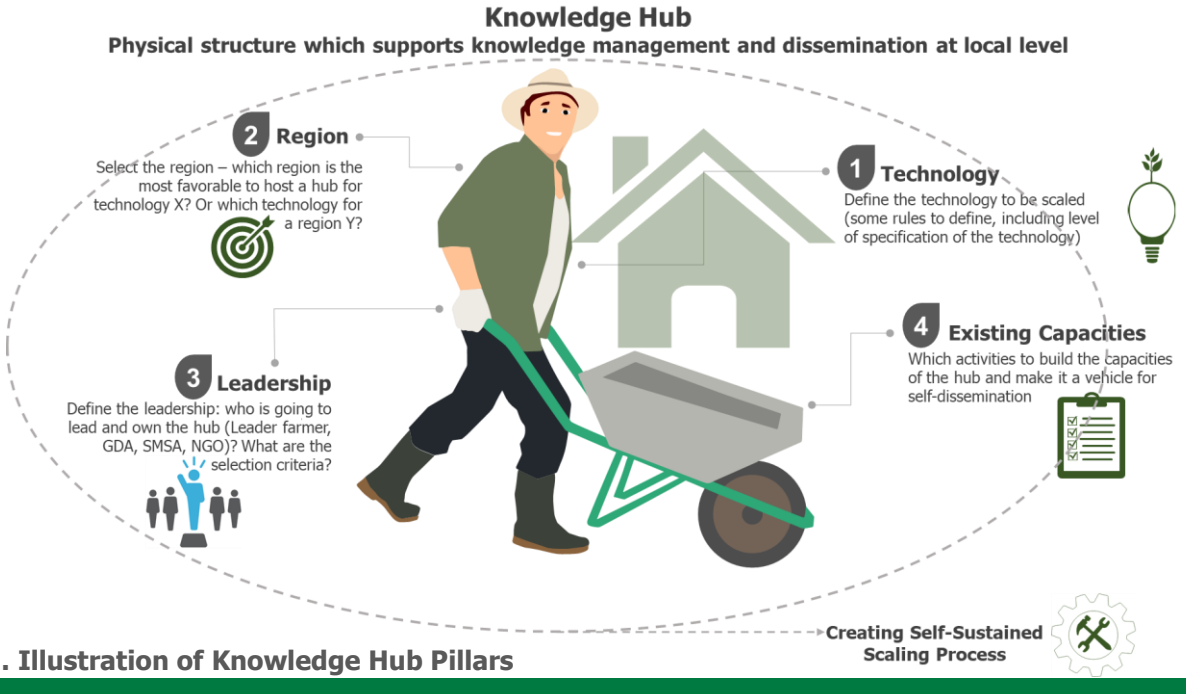


Figure 1. Illustration of Knowledge Hub Pillars

Table 1. Components and Selection Criteria of a Knowledge Hub

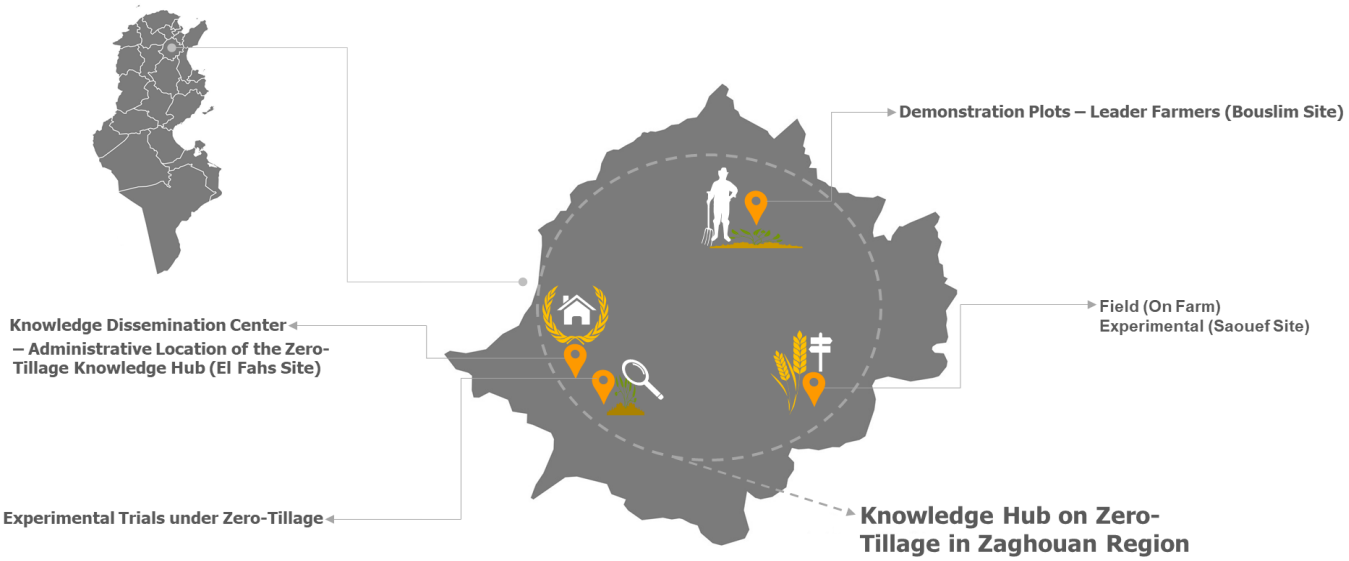
Pillars of a KH	Description	Selection criteria	Type of investments needed
Technology	Not all technologies can work everywhere. There should be careful consideration of local contexts (biophysical, social, economic, etc.) before selecting the technology to be promoted through the hub.	■ Demand driven; ■ Relevant for the dominant production system; ■ Simple and affordable (at all levels) to smallholder farmers.	■ Testing plots in farmers' fields (called 'innovation modules'); ■ Experimental plots (called 'experimental platforms'); ■ Farmers' fields adapt learned innovations (called 'extension area'); ■ Related to a limiting factor in the dominating farm system.
Region	Need to select appropriate regions where the technology is relevant. Need to have an early demand for the technology.	■ Existence of high demand for the technology in the region; ■ Existence of a minimum number of farmers practicing the technology.	■ Agroecological area appropriate to the technology selected.
Leadership	Refers to motivation, engagement, and other related factors ensuring the sustainability of the KH after the end of the project. These can be found in stakeholders of different background (NGOs, farmers associations, cooperatives, private farmers, etc.).	■ Motivation and engagement; ■ Co-investment in building the KH; ■ Inclusive and open on the wider neighboring farmers communities; ■ Existence of minimum knowledge about the technology.	■ Training in leadership and communication.
Existing capacities	It is preferred to engage in a platform where a minimum of human and physical resources exists. This will minimize the project investments to rehabilitate and upgrade the selected KH. This can implicitly also refer to a higher chance of sustainability for the hub (since stakeholders have been already investing in knowledge products).	■ Existence of physical infrastructure which can be upgraded to host training and other scaling-related activities; ■ Diversified activities and services to farmers and existence of relevant human resources which can be trained.	■ Investments in knowledge materials and supports; ■ Investments in capacity development (training these who will be the hub trainers); ■ Investments in physical pedagogical infrastructure.

Similar to other agricultural and development-oriented initiatives such as the MasAgro, the KH is expected to be based on physical infrastructure, including research platforms (preferably those which exist or are focusing on the same agroecological area), a network of demonstration plots, and extension and impact demonstration areas (Van Loon et al., 2020). These will serve as a network for knowledge exchange and support training and dissemination activities which will be implemented in the hub area (and similar agroecological areas where the same technology is relevant). To complement this definition, **Figure 2** presents an illustration of a KH on zero tillage in the region of Zaghouan, Tunisia. It basically highlights that the KH is not necessarily located in a single place or plot. It can rather be a network of neighboring sites where the same technology problems and research for development questions are being tackled. It also refers to sites which generate strong evidences about the technology for wider capacity development (field days, etc.) and policy advocacy.

It is important to remember that different scaling activities, which will be (jointly) undertaken by the project research team and the KH leaders, will be defined based on the scaling road maps[2], as identified by the local stakeholders. Not many operational tools are available to accurately define a set of effective scaling activities to be part of a scaling road map. The International Maize and Wheat Improvement Center's Scaling Scan tool (Jacobs et al., 2018) remains one of the only such tools available. This tool, however, might be complicated to use by local stakeholders and can lead to subjective responses and limited evaluation of scaling constraints. Nevertheless, the basic principle of identifying scaling activities by tackling constraining factors to scaling remains highly relevant.

[2] A scaling road map provides a list of scaling activities mapped to the impact pathway of the project.

Figure 2. Illustration of a Knowledge Hub on Zero-Tillage in the Region of Zaghouan, North Eastern Tunisia



Partnership for Scaling – The 4-Wheels Approach

A KH not well connected to a wide network of scaling partners would not result into effecting scaling process. Scaling partnership is needed to enhance the effectiveness of scaling activities, reduce scaling costs, and ensure the sustainability of the scaling process. Many research projects tend to partner with potential stakeholders with whom they already have a comfortable relationship[3], or those which are already part of their social and professional networks, rather than looking for additional partners who can add value to the project. Generally, there is no systematic way to identify and map partners based on the type of knowledge management products they could help to disseminate. In this manual, we suggest the 4-Wheels (4-W) approach for comprehensive and generic mapping of potential scaling partners of agricultural R4D projects into four homogenous groups.

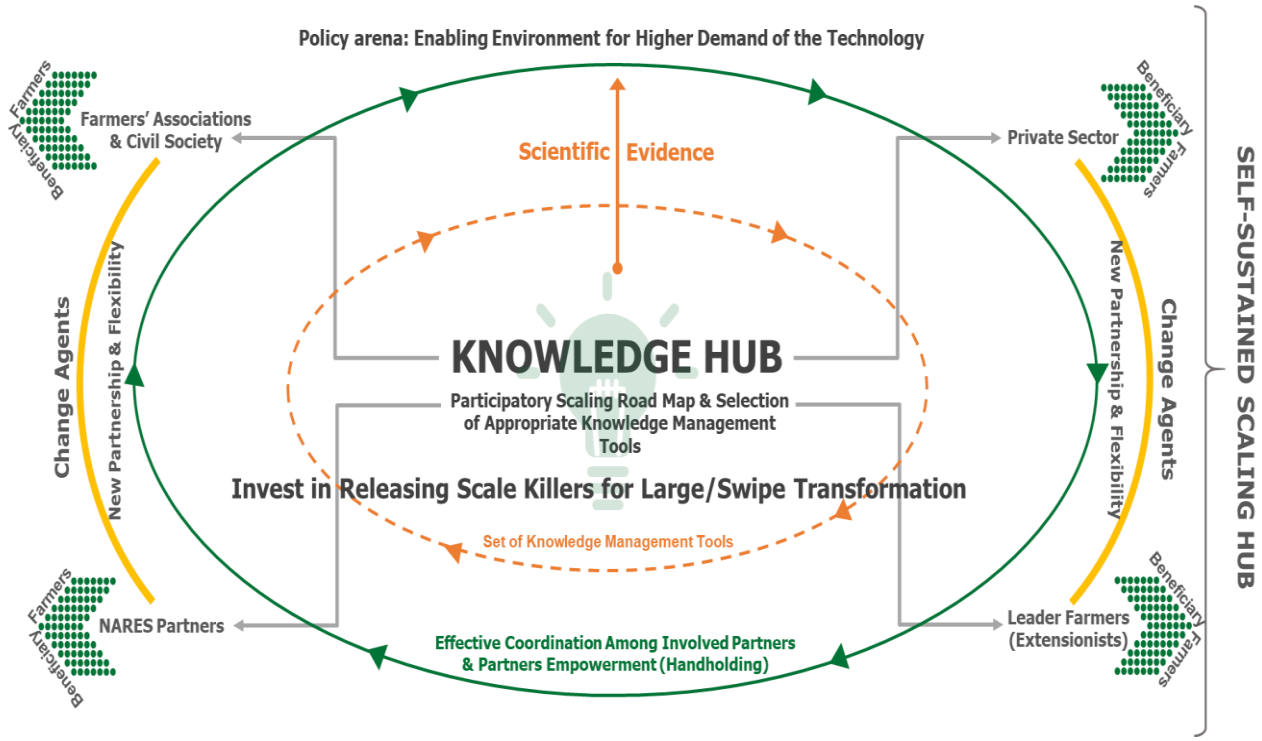
The 4-W approach focuses on generating higher demand for the technology by building on three embedded stakeholder areas, including the R4D project core team responsible for the coordination of the scaling road map; the four key types of change agents necessary for stimulating transformative changes; and the policy arena responsible for stimulating enabling environments (or vertical scaling).

The framework also considers a set of tools needed to interact within and between these arenas and partners. These tools focus on knowledge management, coordination mechanisms, handholding of scaling partners, and monitoring and evaluation.

The 4-W framework divides scaling partners – also called 'change agents' – into four categories: i) farmers' groups and associations of different types, ii) civil society (including non-governmental organizations (NGOs) and the private sector, iii) national public development partners, and finally, iv) leader farmers and extensionists who are key for the local spread of the technology (**Figure 3**). Partnering with each of these four types of partners needs careful consideration of their respective incentives and motivations, in addition to the design of appropriate knowledge products they can respectively help to disseminate. The objective is to make each these 'change agents' a 'vehicle' for scaling the specific agricultural technology and thus generate scaling dynamics locally and further afield.

[3] In some cases, restrictions and agreements dictate the type of partners to be involved.

Figure 3. Partnership for Self-Sustained Scaling Hub – The "4-Wheels Approach"



Self-Sustained Scaling Hubs:

Operationalizing Knowledge Hubs through the 4-W Networking Approach

The KH will be used to mainstream technical knowledge about the technology to different intermediary beneficiaries who will support dissemination to the final technology users; farmers. Intermediary beneficiaries, as defined by the 4-W approach, fall into four types (**Figure 3**). Once the KH has been established, a series of networking events will be undertaken to position the KH in the middle of an active and engaged network of professional public and private partners.

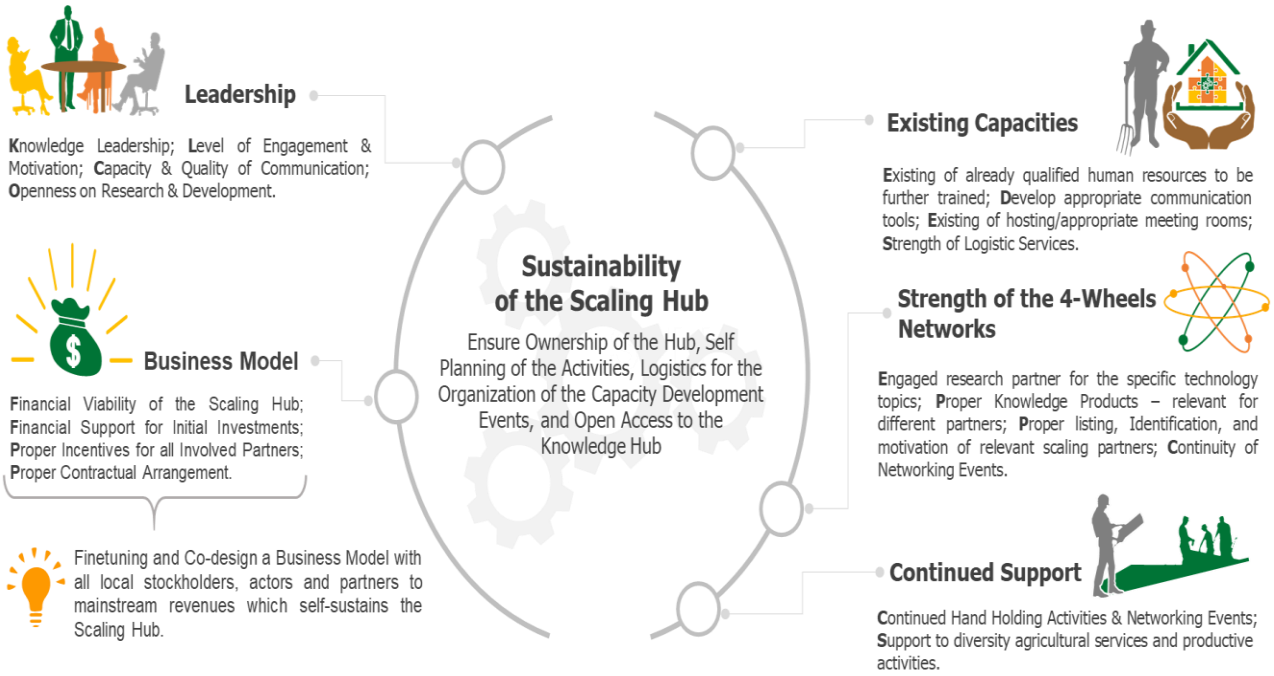
These partners will further be engaged to make use and access to the KH for their own dissemination activities, be trained on the technology (if needed) as well as on effective ways to communicate with farmers. This networking operation will initiate a scaling process, in which the KH will be central. It is important, however, to consider the importance of maintaining appropriate levels of communication with the partners through effective and especially tailored knowledge management tools and products to each of them. Ensuring that the partners are interested in the technology, by providing targeted incentives, will be key to their active participation as ambassadors of the technology. A KH that is focused on one technology and that is well connected to local partners (through a 4-W perspective) would generate a continuous and sustainable scaling processes, which we define in this manual as SHs. SHs are a form of virtual multi-stakeholder's network which interacts around a real tangible physical knowledge platform (also called KH in this manual).

Sustainability of Scaling Hubs

Sustainability Criteria

Many factors would contribute to the sustainability of SHs and should be considered. Some of these refer to early selection criteria of the KH hosting agent/organization, while others refer to the incentives generated by the KH for the different stakeholders involved to further stimulate and sustain scaling processes. **Figure 4** provides an illustration of some SH sustainability criteria. It is important that the KH is created under favorable conditions, which ensure the best use is made of it. Important criteria to consider when selecting KHs include leadership (including knowledge management leadership), level of engagement and motivation, communication skills and capacities, and the level of access (openness) of research and development. It is also important to consider existing physical infrastructure, since this also reflects the motivation and engagement of the local KH host. The existence of qualified human resources, in addition to other logistical and communication skills and capacities, must also be considered. The sustainability of the SHs will also depend on the strength of the networking operations and the set of scaling partners who will join and make use of the KH. It is also important to consider continuous financial support of the KH in the long-term, which may be achieved through public subsidies, donors support, and local financial resources. Finally, a key SH sustainability factor is the effectiveness of the business model that will be deployed for scaling.

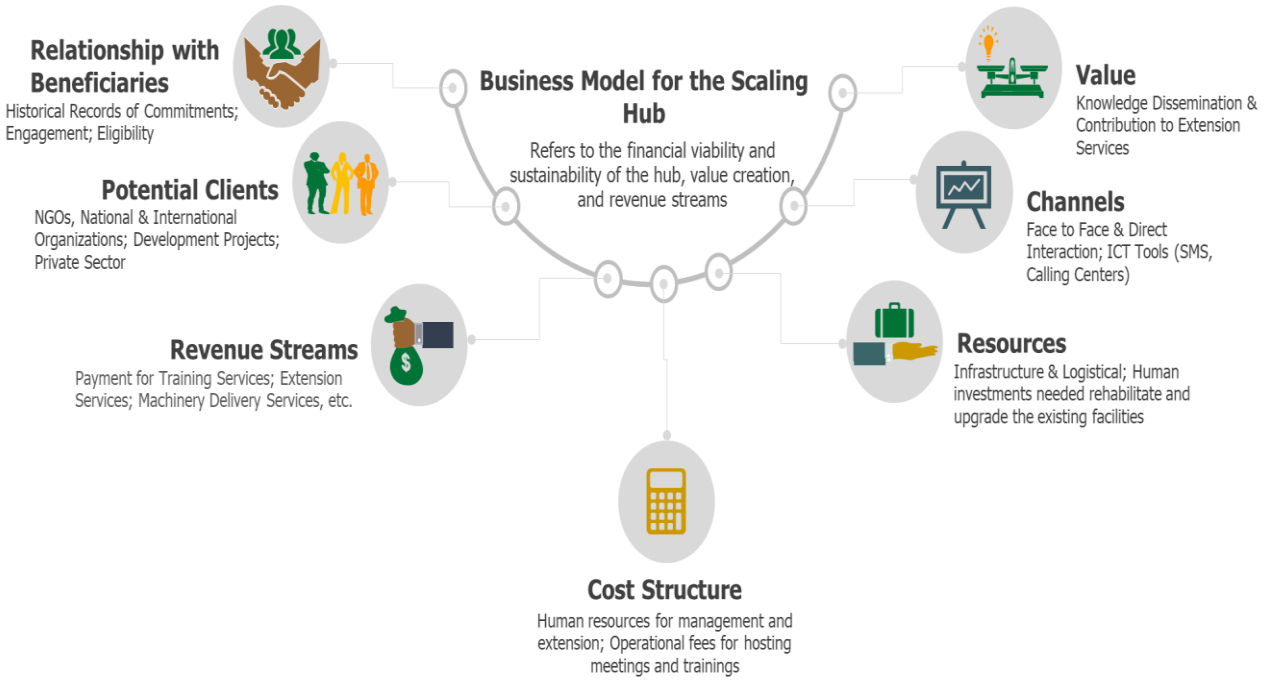
Figure 4. Factors Ensuring the Sustainability of the Scaling Hubs



The Business Model of the Scaling Hub

The business model is a key SH success factor. Design of the successful business model for sustainable scaling requires asking farmers' associations, cooperatives, and other agents which provide extension services (including organization of training, field days, timely follow up services, SMS and other approaches) about the incentives which makes of providing these services to farmers. The business model also needs to include a mechanism which allows the KH hosting agent to raise funding (and other forms of benefits) by being involved in the scaling activities for the selected technology. The business model can be slightly different from one type of technology to another, but a generic way to illustrate it would be as in **Figure 5**. Adjustments would always be needed depending on the general context and technology context planned to be scaled through the SH.

Figure 5. Generic Business Model for the Scaling Hub of Agricultural Technologies



Protocol for Scaling Hub Implementation (Version 1.0)

Step 1 – Selection of KH hosting organization/platform

- Task 1.1. Selection of promising technology (relevant for the project, region, and context). This can happen through cooperation between the project teams, and their national and local partner;
- Task 1.2. Identify potential public and private partners who might be members (or clients) of the KH. This includes an assessment of the actual demand for the technology in the dominating farming systems.

Step 2 – Capacity assessment of the KH and investment in appropriate knowledge products

- Task 2.1. Preliminary assessment of local partners engagement (can be straightforward or based on questionnaire, manifestation of interest, existing partnership, etc.). The rationale is to select a KH manager who will ensure the maintenance and sustainability of the knowledge products and materials which will be invested;
- Task 2.2. Assessment of technical and infrastructure capacities within the KH.

Step 3 – Handholding activities to build the knowledge dissemination capacity of the KH

- Task 3.1. Handholding of the KH manager and other personnel (these are not necessarily the personnel of the KH, as they can be leader farmers, NGOs, etc.);
- Task 3.2. Minimum co-investment in appropriate infrastructure which will allow the KH to function as a knowledge dissemination center;
- Task 3.3. Investment in demonstration plots, and other experimental fields to further generate context-specific knowledge and evidences of the technology benefits;
- Task 3.4. Investment in generating knowledge products useful for technology dissemination (flyers, posters, videos, etc.).

Step 4 – Connect the KH with wider local and regional research and development stakeholders: first step to operationalize a "Scaling Hub"

- Task 4.1. A large workshop event where all relevant stakeholders will be invited to present the established SH and discuss potential joint scaling activities.

Step 5 – Co-design scaling activities, led by the KH members (institutional arrangements, clients, beneficiaries, and funding activities)

- Task 5.1. Refine the co-designed scaling activities with different 4-W partners;
- Task 5.2. Develop joint sub-agreements (including activities and budgets) with different 4-W partners for the implementation of the defined scaling activities.

Step 6 – Social learning and adaptation

- Task 6.1. Measure social learning and progress on social capital within and beyond the scaling hub, based on a set of knowledge and social network indicators which can be constantly collected to monitor the progress and sustainability of the created hubs (**Annex 1**).

Conclusions and Ways Forwards

To conclude, it is important to mention that the SHs are not an end by themselves. Rather, they are intended to catalyze scaling processes within the framework of efficient agricultural innovation systems. The concepts presented in this manual will be tested during 2020/2021 in the framework of ICARDA projects in Tunisia, and conclusions will be drawn based on actors' responses to the different handholding and scaling implementation activities. The business model of the KHs and SHs remains a key concept to be carefully considered to provide more careful reflections on this aspect.

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Annex 1: Gantt Chart for the Implementation of Scaling Hubs over a Year

Step	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12
Step 1 – Selection of hosting organization/platform of the KH												
Task 1.1. Selection of promising technologies (relevant for the projects, regions, and context). This can happen through concertation between the project teams, and their national and local partners												
Task 1.2. Identify potential public and private partners who might be members (or clients) of the KH. This includes an assessment of the actual demand for the technology in the dominating farming systems												
Step 2 – capacity assessment of the selected hubs and investments in appropriate knowledge products												
Task 2.1. Preliminary assessment of local partners engagement (can be straightforward or based on questionnaire, Manifestation of interest, existing partnership, etc.). The rationale is to select a platform holder/ manager who will ensure the maintenance and sustainability of the knowledge products and materials which will be invested												
Task 2.2. Assessment of technical and infrastructure capacities within the hub												
Step 3 – Handholding activities to build the knowledge dissemination capacity of the established KH												
Task 3.1. Handholding of the KH managers and personnel (these are not necessarily the personnel of the KH, as they can be leader farmers, NGO, etc.)												
Task 3.2. Minimum co-investments in appropriate infrastructure which will allow the hub to be functional as a knowledge dissemination center												
Task 3.3. Investments in demonstration plots, and other experimental fields to further generate context-specific knowledge and evidences of the technology benefits												
Task 3.4. Investment in generating knowledge products useful for technology dissemination												
Step 4 – Connecting the KH with wider local and regional, research and development stakeholders – First step to operationalize a "Scaling Hub"												
Task 4.1. A large workshop event where all relevant stakeholders will be invited to present the established network and discuss potential joint scaling activities												
Step 5 – Co-design of scaling activities led by the established of the KH (institutional arrangements, clients, beneficiaries, and funding activities)												
Task 5.1. Refine the co-designed scaling activities with different 4-W partners												
Task 5.2. Develop joint sub-agreements (including activities and budgets) with different 4-W partners for the implementation of the defined scaling activities												
Step 6 – "Social learning" and adaptation												
Task 6.1. Measuring social learning and progress on social capital within and beyond the hub based on a set of knowledge and social network indicators which can constantly be collected to monitor the progress and sustainability of the created hubs												

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